PEER VICTIMIZATION AND SUBSTANCE USE
IN EARLY ADOLESCENCE:
LONGITUDINAL ANALYSES OF RISK AND PROTECTIVE FACTORS

BY

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DISSERTATION

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Abstract

This dissertation uses socio-ecological and transactional frameworks (Bronfenbrenner, 1977; Espelage & Swearer, 2003; Sameroff & Chandler, 1975) to examine how variables in adolescents' individual, family, and peer contexts interact to predict, and prevent, peer victimization and subsequent substance use. Through a series of analyses the dissertation examines risk and protective factors including depression and self-esteem (individual ecology); family conflict and family closeness (family ecology); and association with delinquent peers and peer social support (peer ecology). These variables are hypothesized to have mediating and moderating roles in the association between peer victimization and substance use. These questions are examined as a secondary data analysis using longitudinal data collected at four time points over a period of two years in a diverse (49% female, 51% Black, 34% Caucasian) middle school sample of 1132 early adolescents. Longitudinal structural equation modeling was used the primary data analytic technique. A transactional association was found between peer victimization and substance use. Additionally, all the variables examined significantly influenced the relation between peer victimization and substance use. Depression, self-esteem, family conflict, and peer social support were found to have meditational associations with peer victimization and substance use. Family closeness and affiliation with delinquent peers was found to moderate the association between peer victimization and substance use. The implications of these findings and potential points of intervention and prevention are discussed.

ACKNOWLEDGEMENTS

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Chapter 1

Introduction

The present study examines the longitudinal associations between peer victimization and substance use, as well as risk and protective factors for this association in the middle school years. Peer victimization increases significantly during this period and it is also the period where adolescents typically first encounter illicit substances. Correlations between peer victimization and substance use have been documented in the research literature, but little is known about the pathways through which they exert their influence on each other. Given the adverse outcomes of both peer victimization and substance use, the present study aims to examine the nature of the association between these variables and identify risk and protective factors that might facilitate intervening in this unhealthy association.

Peer victimization is an increasingly documented phenomenon in schools across the United States (Espelage & Swearer, 2010 for a review). Peer victimization seems to increase dramatically in the middle school years of early adolescence, potentially due to increased peer interactions and decreased adult supervision typical of the transition from elementary school to middle school (Espelage & Swearer, 2010). Estimates from the National Center for Education Statistics found that 14% of students between the ages of 12 and 18 reported being bullied or victimized by peers within the 6 months prior to being surveyed (DeVoe & Kaffenberger, 2005).

Peer victimization is associated with a range of negative psychological, educational, physical, and social consequences (Hawker & Boulton, 2000). These include greater depressive symptomology, lower global self-worth, higher anxiety and poorer

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perceptions of competence (Callaghan & Joseph, 1995); decreased school attendance (Swearer, Espelage, Vaillancourt, & Hymel, 2010); psychosomatic complaints (Fekkes, Pijpers, & Verloove-Vanhoric, 2004); poorer psychosocial development and/or adjustment (Eisenberg, Neumark-Sztainer, & Perry, 2003; Nansel, Overpeck, Pilla, Ruan, Simons-Morton, & Scheidt, 2001; Wilkins-Shurmer, O'Callaghan, Najman, & Bor, 2003) and more extreme behaviors such as school homicides and increased suicidality (Kimmel & Mahler, 2003; Klomek, Sourander, & Niemela, 2009). Thus, peer victimization has been implicated as a risk factor for several negative outcomes.

One of the several negative outcomes associated with peer victimization in adolescence is substance use. Substance use has been identified as a correlate of peer victimization in cross-sectional studies (Luk et al., 2010; Mitchell, Sullivan, Farrell, & Kleiwer, 2006; Niemela et al., 2011; Sullivan, Farrell, & Kleiwer, 2006; Tharp-Taylor, Haviland, & D'Amico, 2009). However, no longitudinal studies have systematically examined the association between peer victimization and substance use in adolescent populations. Longitudinal studies examining victimization perpetrated by adults has been found to predict substance use in adolescents (Begle et al., 2011; Finkelhor et al., 2009; Hamburger, Leeb, & Swahn, 2008; Kilpatrick et al., 2000; Widon, Marmorstein, & White, 2006). These studies theorize that adolescents turn to substance use as a means of coping with the negative affect of being victimized by adults in their life. As documented above, peer victimization is also associated with negative affect including depression, anxiety and lower self-worth. It is, therefore, likely that the relation between victimization and substance use will translate to the peer context, particularly in early adolescence when peer relations become more central to an adolescents world. The

present study will examine whether peer victimization impacts substance use in adolescents in a manner similar to victimization by adults.

Identifying peer victimization as a potential precursor of substance use is a useful focus for research. Adolescent alcohol misuse is a major public health concern, with consequences including driving intoxicated, suicidal orientations, alcohol dependence, early sexual activity, and dropping out of school. Studies have shown that abuse of alcohol and other drugs in late childhood and early adolescence is associated with greater drug involvement and greater potential for chronicity in adulthood (Gerstein & Green, 1993; Hawkins, Catalano, & Miller, 1992). Exposing the developing adolescent brain to substances may interrupt key processes of brain development, possibly leading to mild cognitive impairment and risk for escalation of drinking (Substance Abuse and Mental Health Services Administration, 2002). In short, involvement in substance use at early developmental stages has life-long health consequences.

While peer victimization can occur early in childhood, substance initiation and use typically begins in the middle school years (D'Amico, Ellickson, Ellickson, Collins, Martino, & Klein, 2005; Johnston, O'Malley, Bachman, & Schulenberg, 2012). Understanding the relation between peer victimization and substance use in early adolescence will help substance use prevention efforts understand the needs of the already vulnerable population of victimized adolescents. However, most research on substance initiation and use has focused on high school or college students (Holt & Espelage, 2007; Strouse, Goodwin, & Roscoe, 1994). Prevalence research, however, indicates that in 2011, the percentage of 8th graders using any illicit drug during the past year was 18.2 %, and lifetime use was 26.4 % (Johnston et al., 2012). This indicates that

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by the time adolescents enter high school many of them have already engaged in substance use, making the middle school years an important period to examine the antecedents of substance use, as well as identify risk and protective factors.

The present study aims to address this gap in the literature by examining risk and protective factors for substance use in an early adolescent sample using a short-term longitudinal design that covers the middle-school years. In addition to examining the relation between peer victimization and substance use, the study will also examine potential mediators and moderators of this association, including variables in the individual, peer, and family contexts.

Theoretical Approaches to Examining the Relation between Peer Victimization and Alcohol and Other Drug Use in Early Adolescence

Socio-ecological theories describe the influence of processes and variables in different contexts, how they interact with each other and how they combine to influence developmental outcomes in adolescents (Bronfenbrenner, 1977). However, the influence of these external variables is not experienced passively by individuals. People also act upon their environment and attempt to influence and control it to their advantage. Thus, a transactional model of development is useful in delineating the interactions between the adolescent and their environment (Sameroff, 2009). This framework theorizes that the development of any process or behavior in individuals is the product of continuous dynamic interactions of the individual and the experience provided by his or her social settings (Sameroff, 2009). The transactional model emphasizes the bidirectional, interdependent effects of adolescents and their environment. This study will draw upon the transactional and ecological models of development (Bronfenbrenner, 1977; Espelage

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& Swearer, 2003; Sameroff & Chandler, 1975) in examining how multiple contexts of the adolescents' social ecology influence adolescent development in relation to peer victimization and substance use.

In addition to examining the interaction of peer victimization and substance use, it is also useful to examine variables that might facilitate or buffer these associations. The presence of risk factors in different contexts in adolescents' lives presents challenges to the successful resolution of stage salient developmental issues in adolescence and put them at risk for other negative experiences (Cicchetti, 1989). Peer victimization is one such risk factor and can result increase the possibility of problematic developmental outcomes and psychopathology (Cicchetti, 1990). Conversely, the presence of protective factors in any of the contexts in which adolescent development unfolds may provide a buffer to these negative developmental outcomes. This may explain why some adolescents display positive developmental outcomes despite experiencing victimization from peers or engaging in substance use. This study examines the influence of several risk and protective factors in the association between peer victimization and substance use in the individual, family and peer contexts.

However a competing set of theories, the lifestyle and routine activities theories (Cohen, 1981; Garofalo, Siegel, Laub, 1987; Gottfredson, 1986; Hindelang, Gottfredson, Garofalo, 1978; Miethe and Meier, 1994), posit that engaging in high-risk behaviors including substance use increases the likelihood of being victimized, and that engagement in such behaviors precedes the victimization. These theories suggests that due to the typically illicit nature of these high risk activities individuals are placed in situations that can be dangerous, and where victimization is more likely to occur. By choosing to engage

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in certain activities and behaviors, individuals implicitly choose to enter certain environments which carry with them inherent risks for victimization. In the adolescent population engaging in substance use is illegal, and procuring and using substances is inherently risky, increasing the chances of victimization. Thus, in contrast to coping theories, lifestyle theories suggest that substance use will precede victimization.

These competing sets of theories have both found considerable support in the literature. However, due to limitations in design and methodology, these studies do not provide conclusive evidence about the nature or directionality of the relation between victimization and substance use. The current study therefore, will use both sets of theories to examine how peer victimization and substance use impact each other during the middle school years.

Conclusion

Peer victimization is a significant problem in middle schools, and has been associated with substance use. Substance use in early adolescence, in turn, has significant negative short and long-term consequences. More research is needed to understand the nature of this association and its correlates, particularly in early adolescence when individuals are typically first exposed to substances. The present study examines the association between peer victimization and substance use and a transactional model of development in hypothesized. In addition, individual and contextual influences and their interactions with each other are examined in order to identify the most salient risk and protective factors that explain why some students use substances in response to peer victimization while others do not. Guided by socio-ecological, coping and lifestyle theories, variables in the individual, peer, and family contexts are examined. The broad

hypothesis is that contextual risk factors will act as added stressors which increase the likelihood of substance use; and the contextual protective factors act as buffers to the stress of peer victimization, and reduce the likelihood of substance use. Four waves of data collected over two years are examined using longitudinal developmental methodology in order to examine the processes by which these variables exert their influence on each other.

Chapter 2

Brief Review of the Literature

Baltes, Reese and Nesserole (1977) stated that the purpose of developmental research is the description, explanation, and optimization of processes that lead to an outcome or sequence of outcomes. This framework will be used to examine the relation between peer victimization and substance use in early adolescence. The present study will first describe the nature of the relation and the change between the two constructs over time. It then examines what predictive factors explain this change in the two constructs beyond the autoregressive effects (risk factors). It also examines what the levers for change might be to ameliorate substance use (protective factors). This will be done through the lens of a transactional and ecological framework, using variables within the individual, family and peer contexts of adolescent development.

Description

The present study begins by examining the developmental processes in question (Baltes, et al., 1977) and begins by examining the nature of the relation between peer victimization and substance use. Research examining the interaction of these variables is limited. The few studies that do have found an association between peer victimization and substance use, although the direction of this association is still contested. Short-term longitudinal studies have found that substance use predicted future peer victimization in high-school samples (Nansel, Overpeck, Pilla, Ruan, Simmons-Morton, & Scheidt, 2001; Patterson, 1982; Rani & Thomas, 2000; Windle, 1994). Other short-term longitudinal studies have found contradictory results, finding that victimization from peers increased the likelihood that adolescents would engage in substance use over a one-year period

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(Kaltiala-Heino et al., 1999; Tharp-Taylor, Haviland, & D'Amico 2009; Topper, Castellanos-Ryan, Mackie, & Conrad, 2011). Cross-sectional studies have also documented the association between peer victimization and substance use (Mitchell, Ybarra, & Finkelhor, 2007; Sullivan, 2006). Other cross-sectional studies found that peer victimization is associated with substance use only when the victims are also engaged in bullying behavior, i.e. were classified as bully-victims (Nansel, Craig, Overpeck, Saluja, & Ruan, 2004).

Thus, findings from previous research examining the association between peer victimization and substance use among adolescents are inconclusive. The contradictory findings could be limited by the study designs and sampling methods employed. Many of the studies are cross-sectional in nature, limiting the ability to truly examine the directionality of the association between the two constructs. Those that are longitudinal, typically collect data at two time-points over a varying range of periods from ten months to ten years. This duration may not be appropriate for the true relations between the constructs to be documented. As suggested by socio-ecological and transactional theories, it is likely that peer victimization and substance use will interact over time, and exhibit a reciprocal influence. Two time points provides information about the linear association between two constructs, but is not be sufficient to document the more complex, non-linear development of this relation (Card & Little, 2007). Additionally, if the critical period of change is expected to vary across individuals, then additional time points may be needed than if the period of change is homogeneous (Card & Little, 2007). Thus, while these previous studies represent an important step forward, the lack of multiple time points limits the inferences about the nature and directionality of these relations.

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The present study aims to address this and uses longitudinal data collected at four time points over two years in a middle school sample to examine the nature and direction of the relation between peer victimization and substance use. A transactional relation is hypothesized for this association (Sameroff, 2009). Peer victimization is hypothesized to predict future substance use which in turn will predict future victimization.

Explanation

Variables across contexts affect the individual directly, but also through their impact on the processes at play within and across contexts (Baltes, et al., 1977). Therefore, once the nature of the relation between the constructs of peer victimization and substance use is documented and described, this study examines factors in various contexts that might explain this association. A socioecological framework (Bronfenbrenner, 1977; Espelage & Swearer, 2003) is used to explore potential explanatory factors within individual, peer and family ecologies as potential moderators and/or mediators.

Individual-level influences

Certain individual characteristics have been found to put children at risk for peer victimization. Furthermore, how an adolescent interprets, reacts, and copes with peer victimization will impact whether they engage in substance use as a coping mechanism. Individual characteristics of the victimized adolescent potentially explain the relation between peer victimization and substance use. Research has documented that peer victimization is associated with negative mental health outcomes for adolescents including depression and anxiety (Barchia & Bussey, 2010; Hawker & Boulton, 2000; Skapinakis et al., 2011; Swearer et al., 2010). Adolescents with a major depressive

episode were about twice as likely to start using alcohol or an illicit drug compared to youth who had not experienced a major depressive episode in the past year (National Survey on Drug Use and Health, 2011). Seals and Young (2003) found that victims of traditional bullying were at higher risk for depression in both male and female adolescents. Similarly, Menesini and colleagues (2009) reported that victims were more likely to experience depressive symptoms than bullies and uninvolved stude-nts. Thus, associations between depression, peer victimization and substance use have been found. However, the cross-sectional nature of the studies prevents inferences about the temporal sequence of these associations.

The present study will examine the longitudinal associations between peer victimization, depression and substance use. It is hypothesized that depression will precede peer victimization, which will then predict substance use. As Swearer and colleagues (2003) outline, common comorbid behavioral and psychological problems associated with individuals suffering from anxiety include depression (Lewinson, Zinbarg, Seeley, Lewinsohn, & Sack, 1997); inability to establish or maintain satisfying relationships (Chipuer, 2001); loneliness (Galanki & Vassilopoulou, 2007); and low self-worth (Grills & Ollendick, 2002). Adolescents who are victimized typically experience anxiety as a response (Gladstone, Parker, & Malhi, 2006; Hawker & Boulton, 2000; Huphrey, Storch & Geffenk, 2007), and tend to isolate themselves, be fearful of school and often skip classes to avoid confrontations with their aggressors (Swearer et al., 2010). All these factors negatively impact friendship-making skills and may increase the risk of peer victimization. In addition, psychological difficulties in adolescence increase the likelihood that they will turn to substance use as a means to cope (Luk, Wang, & Simons-

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Morton, 2010), and possibly as a means to find a peer group that is accepting of them. Thus, depressive behaviors appear to put youth at risk for peer victimization, which in turn puts them at risk for substance use. Only one single study has explored the impact of depression on the relation between peer victimization and substance use. This study concluded that depression mediated the association between bullying victimization and substance use among adolescents (Luk, et al., 2010). This study, however, used cross-sectional data, limiting the inferences that can be made about the mediating role of depression.

In summary, guided by coping theories the present study hypothesizes that an adolescent struggling with depression is at risk for peer victimization and is likely to use substances to cope with the negative affect of depression and the consequent peer victimization.

Family-level Influences

The family is the primary social context in which children develop and it continues to be a salient developmental context in early adolescence. Family conflict has a deleterious effect on the adolescent's psychological health (Adam & Chase-Lansdale, 2002; Bakker, Ormel, Verhulst & Oldehinkel, 2011; Forman & Davies, 2003). Family conflict includes conflict between adults in the family as well as negative behaviors directed towards the adolescent from parents or siblings. Negative family experiences disrupt the safety and supportiveness of his/her primary support system and socializing context (Bakker et al., 2011; Forman & Davies, 2003; Gestsdottir & Lerner, 2008). Victimization in the family context in general has been found to put adolescents at risk for victimization in other contexts (Mohr, 2006). Maltreatment by parents including

physical, sexual, and emotional abuse and neglect has been found to increase the risk of peer victimization (Shields & Cicchetti, 2001). Sibling aggression has also been found to be a predictor of peer victimization (Duncan, 2004). The operating mechanism is thought to be the transference of behaviors and interpersonal characteristics signaling victimization from the family setting to the peer setting (Shields & Cicchetti, 2001).

The present study examines whether such transference of interpersonal difficulties in the family context spill over into the peer context and increase the risk for peer victimization. Victimization in both family and peer contexts will likely have a debilitating effect on adolescents psychological health. It is hypothesized that one avenue that adolescents may use to cope with victimization is to use substances. The present study, therefore, examines whether family stressors, including family conflict and sibling aggression, and substance use is mediated by peer victimization.

Peer-level influences

Peer relations dominate the social world of early adolescents. The amount of time spent with peers increases in this developmental phase and peer relationships typically become the primary social context that influences social development (Larson, 1989; Rubin, Bukowski, & Parker, 2006). Consequently, to be rejected and victimized by one's peers is particularly distressing, and victimized adolescents might look to find other avenues through which to gain acceptance from peers. They may also attempt to be perceived as tough in the hope of preventing further victimization. This can result in youth engaging with delinquent peers, reputed for their defiance of rules and authority, as a means of finding belongingness and protection in a peer group (Khatri, Kupersmidt, & Patterson, 2000; Sullivan, Farrell, & Kliewer, 2006; Wong, 2009).

Substance use is one of several delinquent behaviors that make their appearance in this developmental phase. Peer influence is one of the most prominent determinants of substance use initiation in adolescence (Bauman & Ennett, 1996; Kobus, 2003). In fact, the number or percentage of substance using friends is the most potent predictor of an adolescent's substance use. Peer socialization theories suggest that peer influence operates through both direct and indirect socialization mechanisms; peers provide support and social opportunities to engage in substance use, and peers reinforce and shape attitudes toward substance use (Leventhal & Cleary, 1980; Prinstein & Wang, 2005).

Just as peer influence can encourage substance use, peer norms that condemn substance use can be a powerful deterrent to experimentation with substances and their continued use. Not all victimized youth may join (or be able to join) delinquent peer groups, so although victimized adolescent may resort to unhealthy coping mechanism, it is possible that a peer group that condemns substance use might temper the association between peer victimization and substance use. Therefore, the present study examines whether affiliation with delinquent peers moderates the relation between peer victimization and substance use.

Optimization

In addition to examining variables that explain the relation between peer victimization and substance use, it is important to examine variables that might buffer this unhealthy association. The previous section examined factors in the individual, peer, and family contexts that increase the vulnerability of victimized adolescents to engage in substance use. The following section examines variables in these same contexts that may provide protective influences for victimized adolescents, buffering them from engaging

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in substance use. Positive influences from other contexts could potentially intervene in the interpretation and experience of peer victimization, potentially ameliorating the negative psychological impact of these experiences. Identifying these variables will provide information on where prevention and intervention efforts could focus their efforts. The present study examines variables within the individual, family, and peer contexts that might have protective effects for substance use for victimized adolescents.

Individual-level Influences

As discussed above, peer victimization has several negative mental health outcomes that increase the risk that the adolescent will engage in substance use as a coping mechanism. One of the negative outcome of peer victimization is reduced self-esteem and self-worth (Jankauskiene, Kardelis, Sukys, & Kardeliene, 2008; Overbeek, Zeevalkink, Vermulst, & Scholte, 2010). Reduced self-esteem, in turn, has been found to increase the probability of adolescents engaging in substance use (Peterson, Buser, & Westburg, 2010; Wheeler, 2010; Wild, Flisher, Bhana, & Lombard, 2004).

However, attributions about the causes for being victimized mediate the psychological effects of victimization, and adolescents with higher self-esteem are more likely to attribute the cause of victimization to the perpetrator, an attribution style that is adaptive compared to attributing victimization to attributions of oneself (Kingsbury, 2004). Additionally, adolescents have multiple sources of self-esteem (Crockett, 1997). Self-esteem from different sources has been found to have differential impact on substance use (Wild, et al., 2004). Thus, although peer victimization might adversely affect self-esteem derived from the peer domain, alternative sources of self-esteem may compensate for this, and buffer the negative coping response of substance use from peer

victimization. The present study examines this hypothesis and will test whether the protective effects of self-esteem mediate the relation between peer victimization and substance use.

Family-level Influences

As mentioned earlier, the family is the primary context in which children develop socially and psychologically. Adolescents may have achieved adequate social and psychological development in the family context, but still find themselves at the receiving end of peer victimization in school. Children who were not bullied in elementary school may find themselves the targets of victimization when they enter middle school (Espelage & Swearer, 2003). This is a challenging experience for youth who have been socially successful thus far, and presents them with a challenging obstacle to psychological health. However, despite the negative experiences in the school context, it is possible that continued positive experiences in the family context can shield the adolescent from engaging in unhealthy behaviors to cope with the negative feelings associated with being victimized (Espelage & Holt, 2006; Peterson et al., 2010). Thus, family social support is posited to be a strong protective factor in the association between peer victimization and substance use.

Parental monitoring has also been found to be a strong deterrent for substance use in early adolescents (Berch, Hagguist, & Starrin, 2011; Pederson & Skrondal, 1996). When adolescents feel that their parents are interested and active in keeping track of their activities, friends, and interests they refrain from engaging in delinquent behaviors including substance use (Kiesner, Poulin, & Dishion, 2010). This study examines whether family closeness, conceptualized to be a combination of family social support

and parental monitoring moderates the effect of peer victimization on substance use in early adolescence.

Peer-level Influences

Peer victimization can be particularly painful in early adolescence given the salience of the peer context in this developmental phase. However, victims are not always universally targeted by all their peers. If the victims have peers with whom they have positive relationships, it is possible that the negative effects of the victimization from select peers may be buffered. Positive relationships with some peers may help the victim attribute the victimization behaviors to the perpetrator rather than their own deficiency (Kingsbury, 2004). This positively impacts their interpretation of and coping with the victimization experiences. Thus, positive peer relationships potentially buffer the harmful psychological consequences of peer victimization, which in turn might reduce the likelihood of substance use in early adolescence.

No studies were found that examine the impact of peer social support on the relation between peer victimization and substance use. However, research has shown that positive peer relations are an effective means of helping youth who are trying to recover from substance abuse and stay away from substances (Page, Hammermeister, & Roland, 2002; Rowe, Bellamy, Baranoski, Wieland, O'Connell, Benedict, Davidson, Buchanan, & Sells, 2007; Smith, Cleeland, & Dennis, 2009). Positive peer relations provide youth the necessary social support required to overcome addiction, as well as avenues for other healthier activities. Peer social support is therefore a potential protective factor for substance use (Sobocinski, 1993; Wills, Resko, Ainette, & Mendoza, 2004). The present

study examines the protective role of peer social support and will examine whether peer social support mediates the relation between peer victimization and substance use.

Summary and Research Questions

The relation between peer victimization and substance use has only recently become a subject of investigation. Although research has documented the association between the two constructs the directionality of the relation is not clear. Additionally, few studies have examined additional constructs that might help explain this relation, particularly in early adolescence when initial exposure and contact with substances typically occurs. Specifically, research is needed to understand the risk and protective factors present in the different contexts in which adolescents develop. Additional research will serve to understand the complexity of this association and identify the levers for change to ameliorate substance use in this young population. The present study aims to address this need by examining the impact of individual and contextual variables on the association between peer victimization and substance use in a longitudinal sample of middle school students. It presents hypotheses for the nature of these associations based on previous research. However, given the limited research on this topic, the hypothesized transactional model of development, and the exploratory nature of this dissertation, several permutations of the variables in question will be examined to identify longitudinal associations. Longitudinal structural equation modeling (SEM) will be utilized to explore the following research questions (organized by context):

RQ1. How are peer victimization and substance use related across the middle school years?

RQ2. Does peer victimization mediate the relation between depression and substance use?

RQ3. Does self-esteem mediate the relation between peer victimization and substance use?

RQ4. Does peer victimization mediate the relation between family conflict and substance use?

RQ5. Does family closeness moderate the relation between peer victimization and substance use?

RQ6. Does affiliation with delinquent peers moderate the relation between peer victimization and substance use in early adolescence?

RQ7. Does peer social support mediate the relation between peer victimization and substance use?

Chapter 3

Methods

The present study involves secondary data analysis of a subset of longitudinal data collected from four middle schools in Illinois as part of a larger grant-funded investigation of risk and protective factors for bullying and sexual violence experiences.

Participants

Participants for the original study included 1132 middle school students (grades 5-7) from four schools in a mid-western city (51% Black, 34% Caucasian, 3% Hispanic, 3%Asian, 1% Native American/Indian, 8% Other). The sample was almost evenly distributed among males and females (49.1 % female). Data were collected over four waves including Spring 2008, Fall 2008, Spring 2009, and Fall 2009 and included three cohorts (5th graders in 2008 – 7th graders in 2009; 6th graders in 2008 – 8th graders in 2009; $7th^{th}$ graders in 2008 – 9th graders in 2009).

Measures

Participants completed a survey including demographic variables and a battery of scales. The questionnaire included questions about their sex, age, grade, and race. For race, participants were given six options: African-American (not Hispanic), Asian, White (not Hispanic), Hispanic, Native American, and Other (with a space to write in the most appropriate racial descriptor).

Independent variable:

Victimization from peers was assessed using the University of Illinois Victimization Scale (UIVS; Espelage & Holt, 2001). Students were asked how often the following things happened to them in the past 30 days: "Other students called me names"; "Other

students made fun of me"; "Other students picked on me"; and "I got hit and pushed by other students". Response options include "Never", "1-2 times", "3-4 times", "5-6 times", and "7 or more times." Factor loadings ranged from .55 through .92 for these items, which accounted for 6% of the variance in the factor analysis. Higher scores indicate more self-reported victimization. The Cronbach alpha coefficient for current study was .79.

Dependent variable:

Substance use was assessed with an 8-item scale (Farrell, Kung, White, & Valois, 2000) which asked students to report how many times in the past year they used alcohol and/or drugs. The scale consisted of items such as, "Smoked cigarettes", "Drunk liquor", and "Used inhalants". Responses are recorded on a 5-point Likert-type scale with options ranging from 1 (Never) to 5 (10 or more times). A Cronbach's alpha of .87 was found with a sample of urban adolescents and .88 with a sample of rural adolescents (Farrell, Kung, White, & Valois, 2000). The authors also reported positive correlations with risk behaviors such as Self-Reported Delinquency and negative correlations with positive behaviors and school attendance (Farrell, Kung, White, & Valois, 2000). In the current study, the Cronbach's alpha was .90.

Risk and protective factors at different levels in the socio-ecological framework were measured using the following instruments:

Person-level variables

Depression was assessed using the *Orpinas Modified Depression Scale.* This 6-item scale (Orpinas, 1993) asked adolescents to indicate how often they felt or acted certain ways in the previous 30 days. Examples include: "Did you feel happy", and "Did

you feel hopeless about your future." Responses were recorded on a 5-point Likert-type scale with options ranging from 1 (Never) through 5 (Almost Always). Scores were calculated by summing all responses, with a possible range of 6 to 30, with higher scores indicating more depressive symptoms. The Modified Depression Scale has demonstrated good internal consistency ($\alpha = .74$) when administered to adolescents aged 10 to 18 (Orpinas, 1993). In the current study, good internal consistency reliability was found with a Cronbach alpha of .82.

Self-Esteem will be assessed using the 4-item *Self-Esteem Subscale* from the *Weinberger Adjustment Inventory-Distress scale* (Weinberger & Schwartz, 1990. Respondents were asked to think about how often their feelings align with the items on the scale. Examples included: "I feel I can do things as well as other people can", and "I feel that I am a special or important person". Responses were recorded on a 5-point Likert-type scale with options ranging from 1 (Never) through 5 (Almost Always). Weinberger and Bartholomew (1996) found a Cronbach's alpha coefficient of .92 for the entire Distress Scale. When a confirmatory factor analysis was conducted by the scale developers (Weinberger, 1997), the self-esteem subscale was found to have a coefficient alpha of .77 for 10 to 17 year old youths in a non-clinical sample ($n = 184$).

<u>Family-level variables</u>

The Family Conflict and Hostility Scale (Thornberry, Krohn, Lizotte, Smith, & Tobin, 2003) was used to measure the level of perceived conflict and hostility in the family environment. The scale contained three items from a larger survey designed for the Rochester Youth Development Study. Respondents indicated on a 4-point scale how often hostile situations had occurred in their families in the past 30 days. Responses range

from 1 (*Often*) through 4 (*Never*). Responses were averaged to compute a total score. Scores ranged from 1 through 4 with higher scores indicating higher levels of family conflict and hostility. Psychometric properties will be evaluated in the current study.

A *sibling aggression perpetration* scale was created for this study and included five items that assessed the aggression between siblings. Items were selected from the University of Illinois Bullying Scale in order to parallel that scale. Five items emerged as a scale in factor analysis, viz.: I upset my brother or sister for the fun of it; I got into a physical fight with my brother or sister; I started arguments with my brother or sister; I hit back when a sibling hit me first; and I teased my siblings for the fun of it. A Cronbach alpha coefficient of .81 was found for this study.

The *Parental Supervision subscale* from the *Seattle Social Development Project* (Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002) was used to measure respondents' perceptions of established familial rules and perceived parental awareness regarding school work and attendance, peer relationships, alcohol or drug use, and weapon possession. The subscale included 8 items measured on a 4-point scale ranging from 1 (never) to 4 (always). Example items included, "My family has clear rules about alcohol and drug use" and "My parents ask if I've gotten my homework done." As reported in Measuring Violence-Related Attitudes, Behaviors, and Influences Among Youths: A Compendium of Assessment Tools (CDC, 2005), internal consistency was reported to be a Cronbach's alpha of .83. In the current study at Wave 1, the scale had a Cronbach's alpha of .86.

Family social support was measured using the family subscale from the *Vaux Social Support Record.* The VSSR is a 9-item questionnaire that is an adaptation of

Vaux's (1986) Social Support Appraisals (SSA) 23-item scale that was designed to assess the degree to which a person feels cared for, respected, and involved (Vaux, 1986) The family subscale included three items that measure the support available from the family. Scores range from 0 to 6, with higher scores indicating greater perceived support. A sample item is "There are people in my family I can talk to, who care about my feelings and what happens to me." The family subscale showed good internal consistency across samples. Mean Cronbach alpha coefficients were.80 for the five student samples, and .81, and for the five community samples. Internal consistency reliability for the family social support scale was .78-.82.

Peer-level variables

Peer delinquency was assessed using the *Friend's Delinquent Behavior-Denver Youth Survey* (Institute of Behavioral Science, 1987). This 7-item scale asked students to report how many of their friends, in the past year engaged in delinquent behaviors, including: "Hit or threatened to hit someone", "Purposely damaged or destroyed property that did not belong to them", and "Used alcohol". Responses were recorded on a 5-point Likert-type scale with options ranging from 1 (None of Them) through 5 (All of Them). A Cronbach's alpha of .89 was found in the original study. In the current study, the scale had a Cronbach's alpha of .88.

Peer social support was measured using the peer subscale from the *Vaux Social Support Record.* The VSSR is a 9-item questionnaire that is an adaptation of Vaux's (1986) Social Support Appraisals (SSA) 23-item scale that was designed to assess the degree to which a person feels cared for, respected, and involved (Vaux, 1986). The peer subscale included three items that measured the support available from the peer group.

Scores range from 0 to 6, with higher scores indicating greater perceived support. A sample item is "I have friends I can talk to, who care about my feelings and what happens to me." The SSA peer subscale showed good internal consistency across samples. Mean Cronbach alpha coefficients were.84 for the five student samples, and .84 for the five community samples. Internal consistency reliability for the peer social support subscale was estimated to be .83-.87.

Procedures

Because the proposed study will involve secondary data analysis, the research procedures described have already occurred. In early Spring 2008, the primary investigator attended parent-teacher conferences and staff meetings and announced the study in school newsletters, district newsletters, and emails from school principals. Letters describing the study purpose and procedures were sent to parents through mail and through email from the school principals along with parental consent forms for his/her child's participation in the data collection. Parents were asked to return the form only if they did not want their child to participate in the study. In addition, to ensure that participants understood their rights and risks, signed student assent forms were obtained at each data collection time point. After the assent script was read out loud to students whose parents had passively consented to their participation, students were asked to indicate their consent by signing the first page of the survey. Students were told that their participation was strictly voluntary and they could stop responding at any point during the survey and skip questions they did not want to answer. Students were also told that their answers would remain confidential unless they indicated that they had intentions of harming themselves or that someone else was harming them. They were also told that

their names would be converted to numbers and removed from their survey answers before data entry.

The self-report surveys were administered in classrooms of 20 to 25 students during designated class periods. Survey administration lasted approximately 40 minutes. At each data collection, trained graduate and undergraduate students read the survey items out loud to participants, monitored participants' progress, and ensured data integrity by answering questions and noting when participants appeared to be responding randomly to survey items. The importance of privacy was emphasized during survey administration and students were given a blank sheet of paper to cover their answers as they worked. The same study procedures were repeated in Spring 2008, Fall 2008, Spring 2009, and Fall 2009. However, data collection occurred over two consecutive days in Spring 2008 because a larger number of survey items were being piloted.

Participant names were converted to unique ID numbers within three hours of survey administration and removed from the survey and shredded. Participant names and ID numbers are stored in an Excel spreadsheet accessible only to the primary investigator. The dataset provided for the purpose of the current study only contains ID numbers. All research materials are stored on password-protected hard drives and university servers, and in locked file cabinets.

Data Analyses

Descriptive analyses were conducted using SPSS 17.0. Descriptive statistics computed included frequency tabulations, means and standard deviations for all measures, bivariate and partial correlations between major study variables, and distribution statistics (i.e., skewness and kurtosis). Longitudinal structural equation

modeling (SEM) will be the primary analytic technique used in the study. LISREL 8.8 was used to run measurement models and SEM analyses. Given the number of research questions in this dissertation and the similarity of the analyses, typical data analytic procedures will be broadly outlined to avoid repetition.

Data obtained for this secondary data analysis had undergone missing data imputation to manage missingness in the dataset due to item non-response and attrition. A multiple imputation procedure was employed to preserve the integrity of each group of respondents and create a parsimonious dataset. Using Kärnä and colleagues (2011) as a model, data were imputed with the SAS PROC MI function, using the MCMC algorithm. In total, 100 imputations were conducted separately for the entire sample population using scale approximations due to the overall size of the sample and the total number of variables. Next, the average imputed value for each missing data point was calculated, which according to Kärnä and colleagues "represents the best population estimate of the value needed to reproduce the population parameters" (p. 55). Overall, one parsimonious data set was created, which best represents the sample population.

If the number of items measuring a construct was large, they were parceled. An item-to-construct balance method was used to develop parcels for all of the scales (Little et al., 2002). In order to have a just identified model, items from the scales were parceled into three predictor parcels for each latent construct. To do this, a single item exploratory factor analysis was run in SPSS using maximum likelihood estimation with one fixed factor. Items were divided into three parcels based on the factor loading of each item onto the single factor and these items were averaged to create the parcel value. Items were averaged, as opposed to summed, to reflect the actual scale that was used to record the

item-level information as well as maintain comparable metrics between parcels. The advantages of parcels over single items include greater reliability, more communality, a higher ratio of common-to-unique factor variance, reductions in distributional violations, and decreased chance for correlated residuals or dual loadings (Little, Cunningham, Shahar, & Widaman, 2002). Internal reliabilities (i.e., Cronbach's α) for each scale were calculated using parceled indicators (Roche, Ghazarian, Little, & Leventhal, 2011).

The equivalence of measurement was examined to establish that constructs were comparable across time points,. A confirmatory factor analysis procedure using a structural equation model framework was conducted across the variables in each analysis to ensure that the constructs investigated were measured equivalently across all time points. Three levels of invariance were tested: Configural invariance (which establishes that the pattern of fixed & free parameters is the same), weak factorial invariance (which establishes that the relative factor loadings are proportionally equal across time) and strong factorial invariance (which establishes that the relative indicator means are proportionally equal across groups). The effects-coding method of scaling for the latent constructs was used in these analyses. This method maintains the original metric of the observed variables in the latent construct form and the latent construct values, therefore, have meaningful interpretations (Little, Slegers, & Card, 2006). The factor loadings for the constructs at all time points were examined for statistical significance and the completely standardized factor loadings are reported for each analysis.

To examine model fit throughout each step, several statistics are reported. First, the chi-square statistic divided by the degrees of freedom was examined to assess the overall model fit. While chi-square is overly sensitive to sample size, it is usually the

null-hypothesis significance test (Cheung & Rensvold, 2002), and a chi-square/df ratio below 3 is often considered an acceptable fit (Kline, 1998). Additionally, several relative fit indices were examined, as they may be more appropriate in predicting model fit because they are less reliant on sample size (Hu & Bentler, 1999; Immekus & Maller, 2009). For this study, the Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) were used. TLI, and CFI scores greater than .95 are considered an acceptable fit (Pinterits, Poteat, & Spanierman, 2009; SchermellehEngel, Moosbrugger, & Müller, 2003), and RMSEA scores of above .1 are considered a poor fit, between .08 and .1 a mediocre fit, between .05 and .08 an acceptable fit, .01 and .05 a close fit, and .00 an exact fit (Hu & Bentler, 1999). Finally, Cohen's *d* is reported as a measure of effect size for latent mean differences (Cohen, 1988). Once model fit and measurement equivalence was established a structural model was imposed on the data.

The structural model that was used to examine the initial relation between peer victimization and substance is shown in Figure 1. This model explores the transactional nature of the association between peer victimization and substance use. This model included cross-lagged and auto-regressive paths moving forward in time for both the latent variables. Cross-lagged paths were included to examine predictive associations between the two constructs across time while auto-regressive paths were included to control for previous levels of the construct. All possible cross-lagged and auto-regressive paths moving one step forward in time were included in the initial structural model.

Figure 1. Transaction model (only structural paths shown)
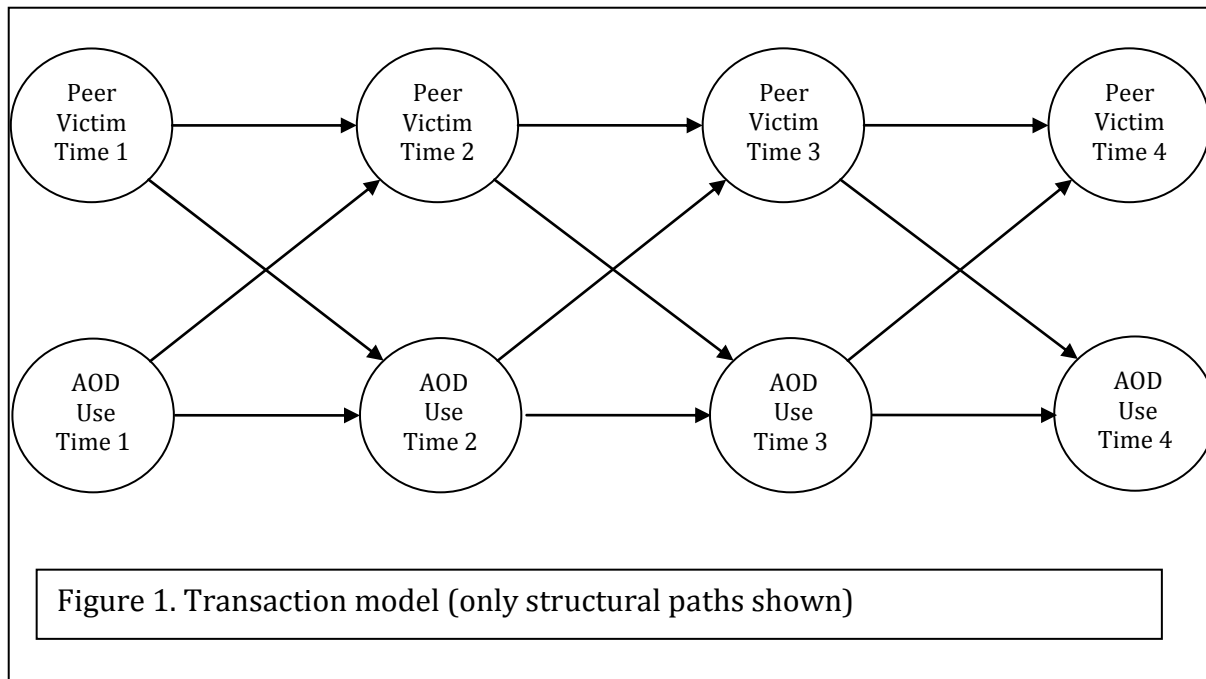
Non-significant paths were then pruned from the model. Based on the modification indices suggested by the statistical software output, additional paths were tested for significance for inclusion in the model. These additional paths included cross-lagged and auto-regressive paths from latent variables that predicted constructs more than one wave after themselves. Additionally, demographic characteristics including gender, race, grade and school were included as covariates in all the analyses to control for their influence on the model.

Mediation effects were examined using a product-of-coefficients test. This test is the product of the estimate of the effect of the independent variable on the potential mediator (*a*) and the estimate of the potential mediator on the outcome variable (*b*) when the independent variable predicting the outcome variable is also included in the model (Figure 2). These values were obtained within a structural equation modeling framework controlling for previous levels of the latent variables and for the covariates. The significance of the product-of-coefficients product was determined using the Monte Carlo

method for examining mediation (Selig & Preacher, 2008). This method uses the

unstandardized coefficients and standard errors obtained from the SEM to compute the

product of *a* and *b*. This is repeated a very large number of times using random sampling

and the resulting distribution of the product-of-coefficients is used to estimate a

confidence interval around the observed value of *a*b* (Selig & Preacher, 2008).

Figure 2. Structural model examining mediation (only structural paths shown)
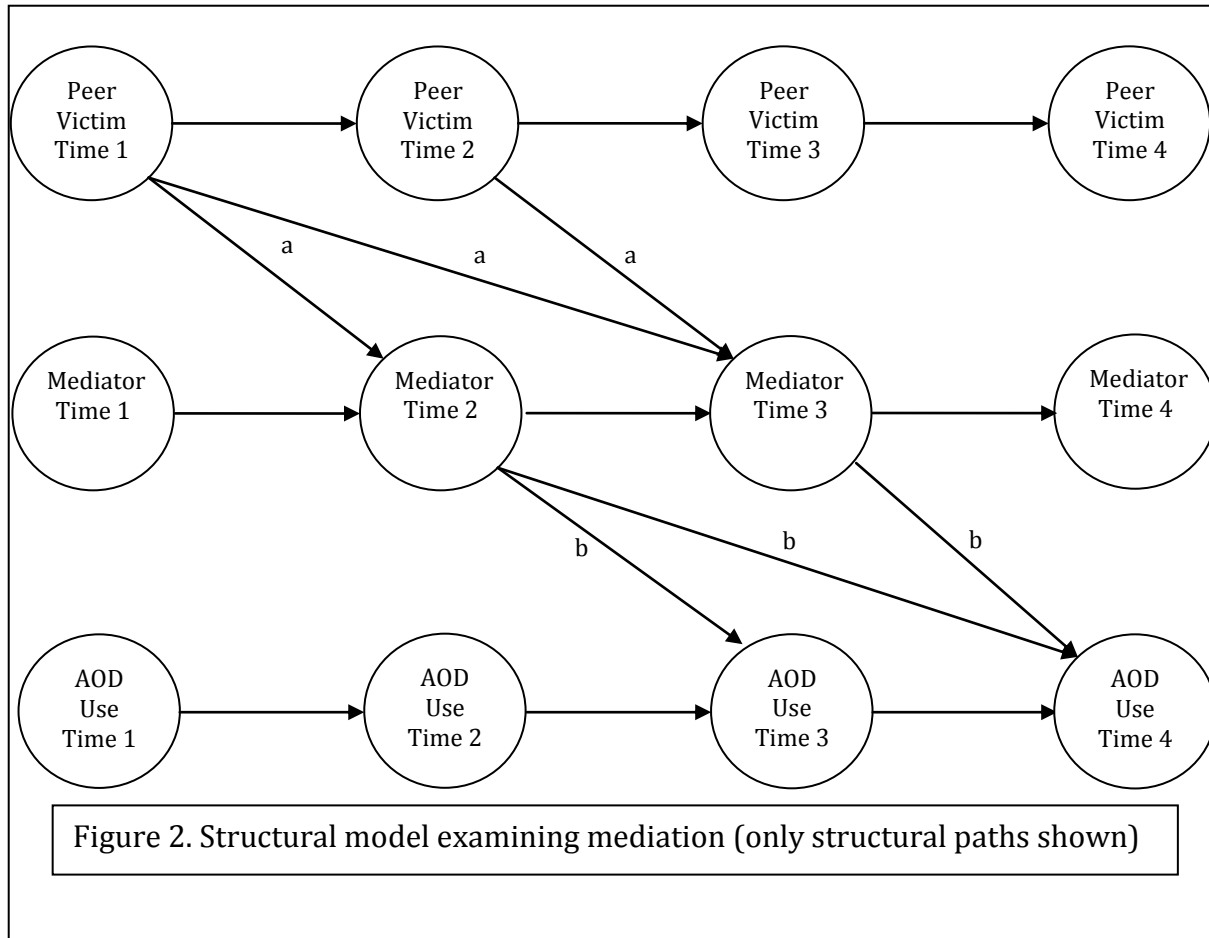
Mediation was concluded if the confidence intervals did not include zero. In the analyses

presented here the 95% confidence interval was calculated with 20,000 repetitions of the

simulation. This method for determining the significance of the indirect effect has been

developed to examine simple mediation between three variables and consequently

different combinations of three waves of data were tested to examine mediation across

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the four waves of data (viz. Wave 1 → Wave 2 → Wave 3; Wave 2 → Wave 3 →Wave 4; Wave 1 → Wave 2 → Wave 4; Wave 1 → Wave 3 →Wave 4). In each case, mediation was examined for all permutations of the variables in question. This was done to examine the temporal sequence of the three variables and identify transactional associations.

Moderation was tested within a typical structural equation modeling framework. An orthogonalized latent variable interaction construct was created using the procedure outlined in Little et al. (2006) in order address the problems of co-linearity and bouncing Beta's. A structural model was then be imposed that has all Time n constructs (except the interaction construct) predicting the constructs at Time $(n +1)$. This was done to account for the variance explained by direct associations between the constructs. The interaction construct only predicted substance use at the following time point. The significance of the path from the interaction constructs to substance use was interpreted as evidence for moderation.

Once these initial structural models were imposed, non-significant paths were removed from the model. Additional paths were added based on theory and the modification indices presented by the statistical program. The equality of the moderation between time points was examined by running a three group structural model that had all Time n constructs predicting substance use at Time $(n +1)$. The results of the final structural model was compared with the strong invariance model, and will be presented in the results.
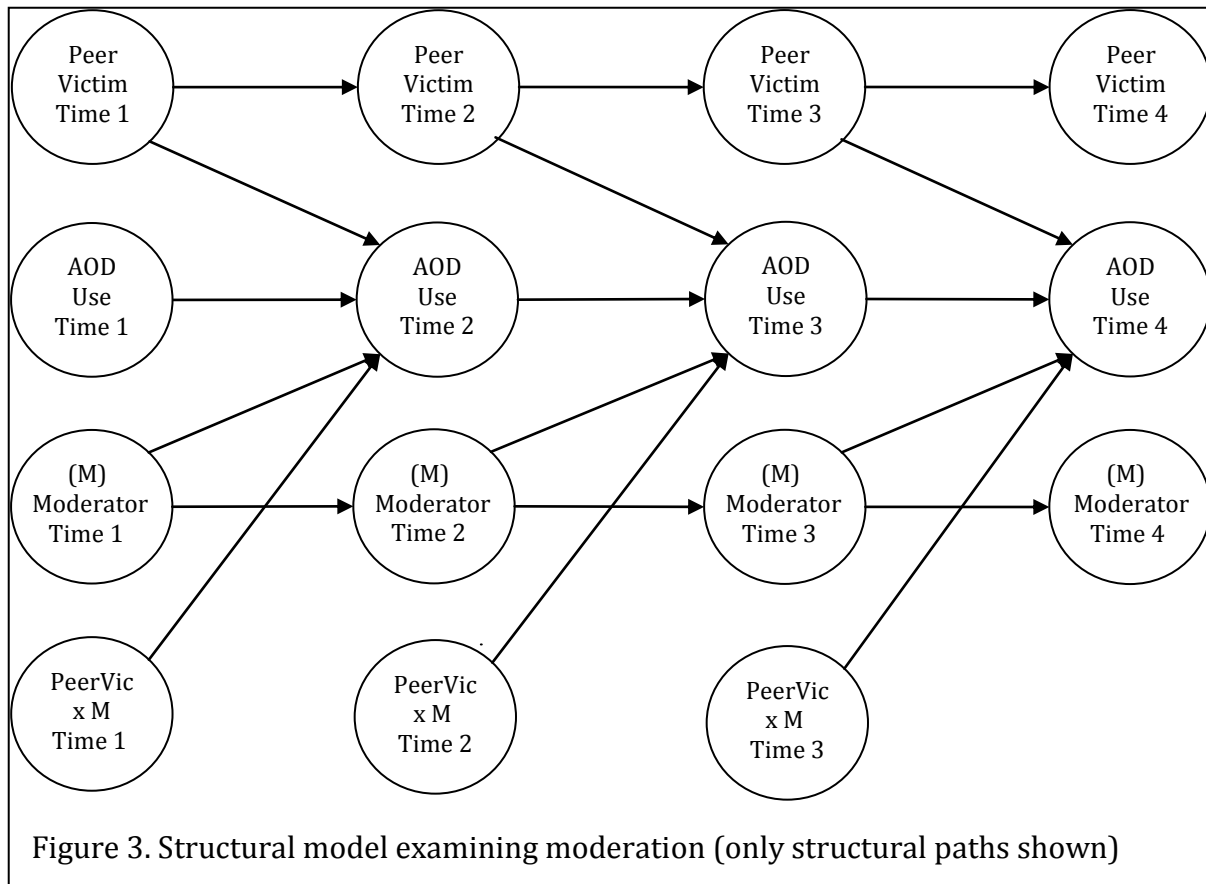
Figure 3. Structural model examining moderation (only structural paths shown)

Demographic characteristics including gender, race, grade and school were included as covariates in all the analyses to control for their influence on the model.

<center>**Chapter 4**</center>

<center>**Results**</center>

Results are summarized in this section with key information provided. Additional information from each analysis including the correlation matrices, loading and intercept values, residuals, and r-squared values for each indicator are presented in tables at the end of the document.

RQ1. How are peer victimization and substance use related across the middle school years?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for both the peer victimization and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.69 to 0.88, while those for substance use ranged from 0.76 to 0.95. The model fit for the measurement model was: $\chi^2_{(300, n=1132)} = 1051.40$ ($p < 0.001$); RMSEA = .046 $_{(0.043\,;\,0.049)}$; CFI = .966; NNFI = .943; indicating a good fit to the data. Table 1 provides the results of the model's goodness of fit tests. Table 2 provides information about individual indicators and the relationship of each to its respective construct. The correlation matrix for latent variables is presented in Table 3 from the strong factorial invariance solution.

Structural Model

Once factorial invariance was established the next step was to fit the proposed structural model. As hypothesized, the structural model provided good fit to the data, $\chi^2_{(381, n=1132)} = 1490.55$; RMSEA = .050 $_{(0.047\,;\,0.053)}$; CFI = .949; NNFI = .933. The final

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model was comparable to the strong invariance model documenting that the structural

paths imposed on the data are consistent with the patterns in the covariance matrix.

Figure 4 illustrates the final structural model. As Figure 4 shows, peer victimization

measured at consecutive time points were strongly related, as were the substance use

latent variables which indicate the relative stability of these variables over the measured

time period. These results show a transactional model, involving the cross-lagged

coefficients across the four waves. The cross-lagged effects indicated that higher peer

victimization at earlier time points were predictive of increases in substance use at later

time points and vice-versa (after controlling for previous levels of substance use). The

results also indicate that peer victimization has a delayed effect on increasing substance

use, particularly for victimization occurring in the initial middle school years. This

suggests show support for the hypothesis that peer victimization and substance use

operate within a reciprocal influence model.

Figure 4. Transactional relation between peer victimization and substance use (AOD Use).
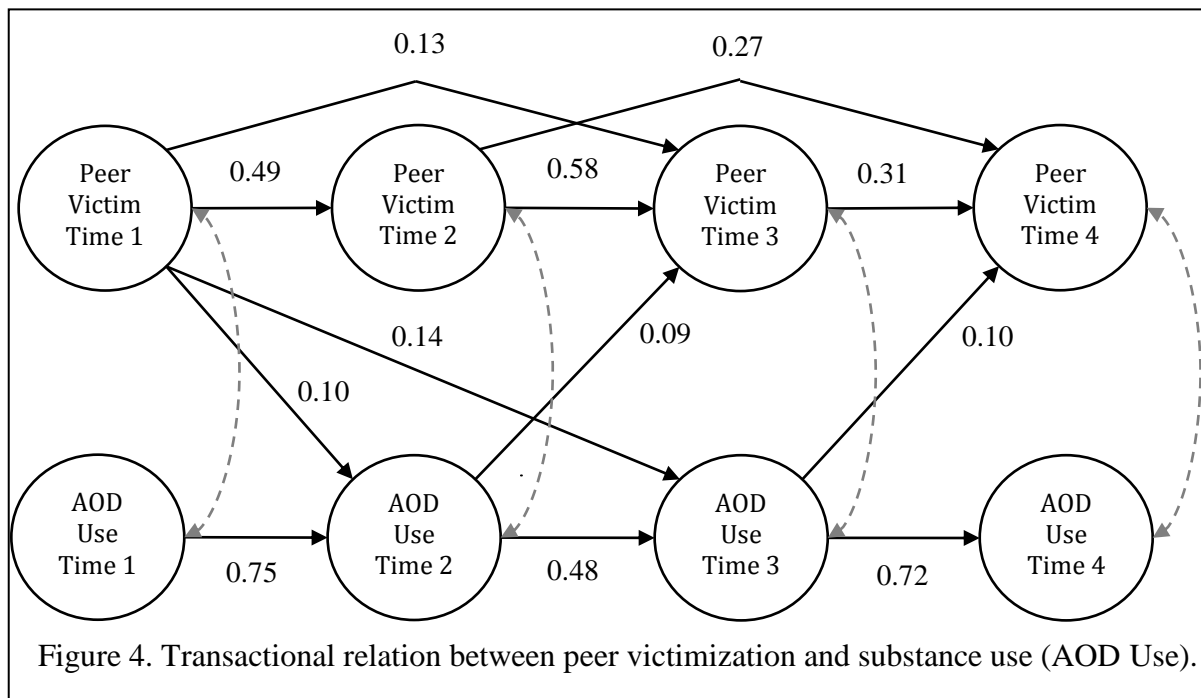
Note. Only significant structural paths shown.

RQ2. Does peer victimization mediate the association between depression and substance use?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for peer victimization, depression, and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.70 to 0.88, those for depression ranged from 0.81 to 0.92, while loadings for substance use ranged from 0.76 to 0.95. The model fit for the measurement model was: $\chi^2_{(642, \text{n}=1132)}= 1818.49$ ($p < 0.001$); RMSEA = .039 $_{(0.039 \,;\, 0.041)}$; CFI = .966; NNFI = .950; indicating a good fit to the data. Table 4 provides the results of the model's goodness of fit tests. Table 5 provides information about individual indicators and the relationship of each to its respective construct. The correlation matrix for latent variables is presented in Table 6 from the strong factorial invariance solution.

Mediational analyses

All permutations of the variables were examined in the mediation analyses to identify transactional associations.

Depression → Peer Victimization → Substance Use: Results indicated three different mediated pathways from depression to substance use through the mediator of peer victimization (Figure 5). The indirect effects differed in their sign, with one path indicating that increases in depression predicted increases in substance use as mediated through peer victimization. The direct effect was not significant indicating full mediation. The two other paths indicated that increases in depression would result in decreases in

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substance use due to changes in peer victimization. In these two pathways, the direct

effect continued to be significant, indicating partial mediation.

Substance Use → Peer Victimization → Depression: Substance use was found to predict

increases in depressive symptoms through increases in peer victimization (Figure 5). All

analyses indicated partial mediation for this permutation of variables.

Figure 5. Compiled results from mediation analyses examining associations
between depression, peer victimization, substance use (AOD Use)
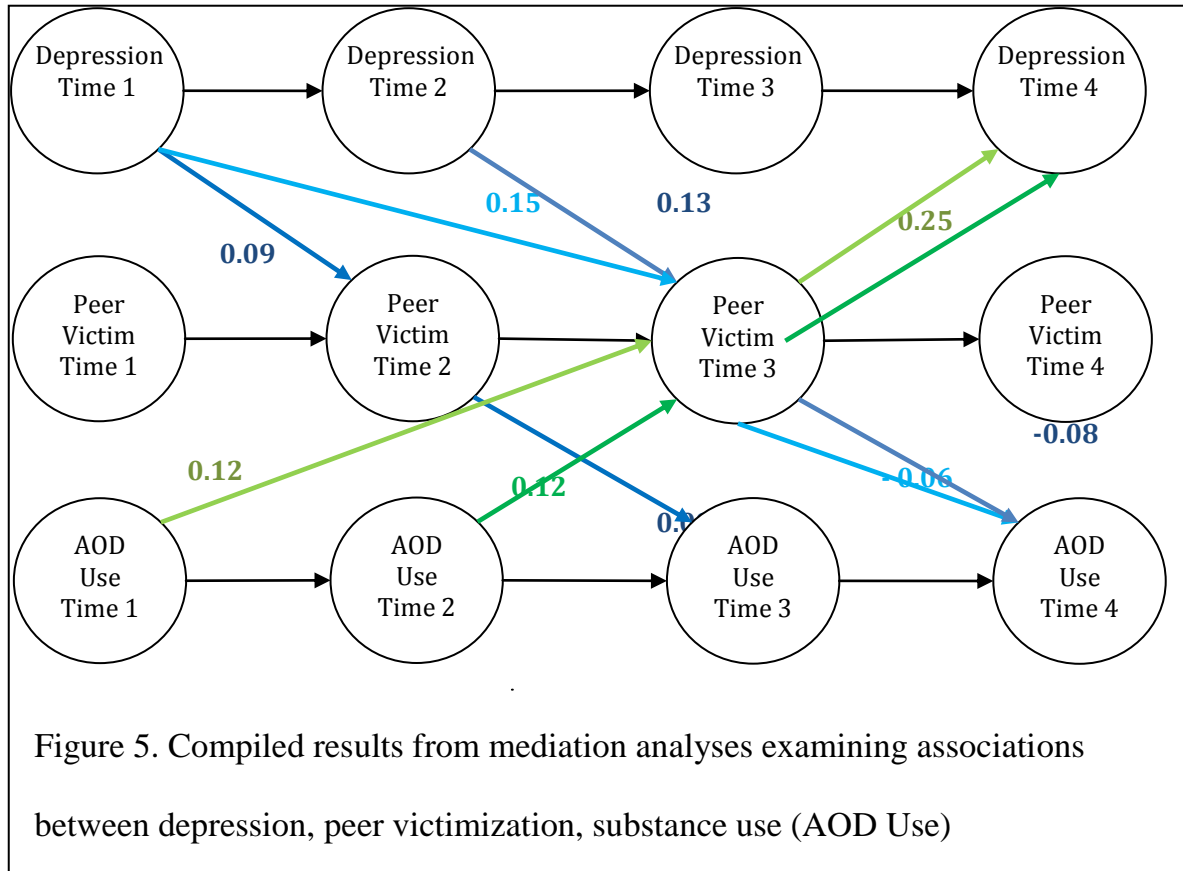
Note. Each colored pathway represents results from unique three-wave analyses.

Depression → Substance Use → Peer Victimization: Depression was also found to

predict increases in peer victimization as a result of increases in substance use (Figure 6).

Two mediation pathways were found for this result, one indicating full mediation and the

other indicating partial mediation.

Peer Victimization → Substance Use → Depression: Three significant mediation

pathways were found that indicated that peer victimization predicted increases in

depression through increases in substance use. All analyses indicated partial mediation

(Figure 6).

Figure 6. Compiled results from mediation analyses examining associations between depression, peer victimization, substance use (AOD Use)
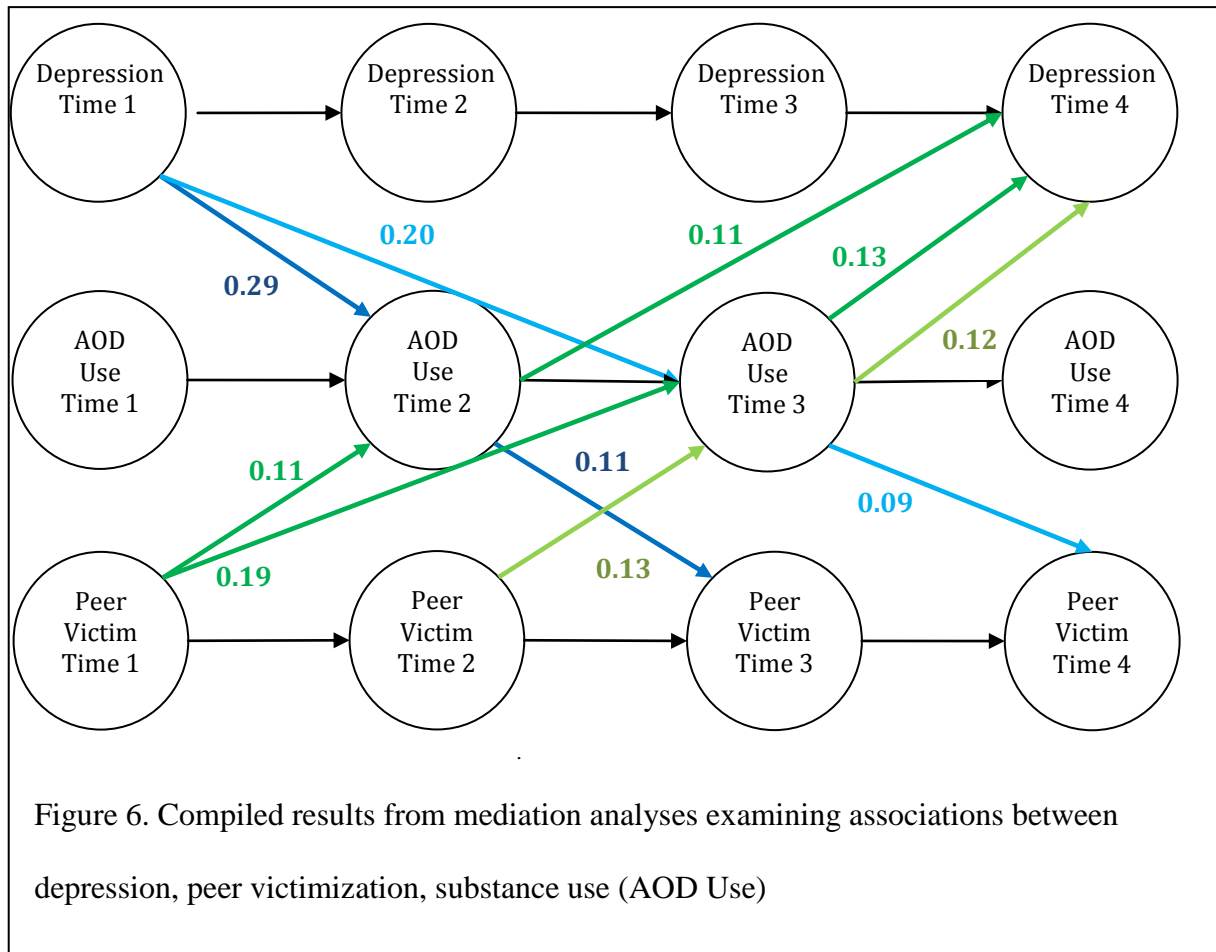
Note. Each colored pathway represents results from unique three-wave analyses.

No significant results were found when the meditational role of depression was

examined for the association between peer victimization and substance use (Peer

Victimization → Depression → Substance Use analyses and the Substance Use →

Depression → Peer Victimization analyses).

In summary, depression, peer victimization and substance use appeared to be risk factors for each other in most analyses. One finding, however, indicated that increases in depression predicted decreases in substance use through changes in peer victimization. Results of the mediation analyses are presented in Table 7.

RQ3. Does self-esteem mediate the association between peer victimization and substance use?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for peer victimization, self-esteem, and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.69 to 0.88, those for self-esteem ranged from 0.81 to 0.88, while loadings for substance use ranged from 0.76 to 0.95. The model fit for the measurement model was: $\chi^2_{(642, n=1132)}=1763.27$ (p < 0.001); RMSEA = .038 $_{(0.036\,;\,0.041)}$; CFI = .966; NNFI = .949; indicating a good fit for the data. Table 8 provides the results of the model's goodness of fit tests. Table 9 provides information about individual indicators and the relationship of each to its respective construct. The correlation matrix for latent variables is presented in Table 10 from the strong factorial invariance solution.

Mediation Analysis

All permutations of the variables were examined in the mediation analyses to identify transactional associations.

Self-Esteem→ Substance Use → Peer Victimization: Four significant indirect effects were found for the meditational role of substance use in the association between self-

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esteem and peer victimization. Higher levels of self-esteem were found to reduce levels

of peer victimization when mediated by substance use (Figure 7). Results from individual

paths indicated that higher self-esteem predicted lower levels of substance use, while

higher levels of substance use predicted higher levels of peer victimization.

Figure 7. Compiled results from mediation analyses examining associations
between peer victimization, self-esteem, and substance use (AOD Use)
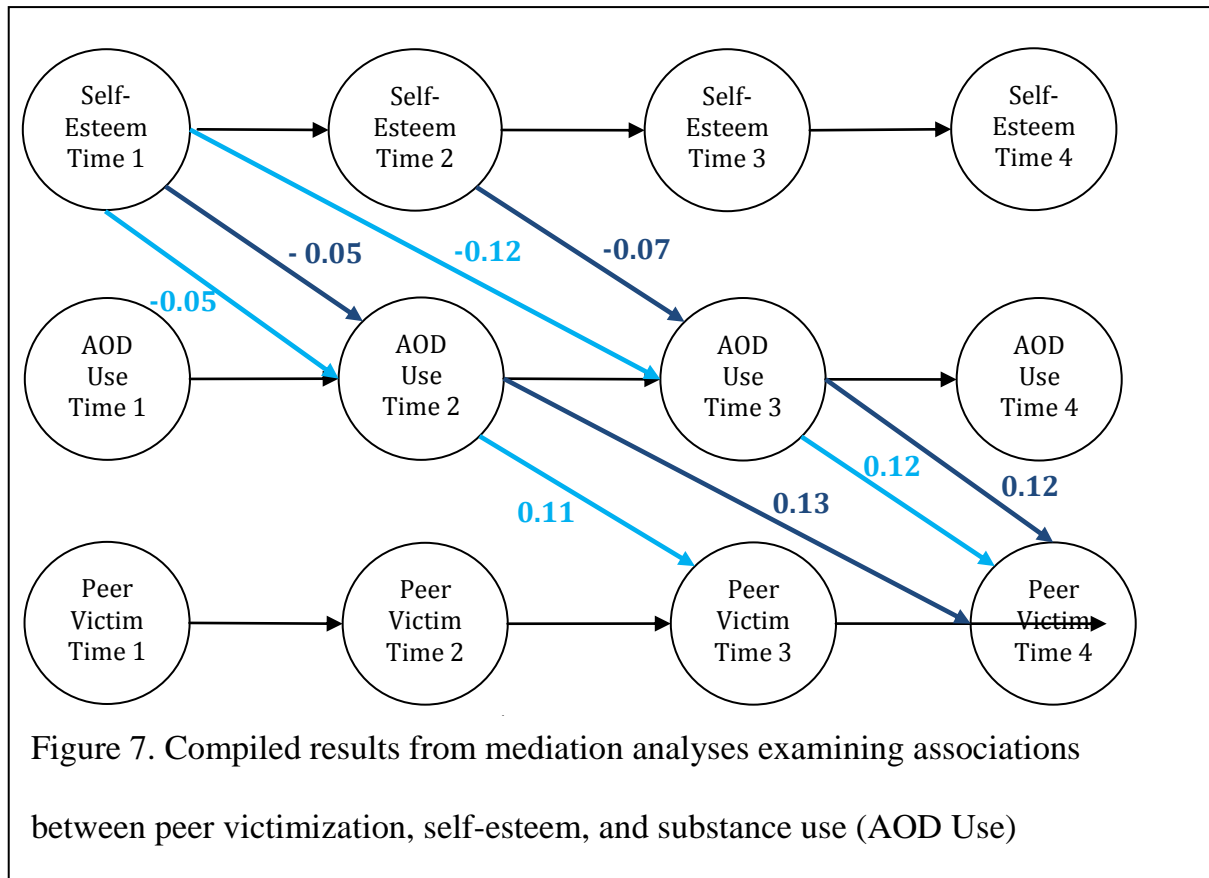
Note. Note. Each colored pathway represents results from unique three-wave analyses.

Peer Victimization → Self-Esteem → Substance Use: A significant positive indirect

effect was found when examining whether self-esteem mediated the relation between

peer victimization and substance use confirming the hypothesized relation between the

variables (Figure 8). As peer victimization increases substance use increases through peer

victimizations effect on self-esteem. Individual paths indicated that peer victimization

resulted in a decrease in self-esteem which in turn resulted in an increase in substance

use. Additionally, the direct effect from peer victimization to substance use was not

significant indicating full mediation.
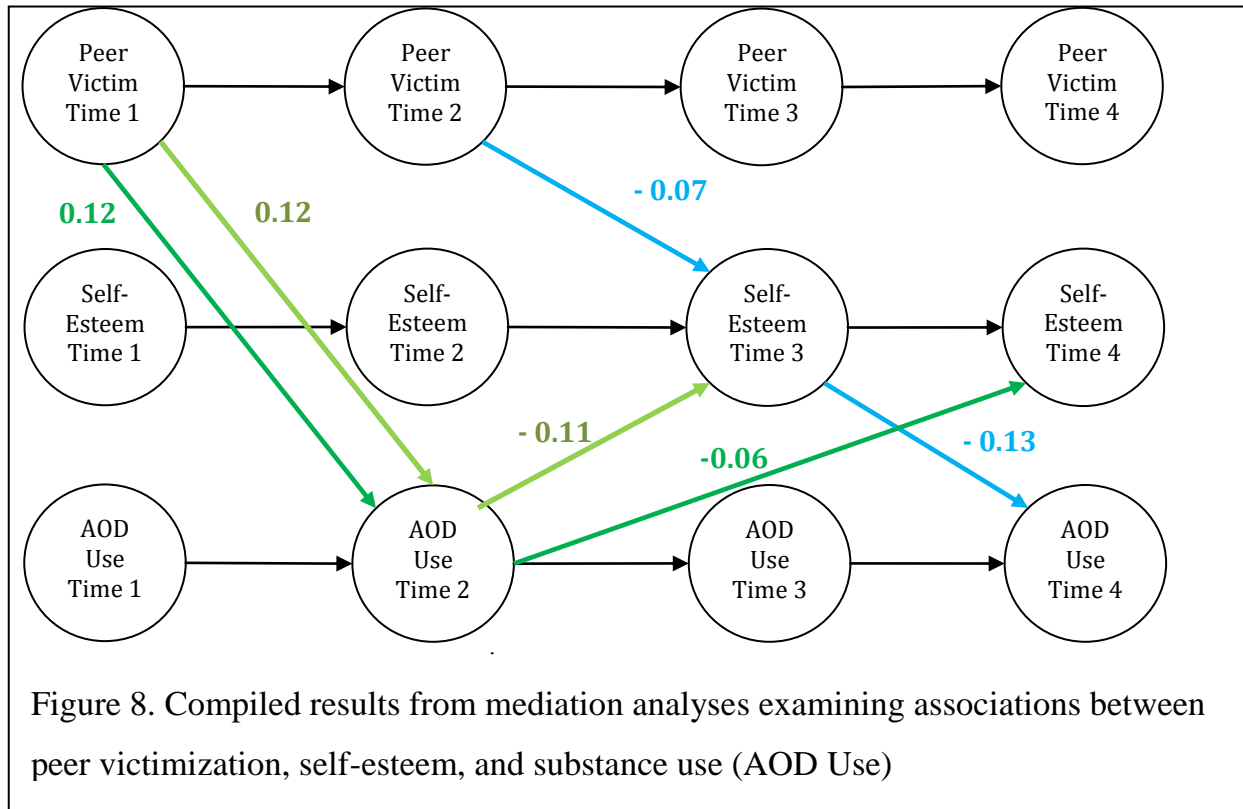
Figure 8. Compiled results from mediation analyses examining associations between peer victimization, self-esteem, and substance use (AOD Use)

Note. Three-wave analyses are color coded to separate the results.

Peer Victimization → Substance Use → Self-Esteem: Increased peer victimization was

found to reduce self-esteem when mediated fully by substance use (Figure 8). Peer

victimization predicted increases in substance use, and increased substance use predicted

lower levels of self-esteem.

In summary, self-esteem was negatively affected by increases in peer victimization and

substance use, but higher levels of self-esteem were found to buffer the transition from

peer victimization to substance use.

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Analyses examining the meditation processes from Self-Esteem → Peer Victimization → Substance Use; Substance Use → Self-Esteem→ Peer Victimization; and Substance Use → Peer Victimization → Self-Esteem revealed no significant results. Results of the mediation analyses are presented in Table 11.

RQ4. Does peer victimization mediate the relation between family conflict and substance use?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for peer victimization, family stressors, and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.70 to 0.87, those for family stressors ranged from 0.42 to 0.90, while loadings for substance use ranged from 0.76 to 0.94. The model fit for the measurement model was: $\chi^2_{(642,\ n=1132)}=2682.87$ (p < 0.001); RMSEA = .051 $_{(0.049\ ;\ 0.054)}$; CFI = .936; NNFI = .905; indicating an acceptable model fit. Table 12 provides the results of the model's goodness of fit tests. Table 13 provides information about individual indicators and the relationship of each to its respective construct. The correlation matrix for latent variables is presented in Table 14 from the strong factorial invariance solution.

Mediation Analysis

All permutations of the variables were examined in the mediation analyses to identify transactional associations.

Family Conflict → Substance Use → Peer Victimization: Family conflict predicted

increases in peer victimization as mediated by substance use across all waves of data

(Figure 9). All paths in these analyses were positive and the direct effect in two mediation

analyses was significant indicating occasional partial mediation.

Figure 9. Compiled results from mediation analyses examining associations between
family conflict, peer victimization, and substance use (AOD Use)

Note. Three-wave analyses are color coded to separate the results.

Peer Victimization → Family Conflict → Substance Use: A significant positive indirect

effect was found for peer victimization and substance use as mediated by family stressors

(Figure 10). Here, too, all paths in these analyses were positive and the direct effect in

both mediation analyses was significant indicating partial mediation.

Substance Use → Family Conflict → Peer Victimization: A positive indirect effect was

found when testing the meditational role of family conflict on the association between

substance use and peer victimization. Substance use predicted increases in peer

victimization as mediated by family conflict (Figure 10).

Figure 10. Compiled results from mediation analyses examining associations between family conflict, peer victimization, substance use (AOD Use)
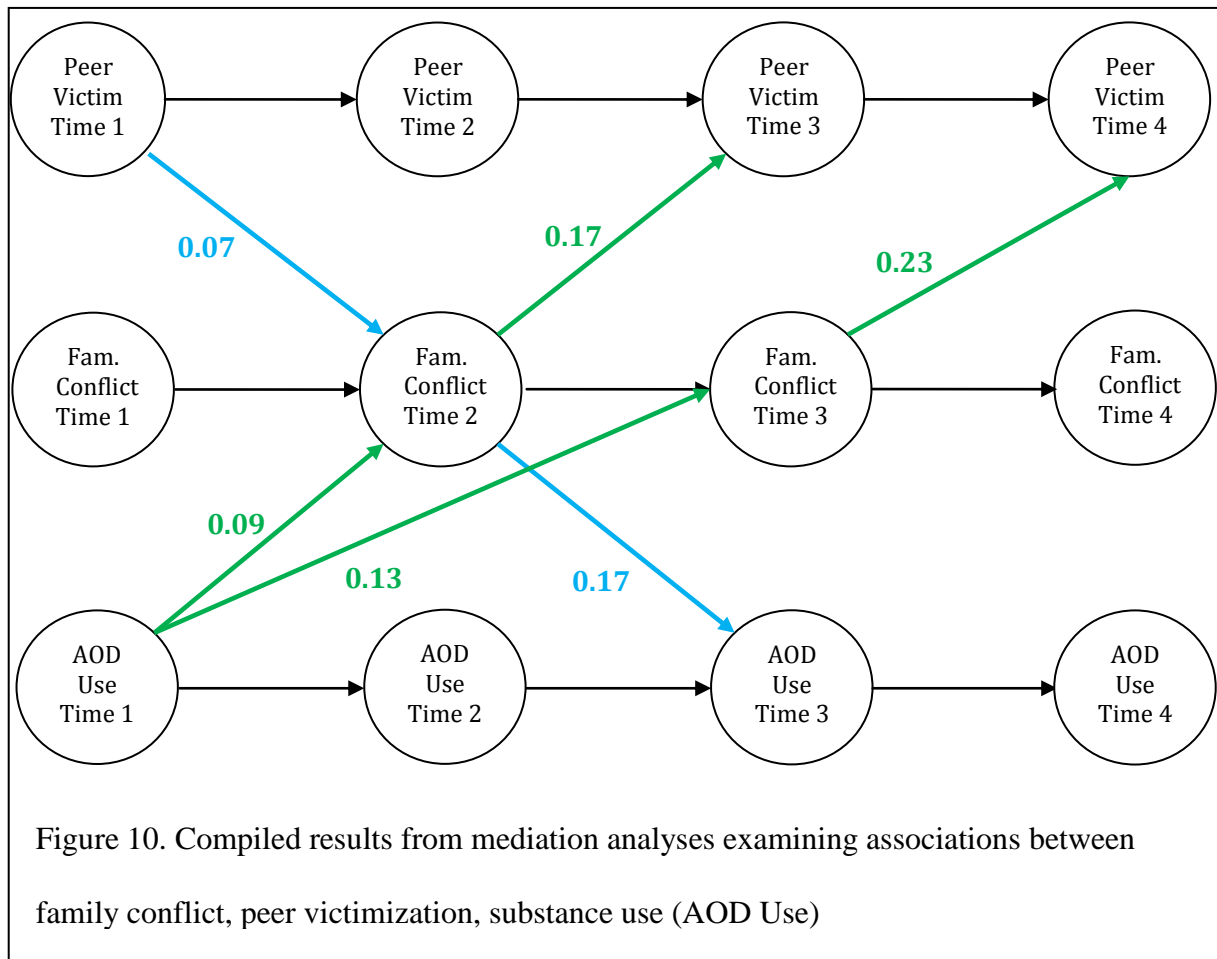
Note. Three-wave analyses are color coded to separate the results.

Family Conflict → Peer Victimization → Substance Use: A significant positive indirect

effect was found when examining whether peer victimization mediated the relation

between family conflict and substance use (Figure 11). Increased levels of family conflict

predicted increased peer victimization which predicted increased substance use. The

direct path between family stressors and substance use was significant indicating partial

mediation.

Peer Victimization → Substance Use → Family Conflict: Two positive mediation

pathways indicated that peer victimization predicted increases in family conflict as

mediated by substance use (Figure 11).

Figure 11. Compiled results from mediation analyses examining associations between

family conflict, peer victimization, substance use (AOD Use)
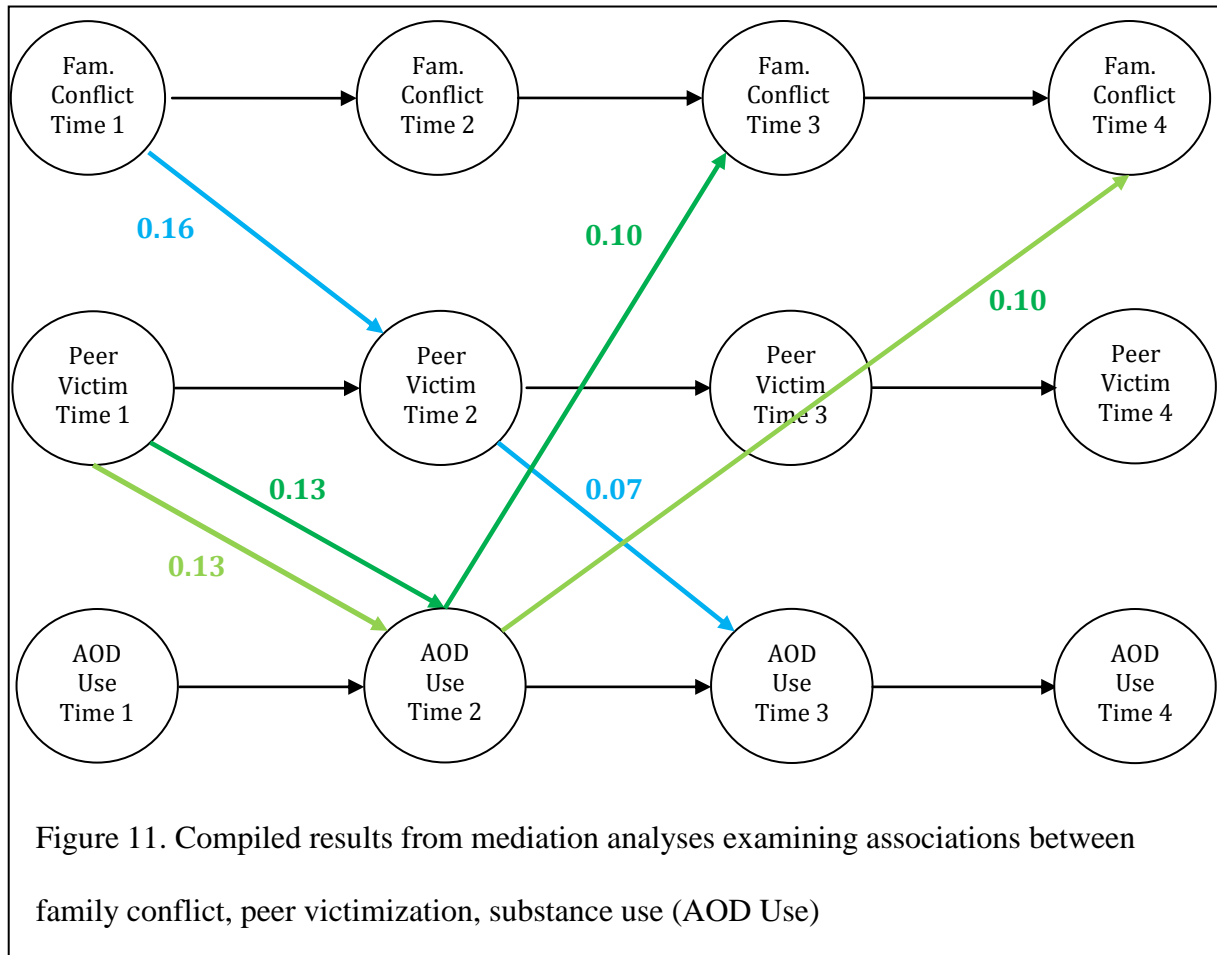
 Note. Three-wave analyses are color coded to separate the results.

Analyses examining whether peer victimization mediated the association between

substance use and family conflict revealed no significant results.

In conclusions, positive mediating associations were found among family conflict,

peer victimization and substance use. Results of the mediation analyses are presented in

Table 15.

RQ5. Does family closeness moderate the association between peer victimization and substance use in early adolescence?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for peer victimization, family closeness, and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.69 to 0.89, those for family closeness ranged from 0.43 to 0.95, while loadings for substance use ranged from 0.76 to 0.95. The model fit for the measurement model was: $\chi^2_{(642, n=1132)}=1868.62$ (p < 0.001); RMSEA = .040 $_{(0.038 ; 0.042)}$; CFI = .962; NNFI = .943; indicating a good fit to the data. Table 16 provides the results of the model's goodness of fit tests. Table 17 provides information about individual indicators. The correlation matrix for latent variables is presented in Table 18 from the strong factorial invariance solution.

Moderation analysis

Results indicated that family closeness moderated the relation between peer victimization and substance use across all waves of data, i.e., the association between peer victimization and substance use is dependent on levels of family closeness. The structural model examining moderation involved predictive paths from all variables at Time *n* predicting the focal constructs at Time *n+1*, except for the interaction construct which predicted only substance use at the following time point. Non-significant paths were removed. Figure 12 illustrates the final structural model. Additional analyses were conducted to examine whether the moderation paths were significantly different from each other. These indicated that the moderation effect from Time 1 to Time 2 was

equivalent to the moderation effect from Time 2 to Time 3; and the moderation effect

from Time 3 to Time 4 was significantly different from the other two paths.

Figure 12. Structural model from moderation analyses examining the moderating effect
of family closeness on the association between peer victimization and substance use.
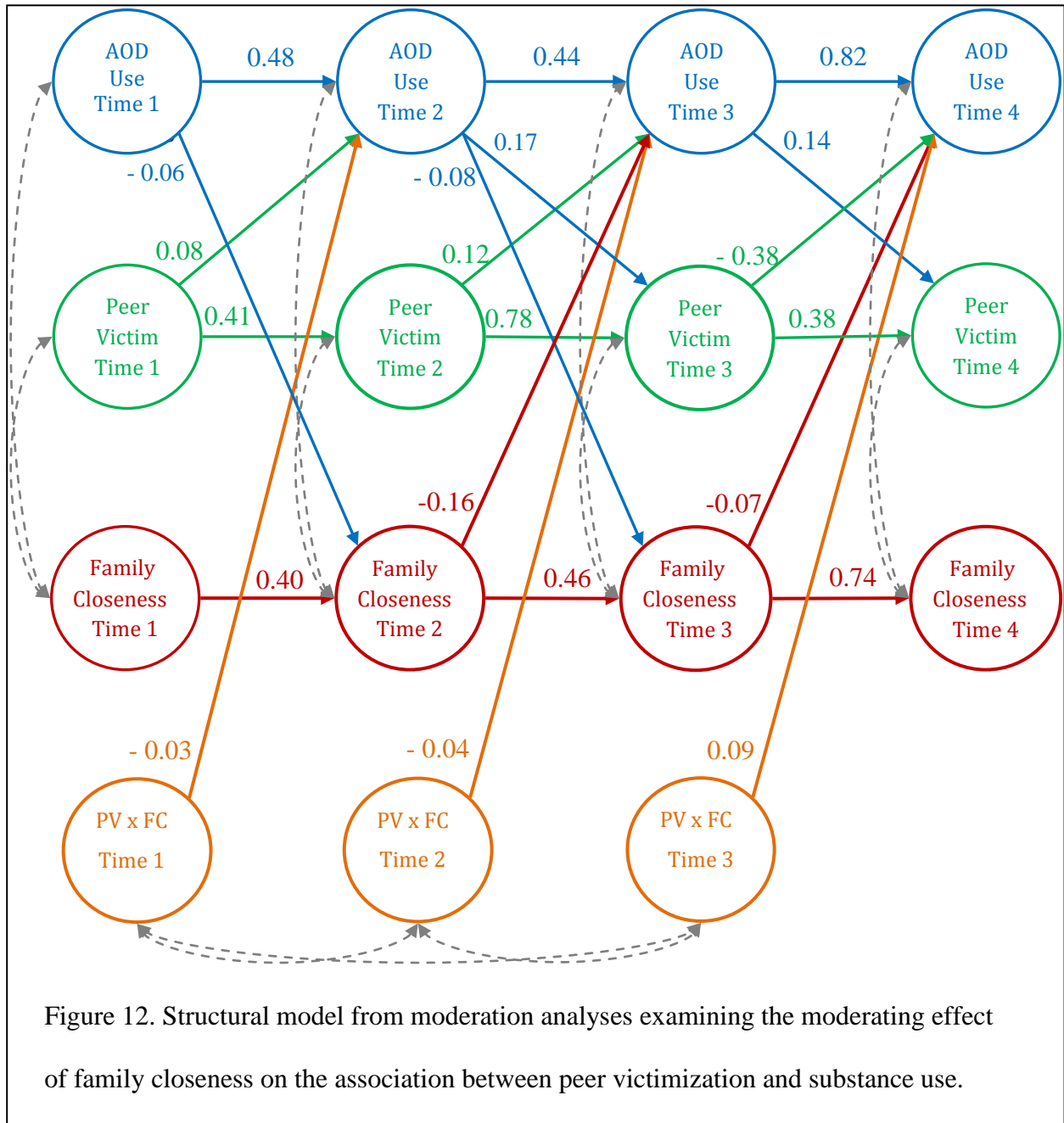
As Figure 12 shows, peer victimization measured at consecutive time points were

strongly related, as were the substance use latent variables and the family closeness

variables which indicate the relative stability of these variables over the measured time

period. As family closeness increases substance use decreases over time. In the last

moderation effect the direction of the effect changes due to the change in the path from

peer victimization to substance use from Time 3 to Time 4. The transactional association

between peer victimization and substance use is further documented in this analysis.

Additionally, a transactional association emerged between substance use and family

closeness. Increases in substance use predicted increases in peer victimization.

RQ6. Does affiliation with delinquent peers moderate the relation between peer
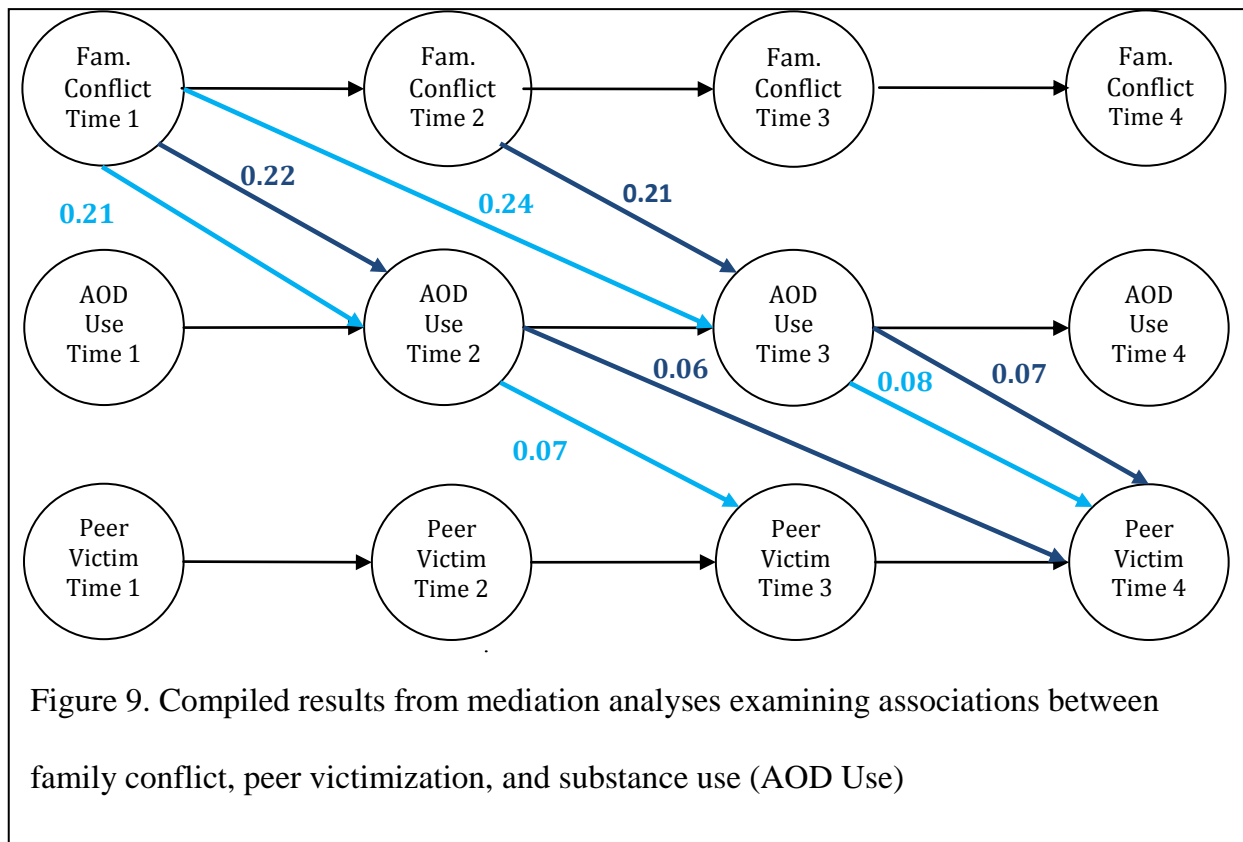
victimization and substance use in early adolescence?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions

of the latent variables. The factor loadings for peer victimization, affiliation with

delinquent peers, and substance use constructs at all time points were statistically

significant. The completely standardized factor loadings for peer victimization ranged

from 0.69 to 0.88, those for peer social support ranged from 0.74 to 0.95, while loadings

for substance use ranged from 0.78 to 0.94. The model fit for the measurement model

was: $\chi^2_{(642,\ n=1132)}$=2343.62 (p < 0.001); RMSEA = .047 $_{(0.045\ ;\ 0.050)}$; CFI = .953; NNFI =

.931; indicate good model fit. Table 19 provides the results of the model's goodness of fit

tests. Table 20 provides information about individual indicators and the relationship of

each to its respective construct. The correlation matrix for latent variables is presented in

Table 21 from the strong factorial invariance solution.

Moderation Analysis

Moderation was tested in the manner described in the previous analysis. Affiliation with

delinquent peers was found to moderate the path from peer victimization to substance use

at the first time point. Affiliation with delinquent peers moderated the association

between peer victimization and substance use from Time 2 to Time 3, i.e., the effect of

peer victimization on substance use is dependent on levels of affiliation with delinquent

peers. Figure 13 illustrates the final structural model.

Figure 13. Structural model from moderation analyses examining the moderating effect

of affiliation with delinquent peers on the association between peer victimization and
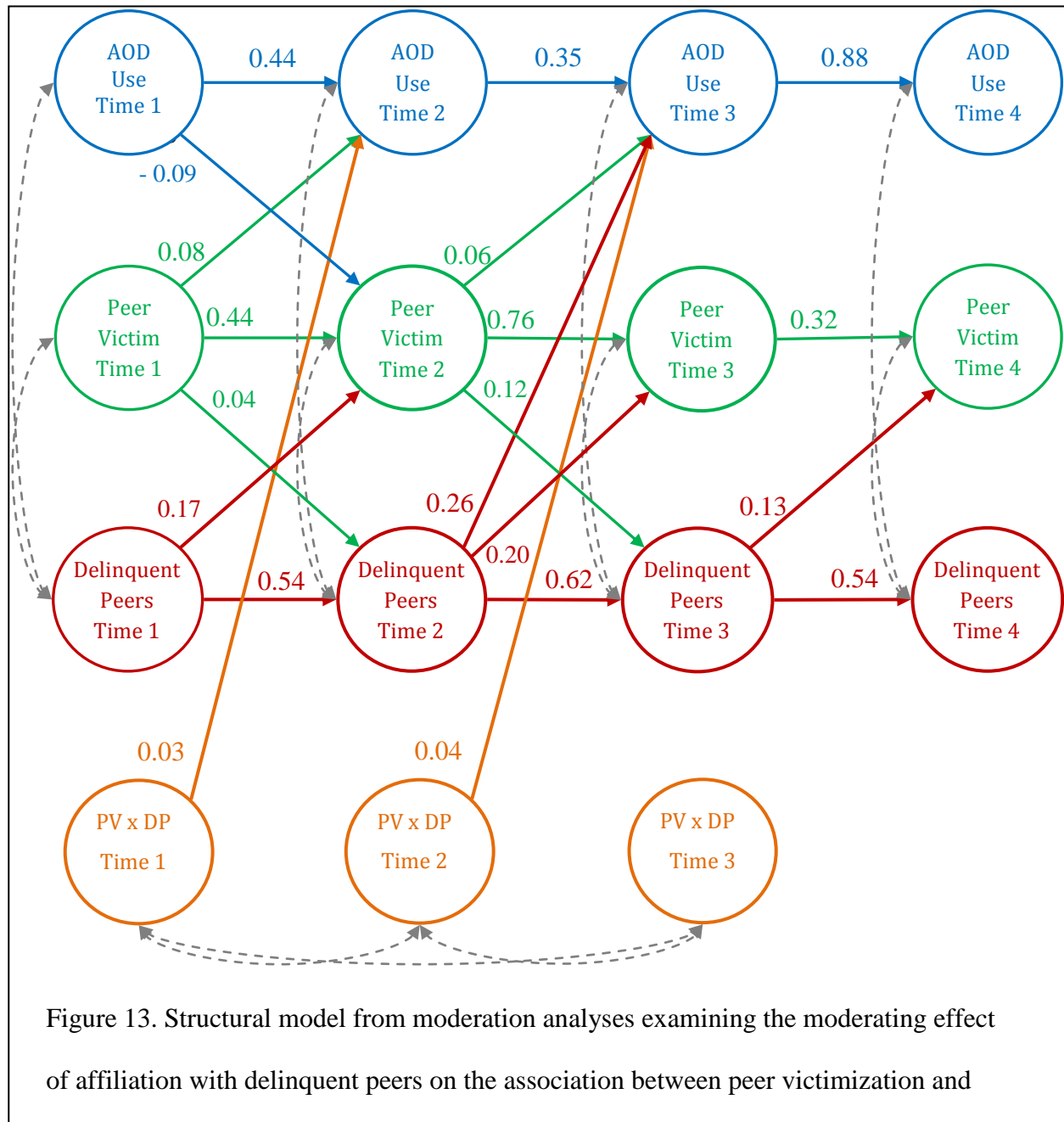
As Figure 13 shows, peer victimization measured at consecutive time points were strongly related, as were the substance use latent variables and the delinquent peers latent variables which indicate the relative stability of these variables over the measured time period.

RQ7. Does peer social support mediate the relation between peer victimization and substance use in early adolescence?

Measurement Model

Confirmatory factor analysis was used to test the measurement model and the definitions of the latent variables. The factor loadings for peer victimization, peer social support, and substance use constructs at all time points were statistically significant. The completely standardized factor loadings for peer victimization ranged from 0.69 to 0.88, those for peer social support ranged from 0.74 to 0.89, while loadings for substance use ranged from 0.76 to 0.95. The model fit for the measurement model was: $\chi^2_{(642, n=1132)}=1680.72$ ($p < 0.001$); RMSEA = .037 $_{(0.035\,;\,0.039)}$; CFI = .966; NNFI = .950; indicating a good fit to the data. Table 22 provides the results of the model's goodness of fit tests. Table 23 provides information about individual indicators and the relationship of each to its respective construct. The correlation matrix for latent variables is presented in Table 24 from the strong factorial invariance solution.

Mediation analysis

All permutations of the variables were examined in the mediation analyses to identify transactional associations.

Peer Victimization → Substance Use → Peer Social Support: Three positive mediation pathways indicated that peer victimization predicted decreases in peer social support

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when mediated by substance use (Figure 14). Increases in peer victimization predicted

increases in substance use, while increases in substance use predicted decreases in peer
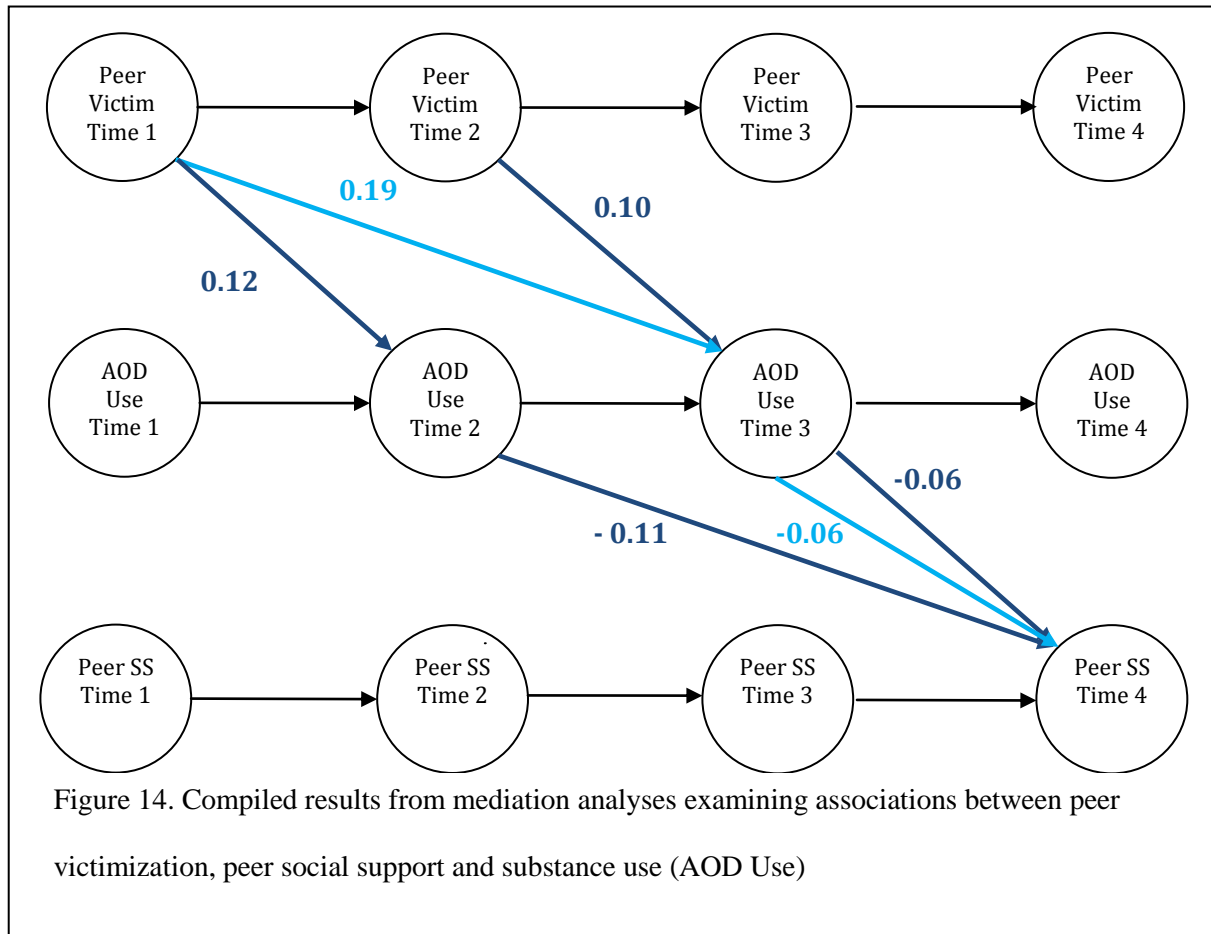
social support.

Figure 14. Compiled results from mediation analyses examining associations between peer

victimization, peer social support and substance use (AOD Use)

Note. Three-wave analyses are color coded to separate the results.

Peer Victimization → Peer Social Support → Substance Use: Two significant, negative

indirect effects were found from peer victimization to substance use as mediated by peer

social support (Figure 15). In one of these, the direct effect was not significant indicating

full mediation, while in the other, a significant negative direct effect was found indicating

partial mediation.

Peer Social Support → Peer Victimization → Substance Use: These results indicated that

increases in peer social support predicted decreases in substance use through the

mediation of peer victimization (Figure 15). Increases in peer social support predicted

increases in peer victimization which in turn predicted increases in substance use. The

direct path between peer social support and substance use was significant in one path

indicating partial mediation. Additionally, the different directions of the indirect and

direct effects suggest that an additional mediator impacts the associations between the

three constructs.

Analyses examining mediation in the Peer Social Support → Substance Use → Peer

Victimization pathway; Substance Use → Peer Victimization → Peer Social Support

pathway; and Substance Use → Peer Social Support → Peer Victimization pathway did

not reveal any significant results.

Generally, these results indicated that as hypothesized increases in peer victimization

resulted in decreases in substance use when mediated by peer social support. In other

words, peer social support suppressed the effect of peer victimization on substance use.

Furthermore, increases in peer victimization resulted in decreases in peer social support

when mediated by substance use. Results of the mediation analyses are presented in

Table 25.

Figure 15. Compiled results from mediation analyses examining associations between peer victimization, peer social support (peer SS) and substance use (AOD Use)

Note. Three-wave analyses are color coded to separate the results.

Chapter 5

Discussion

This study aimed to examine the longitudinal associations between peer victimization and substance use in early adolescence, and then identify risk and protective factors for this association. Findings from this study provide strong support for the link between peer victimization and initiation and continued substance use in middle school. Peer victimization emerged as a precursor to substance use, but over time a reciprocal influence was observed between peer victimization and substance use. The precedence of peer victimization is not surprising, since peer victimization begins as early as pre-school and becomes an established phenomenon in elementary school, while exposure and access to substance typically begins later in development. Nonetheless, early victimization experiences appear to have a long-term effect on substance use, which continued for the duration of the two years after controlling for previous levels of peer victimization and substance use. These paths from peer victimization to substance use provide support for the coping theories that suggest that adolescents use substances to cope with the negative affect of being victimized.

There were however, consistent predictive paths from substance use to future peer victimization, suggesting that there is more than coping processes at work in the relation between peer victimization and substance use. These paths from substance use to peer victimization support the lifestyle and routine activities theories that suggest that it is engagement in substance use puts adolescents in environments that increase the risk for peer victimization.

Thus, while different time frames and time lags between waves supported both coping theories and lifestyle theories, the complete results support the conclusion that a transactional relation exists between peer victimization and substance. Peer victimization appeared to be the initial risk factor for substance use, although over time substance use becomes a risk factor for peer victimization. With increases in both autonomy and access to substances, it appears that victimized youth turn to substance-use as a coping mechanism, which in turn puts them at risk for further victimization. Given the transactional relation of peer victimization and substance use, the identification of risk and protective factors can point to intervening variables that may disrupt these negative reciprocal influences.

A socio-ecological model was used as a framework for examining potential risk and protective factors in the individual, family and peer context and in keeping with transactional theories reciprocal influences between these constructs were examined. Results indicated that all variables examined influenced the association between peer victimization and substance use, and all demonstrated transactional associations among constructs.

<div align="center">**Individual Context**</div>

Depression

Depression was found to be a risk factor for peer victimization, substance use and their association over time. Furthermore, peer victimization and substance use were found to increase levels of depressive symptoms over time. Thus, the three constructs were found to be risk factors for each other and the presence of any of these conditions increased the risk for experiencing the others. Research has documented that depression

and associated behaviors impair the ability to develop and maintain relationships, which likely increases the risk of victimization for youth (Swearer et al, 2003). Coping theories would suggest that adolescents who have negative experiences across contexts are at greater risk for developing unhealthy coping strategies, including substance use, and therefore increases in depression and peer victimization would predict increases in substance use. Lifestyle theories would suggest that youth who engage in substance use put themselves at risk for peer victimization, and the combination of these experiences might result in depressive symptomatology. This sequence of events was also supported by the data.

A finding that appeared inconsistent with this general pattern of increased risk, showed that increases in depression predicted *decreases* in substance use when mediated by peer victimization. No studies were found that documented or theorized about an inverse relation between peer victimization and substance use. However, it is possible that just as depression increases peer victimization, (hypothesized to operate through its negative impact relationship building skills), it might also negatively impact an adolescents ability to form consistent friendships. Previous research indicates that substance use in adolescence is primarily initiated through peers, so one explanation for this mediating effect might be that the combined effects of being depressed and victimized might cause youth to withdraw from peer groups as a means to cope, thereby restricting their access to substances. However, it is also possible that there are other variables at play in these associations and it would be interesting to explore how this 'protective' effect of depression on substance use unfolds. Additionally, contrary to the hypotheses presented in Luk et al (2010), analyses examining the mediating role of

depression on the association between peer victimization and substance use did not yield any significant findings. Thus, the depressive symptoms were found to play a significant role in the association between peer victimization and substance use.

Self-esteem

Findings from this study provide strong support for the links among peer victimization, reduced self-esteem, and initiation and continued substance use in middle school. Increased levels of peer victimization predicted increased levels of substance through the mediation pathway of self-esteem. The individual paths indicate that peer victimization negatively impacted adolescent self-esteem, and reduced self-esteem resulted in increased substance use. This finding connects two bodies of literature, one that has documented the negative impact of peer victimization on self-esteem and another that examines how reduced self-esteem increases the risk of substance use in early adolescents. It is also consistent with coping theories of substance use. Cooper (1994) identified various motivations for adolescents to drink and in a later study found that experiencing negative emotions predicted alcohol use. It is likely that substance-use could be a coping mechanism for peer victimization and consequent negative affect associated with lowered self-esteem.

Furthermore, higher levels of self-esteem in earlier waves were found to reduce peer victimization and substance use and their association. So, although peer victimization and substance use negative impact self-esteem, higher initial levels of self-esteem provide protective influences from substance use and peer victimization.

In summary, self-esteem interacts with peer victimization and substance use and has the potential to provide a protective influence on the association between peer

victimization and substance use. These findings also provide insight into interrelations and directionality of these associations. It sheds light on a potential point of intervention, and both bullying and substance-use prevention programs would do well to address the impact peer victimization and substance use have on an individual. Self-esteem, however, is a muddy concept, (Baumeister, Campbell, Krueger & Vohs, 2003) and additional research that examines the processes by which victimization impacts self-esteem and the processes by which self-esteem influences an adolescents decision to use substances might be a useful next step.

The findings on the role of depression and self-esteem on peer victimization and substance use highlight the complex processes by which an individual internal ecology (depression and self-esteem) impacts the behavior of others (victimization by peers) and the behavioral choices an individual makes (substance use). They also provide insight into how psychological processes impact and influence the interpretation of peer victimization and how these influence behavioral coping decisions such as substance use. Depression has been associated with lowered self-esteem, and it would be interesting to examine how depression and self-esteem interact to facilitate or prevent peer victimization and substance use.

Family Context

The family is the primary social context in which children develop and it continues to be a salient developmental context in early adolescence. However, early adolescence represents a time of significant changes in children's relationships with both their peers and their parents that presents both challenges to and opportunities for healthy development (Fuligni & Eccles, 1993). Although peer victimization typically occurs

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outside the family context, the positive or negative conditions in the home can impact adolescents' vulnerability and resilience to negative experiences in the peer context. Additionally, developmental, transactional, and psychodynamic frameworks suggest that interpersonal, behavioral, and psychological patterns from one's family of origin are manifested in other contexts. Thus, it is likely that a negative family environment can negatively impact the transactional associations between peer victimization and substance use, while a positive family environment might serve as a protective influence for this association.

Family Conflict

Findings examining the impact of family conflict on the relation between peer victimization and substance revealed reciprocal influences between these constructs. The most consistent finding was that family conflict resulted in increases in peer victimization when mediated by substance use. In other words, adolescents who experienced conflict at home were likely to use substances and the presence of both of these conditions resulted in increases in peer victimization. However, almost all sequential combinations of these constructs resulted in significant mediation findings suggesting that family conflict, substance use and peer victimization interact over the middle school period and the presence of any of these risk factors increases the chances of the adolescent experiencing the others. For instance, increases in family conflict resulted in increases in substance use through increases in peer victimization. Similarly increases in peer victimization resulted in increases in substance use through increases in family conflict.

Transactional theories and social interaction learning theory provide theoretical frameworks for understanding the mechanisms of these associations. Adolescents who

witness or experience conflict and aggression in their family context, develop unhealthy interpersonal characteristics which are recreated in the peer context. (see Criss & Shaw, 2005; Haynie & McHugh, 2003; Snyder, Bank, & Burraston, 2005). Socio-ecological theories posit that negative experiences in one context may result in patterns of behavior that put an individual at increased risk in other contexts. The combination of experiencing conflict and victimization both in the home and school context undoubtedly impact adolescents psychological well-being. Coping theories would suggest that adolescents might turn to substance use as a means of coping with the stress and negative affect that results from such poly-victimization.

In summary, interpersonal difficulties in the family and peer context are found to spill over into each other and increase the risk for poly-victimization. Furthermore, using substances to cope with interpersonal conflict in one context increases the risk of experiencing conflict in the other.

Family Closeness

Parental monitoring and parental social support was found to buffer the impact of peer victimization on substance use in early adolescence. This finding is consistent with socio-ecological theories which posit that harmful influences in one context can be buffered by positive influences in other domains (Espelage & Swearer, 2003). Although the peer context is a salient one in early adolescence, children are still very much rooted in their family context. A supportive family environment and involved parents may facilitate a victimized adolescents understanding of his/her victimization experiences and provide protective influence for the negative fallout of negative experiences in the peer context. This in turn is likely to help adolescent attribute these to external causes, thereby

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buffering the reduced self-esteem and associated affect (Kingsbury, 2004). Involved

parents are also more likely to monitor their victimized child's behavior and affect, which

has been found to be a strong deterrent for substance use.

Thus, the quality of the family environment was found to impact the association

between peer victimization and substance use in multiple ways. Discordant families were

found to put adolescents at risk for both peer victimization through (social learning

processes), and substance use (through coping processes). Prevention and intervention

programs targeting both bullying prevention and substance use are typically school based.

These findings point to the need for such programs to extend beyond the school context

and incorporate to peer relations and family climate in targeting adolescents at risk for

bullying and substance use.

Peer Context

Establishing fulfilling peer relations is a central developmental task of early

adolescence. Adolescents in this developmental period become more concerned about

peer acceptance and popularity and begin to turn to their friends more often as sources of

advice and comfort (Gould & Mazzeo, 1982; Fuligni & Eccles, 1993). Being victimized

by peers therefore, is a significant challenge to adolescent well-being. However,

adolescents are typically victimized by select groups of peers, and these experiences

might result in adolescents being motivated to find peer groups that are accepting of them

in unconventional ways, both to meet their interpersonal needs and to provide protection

from their aggressors. Finding social support from positive peer relations can provide

corrective interpersonal experience that might result in healthy coping habits and

consequently prevent substance use.

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Affiliation with Delinquent Peers

Affiliation with delinquent peers was found to moderate the impact of peer victimization on future substance use. In other words, peer victimization had a differential impact on substance use depending on the degree to which youth affiliated with delinquent peers. This is in keeping with two bodies of literature, one which documents that victimization experiences predict association with delinquent peers, and another which points to delinquent peers as providing the means and opportunities for substance use in early adolescence. Challenges to developing positive relationships with prosocial peers can result in affiliation with delinquent peers (Beuhler, 2006; Dishion, Andrews, & Crosby, 1995). Adolescents' efforts to find positive peer relations to counter their victimization experiences is a healthy response to the problem. However, as findings documented earlier in this study suggest, victimized youth typically experience other interpersonal challenges that might impair their ability to find positive peer groups. Membership in delinquent peer groups are based more on participation in certain behaviors rather than on interpersonal relationships (Rubin, Bukowski, & Parker, 2007), potentially providing a more accessible, although problematic, means of gaining a peer group. Affiliation with delinquent peers has been documented to be a training ground for participation in truancy, misdemeanors, and substance use. It appears that delinquent peer groups provide opportunity, means, and encouragement for engaging in substance use, and victimized youth are particularly vulnerable to these influences.

Peer Social Support

Social support from peers, presumably not involved in the victimization, was found to buffer the relation between peer victimization and substance use. Findings

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suggested that as victimization by peers increased, adolescents who perceived greater

social support in their peer groups were less likely to turn to substances as a coping

mechanism for peer victimization experiences. A supportive peer group probably

prevents the adolescent to attributing the victimization to personal characteristics or

flaws, since they are able to have successful relationships with other peers. This in turn

provides a protective effect on the lowered self-esteem associated with peer

victimization, and consequently prevents the adolescent from turning to substance use as

a coping mechanism. The existence of a positive peer group is also likely to provide the

victimized adolescents with alternative, healthier means of coping.

Results also indicated that peer victimization resulted in lower peer social support

when mediated by increases in substance use. This suggests that although victimized

youth might successfully find support from other peers (and be protected from substance

use), victimized peers who first resort to substance use are less likely to receive support

from peers. Thus using substances appears to prevent victimized youth from finding

supportive peer groups.

Other results indicated that increases in perceived social support were predictive

of decreases in substances as mediated by peer victimization. While the impact of peer

social support and peer victimization on substance use are consistent with theory, the

positive predictive path from peer social support to peer victimization presented

challenges to interpretation. Results suggested that the inclusion of additional mediators

might be warranted to more appropriately explain the associations among these variables.

As indicated by the previous finding, it is also possible that adolescents who affiliated

with delinquent peers experience peer social support, but, as suggested by lifestyle

theories, the affiliation with delinquent peers puts them at increased for victimization. If this were the case, then these youth experience multiple risk factors for substance use through association with their peer group as well as the negative impact of peer victimization. However, the varied results from this analysis indicate that additional research is necessary to delineate how peer victimization, peer social support and substance use influence each other in early adolescence.

These two sets of findings reflect the salience of peer relations in early adolescence and the complexity of adolescent peer relations. Although the association between peer victimization and affiliation with delinquent peers puts youth at risk for long-term negative consequences, in the short term it might be an effective strategy to find validation and support from an alternative peer group.

General conclusions

Using a socio-ecological framework this study examined risk and protective factors for the association between peer victimization and substance use in the individual, family and peer ecology. Broadly speaking, findings documented depression, family conflict, and association with delinquent peers as risk factors for substance use in victimized youth. Positive self-esteem, family closeness, and peer social support emerged as protective factors for this association. However, the longitudinal examination of these associations revealed that these variables interacted in complex ways with each other.

Some broad themes emerged across all analyses. It appears that initiation into substance use in this population is a group activity and any process that interferes with access to peer groups reduces substance use. For example, it was hypothesized that youth who were depressed and experienced victimization would be more likely to engage in

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unhealthy coping mechanisms such as substance use. Results however, indicated that when depressed adolescents experience victimization from their peers they are less likely to use substances, potentially due to their isolation and withdrawal from interactions with peers which restricts access to substances. However, results from the peer context reflect the varied nature in which peers interact. Although peer victimization negatively impacts adolescent health, positive relationship with other peers can buffer this negative impact. At the same time, if these positive relationships are found through affiliation with delinquent peers, it can put victimized youth at additional risk for unhealthy behaviors such as substance use.

Analyzing different permutations of variables predicting substance use revealed that variables typically had reciprocal influences on each other over time. For example, family conflict and peer victimization were predictors for each other in their associations with substance use. Thus, more nuanced theories that incorporate these reciprocal influences are warranted.

Additionally, these findings documented the resilience of victims of peer aggression. Peer victimization has significant detrimental effects on various aspects of adolescent health. However, findings suggest that the presence of protective factors can do much to ameliorate the risk of future substance use, even if these do not directly target the victimization or substance use. Some of the mechanisms by which adolescents compensate for the negative experiences of peer victimization however can be problematic, including the affiliation with delinquent peers. Nonetheless, this reflects the adaptability of youth to adverse environments, who are likely making the best of a difficult situation.

All findings reflected the influence of different ecologies on each other. Each analysis examined at least two contexts in which adolescent development unfolds and documented the reciprocal influences of these contexts on adolescent substance use. More importantly, the findings demonstrate that negative experiences in one context can be influenced by variables in another context, thereby providing additional avenues through which prevention and intervention can occur.

Study Limitations and Future Directions

A major strength of this study is the use of longitudinal data and longitudinal data analysis. Longitudinal studies have an advantage over cross-sectional research designs because they allow researchers to detect change over time. This, however, is a short-term longitudinal study and it would be strengthened by following students over a longer period of time. For instance, family influences on peer victimization undoubtedly begin before middle school and experiences in middle school likely impact an individual's experiences with substances beyond the middle school years. Following students as they transition from middle school to high school and into college would also provide greater insight about the social and psychological correlates of peer victimization and substance use.

The sample used in this study was racially and economically diverse. However, the analyses in this study controlled for gender, race, age and school and is limited in its ability to provide a rich and nuanced understanding of the lived experiences of study participants. Person-centered analyses examining demographic differences are likely to reveal unique and valuable findings for the application of such research. Additionally, the methodology used in this study does not differentiate between the experiences of

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adolescents who are only on the receiving end of victimization, and those who both perpetrate and receive victimization (bully-victims). The findings from this study are also limited by the reliance on self-report data.

All the research questions in this study examined the interaction of three variables, viz. peer victimization, substance use, and a single risk or protective variable. This provided somewhat piecemeal results and relied on logical and theoretical inferences to delineate more complex processes. Although examining the interaction of just three variables in each model might be considered simplistic, the dearth of research examining risk and protective factors in the relation between peer victimization and substance use make these basic research questions an important first step. Most the research has examined bivariate relations between the constructs examined here, and including intervening variables in mediating and moderating hypotheses help build theory about the processes involved and connect often disparate bodies of literature. Additionally, the longitudinal methodology and statistical analyses allow for inferences about the directionality of these associations and strengthen their validity.

Thus, the findings from this study are a step forward in examining an important, yet relatively understudied, area of adolescent development and health. The findings from these analyses provide a fertile foundation for future research. Studies examining more complex interactions of these variables across contexts are needed to examine the complex processes occurring across contexts that influence victimized youth to engage in substance use. For instance, social information learning theories hypothesizes conflict between family members teaches children coercive interpersonal behaviors which when translated to the peer context may result in rejection from typical peer groups. This might

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cause youth to affiliate with deviant peer groups, which provide a context for additional training and practice of coercive interactions and provide a gateway to substance use. (Dishion, Andrews, & Crosby, 1995). There are several such interesting hypotheses and these findings set the stage for more focused and complex studies.

The longitudinal data analyses conducted in this dissertation also facilitate unique and complex interpretations of the data. However, conclusions regarding mediation processes were limited by examining three waves of data at a time. Expanding the Monte Carlo method of examining mediation to examine more than three wave of data would allow the examination of more complex and nuanced mediation processes.

Conclusion

Peer victimization and substance use were found to reciprocally influence each other during early adolescence. Depression, family conflict and affiliation with delinquent peers were identified as risk factors for this association. Higher levels of self-esteem, family closeness and peer social support were found to be protective factors for these phenomena and their association. These findings provide further credence to socio-ecological theories that discuss the interaction of various contexts as they pertain to adolescent development. Transactional association were found among almost all variables examined, identifying a need for more complex theories that can account for the reciprocal influences at play in adolescence. The study also identifies key variables that can be targeted in prevention and intervention efforts. This study is a significant step forward in establishing the association between peer victimization and substance use in early adolescence and in identifying predictive and protective variables for this unhealthy association.

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Tables

Table 1

Fit Indices for the Peer Victimization and Substance Use Transactional Analysis Confirmatory Factor Analysis and Final Structural Model

Model	χ^2	df	p	$\Delta \chi^2$	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
					Measurement Model Estimates[a]								
Null	22369.14	501											
Configural	1051.40	300	<.001	---	---	---	0.046	0.043 ; 0.049	0.966	---	0.943	---	---
Weak	1303.33	312	<.001	251.93	12	---	0.052	0.049 ; 0.055	0.955	0.011	0.927	0.015	Yes
Strong	1399.30	324	<.001	95.98	12	---	0.053	0.051 ; 0.056	0.951	0.004	0.924	0.003	Yes
					Longitudinal Structural Model[b]								
Initial SEM	1522.28	365	<.001	122.97	41	<.001	0.052	0.049 ; 0.055	0.947	0.004	0.927	0.004	No
Final SEM	1490.55	381	<.001	91.24	57	0.003	0.050	0.047 ; 0.053	0.949	0.002	0.933	0.000	Yes

Note. [a]: Evaluated with the CFI difference test; [b]: Evaluated with the chi-square difference test

Table 2

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model for the Peer Victimization and Substance Use Transactional Analysis

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Peer Victimization (Time 1):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.771	0.405	0.595
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.866	0.250	0.750
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.737	0.457	0.543
Peer Victimization (Time 2):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.790	0.376	0.624
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.874	0.236	0.764
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.728	0.469	0.531
Peer Victimization (Time 3):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.757	0.427	0.573
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.852	0.274	0.726
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.690	0.524	0.476
Peer Victimization (Time 4):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.780	0.392	0.608
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.884	0.218	0.782
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.765	0.415	0.585

Table 2 (cont.)

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	R^2
Substance Use (Time 1):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.767	0.411	0.589
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.946	0.106	0.894
Parcel 3	0.963 (0.009)	0.016 (0.01)	0.832	0.308	0.692
Substance Use (Time 2):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.824	0.321	0.679
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.951	0.095	0.905
Parcel 3	0.963 (0.009)	0.016 (0.01)	0.879	0.228	0.772
Substance Use (Time 3):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.815	0.336	0.664
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.916	0.160	0.840
Parcel 3	0.963 (0.009)	0.016 (0.01)	0.876	0.232	0.768
Substance Use (Time 4):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.818	0.330	0.670
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.931	0.133	0.867
Parcel 3	0.963 (0.009)	0.016 (0.01)	0.759	0.424	0.576

[a]Common Metric Completely Standardized Solution

Table 3

Correlations between Latent Constructs for the Peer Victimization and Substance (AOD) Use Transactional Analysis

	PeerV1	PeerV2	PeerV3	PeerV4	AOD1	AOD2	AOD3	AOD4
PeerV1	1.000							
PeerV2	0.467	1.000						
PeerV3	0.440	0.661	1.000					
PeerV4	0.328	0.491	0.497	1.000				
AOD1	0.145	0.040	0.115	0.128	1.000			
AOD2	0.229	0.179	0.221	0.205	0.768	1.000		
AOD3	0.243	0.184	0.173	0.201	0.364	0.509	1.000	
AOD4	0.115	0.141	0.077	0.211	0.310	0.380	0.728	1.000
Means	1.617	1.704	1.635	1.519	1.237	1.255	1.246	1.231
SD	0.349	0.547	0.398	0.279	0.129	0.277	0.193	0.123

Table 4

Fit Indices for the Depression → Peer Victimization → Substance Use Mediation Analysis Confirmatory Factor Analysis

Model	χ^2	df	p	$\Delta \chi^2$	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
					Measurement Model Estimates[a]								
Null	35835.18	957											
Configural	1818.49	642	<.001	---	---	---	0.039	0.039 ; 0.041	0.966	---	0.950	---	---
Weak	2107.29	660	<.001	288.80	18	---	0.043	0.043 ; 0.045	0.959	0.008	0.940	0.010	Yes
Strong	2220.59	678	<.001	113.29	18	---	0.044	0.044 ; 0.046	0.956	0.003	0.938	0.002	Yes

Note.   [a]: Evaluated with the CFI difference test

Table 5

Loading and Intercept Values, Residuals, and R-squared Values for Each Indicator from the Strong Metric Invariance Model for the

Mediation Analyses examining associations between Depression, Peer Victimization, and Substance Use

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Depression (Time 1):					
Parcel 1	1.023 (0.009)	-0.165 (0.02)	0.891	0.206	0.794
Parcel 2	0.975 (0.008)	-0.068 (0.02)	0.882	0.221	0.779
Parcel 3	1.002 (0.009)	0.233 (0.02)	0.850	0.277	0.723
Depression (Time 2):					
Parcel 1	1.023 (0.009)	-0.165 (0.02)	0.866	0.251	0.749
Parcel 2	0.975 (0.008)	-0.068 (0.02)	0.876	0.233	0.767
Parcel 3	1.002 (0.009)	0.233 (0.02)	0.808	0.346	0.654
Depression (Time 3):					
Parcel 1	1.023 (0.009)	-0.165 (0.02)	0.868	0.246	0.754
Parcel 2	0.975 (0.008)	-0.068 (0.02)	0.882	0.222	0.778
Parcel 3	1.002 (0.009)	0.233 (0.02)	0.820	0.328	0.672
Depression (Time 4):					
Parcel 1	1.023 (0.009)	-0.165 (0.02)	0.897	0.196	0.804
Parcel 2	0.975 (0.008)	-0.068 (0.02)	0.921	0.152	0.848
Parcel 3	1.002 (0.009)	0.233 (0.02)	0.862	0.257	0.743

Table 5 (cont.)

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Peer Victimization (Time 1):					
Parcel 1	1.050 (0.012)	-0.026 (0.02)	0.776	0.305	0.602
Parcel 2	1.239 (0.012)	-0.253 (0.02)	0.860	0.260	0.740
Parcel 3	0.711 (0.010)	0.280 (0.02)	0.742	0.450	0.550
Peer Victimization (Time 2):					
Parcel 1	1.050 (0.012)	-0.026 (0.02)	0.793	0.371	0.629
Parcel 2	1.239 (0.012)	-0.253 (0.02)	0.867	0.248	0.752
Parcel 3	0.711 (0.010)	0.280 (0.02)	0.735	0.459	0.541
Peer Victimization (Time 3):					
Parcel 1	1.050 (0.012)	-0.026 (0.02)	0.759	0.424	0.576
Parcel 2	1.239 (0.012)	-0.253 (0.02)	0.844	0.288	0.712
Parcel 3	0.711 (0.010)	0.280 (0.02)	0.695	0.517	0.483
Peer Victimization (Time 4):					
Parcel 1	1.050 (0.012)	-0.026 (0.02)	0.782	0.288	0.612
Parcel 2	1.239 (0.012)	-0.253 (0.02)	0.880	0.226	0.774
Parcel 3	0.711 (0.010)	0.280 (0.02)	0.770	0.406	0.594

Table 5 (cont.)

| Indicator | Equated Estimates | | Standardized Estimates | | |
	Loading (SE)	Intercept (SE)	Loading[a]	Theta	R^2
Substance Use (Time 1):					
Parcel 1	0.983 (0.010)	0.083 (0.01)	0.771	0.405	0.595
Parcel 2	1.053 (0.009)	-0.098 (0.01)	0.942	0.112	0.888
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.834	0.305	0.695
Substance Use (Time 2):					
Parcel 1	0.983 (0.010)	0.083 (0.01)	0.827	0.316	0.684
Parcel 2	1.053 (0.009)	-0.098 (0.01)	0.949	0.099	0.901
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.880	0.225	0.775
Substance Use (Time 3):					
Parcel 1	0.983 (0.010)	0.083 (0.01)	0.818	0.331	0.669
Parcel 2	1.053 (0.009)	-0.098 (0.01)	0.914	0.164	0.836
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.877	0.231	0.769
Substance Use (Time 4):					
Parcel 1	0.983 (0.010)	0.083 (0.01)	0.826	0.318	0.682
Parcel 2	1.053 (0.009)	-0.098 (0.01)	0.923	0.148	0.852
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.764	0.416	0.584

[a]Common Metric Completely Standardized Solution

Table 6

Correlations between Latent Constructs for the Mediation Analyses examining associations between Depression, Peer Victimization,

and Substance Use (AOD)

	Depr1	Depr2	Depr3	Depr4	PeerV1	PeerV2	PeerV3	PeerV4	AOD1	AOD2	AOD3	AOD4
Depr1	1.000											
Depr2	0.799	1.000										
Depr3	0.568	0.686	1.000									
Depr4	0.532	0.589	0.687	1.000								
PeerV1	0.395	0.318	0.361	0.341	1.000							
PeerV2	0.411	0.509	0.408	0.465	0.468	1.000						
PeerV3	0.316	0.405	0.450	0.468	0.439	0.662	1.000					
PeerV4	0.318	0.362	.366	0.514	0.328	0.493	0.498	1.000				
AOD1	0.235	0.202	0.171	0.194	0.142	0.040	0.113	0.127	1.00			
AOD2	0.280	0.304	0.256	0.294	0.226	0.178	0.219	0.203	0.768	1.000		
AOD3	0.205	0.276	0.308	0.328	0.244	0.186	0.174	0.201	0.366	0.511	1.000	
AOD4	0.164	0.190	0.190	0.344	0.116	0.143	0.078	0.209	0.313	0.383	0.730	1.000
Means	2.481	2.514	2.497	2.401	1.616	1.704	1.635	1.519	1.237	1.255	1.246	1.231
SD	0.487	0.583	0.508	0.472	0.349	0.547	0.397	0.279	0.129	0.278	0.194	0.124

Table 7. 95% Confidence intervals for mediation analyses examining associations between depression, peer victimization, and substance use

Waves	Effect of X on M (a)		Effect of M on Y (b)		Direct Effects (c')		Indirect Effect (a x b)	95% CI		Includes zero?
	B	SE	B	SE	B	SE	Boot	Lower	Upper	
Depression → Peer Victimization → Substance Use Analysis										
1 - 2 - 3	0.305	0.036	0.053	0.020	0.034	0.021	0.0162	0.004	0.029	No
2 - 3 - 4	0.108	0.028	-0.044	0.016	0.042*	0.013	-0.005	-0.009	-0.001	No
1 - 3 - 4	0.176	0.031	-0.051	0.014	0.061*	0.013	-0.009	-0.015	-0.004	No
1 - 2 - 4	0.307	0.034	0.005	0.016	0.023	0.016	0.003	-0.008	0.011	Yes
Peer Victimization → Depression → Substance Use Analysis										
1 - 2 - 3	0.019	.033	0.058	.018	-0.047	0.016	-0.002	-0.003	0.005	Yes
2 - 3 - 4	0.108	.029	-0.015	.013	-0.013	0.009	-0.0002	-0.005	0.001	Yes
1 - 3 - 4	0.192	0.037	-0.007	0.013	-0.035	0.011	-0.0002	-0.007	0.004	Yes
1 - 2 - 4	0.027	0.032	0.040	0.016	-0.038	0.014	-0.002	-0.001	0.004	Yes
Substance Use → Depression → Peer Victimization Analysis										
1 - 2 - 3	0.080	0.047	0.089	0.026	0.132	0.048	0.006	-0.007	0.015	Yes
2 - 3 - 4	0.048	0.035	0.156	0.026	0.051	0.030	0.008	-0.003	0.020	Yes
1 - 3 - 4	0.123	0.054	0.162	0.026	0.045	0.037	0.020	-0.003	0.040	Yes
1 - 2 - 4	0.087	0.046	0.125	0.025	0.083	0.043	0.011	-0.0003	0.0245	Yes
Depression → Substance Use → Peer Victimization Analysis										
1 - 2 - 3	0.067	0.017	0.109	0.033	0.052	0.027	0.007	0.002	0.014	No
2 - 3 - 4	0.099	0.018	0.061	0.037	0.125	0.024	0.006	-0.001	0.014	Yes
1 - 3 - 4	0.092	0.020	0.076	0.036	0.116***	0.024	0.007	0.0004	0.015	No
1 - 2 - 4	0.066	0.017	0.060	0.030	0.112	0.025	0.004	- 0.001	0.009	Yes

Table 7 (cont.)

Substance Use → Peer Victimization → Depression Analysis

1 - 2 - 3	-0.050	0.063	0.119	0.025	0.096	0.049	-0.006	-0.022	0.009	Yes
2 - 3 - 4	0.150	0.033	0.269	0.028	0.119***	0.030	0.040	0.022	0.061	No
1 - 3 - 4	0.108	0.054	0.261	0.027	0.095*	0.043	0.028	0.001	0.057	No
1 - 2 - 4	-0.020	0.062	0.236	0.025	0.135	0.048	-0.005	-0.034	0.024	Yes

Peer Victimization → Substance Use → Depression Analysis

1 - 2 - 3	0.094	0.020	0.041	0.034	0.137	0.034	0.004	-0.002	0.011	Yes
2 - 3 - 4	0.075	0.018	0.187	0.036	0.198***	0.024	0.014	0.006	0.024	No
1 - 3 - 4	0.144	0.024	0.191	0.037	0.162***	0.029	0.028	0.015	0.043	No
1 - 2 - 4	0.099	0.020	0.133	0.033	0.204***	0.032	0.013	0.006	0.023	No

Note. Analyses in grey font represent non-significant findings.

*p<0.05; **p<0.01; ***p<0.001

Table 8

Fit Indices from the Confirmatory Factor Analysis for the Mediation Analyses examining associations between Self-esteem, Peer Victimization, and Substance Use

Model	χ^2	df	p	$\Delta\chi^2$	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
						Measurement Model Estimates[a]							
Null	34024.76	957											
Configural	1763.27	642	<.001	---	---	---	0.038	0.036 ; 0.041	0.966	---	0.949	---	---
Weak	2036.29	660	<.001	273.02	18	---	0.042	0.040 ; 0.045	0.958	0.008	0.940	0.010	Yes
Strong	2154.99	678	<.001	118.70	18	---	0.043	0.041 ; 0.045	0.955	0.003	0.937	0.003	Yes

Note.   [a]: Evaluated with the CFI difference test

Table 9

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model for the

Mediation Analyses examining associations between Self-esteem, Peer Victimization, and Substance Use

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Peer Victimization (Time 1):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.773	0.402	0.598
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.864	0.253	0.747
Parcel 3	0.707 (0.010)	0.286 (0.02)	0.738	0.455	0.545
Peer Victimization (Time 2):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.791	0.374	0.626
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.871	0.241	0.759
Parcel 3	0.707 (0.010)	0.286 (0.02)	0.730	0.467	0.533
Peer Victimization (Time 3):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.758	0.425	0.575
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.850	0.277	0.723
Parcel 3	0.707 (0.010)	0.286 (0.02)	0.691	0.523	0.477
Peer Victimization (Time 4):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.781	0.390	0.610
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.883	0.221	0.779
Parcel 3	0.707 (0.010)	0.286 (0.02)	0.766	0.413	0.587

Table 9 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Self-Esteem (Time 1):					
Parcel 1	0.991 (0.010)	-0.043 (0.04)	0.848	0.282	0.718
Parcel 2	1.023 (0.010)	-0.095 (0.04)	0.813	0.339	0.661
Parcel 3	0.987 (0.010)	0.138 (0.04)	0.836	0.301	0.699
Self-Esteem (Time 2):					
Parcel 1	0.991 (0.010)	-0.043 (0.04)	0.844	0.288	0.712
Parcel 2	1.023 (0.010)	-0.095 (0.04)	0.815	0.336	0.664
Parcel 3	0.987 (0.010)	0.138 (0.04)	0.811	0.342	0.658
Self-Esteem (Time 3):					
Parcel 1	0.991 (0.010)	-0.043 (0.04)	0.864	0.253	0.747
Parcel 2	1.023 (0.010)	-0.095 (0.04)	0.854	0.270	0.730
Parcel 3	0.987 (0.010)	0.138 (0.04)	0.846	0.285	0.715
Self-Esteem (Time 4):					
Parcel 1	0.991 (0.010)	-0.043 (0.04)	0.879	0.228	0.772
Parcel 2	1.023 (0.010)	-0.095 (0.04)	0.854	0.271	0.729
Parcel 3	0.987 (0.010)	0.138 (0.04)	0.852	0.275	0.725

Table 9 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	R^2
Substance Use (Time 1):					
Parcel 1	0.980 (0.010)	0.087 (0.01)	0.769	0.408	0.592
Parcel 2	1.056 (0.009)	-0.101 (0.01)	0.944	0.109	0.891
Parcel 3	0.965 (0.009)	0.014 (0.01)	0.833	0.307	0.693
Substance Use (Time 2):					
Parcel 1	0.980 (0.010)	0.087 (0.01)	0.825	0.319	0.681
Parcel 2	1.056 (0.009)	-0.101 (0.01)	0.951	0.096	0.904
Parcel 3	0.965 (0.009)	0.014 (0.01)	0.879	0.227	0.773
Substance Use (Time 3):					
Parcel 1	0.980 (0.010)	0.087 (0.01)	0.816	0.335	0.665
Parcel 2	1.056 (0.009)	-0.101 (0.01)	0.916	0.161	0.839
Parcel 3	0.965 (0.009)	0.014 (0.01)	0.877	0.231	0.769
Substance Use (Time 4):					
Parcel 1	0.980 (0.010)	0.087 (0.01)	0.822	0.324	0.676
Parcel 2	1.056 (0.009)	-0.101 (0.01)	0.928	0.138	0.862
Parcel 3	0.965 (0.009)	0.014 (0.01)	0.762	0.420	0.580

[a]Common Metric Completely Standardized Solution

Table 10

Correlations between Latent Constructs for the Mediation Analyses examining associations between Self-esteem, Peer Victimization, and Substance Use

	PeerV1	PeerV2	PeerV3	PeerV4	SEst1	SEst2	SEst3	SEst4	AOD1	AOD2	AOD3	AOD4
PeerV1	1.000											
PeerV2	0.467	1.000										
PeerV3	0.440	0.662	1.000									
PeerV4	0.328	0.492	0.499	1.000								
SEst1	-0.196	-0.145	-0.077	-0.121	1.000							
SEst2	-0.209	-0.185	-0.112	-0.110	0.690	1.000						
SEst3	-0.088	-0.172	-0.117	-0.093	0.564	0.591	1.000					
SEst4	-0.120	-0.125	-0.116	-0.076	0.707	0.663	0.598	1.000				
AOD1	0.144	0.040	0.115	0.128	-0.059	-0.185	-0.218	-0.150	1.00			
AOD2	0.228	0.179	0.221	0.205	-0.095	-0.098	-0.157	-0.116	0.769	1.000		
AOD3	0.244	0.185	0.173	0.201	-0.135	-0.111	-0.104	-0.111	0.366	0.510	1.000	
AOD4	0.115	0.142	0.078	0.210	-0.134	-0.078	-0.195	-0.089	0.313	0.381	0.729	1.000
Means	1.617	1.704	1.635	1.519	3.723	3.673	3.670	3.647	1.237	1.255	1.246	1.231
SD	0.349	0.546	0.398	0.279	0.626	0.808	0.761	0.579	0.129	0.277	0.193	0.124

Table 11. 95% Confidence intervals for mediation analyses examining associations between self-esteem, peer victimization, and

substance use

Waves	Effect of X on M (a)		Effect of M on Y (b)		Direct Effects (c')		Indirect Effect (a x b)	95% CI		Includes zero?
	B	SE	B	SE	B	SE	Boot	Lower	Upper	
Peer Victimization → Self-Esteem → Substance Use Analysis										
1 - 2 - 3	-0.150	0.041	-0.018	0.014	0.101	0.022	0.003	-0.001	0.008	Yes
2 - 3 - 4	-0.080	0.033	-0.050	0.010	-0.011	0.011	0.004	0.001	0.008	No
1 - 3 - 4	0.013	0.043	-0.051	0.009	-0.044	0.014	-0.0006	-0.005	0.004	Yes
1 - 2 - 4	-0.142	0.039	-0.019	0.013	0.017	0.020	0.003	-0.001	0.007	Yes
Self-Esteem → Peer Victimization → Substance Use Analysis										
1 - 2 - 3	-0.044	0.030	0.056	0.018	-0.047	0.016	-0.002	-0.007	0.001	Yes
2 - 3 - 4	0.007	0.020	-0.023	0.014	-0.013	0.009	-0.0002	-0.001	0.001	Yes
1 - 3 - 4	0.006	0.026	-0.027	0.014	-0.035	0.011	-0.0002	-0.002	0.001	Yes
1 - 2 - 4	-0.054	0.029	0.033	0.016	-0.038	0.014	-0.002	-0.005	0.0002	Yes
Substance Use → Self-Esteem → Peer Victimization Analysis										
1 - 2 - 3	-0.375	0.063	0.019	0.020	0.165	0.048	-0.007	-0.023	0.007	Yes
2 - 3 - 4	-0.167	0.044	-0.002	0.018	0.111	0.030	-0.0003	-0.006	0.005	Yes
1 - 3 - 4	-0.455	0.065	-0.007	0.019	0.099	0.045	0.003	-0.014	0.021	Yes
1 - 2 - 4	-0.363	0.061	-0.003	0.018	0.156	0.045	0.001	-0.012	0.014	Yes
Substance Use → Peer Victimization → Self-Esteem Analysis										
1 - 2 - 3	-0.034	0.063	-0.063	0.032	-0.275	0.064	0.002	-0.006	0.012	Yes
2 - 3 - 4	0.138	0.033	-0.048	0.035	-0.030	0.040	-0.007	-0.018	0.003	Yes
1 - 3 - 4	0.108	0.055	-0.053	0.034	-0.052	0.056	-0.006	-0.018	0.002	Yes
1 - 2 - 4	-0.024	0.063	-0.007	0.027	-0.087	0.053	0.0002	-0.004	0.004	Yes

Table 11 (cont.)

Self-Esteem→ Substance Use → Peer Victimization Analysis

1 - 2 - 3	-0.036	0.015	0.130	0.032	0.020	0.022	-0.005	-0.010	-0.001	No
2 - 3 - 4	-0.032	0.014	0.146	0.036	-0.026	0.018	-0.005	-0.010	-0.001	Yes
1 - 3 - 4	-0.066	0.017	0.141	0.036	-0.049	0.021	-0.009	-0.020	-0.003	Yes
1 - 2 - 4	-0.033	0.015	0.125	0.029	-0.026	0.020	-0.004	-0.009	-0.0004	Yes

Peer Victimization → Substance Use → Self-Esteem Analysis

1 - 2 - 3	0.104	0.020	-0.185	0.045	0.081	0.042	-0.020	-0.032	-0.009	No
2 - 3 - 4	0.058	0.017	-0.082	0.047	-0.025	0.029	-0.005	-0.012	0.0006	Yes
1 - 3 - 4	0.145	0.023	-0.059	0.048	-0.078	0.037	-0.009	-0.024	0.005	Yes
1 - 2 - 4	0.107	0.020	-0.087	0.037	0.031	0.035	-0.009	-0.020	-0.002	No

Table 12

Fit Indices for the Confirmatory Factor Analysis from the Mediation Analyses examining associations between Family Conflict, Peer Victimization, and Substance Use

Model	χ2	df	p	$\Delta\chi$2	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
					Measurement Model Estimates[a]								
Null	33015.39	957											
Configural	2682.87	642	<.001	---	---	---	0.051	0.049 ; 0.054	0.936	---	0.905	---	---
Weak	2935.68	660	<.001	252.81	18	---	0.054	0.052 ; 0.056	0.929	0.007	0.897	0.008	Yes
Strong	3203.90	678	<.001	268.22	18	---	0.056	0.056 ; 0.058	0.921	0.008	0.889	0.008	Yes

Note.   [a]: Evaluated with the CFI difference test

Table 13

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model for the

Mediation Analyses examining associations between Family Conflict, Peer Victimization, and Substance Use

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Family Conflict (Time 1):					
Parcel 1	1.119 (0.017)	-0.440 (0.03)	0.808	0.347	0.653
Parcel 2	1.267 (0.018)	-0.514 (0.04)	0.900	0.190	0.810
Parcel 3	0.613 (0.019)	0.954 (0.04)	0.415	0.827	0.173
Family Conflict (Time 2):					
Parcel 1	1.119 (0.017)	-0.440 (0.03)	0.787	0.381	0.619
Parcel 2	1.267 (0.018)	-0.514 (0.04)	0.893	0.203	0.797
Parcel 3	0.613 (0.019)	0.954 (0.04)	0.445	0.802	0.198
Family Conflict (Time 3):					
Parcel 1	1.119 (0.017)	-0.440 (0.03)	0.801	0.358	0.642
Parcel 2	1.267 (0.018)	-0.514 (0.04)	0.852	0.274	0.726
Parcel 3	0.613 (0.019)	0.954 (0.04)	0.438	0.808	0.192
Family Conflict (Time 4):					
Parcel 1	1.119 (0.017)	-0.440 (0.03)	0.824	0.321	0.679
Parcel 2	1.267 (0.018)	-0.514 (0.04)	0.888	0.212	0.788
Parcel 3	0.613 (0.019)	0.954 (0.04)	0.457	0.791	0.209

Table 13 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R²*
Peer Victimization (Time 1):					
Parcel 1	1.046 (0.012)	-0.020 (0.02)	0.771	0.406	0.594
Parcel 2	1.239 (0.012)	-0.254 (0.02)	0.863	0.250	0.745
Parcel 3	0.715 (0.010)	0.273 (0.02)	0.745	0.457	0.555
Peer Victimization (Time 2):					
Parcel 1	1.046 (0.012)	-0.020 (0.02)	0.789	0.377	0.623
Parcel 2	1.239 (0.012)	-0.254 (0.02)	0.873	0.238	0.762
Parcel 3	0.715 (0.010)	0.273 (0.02)	0.736	0.458	0.542
Peer Victimization (Time 3):					
Parcel 1	1.046 (0.012)	-0.020 (0.02)	0.756	0.429	0.571
Parcel 2	1.239 (0.012)	-0.254 (0.02)	0.843	0.289	0.711
Parcel 3	0.715 (0.010)	0.273 (0.02)	0.698	0.513	0.487
Peer Victimization (Time 4):					
Parcel 1	1.046 (0.012)	-0.020 (0.02)	0.781	0.391	0.609
Parcel 2	1.239 (0.012)	-0.254 (0.02)	0.873	0.239	0.761
Parcel 3	0.715 (0.010)	0.273 (0.02)	0.777	0.397	0.603

Table 13 (cont.)

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Substance Use (Time 1):					
Parcel 1	0.985 (0.009)	0.081 (0.01)	0.771	0.406	0.594
Parcel 2	1.048 (0.009)	-0.093 (0.01)	0.943	0.112	0.888
Parcel 3	0.967 (0.009)	0.012 (0.01)	0.835	0.303	0.697
Substance Use (Time 2):					
Parcel 1	0.985 (0.009)	0.081 (0.01)	0.832	0.308	0.692
Parcel 2	1.048 (0.009)	-0.093 (0.01)	0.941	0.114	0.886
Parcel 3	0.967 (0.009)	0.012 (0.01)	0.884	0.219	0.781
Substance Use (Time 3):					
Parcel 1	0.985 (0.009)	0.081 (0.01)	0.822	0.324	0.676
Parcel 2	1.048 (0.009)	-0.093 (0.01)	0.907	0.178	0.822
Parcel 3	0.967 (0.009)	0.012 (0.01)	0.879	0.228	0.772
Substance Use (Time 4):					
Parcel 1	0.985 (0.009)	0.081 (0.01)	0.826	0.317	0.683
Parcel 2	1.048 (0.009)	-0.093 (0.01)	0.924	0.146	0.854
Parcel 3	0.967 (0.009)	0.012 (0.01)	0.764	0.417	0.583

[a]Common Metric Completely Standardized Solution

Table 14

Correlations between Latent Constructs for the Mediation Analyses examining associations between Family Conflict, Peer

Victimization, and Substance Use

	PeerV1	PeerV2	PeerV3	PeerV4	FamC1	FamC2	FamC3	FamC4	AOD1	AOD2	AOD3	AOD4
PeerV1	1.000											
PeerV2	0.469	1.000										
PeerV3	0.441	0.662	1.000									
PeerV4	0.330	0.493	0.498	1.000								
FamC1	0.335	0.294	0.252	0.316	1.000							
FamC2	0.275	0.378	0.313	0.319	0.654	1.000						
FamC3	0.198	0.282	0.361	0.349	0.498	0.705	1.000					
FamC4	0.272	0.370	0.337	0.392	0.545	0.596	0.706	1.000				
AOD1	0.143	0.040	0.114	0.128	0.185	0.189	0.215	0.177	1.00			
AOD2	0.228	0.179	0.220	0.204	0.336	0.421	0.367	0.340	0.766	1.000		
AOD3	0.244	0.186	0.176	0.204	0.284	0.376	0.442	0.332	0.362	0.508	1.000	
AOD4	0.116	0.143	0.078	0.210	0.167	0.232	0.293	0.332	0.310	0.378	0.726	1.000
Means	1.616	1.704	1.635	1.519	1.897	1898	1.864	1.826	1.237	1.253	1.245	1.231
SD	0.350	0.549	0.396	0.278	0.294	0.395	0.339	0.278	0.130	0.277	0.192	0.124

Table 15.

95% Confidence Intervals for the Mediation Analyses examining associations between Family Conflict, Peer Victimization, and Substance Use

Waves	Effect of X on M (a)		Effect of M on Y (b)		Direct Effects (C')		Indirect Effect (a x b)	95% CI		Includes zero?
	B	SE	B	SE	B	SE	Boot	Lower	Upper	
Family Conflict → Peer Victimization → Substance Use										
1 - 2 - 3	0.218	0.046	0.040	0.018	0.084**	0.025	0.009	0.001	0.018	No
2 - 3 - 4	0.117	0.030	-0.025	0.014	-0.029	0.014	-0.003	-0.007	0.0003	Yes
1 - 3 – 4	0.185	0.041	-0.028	0.014	-0.050	0.016	-0.005	-0.011	0.0001	No
1 - 2 – 4	0.232	0.045	0.024	0.016	-0.006	0.021	0.006	-0.002	0.014	Yes
Peer Victimization → Family Conflict → Substance Use										
1 - 2 – 3	0.071	0.031	0.119	0.023	0.080**	0.022	0.008	0.001	0.017	No
2 - 3 – 4	0.035	0.023	-0.025	0.017	-0.011	0.012	-0.001	-0.003	0.0005	Yes
1 - 3 – 4	0.026	0.032	-0.023	0.017	-0.052	0.014	-0.006	-0.003	0.001	Yes
1 - 2 – 4	0.074	0.031	0.040	0.020	-0.002	0.020	0.003	-0.0001	0.008	Yes
Family Conflict → Substance Use → Peer Victimization										
1 - 2 – 3	0.201	0.021	0.094	0.034	0.062	0.035	0.019	0.005	0.034	No
2 - 3 – 4	0.145	0.023	0.080	0.039	0.138***	0.029	0.012	0.001	0.024	No
1 - 3 – 4	0.194	0.026	0.094	0.038	0.183***	0.032	0.018	0.003	0.034	No
1 - 2 – 4	0.204	0.021	0.065	0.032	0.163	0.032	0.013	0.001	0.027	No
Peer Victimization → Substance Use → Family Conflict										
1 - 2 – 3	0.112	0.020	0.108	0.029	-0.031	0.028	0.012	0.005	0.020	No
2 - 3 – 4	0.061	0.017	0.019	0.030	0.129	0.019	0.001	-0.002	0.005	Yes
1 - 3 – 4	0.151	0.023	-0.002	0.030	0.137	0.024	-0.001	-0.009	0.009	Yes
1 - 2 – 4	0.117	0.020	0.096	0.028	0.110***	0.027	0.011	0.004	0.019	No

Table 15 (cont.)

Substance Use → Family Conflict → Peer Victimization

1 - 2 − 3	0.137	0.048	0.096	0.030	0.099*	0.047	0.013	0.003	0.027	No
2 - 3 − 4	0.155	0.047	0.147	0.027	0.096*	0.044	0.023	0.008	0.040	Yes
1 - 3 − 4	0.208	0.049	0.209	0.030	0.044	0.044	0.043	0.021	0.069	No
1 - 2 − 4	0.155	0.047	0.147	0.027	0.096*	0.044	0.023	0.008	0.040	Yes

Substance Use → Peer Victimization → Family Conflict

1 - 2 − 3	-0.037	0.063	0.031	0.021	0.131	0.042	-0.001	-0.007	0.003	No
2 - 3 − 4	0.136	0.033	0.109	0.022	0.075	0.026	0.014	-0.006	0.025	Yes
1 - 3 − 4	0.106	0.054	0.110	0.022	0.008	0.036	0.012	-0.0001	0.026	Yes
1 - 2 − 4	-0.025	0.063	0.139	0.021	0.086	0.041	-0.003	-0.021	0.014	Yes

Note. ** = $p < 0.001$; * = $p < 0.01$

Table 16

Fit Indices for the Confirmatory Factor Analysis for the Moderation Analysis examining the associations between Peer Victimization, Family Closeness, and Substance Use

Model	χ2	df	p	Δ χ2	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
						Measurement Model Estimates[a]							
Null	33056.32	957											
Configural	1868.62	642	<.001	---	---	---	0.040	0.038 ; 0.042	0.962	---	0.943	---	---
Weak	2170.72	660	<.001	302.01	18	---	0.044	0.042 ; 0.046	0.953	0.009	0.932	0.011	Yes
Strong	2304.25	678	<.001	133.53	18	---	0.045	0.043 ; 0.047	0.949	0.004	0.937	0.003	Yes

Note.   [a]: Evaluated with the CFI difference test

Table 17

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model for the Peer Victimization, Family Closeness, Substance Use Moderation Analysis

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Family Closeness (Time 1):					
Parcel 1	1.288 (0.012)	-0.637 (0.04)	0.918	0.158	0.842
Parcel 2	1.336 (0.012)	-0.815 (0.04)	0.892	0.204	0.796
Parcel 3	0.376 (0.011)	1.452 (0.04)	0.440	0.806	0.194
Family Closeness (Time 2):					
Parcel 1	1.288 (0.012)	-0.637 (0.04)	0.920	0.153	0.847
Parcel 2	1.336 (0.012)	-0.815 (0.04)	0.909	0.174	0.826
Parcel 3	0.376 (0.011)	1.452 (0.04)	0.434	0.812	0.188
Family Closeness (Time 3):					
Parcel 1	1.288 (0.012)	-0.637 (0.04)	0.933	0.130	0.870
Parcel 2	1.336 (0.012)	-0.815 (0.04)	0.918	0.158	0.842
Parcel 3	0.376 (0.011)	1.452 (0.04)	0.442	0.805	0.195
Family Closeness (Time 4):					
Parcel 1	1.288 (0.012)	-0.637 (0.04)	0.946	0.106	0.894
Parcel 2	1.336 (0.012)	-0.815 (0.04)	0.919	0.156	0.844
Parcel 3	0.376 (0.011)	1.452 (0.04)	0.479	0.771	0.229

Table 17 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R^2*
Peer Victimization (Time 1):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.771	0.406	0.594
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.866	0.250	0.750
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.737	0.457	0.543
Peer Victimization (Time 2):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.790	0.376	0.624
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.874	0.236	0.764
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.728	0.470	0.530
Peer Victimization (Time 3):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.757	0.427	0.572
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.852	0.274	0.726
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.690	0.524	0.476
Peer Victimization (Time 4):					
Parcel 1	1.046 (0.012)	-0.021 (0.02)	0.779	0.392	0.608
Parcel 2	1.248 (0.013)	-0.267 (0.02)	0.885	0.218	0.782
Parcel 3	0.706 (0.010)	0.288 (0.02)	0.765	0.415	0.585

Table 17 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading*[a]	*Theta*	*R^2*
AOD Use (Time 1):					
Parcel 1	0.982 (0.009)	0.084 (0.01)	0.770	0.407	0.593
Parcel 2	1.054 (0.009)	-0.099 (0.01)	0.942	0.113	0.887
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.834	0.305	0.695
AOD Use (Time 2):					
Parcel 1	0.982 (0.009)	0.084 (0.01)	0.828	0.315	0.685
Parcel 2	1.054 (0.009)	-0.099 (0.01)	0.949	0.100	0.900
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.880	0.226	0.774
AOD Use (Time 3):					
Parcel 1	0.982 (0.009)	0.084 (0.01)	0.819	0.329	0.671
Parcel 2	1.054 (0.009)	-0.099 (0.01)	0.913	0.166	0.834
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.877	0.231	0.769
AOD Use (Time 4):					
Parcel 1	0.982 (0.009)	0.084 (0.01)	0.824	0.322	0.678
Parcel 2	1.054 (0.009)	-0.099 (0.01)	0.926	0.143	0.857
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.762	0.420	0.580

[a]Common Metric Completely Standardized Solution

Table 18.

Correlations, Means, Standard Deviations, and Regression Values between Latent Constructs for the Peer Victimization, Family

Closeness, Substance Use Moderation Analysis

	PeerV1	PeerV2	PeerV3	PeerV4	FamC1	FamC2	FamC3	FamC4	AOD1	AOD2	AOD3	AOD4	X(T1)	X(T2)	X(T3)
PeerV1	1.000														
PeerV2	-0.155	1.000													
PeerV3	-0.039	0.804	1.000												
PeerV4	-0.076	0.690	0.669	1.000											
FamC1	-0.233	0.182	0.113	0.096	1.000										
FamC2	-0.466	0.585	0.452	0.407	0.632	1.000									
FamC3	-0.445	0.610	0.491	0.441	0.556	0.866	1.000								
FamC4	-0.459	0.633	0.516	0.471	0.507	0.831	0.917	1.000							
AOD1	0.045	0.131	0.174	0.182	-0.282	-0.096	-0.010	0.016	1.00						
AOD2	0.528	-0.470	-0.324	-0.291	-0.428	-0.708	-0.701	-0.698	0.420	1.000					
AOD3	0.543	-0.487	-0.367	-0.310	-0.409	-0.700	-0.742	-0.724	0.134	0.778	1.000				
AOD4	0.459	-0.478	-0.395	-0.281	-0.381	-0.665	-0.708	-0.732	0.114	0.705	0.874	1.000			
X (T1)	-	-0.006	0.012	-0.028	-	0.020	-0.023	-0.047	-0.119	-0.084	-	-0.028	1.000		
X (T2)	-0.045	-	0.009	-0.129	0.055	-	0.025	-0.010	-0.056	-0.134	-0.112	-0.070	0.359	1.000	
X (T3)	-0.015	0.049	-	-0.055	0.056	-0.001	-	-0.036	-0.098	-0.147	-0.132	-0.023	0.250	0.528	1.000
Means	1.617	1.704	1.635	1.519	3.054	3.083	3.049	3.030	1.237	1.255	1.246	1.231	-	-	-
SD	0.349	0.547	0.398	0.279	0.179	0.237	0.228	0.199	0.129	0.277	0.193	0.124	-	-	-
β	0.086	0.130	-0.025	-	-0.023	-0.127	-0.026	-	0.466	0.376	0.558	-	-0.026	-0.062	0.070
	PeerV1	PeerV2	PeerV3	PeerV4	FamC1	FamC2	FamC3	FamC4	AOD1	AOD2	AOD3	AOD4	X(T1)	X(T2)	X(T3)

Note. * β is the regression value of the relevant latent variable predicting the outcome variable (AOD Use) at the following wave

Table 19

Fit Indices for the Peer Victimization, Delinquent Peers, Substance Use Moderation Confirmatory Factor Analysis

Model	χ^2	df	p	$\Delta\chi^2$	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
					Measurement Model Estimates[a]								
Null	37544.36	957											
Configural	2343.62	642	<.001	---	---	---	0.047	0.045 ; 0.050	0.953	---	0.931	---	---
Weak	2654.15	660	<.001	310.54	18	---	0.051	0.049 ; 0.053	0.945	0.008	0.921	0.010	Yes
Strong	2836.47	678	<.001	182.31	18	---	0.053	0.051 ; 0.055	0.941	0.004	0.917	0.004	Yes
					Longitudinal Structural Model[b]								
Initial SEM	13139.61	2199	<.001	256.23	101	<.001	0.052	0.051 ; 0.053	0.701	-	0.870	-	No
Final SEM	13037.54	2204	<.001	154.15	106	0.002	0.053	0.052 ; 0.054	0.704	-	0.871	-	Yes

Note. [a]: Evaluated with the CFI difference test

Table 20

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model Peer Victimization, Delinquent Peers, Substance Use Moderation Analysis

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	R^2
Delinquent Peers (Time 1):					
Parcel 1	1.128 (0.008)	-0.059 (0.01)	0.918	0.158	0.842
Parcel 2	1.079 (0.008)	-0.023 (0.01)	0.889	0.209	0.791
Parcel 3	0.792 (0.009)	0.081 (0.02)	0.748	0.441	0.559
Delinquent Peers (Time 2):					
Parcel 1	1.128 (0.008)	-0.059 (0.01)	0.927	0.141	0.859
Parcel 2	1.079 (0.008)	-0.023 (0.01)	0.910	0.172	0.828
Parcel 3	0.792 (0.009)	0.081 (0.02)	0.763	0.418	0.582
Delinquent Peers (Time 3):					
Parcel 1	1.128 (0.008)	-0.059 (0.01)	0.935	0.126	0.874
Parcel 2	1.079 (0.008)	-0.023 (0.01)	0.936	0.123	0.877
Parcel 3	0.792 (0.009)	0.081 (0.02)	0.736	0.458	0.542
Delinquent Peers (Time 4):					
Parcel 1	1.128 (0.008)	-0.059 (0.01)	0.948	0.102	0.898
Parcel 2	1.079 (0.008)	-0.023 (0.01)	0.942	0.112	0.888
Parcel 3	0.792 (0.009)	0.081 (0.02)	0.769	0.409	0.591

Table 20 (cont.)

Indicator		Equated Estimates		Standardized Estimates		
	Loading (SE)	Intercept (SE)	Loading[a]	Theta	R^2
Peer Victimization (Time 1):					
Parcel 1	1.045 (0.012)	-0.018 (0.02)	0.771	0.405	0.595
Parcel 2	1.245 (0.012)	-0.263 (0.02)	0.862	0.258	0.742
Parcel 3	0.710 (0.010)	0.281 (0.02)	0.742	0.449	0.551
Peer Victimization (Time 2):					
Parcel 1	1.045 (0.012)	-0.018 (0.02)	0.788	0.379	0.621
Parcel 2	1.245 (0.012)	-0.263 (0.02)	0.876	0.232	0.768
Parcel 3	0.710 (0.010)	0.281 (0.02)	0.733	0.463	0.537
Peer Victimization (Time 3):					
Parcel 1	1.045 (0.012)	-0.018 (0.02)	0.757	0.427	0.573
Parcel 2	1.245 (0.012)	-0.263 (0.02)	0.850	0.278	0.722
Parcel 3	0.710 (0.010)	0.281 (0.02)	0.692	0.521	0.479
Peer Victimization (Time 4):					
Parcel 1	1.045 (0.012)	-0.018 (0.02)	0.778	0.395	0.605
Parcel 2	1.245 (0.012)	-0.263 (0.02)	0.881	0.223	0.777
Parcel 3	0.710 (0.010)	0.281 (0.02)	0.770	0.408	0.592

Table 20 (cont.)

| Indicator | Equated Estimates | | Standardized Estimates | | |
	Loading (SE)	Intercept (SE)	Loading[a]	Theta	R^2
AOD Use (Time 1):					
Parcel 1	0.991 (0.009)	0.072 (0.01)	0.780	0.392	0.608
Parcel 2	1.038 (0.008)	-0.079 (0.01)	0.933	0.130	0.870
Parcel 3	0.971 (0.009)	0.007 (0.01)	0.838	0.298	0.702
AOD Use (Time 2):					
Parcel 1	0.991 (0.009)	0.072 (0.01)	0.835	0.303	0.697
Parcel 2	1.038 (0.008)	-0.079 (0.01)	0.938	0.121	0.879
Parcel 3	0.971 (0.009)	0.007 (0.01)	0.888	0.212	0.788
AOD Use (Time 3):					
Parcel 1	0.991 (0.009)	0.072 (0.01)	0.825	0.319	0.681
Parcel 2	1.038 (0.008)	-0.079 (0.01)	0.904	0.182	0.818
Parcel 3	0.971 (0.009)	0.007 (0.01)	0.879	0.227	0.773
AOD Use (Time 4):					
Parcel 1	0.991 (0.009)	0.072 (0.01)	0.838	0.297	0.703
Parcel 2	1.038 (0.008)	-0.079 (0.01)	0.910	0.172	0.828
Parcel 3	0.971 (0.009)	0.007 (0.01)	0.778	0.394	0.606

[a]Common Metric Completely Standardized Solution

Table 21

Correlations between Latent Constructs in the Peer Victimization, Delinquent Peers, Substance Use Moderation Analysis

	PeerV1	PeerV2	PeerV3	PeerV4	DelqP1	DelqP2	DelqP3	DelqP4	AOD1	AOD2	AOD3	AOD4
PeerV1	1.000											
PeerV2	0.468	1.000										
PeerV3	0.440	0.662	1.000									
PeerV4	0.328	0.492	0.497	1.000								
DelqP1	0.248	0.180	0.199	0.224	1.000							
DelqP2	0.230	0.282	0.268	0.292	0.683	1.000						
DelqP3	0.262	0.277	0.273	0.278	0.454	0.622	1.000					
DelqP4	0.219	0.385	0.276	0.359	0.396	0.504	0.579	1.000				
AOD1	0.143	0.044	0.117	0.130	0.59	0.421	0.234	0.220	1.00			
AOD2	0.228	0.182	0.221	0.205	0.461	0.606	0.408	0.356	0.767	1.000		
AOD3	0.244	0.186	0.175	0.202	0.343	0.467	0.595	0.404	0.368	0.511	1.000	
AOD4	0.119	0.145	0.081	0.205	0.297	0.348	0.417	0.556	0.316	0.384	0.730	1.000
Means	1.616	1.704	1.635	1.519	1.681	1.604	1.606	1.536	1.237	1.253	1.244	1.232
SD	0.348	0.548	0.398	0.278	0.237	0.362	0.332	0.247	0.130	0.279	0.193	0.127

Table 22

Fit Indices for the Confirmatory Factor Analysis for the Mediation Analysis examining associations between Peer Social Support, Peer Victimization, and Substance Use (AOD)

Model	χ2	df	p	Δ χ2	Δdf	p	RMSEA	RMSEA 90% CI	CFI	Δ CFI	TLI	ΔTLI	Pass?
							Measurement Model Estimates[a]						
Null	31776.26	957											
Configural	1680.72	642	<.001	---	---	---	0.037	0.035 ; 0.039	0.966	---	0.950	---	---
Weak	1940.34	660	<.001	259.63	18	---	0.041	0.039 ; 0.043	0.958	0.008	0.940	0.010	Yes
Strong	2062.47	678	<.001	122.13	18	---	0.042	0.040 ; 0.044	0.955	0.003	0.937	0.003	Yes

Note.   [a]: Evaluated with the CFI difference test

Table 23

Loading and Intercept Values, Residuals, and R2 Values for Each Indicator from the Strong Metric Invariance Model for the Mediation Analysis examining associations between Peer Social Support, Peer Victimization, and Substance Use (AOD)

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	*Intercept (SE)*	*Loading[a]*	*Theta*	R^2
Peer Social Support (Time 1):					
Parcel 1	1.035 (0.010)	-0.040 (0.02)	0.878	0.229	0.771
Parcel 2	1.061 (0.010)	-0.156 (0.02)	0.893	0.202	0.798
Parcel 3	0.904 (0.011)	0.196 (0.02)	0.794	0.370	0.630
Peer Social Support (Time 2):					
Parcel 1	1.035 (0.010)	-0.040 (0.02)	0.823	0.323	0.677
Parcel 2	1.061 (0.010)	-0.156 (0.02)	0.849	0.280	0.720
Parcel 3	0.904 (0.011)	0.196 (0.02)	0.736	0.458	0.542
Peer Social Support (Time 3):					
Parcel 1	1.035 (0.010)	-0.040 (0.02)	0.840	0.293	0.707
Parcel 2	1.061 (0.010)	-0.156 (0.02)	0.879	0.227	0.773
Parcel 3	0.904 (0.011)	0.196 (0.02)	0.742	0.450	0.550
Peer Social Support (Time 4):					
Parcel 1	1.035 (0.010)	-0.040 (0.02)	0.821	0.326	0.674
Parcel 2	1.061 (0.010)	-0.156 (0.02)	0.874	0.237	0.763
Parcel 3	0.904 (0.011)	0.196 (0.02)	0.771	0.405	0.595

Table 23 (cont.)

	Equated Estimates		Standardized Estimates		
Indicator	*Loading (SE)*	*Intercept (SE)*	*Loading[a]*	*Theta*	*R²*
Peer Victimization (Time 1):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.774	0.401	0.599
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.864	0.254	0.746
Parcel 3	0.706 (0.010)	0.287 (0.02)	0.737	0.456	0.544
Peer Victimization (Time 2):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.791	0.374	0.626
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.873	0.238	0.762
Parcel 3	0.706 (0.010)	0.287 (0.02)	0.729	0.468	0.532
Peer Victimization (Time 3):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.757	0.427	0.573
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.851	0.275	0.725
Parcel 3	0.706 (0.010)	0.287 (0.02)	0.691	0.523	0.477
Peer Victimization (Time 4):					
Parcel 1	1.048 (0.012)	-0.024 (0.02)	0.781	0.391	0.609
Parcel 2	1.245 (0.013)	-0.263 (0.02)	0.883	0.221	0.779
Parcel 3	0.706 (0.010)	0.287 (0.02)	0.767	0.412	0.588

Table 23 (cont.)

Indicator	Equated Estimates		Standardized Estimates		
	Loading (SE)	Intercept (SE)	Loading[a]	Theta	R^2
Substance Use (Time 1):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.767	0.412	0.588
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.945	0.106	0.894
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.794	0.308	0.692
Substance Use (Time 2):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.825	0.320	0.680
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.950	0.097	0.903
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.879	0.228	0.772
Substance Use (Time 3):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.815	0.335	0.665
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.916	0.160	0.840
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.876	0.232	0.768
Substance Use (Time 4):					
Parcel 1	0.978 (0.010)	0.089 (0.01)	0.818	0.331	0.669
Parcel 2	1.058 (0.009)	-0.104 (0.01)	0.931	0.133	0.867
Parcel 3	0.964 (0.009)	0.015 (0.01)	0.759	0.424	0.576

[a]Common Metric Completely Standardized Solution

Table 24

Correlations between Latent Constructs for the Mediation Analysis examining associations between Peer Social Support, Peer Victimization, and Substance Use (AOD)

	PeerV1	PeerV2	PeerV3	PeerV4	PeerSS1	PeerSS2	PeerSS3	PeerSS4	AOD1	AOD2	AOD3	AOD4
PeerV1	1.000											
PeerV2	0.468	1.000										
PeerV3	0.441	0.662	1.000									
PeerV4	0.328	0.492	0.498	1.000								
PeerSS1	-0.021	0.071	0.097	0.031	1.000							
PeerSS2	0.052	-0.014	0.014	0.058	0.476	1.000						
PeerSS3	0.100	0.056	0.014	0.094	0.463	0.659	1.000					
PeerSS4	-0.002	-0.018	0.046	-0.139	0.400	0.405	0.491	1.000				
AOD1	0.144	0.041	0.115	0.128	-0.142	-0.127	-0.106	-0.146	1.00			
AOD2	0.228	0.180	0.221	0.205	-0.098	-0.074	-0.034	-0.142	0.768	1.000		
AOD3	0.243	0.185	0.173	0.201	-0.071	-0.081	-0.036	-0.102	0.363	0.508	1.000	
AOD4	0.114	0.141	0.077	0.211	-0.146	-0.106	-0.096	-0.103	0.310	0.380	0.728	1.000
Means	1.616	1.704	1.635	1.519	2.249	2.260	2.266	2.230	1.237	1.255	1.246	1.231
SD	0.349	0.547	0.399	0.279	0.173	0.214	0.201	0.140	0.129	0.276	0.193	0.123

Table 25.

95% Confidence Intervals for the Mediation Analysis examining associations between Peer Social Support, Peer Victimization, and Substance Use (AOD)

Waves	Effect of X on M (a)		Effect of M on Y (b)		Direct Effects (c')		Indirect Effect (a x b)	95% CI		Includes zero?
	B	SE	B	SE	B	SE	Mean	Lower	Upper	
Peer Victimization → Peer Social Support → Substance Use Analysis										
1 – 2 - 3	0.046	0.024	-0.048	0.027	0.108	0.022	-0.002	-0.006	0.0004	Yes
2 – 3 - 4	0.037	0.016	-0.062	0.018	0.000	0.011	-0.002	-0.005	-0.0003	No
1 - 3 - 4	0.076	0.023	-0.061	0.019	-0.035*	0.014	-0.005	-0.009	-0.001	No
1 – 2 - 4	0.040	0.024	-0.076	0.025	0.024	0.019	-0.003	-0.008	0.0005	Yes
Peer Social Support → Peer Victimization → Substance Use Analysis										
1 – 2 - 3	0.142	0.054	0.064	0.018	-0.037	0.030	0.009	0.002	0.019	No
2 – 3 - 4	0.038	0.038	-0.022	0.014	-0.046	0.018	-0.0008	-0.004	0.001	Yes
1 - 3 - 4	0.160	0.047	-0.022	0.014	-0.084	0.020	-0.003	-0.009	0.001	Yes
1 – 2 - 4	0.134	0.054	0.045	0.016	-0.107	0.027	0.006	0.001	0.014	No
Peer Victimization → Substance Use → Peer Social Support Analysis										
1 – 2 - 3	0.103	0.020	0.002	0.023	0.057	0.021	0.0002	-0.005	0.005	Yes
2 – 3 - 4	0.057	0.017	-0.054	0.025	0.001	0.015	-0.003	-0.007	-0.0002	No
1 - 3 - 4	0.143	0.023	-0.052	0.026	-0.006	0.020	-0.007	-0.016	-0.0002	No
1 – 2 - 4	0.107	0.020	-0.074	0.022	0.011	0.020	-0.008	-0.014	-0.003	No
Peer Social Support → Substance Use → Peer Victimization Analysis										
1 – 2 - 3	0.008	0.027	0.133	0.033	0.116	0.041	0.001	-0.006	0.008	Yes
2 – 3 - 4	-0.043	0.028	0.137	0.035	0.098	0.034	-0.006	-0.015	0.001	Yes
1 - 3 - 4	-0.033	0.033	0.127	0.036	0.063	0.038	-0.004	-0.014	0.004	Yes
1 – 2 - 4	0.005	0.028	0109	0.030	0.074	0.038	0.0005	-0.006	0.007	Yes

Table 25 (cont.)

	Substance Use → Peer Victimization → Peer Social Support Analysis									
1 – 2 - 3	-0.039	0.063	0.038	0.017	-0.023	0.033	-0.001	-0.008	0.003	Yes
2 – 3 - 4	0.138	0.033	0.035	0.019	-0.088	0.021	0.004	-0.0003	0.011	Yes
1 - 3 - 4	0.106	0.055	0.025	0.019	-0.092	0.030	0.002	-0.001	0.009	Yes
1 – 2 - 4	-0.026	0.063	-0.008	0.016	-0.093	0.031	0.0002	-0.002	0.003	Yes
	Substance Use → Peer Social Support → Peer Victimization Analysis									
1 – 2 - 3	-0.073	0.039	0.052	0.038	0.165	0.048	-0.004	-0.013	0.002	Yes
2 – 3 - 4	0.004	0.023	0.115	0.035	0.088	0.029	0.0004	-0.005	0.006	Yes
1 - 3 - 4	-0.060	0.037	0.118	0.036	0.090	0.043	-0.007	-0.018	0.001	Yes
1 – 2 - 4	-0.086	0.039	0.097	0.036	0.153	0.044	-0.008	-0.020	0.0003	Yes

Note. * $p<0.05$