

BULLYING, VICTIMIZATION, DEPRESSION, AND  
SUBSTANCE USE: SEX AS A POSSIBLE  
COMPLICATING FACTOR

by

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Presented to the Faculty of the Graduate School of  
The University of Texas at Arlington in Partial Fulfillment  
of the Requirements  
for the Degree of

MASTER OF SCIENCE IN PSYCHOLOGY

THE UNIVERSITY OF TEXAS AT ARLINGTON

December 2012

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## ACKNOWLEDGEMENTS

I would like to thank my committee members, Dr. Linda Perrotti, Dr. Lauri Jensen-Campbell, Dr. Angela Dougall, and Dr. Martha Mann. I would also like to thank my colleagues Rebecca L. Robinson and Dr. Emily Farris for their editorial help, sanity checks, and knowing how to manage the experience. Professionally, I would like to give thanks to Dr. Angela Dougall, Dr. William Ickes, and Dr. Pablo A. Mora for taking an interest in me through regularly discussing my thesis project with me, providing me resources, and consistently offering constructive criticism on how to manage and improve the experience. Personally, I would like to acknowledge my friends, Dr. Aurélie Kapusta, Dr. Perrine Pelosse, Dr. Susan A. Autrey, and Mark Jordan for offering me career advice, perspective, and an outlet for expressing my frustrations in an eloquent fashion. Additionally, I would like to thank my mother and my academic mother for fostering an environment for me to develop my skills (you know who you are and I am very grateful for you both). Finally, I would like to thank my friends and family for the enduring support they have provided me.

November, 26, 2012

ABSTRACT

BULLYING, VICTIMIZATION, DEPRESSION, AND  
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As previous research emphasizes a complex model of substance use regarding bullying dynamics and influence with depression, further investigation is warranted. Adolescents aged 15 years were selected from the Health Behaviors in School Aged Children ( $N = 2656$ ) and the National Institute of Child Healthcare and Development ( $N = 1364$ ) databases. Analyses were performed using mixed regression models with the SPSS PROCESS macro (Hayes, 2012b), employing both mediation and moderated-mediation. Four models were produced from each dataset: (a) mediation of victimization on substance use through depression, (b) moderated-mediation of victimization on substance use through depression, moderated by sex; (c) mediation of bullying on substance use through depression, and (d) moderated-mediation of bullying on substance use mediated through depression, moderated by sex. All models produced were consistent in that relationships were partially mediated through depression. However, only one sex moderated relationship was found between bullying and substance use through depression in the NICHD dataset. This novel finding that females were found at a greater risk for substance use when bullying and depressed highlights the need to investigate the pathology of the female bully. Additionally, the lack of other sex-moderated effects further emphasizes that other factors should be considered.

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CHAPTER 1  
INTRODUCTION

I hate to advocate drugs, alcohol, violence, or insanity to anyone,  
but they've always worked for me.

- Hunter S. Thompson

While substance use is not always substance abuse or dependence, in adolescents substance use in any form is harmful to their health and development. Not everyone that uses substances becomes an addict and there are many different reasons to engage in substance use, such as a response to stress and negative emotions, enhancing positive emotions, or conforming to a group (Annis & Graham, 1995). However, due to ongoing neurodevelopment, substance use is particularly problematic in adolescents, as this can produce lasting consequences into adulthood. Moreover, if substance use is elicited in response to stress and negative emotions, then victimized adolescents are particularly vulnerable for long-term maladaptive behaviors that could manifest in the form of substance use disorder (SUD). The associations between victimization, depression, and substance use, have been studied previously, but not within a specific causative model accounting for the moderating influences of sex differences. The purpose of the current research is to expand upon the relationship between victimization and substance use through depression, while also determining how sex differences influence the relationship. Furthermore, as most research focuses on victims as opposed to bullies, the present research also attempts to discover if interplay between bullying, depression and substance use exists, and if the relationship is also moderated by sex differences.

### 1.1 Substance Use in Adolescence

Adolescence is a critical period for the initiation of substance use. According to the 2009 National Survey on Drug Use and Health, 7% of adolescents aged 15-16 reported binge drinking, 11.6% of adolescents aged 12-17 reported tobacco use, and 9% of adolescents at ages 15-16 reported using some type of illicit drug (Substance Abuse and Mental Health Services Administration, 2010). Early initiation of drug use is correlated with increased risk of legal problems and the later development of SUD. Thus, it is important to understand factors that regulate this behavior.

A growing body of evidence suggests that adolescence is a period of heightened biological vulnerability to the rewarding and addictive properties of substances of abuse. For example, adolescents demonstrate a more rapid progression to addiction and higher rates of dependence compared to adults (Warner, Kessler, Hughes, Anthony, & Nelson, 1995; Estroff, Schwartz, & Hoffmann, 1989; Chen & Kandel, 2002). It has been suggested that the unique, maturational changes which occur in brain reward systems during late adolescence render the adolescent brain more vulnerable to the rewarding properties of addictive drugs (Chambers, Taylor, & Potenza, 2003). If adolescents are at a greater risk for substance abuse and dependence, then further investigation into factors that contribute to these behaviors are paramount to prevention and treatment specific to adolescents.

The heightened predisposition for substance abuse and dependence in adolescents can be explained from a neurodevelopmental perspective. Changes in neural circuitry, as the brain develops from adolescence to adulthood, result in alterations to the reward pathway that render it particularly sensitive to rewarding stimulation (Chambers, Taylor, & Potenza, 2003; Gogtay et al., 2004; Sowell, Thompson, Holmes, Jernigan & Toga, 1999; Volkow et al., 2005; Volkow et al., 2001; Volkow et al., 2006). For example, in neuroimaging studies, cue elicited responses of the basal ganglia have been identified in substance use behaviors (Filbey, 2009). In terms of how this region of the brain is impacted in neurodevelopment, frontal cortex



projections to and from the basal ganglia strengthen during the transition from adolescence to adulthood (Gogtay et al., 2004; Sowell, Thompson, Holmes, Jernigan & Toga, 1999). Cortical projections from the basal ganglia are paramount to decision making and judgment, especially with regard to the execution or inhibition of reward-seeking behaviors. In the functional adult brain, there is increased activation of the cortical projections from the basal ganglia, especially in regards to the anticipation of a reward stimulus (Galvan et al., 2005; Volkow et al., 2005). Neuroimaging data further demonstrates greater recruitment of the nucleus accumbens (NAc) - a region of the basal ganglia within the limbic system which is highly implicated in addiction (DiChiara et al., 2004) - in reward-related behaviors of adolescents compared to young children and adults (Galvan et al., 2006). Therefore, given the enhanced activation of the NAc and the deficit in frontal cortex regulatory mechanisms, adolescents are at higher risk for substance use disorders. It is noteworthy to mention that insult to these reward-related brain regions seems to be sustained when drugs/alcohol use begins in adolescence (DeBellis et al., 2000; see Squeglia, Jacobus, & Tapert, 2009 for review). This is particularly problematic because the use of some substances of abuse (for example non-prescription use of opiate medications), begins in adolescence and often co-occurs with the use of other substances of abuse (Wu, Pilowsky, & Patkar, 2008). This is especially important when one considers the biological foundations for substance use and how psychoactive substances can have long term consequences within developing brains. Thus, the further investigation of risk factors which predispose adolescents to substance use behaviors is warranted as a matter of public health.

### 1.2 Depression and Substance Use

Depression is one of the most commonly diagnosed clinical disorders during adolescence (U.S. Public Health Service, 2007; Hauenstein, 2003; Petersen et al., 1993; Sampson, & Mrazek, 2001; Wade, Cairney, & Pevalin, 2002; Kandel, & Davies, 1986; Rao et al., 1995). Approximately one third of the adolescents with depressive symptoms remain symptomatic later in life (Rao et al., 1995). In addition, major depressive disorder (MDD) is more

common in girls than in boys (Wade, Cairney, & Pevalin, 2002; Kandel, & Davies, 1986; Rao, Daley, & Hammen, 2000). Both adolescent and adult studies have demonstrated that MDD is associated with substance use, abuse, and addiction (Clark, Kirisci, & Tarter, 1998; Merikangas et al., 1998; Armstrong & Costello, 2002; Hauenstein, 2003), and moreover, adolescents with MDD are more likely to reflect comorbid SUD diagnoses (Rowe, Liddle, Greenbaum, & Henderson, 2004; Riggs et al., 2007). In addition, severity of depression in adolescents has been found to be associated with a higher severity of SUD (Riggs, Mikulich, Coffman, & Crowley, 1997; Rao, Daley, & Hammen, 2000; Rowe, Liddle, Greenbaum, & Henderson, 2004; Riggs et al., 2007). According to a national survey from 2005 to 2006 by the Centers for Disease Control and Prevention (CDC), approximately 5.4% of those over the age of 12 reported current depression, and those between the ages of 12 and 17, 4.3% or approximately 1 in 23 American adolescents had current depression (Pratt & Brody, 2008). Given that depression is so commonplace in adolescents, symptoms can persist through the life-span, and comorbidity exists between depression and SUD, investigating factors predisposing adolescents to depression would ideally assist prevention measures.

Naturally, the question exists of why depressed adolescents would choose to engage in substance use. The generally offered explanation is the self-medication hypothesis, or in other words, the tendency for individuals to engage in substance use to treat their own ailments. Evidence for this hypothesis has been found in studies showing that individuals who report engaging in substance abuse do so to alleviate specific symptoms of mental illness, thereby attenuating negative affect, and/or enhancing positive emotions (Annis & Graham, 1995). Thus, psychiatric disorders, particularly anxiety and depression, may be considered risk factors for SUD in adolescents (Rao et al., 1999; Rao, Daley, & Hammen, 2000; Armstrong & Costello, 2002; Ziyadeh et al., 2007; Shrier et al., 2001; Tetrault et al., 2008; Fleming & Jacobsen, 2009; Back et al., 2010; Subramaniam & Stitzer, 2009; Ford et al., 2010; Green et al., 2011; Chiang et al., 2007; Conway, Compton, Stinson & Grant, 2006; Lin et al., 2004). Given the previously

discussed greater vulnerability to the rewarding properties of addictive drugs in adolescents (Chambers, Taylor, & Potenza, 2003), identifying risk factors such as depression would greatly assist in potential interventions.

### 1.3 Adolescent Peer Victimization

Peer victimization – “being bullied” - is a prevalent social health concern which primarily affects adolescents. Being bullied is characterized by an intentional, pervasive and habitual pattern of aggression which involves an imbalance of power between the victim(s) and perpetrator(s) (Olweus, 1986). Rates of peer victimization are highest amongst adolescents in middle school/junior high and according to the nationwide 2009 Youth Risk Behavior Surveillance System (YRBSS), as many as 19.9% of high school students reported being bullied during the past 12 months (Centers for Disease Control and Prevention, 2010). Because the occurrence of bullying and the complexity of its dynamics appear to be greatest within the school environment (Smith, et al., 2008; Klomek, Marrocco, Kleinman, Schonfeld, & Gould, 2007; Williams, Chambers, Logan & Robinson, 1996; Wolke, Woods, Stanford, & Schulz, 2001), victimized children often have more school absences, earn lower grades, and have greater social adjustment problems than non-victimized students (Dake, Price & Telljohann, 2003; Houbre, Tarquinio, Thuillier, & Hergott ,2006; Eisenberg, & Radel, 2005). Consequently, being bullied has recently become recognized as a significant risk factor for severe mental health problems; notably depression, anxiety and SUD (Luk, Wang, & Simmons-Morton, 2010; Kilpatrick et al., 2000; Kim, Koh, & Leventhal, 2005; Klomek et al., 2007; Nansel et al., 2001).

#### *1.3.1 Victimization and Depression*

Victimization, which has often been regarded as a benign rite of passage by previous generations within the general public, could produce serious psychological consequences such as depression. The association between victimization and depression has been extensively studied, and consistently, this relationship appears to be substantiated (Luk, Wang, & Simmons-

Morton, 2010; Bond, Carlin, Thomas, Rubin, & Patton, 2001; Baldry, 2004; Fekkes, Pijpers, & Verloove-Vanhorick, 2004; Fleming & Jacobsen, 2009; Hawker & Boulton, 2000; Kaltiala-Heino, Rimpela, Rantanen, & Rimpela, 2000; Kim, Koh, & Leventhal, 2005; Klomek et al., 2007, Kumpulainen & Rasanen, 2000; Park, Schepp, Jang, & Koo, 2006; Tharp-Taylor et al., 2009; Turner, Finkelhor, & Ormrod, 2006; van der Wal, de Wit, & Hirasing, 2003; Williams et al., 1996; Solberg & Olweus, 2003; Iyer, Dougall, & Jensen-Campbell, 2011). The cumulative effects of recurrent victimization also appear to increase the prevalence of depressive symptoms within victimized adolescents (Ford, Elhai, Conner, & Frueh, 2010; Finkelhor, Ormrod, & Turner, 2009; Finkelhor, Ormrod, & Turner, 2007a; Finkelhor, Ormrod, & Turner, 2007b; Turner et al., 2006; Finkelhor, Ormrod, Turner, & Hamby, 2005). Identification of somatic markers of depression corroborates the idea that victimization and depression are strongly associated. For example, Vaillancourt et al. (2011) found that adolescents who were victimized reflected greater depression, as well as other consistent hallmarks of depression such as decreased cortisol levels and decreased memory performance. Further, the link between victimization and overall health has been found to be mediated by cortisol levels (Knack, Jensen-Campbell, & Baum, 2011), indicating hyper-reactivity in response to adverse conditions. Additionally, it could be said that victimization itself, is a vulnerability factor for the further development of psychiatric disorders (Finkelhor, Ormrod, & Turner, 2007a; Finkelhor, Ormrod, & Turner, 2007b; Turner, Finkelhor, & Ormrod, 2006). As coping strategies are likely employed to deal with repeated bullying, it is particularly concerning when victimized adolescents rely on the coping strategy of substance use.

### *1.3.2 Victimization and Substance Use*

Victimization has been found to be a risk factor for substance use (Luk et al., 2010; Mitchell, Ybarra, & Finkelhor, 2007; Ford et al., 2010; Kilpatrick et al., 2000; Forero, McLellan, Rissel, & Bauman, 1999; Kaltiala-Heino et al., 2000; Kim, Catalano, Haggerty, & Abbott, 2011; Nansel et al., 2001; Tharp-Taylor, Haviland, & D'Amico, 2009). As victimization can be

traumatic and the prevalence increases with age, these factors (trauma and age) have also been routinely associated with the use of alcohol and illicit drugs in adolescents (Nansel et al., 2001; Kilpatrick et al., 2000; Nansel et al., 2004; Hyman et al., 2008; Tharp-Taylor et al., 2009). Furthermore, victimized substance abusers start using drugs and alcohol at a younger age than non-victimized substance users (Kilpatrick et al., 2000). In terms of particular patterns of substance use, victimization in adolescents has been associated with smoking (Tharp-Taylor et al., 2009; Nansel et al., 2001; Forero et al., 1999), alcohol consumption (Tharp-Taylor et al., 2009; Nansel et al., 2004; Nansel et al., 2001), and marijuana use (Tharp-Taylor et al., 2009; Kilpatrick et al., 2000). As previously discussed, adolescents engaging in substance use can manifest problems into adulthood, especially during this developmentally critical period. For example, Hyman and colleagues (2008) identified a predictive trend in cocaine relapse outcomes in women, based on the severity of childhood trauma. They also found that severity of childhood trauma was also predictive of the amount of cocaine that was used. While not all cases of substance use extend to a similar route, even a subset of the population can benefit from findings that could aid in prevention. In other words, in order to better assist prevention, better understanding of the problem is necessitated.

#### 1.4 Bullying

In defining the elements of bullying dynamics, victims are those who are subjected to peer victimization and the perpetrators are those who are engaging in the peer-bullying. As much of the current research is centered on elucidating characteristics typically found in the *victims* of bullying perpetration, additional research is needed to understand factors associated with individuals who are the perpetrators. In considering whether or not researchers and adolescents are defining bullying similarly, Vaillancourt and colleagues (2008b) found that adolescent children reliably identify bullying as “negative behavior” directed towards an individual of lower social standing (“power imbalance”). This is remarkably consistent with how researchers consistently define bullying in operational terms: (a) intentional harm or

disturbance, (b) recurrent pattern of such aggressive behaviors, and (c) a power imbalance, where those perceived as more powerful target those perceived as less powerful (Nansel et al., 2001). Specific manifestations of bullying behaviors have been identified, such that these behaviors can be further categorized into physical bullying, verbal bullying, indirect bullying, and more recently “electronic aggression” or cyber bullying (Nansel, et al., 2001; Li, 2006; David-Ferdon & Hertz, 2007; Smith, et al., 2008; David-Ferdon & Hertz, 2009). These categories of bullying behaviors appear to be preferentially employed by adolescents contingent upon their sex, and this will be further expanded in section *1.5 Sex Differences*. Additionally regarding bullying dynamics, not all bullies are merely just bullies, but rather some are an interesting hybrid of “bully-victims”. These bully-victims bully others and are bullied themselves. Given this identification, some researchers classify bullying dynamics into four categories: (a) bullies, (b) victims, (c) bully-victims, and (d) neither (Nansel, et al., 2001; David-Ferdon & Hertz, 2007; Smith, et al., 2008; David-Ferdon & Hertz, 2009). The current research seeks to focus on the specific dynamics within the categories of bullies and victims, compared to those who have not reported either behavior. The rationale behind this was that the established relationships between victimization, depression, and substance use could be substantiated as a point of reference, and the untested relationships between bullying, depression, and substance use could be determined. The inclusion of bully-victims and those who had experienced neither victimization nor bullying, would not provide to the direct assessment of these models.

#### *1.4.1 Bullying and Depression*

Bullies themselves are not without their psychopathologies, despite those who are victimized receiving the majority of research. A study by Juvonen, Graham, and Schuster (2003) investigated psychiatric comorbidity within the bullying dynamic categories, and despite considering bullies the “psychologically strongest” and bully-victims as the “most troubled”, other researchers have consistently found that bullies reflect comorbidity with axis I disorders (anxiety disorders, depressive disorders, etc.), and conduct disorder (Hodgins, Cree, Alderton, & Mak,

2008; Armstrong & Costello, 2002; Subramaniam & Stitzer, 2009; Morris, Zhang & Bondy, 2006; Klomek et al., 2007; Kaltiala-Heino et al., 2000; Kim et al., 2005; van der Wal et al., 2003; Wolke et al., 2001; Chiang et al., 2007; Forero et al., 1999). While bullying others has also been associated with a high risk for depression (Klomek et al., 2007; Kaltiala-Heino et al., 2000; Kim et al., 2005; van der Wal et al., 2003; Wolke et al., 2001), this link is not as firmly grounded, as other studies have provided conflicting results (Kim, Leventhal, Koh, & Boyce, 2006; Fekkes et al., 2004; Juvonen et al., 2003). Even though it is fairly common for depression to manifest as aggression, the association of bullying with conduct disorder provides a more logical relationship (Chiang et al., 2007; Morris, Zhang, & Bondy, 2006; Subramaniam & Stitzer, 2009; Hodgins, Cree, Alderton, & Mak, 2008; Armstrong & Costello, 2002). In a study by Pisetsky and colleagues (2008), it was postulated that adolescent males engaged in disordered eating and concomitant substance use (specifically steroid use and inhalant use), due to impulsivity. As one of the major hallmarks of conduct disorder is impulsivity, in adolescents, this impulsivity could either be an effect of maturation or behaviors consistent with bullying. Nevertheless, as the role of depression is not very clear in bullies, further investigation is needed to clarify what relationship exists.

#### *1.4.2 Bullying and Substance Use*

Limited research exists regarding the explicit investigation of bullying and substance use, but rationale can be found in an analogous relationship within the aforementioned psychiatric comorbidity of conduct disorder. For example, conduct disorder has been associated with an increased risk of substance use (Morris, Zhang, & Bondy, 2006; Subramaniam & Stitzer, 2009; Hodgins, Cree, Alderton, & Mak, 2008; Armstrong & Costello, 2002; Merikangas et al., 1998). Similarly, those with antisocial personality disorder -the adult analog to conduct disorder- have also been found to be at a greater risk for substance use (Chiang et al., 2007; Darke Torak, Kaye, Ross, & McKetin, 2010). Both conduct disorder and antisocial personality disorder share many features in common with the archetype of a bully (Vaughn et al., 2010), which could

offer comparison to related factors regarding bullying. By taking this comparative approach, one could see how researchers provided the rationale and justification for further investigation into the relationship between bullying and substance use.

To complicate matters further, while considering the category of the bully-victim, evidence has also been found implicating conduct disorder to be predictive of victimization (Hodgins et al., 2008). Given the association between victimization and substance use, this also provides some legitimacy in the association of bullying to substance use behaviors, but perhaps through a different path of behaviors. In a similar fashion, a study by Darke and colleagues (2010) found that in heroin and methamphetamine addicts, violent offending was also related to prior victimization. In conjecture, perhaps these bullying behaviors are learned from prior victimization, or perhaps these behaviors are only specific to those that are within the bully-victim category. Either way, these relationships must be considered to further understand how bullying is related to substance use.

Because all adolescent bullies are unlikely to meet the diagnostic criteria for conduct disorder, it is also unlikely that all bullies will develop antisocial personality disorder. Still, bullying at an early age appears to be a significant predictor for early adulthood violence, heavy alcohol consumption, and marijuana use (Kim, Catalano, Haggerty, & Abbott, 2011). Adolescent studies have found that bullying has been associated with substance use (Kim et al., 2011; Nansel et al., 2004; Nansel et al., 2001; Kaltiala-Heino et al., 2000; Tharp-Taylor et al., 2009; Morris et al., 2006), and specific substance use patterns have also been revealed, such that bullies reflect increased preference for alcohol consumption (Kim et al., 2011; Nansel et al., 2004; Nansel et al., 2001; Kaltiala-Heino et al., 2000), smoking (Tharp-Taylor et al., 2009; Morris et al., 2006), and marijuana use (Kim et al., 2011; Tharp-Taylor et al., 2009) compared to non-bullying adolescents. These findings have helped provide rationale for why bullies could be at a greater risk for SUD. Furthermore, as bullying can produce long-term consequences for young adults, investigation into bullying and the subsequent long-term effects is essential.



Whether or not bullies are members of the antisocial spectrum of society, understanding the relationship between bullying, substance use and depression may provide insight into potential methods to address the greater public health within communities.

### 1.5 Sex Differences

In review of the literature, findings are typically inconsistent regarding bullying dynamics and substance use when investigated either independently or in conjunction. In other words, most studies find or fail to find sex differences depending on how the investigations were conducted. Specifically, many focus on routine differences between the sexes on specific variables, and others focus on the use of stratified analyses. These may infer some differences, but without a true point of reference it is often difficult to interpret such findings.

#### *1.5.1 Sex Differences in Bullying Dynamics*

Regarding sex differences within bullying dynamics, the general consensus amongst the previous research has been that males are more likely to bully others and that no real sex differences exist in victimization. In other words, while males are more likely to be perpetrators, research has found that males and females are equally likely to be victimized (Klomek, et al., 2007; Williams et al., 1996; Wolke et al., 2001; Nolin, Davies, & Chandler, 1996; Nansel et al., 2001; Carlye & Steinman, 2007; Craig & Harel, 2004; Forero, McLellan, Rissel, & Bauman, 1999; Morris, Zhang, & Bondy, 2006; Tharp-Taylor, Haviland, & D'Amico, 2009). However, some studies have identified specific sex differences across bullying behaviors. For example, regarding the previously categorized bullying behaviors (see section *1.4 Bullying*), males preferentially engage in physical and verbal bullying and females preferentially engage in verbal and indirect bullying (Nansel, et al., 2001). In reference to bullying dynamic categories (see section *1.4 Bullying*), as males and females overall are just as likely to be victims, males are typically more likely to be bullies or bully-victims compared to females (Klomek et al., 2007; Kumpulainen & Rasanen, 2000; Wolke et al., 2001; Morris, Zhang, & Bondy, 2006; Juvonen, Graham, & Schuster, 2003; Carlye & Steinman, 2007; Forero et al., 1999). Thus, sex

differences in bullying dynamics could illuminate differential motivations or sex specific coping strategies in response to these dynamics. Understanding these differential motivations or sex specific coping strategies could further assist in more effective interventions to assist adolescents involved in bullying dynamics.

### *1.5.2 Sex Differences in Substance Use*

Many epidemiological studies on substance use combine adolescents and adults in analyses, even though adolescents are less likely to use substances compared to adults. According to epidemiological data, when including all age ranges sex differences occur, such that males overall are more likely to use substances than females (Substance Abuse and Mental Health Services Administration, 2011; Substance Abuse and Mental Health Services Administration, 2010; Milani et al., 2004; Isralowitz & Rawson, 2006; Svensson, 2003; Poulin, et al., 2005; Schepis et al., 2011). Moreover, even though males are more likely to use substances, sex differences also manifest in a substance specific manner. For example, regarding sex differences within specific substances, the data consistently show that these differences are driven by alcohol using males (Isralowitz & Rawson, 2006; Poulin, et al., 2005; Svensson, 2003), males using marijuana (Isralowitz & Rawson, 2006; Svensson, 2003; Schepis et al., 2011), and females who smoke (Isralowitz & Rawson, 2006; Poulin, et al., 2005). Furthermore, regarding non-medical prescription drug use (NMPDU), one study found that college-aged males were more likely to report use (McCabe, Teter, & Boyd, 2005), but another found preference of females with NMPDU (Young, Glover, & Havens, 2012). However, as studies regarding sex differences in substance use are not always quantified in the same manner, special attention is needed regarding the construct of such studies. For example, a potential complication in studying sex differences in substance use could be how the study or more specifically the questions are constructed, as these constructs could influence how participants report the outcomes found within a study. Additionally, age specific sex differences

need further identification to understand the factors motivating such behavior and the course of actions regarding substance use behaviors.

In addition to simply looking at substance use, poly-drug use, or multiple substance use, has also revealed sex differences. For example, heavy illegal drug use has been found to be greater in males than in females (Milani et al., 2004). Furthermore, with regard to “recreational” substance use in poly-drug users, sex specific differences have been found such that males exhibit a preference for psychostimulants, amyl nitrate, and opiates, whereas females exhibit a preference for cocaine and psychotherapeutic agents (Milani et al., 2004). In poly-drug using males, the pattern of use appears to be consistent with the research by Annis & Graham (1995), such that males are more likely to use drugs to enhance positive emotions and females are more likely to use drugs in response to stress and negative emotions. A study by Tetrault and colleagues (2008), investigating non-medical prescription opioid use (NMPOU) in adolescents, revealed that in regular NMPOU abusers, females were more likely to smoke and males were more likely to use inhalants, in addition to NMPOU. The greater preference for cigarettes in females within this population was also substantiated by Back et al. (2010). In a study of opiate users with psychiatric diagnoses, more males than females were represented, but females initiated substance use at a much younger age (Chiang et al., 2007). In speculation, perhaps the reason for a smaller number of females within this study could be the reluctance on behalf of females to seek treatment for opiate addiction. It is also important to note that opiate misuse is steadily increasing in females (Green et al., 2009; Green et al., 2011). Nevertheless, the underlying reasons for substance use and differences between the sexes may be far more complex than researchers have envisioned.

### *1.5.3 Sex Differences in Integrative Models*

Sex differences amidst bullying dynamics, psychopathology, and substance use also illuminate a more complex conceptualization of the problem at hand. Additionally, this appears to be a major area warranting clarification within the growing body of literature. Research

regarding sex differences within psychopathology on substance use indicate that females reflect a greater association with psychiatric Axis I disorders (particularly depression), and less of an association with criminal activities, as compared to males (Lin et al., 2004; Back et al., 2010; Conway, Compton, Stinson, & Grant, 2006; Green et al, 2009; Poulin, et al., 2005). A possible explanation for why males are less likely to be depressed could be that females are more likely to report symptoms of depression. This could be inferred from research that females are generally more likely to report experiencing overall medical problems than males (Green et al, 2009) as well as females are more likely to report poorer perceived health and greater symptoms of any kind over their lifespans (Macintyre, Hunt, & Sweeting, 1996). As depression is a medical condition (the general public is typically inundated by anti-depressant commercials saying this verbatim as well), males may be less inclined to indicate depression just as any other medical problem. However, to complicate matters further, a condition has been found in which males would be more likely to report depression. Specifically, adolescent males who were sexually active substance users and reported the highest levels of depression were more than three times as likely to have an STD (Shrier et al., 2001). This relationship between sexually active adolescent males high in depressive symptoms and incidence of STDs was found to be mediated through their substance use, suggesting that a relationship between depression and substance use also exists in males. In speculation, this could indicate that males are more likely to report depression when other medical conditions, which would warrant prompt attention, are found. Thus, while differences in reported levels of depression exist between males and females, there still could be a plausible relationship between substance use and depression in both sexes.

Sex differences in bullies and patterns of substance use have been found to be related in a substance specific manner. For example, girls who bully others are more likely to smoke cigarettes (Morris et al., 2006) and use marijuana (Tharp-Taylor et al., 2009) than boys who engage in bullying behaviors. Sex and victimization also appear to influence the frequency of

substance use and the type of substance used. For example, victimized males were more likely to use marijuana and consume alcohol (Ford et al., 2010; Kilpatrick et al., 2000). In men, victimization has been more strongly associated with substance use than in women, and this relationship is even greater in sexual minority groups (Hughes et al., 2010). Investigating bullying dynamics, depression, and substance use, a Chilean study found that males were more likely to report victimization, females were more likely to report depression, and that males were more likely to use alcohol and marijuana whereas females preferred smoking (Fleming & Jacobsen, 2009). The finding that males were more likely to report being victimized was noted by the authors as being contradictory to previous studies, but nevertheless this poses the question of what other factors could influence such findings. Finally, investigating victimization, depression and substance use, Luk and colleagues (2010) found in their sex-specific stratified analyses that the relationship between victimization and substance use appears to be mediated by depression for females, but not for males. Considering the complex and sometimes contradictory findings when integrating the factors of bullying dynamics, depression, substance use, and sex differences, further research is needed to better understand why such differences are accounted or not.

### 1.6 Summary

Although, it is well established that adolescent exposure to victimization is a vulnerability factor for psychiatric disorders and substance use, the concurrent relationship between victimization, depression, and substance use still lacks in-depth understanding. Likewise, similar relationships have been established for bullying, depression, and substance use, but not in a simultaneous model. To better address the growing problems of substance use and bullying dynamics, understanding the synergistic effects within these realms may provide more effective avenues of treatment. As sex differences are inconsistent and often overlooked in integrative models, these elements should be addressed in combination. Specifically, research is needed regarding how sex influences the relationship between victimization,

depression, and substance use, and in the same manner, how sex differences influences an integrative model for bullying, depression, and substance use.

### 1.7 Experimental Hypotheses and Objectives

The purpose of the current study was to better understand the relationships between bullying dynamics, depression, and the compensatory behavior of substance use. Further, using samples of 15-year-old adolescents, this study attempted to uncover the specifics of these relationships at the pinnacle age of typical bullying dynamics. As previous research emphasized a complex model of substance use regarding bullying dynamics and influence with depression, further investigation was warranted. The published literature has been inconsistent in regard to substance use within the realms of bullying dynamics and depression, and also with regards to sex differences. Therefore, revisiting the work of Luk and colleagues (2010), mediation analyses performed on integrative models of victimization and depression on substance use should include sex differences as a moderating factor in the analyses. Additionally, sex-moderated analyses performed on bullying and depression in a separate integrative model of substance use would also address a major area lacking in the current body of literature. Specific aims of the present study were:

(I.) to determine substance use influenced by depression, victimization, and sex differences.

(II.) to determine substance use influenced by depression, bullying, and sex differences.

Specific hypotheses are detailed for each specific aim. These are expressed in the following subsections.

*1.7.1 Specific Aim I: The role of substance use as influenced by victimization, depression and sex differences.*

#### 1.7.1.1 Hypothesis 1

The relationship between victimization and substance use is mediated by depression, in that victimized adolescents reflect greater substance use accounted for by depression.

#### 1.7.1.2 Hypothesis 2

The relationship between victimization, depression, and substance use is moderated by sex. Specifically, the relationship of depression in response to victimization on substance use is more apparent in females.

*1.7.2 Specific Aim II: The role of substance use as influenced by bullying, depression and sex differences.*

#### 1.7.2.1 Hypothesis 3

The relationship of bullying and substance use is mediated by depression. Specifically, bullying adolescents are more likely to engage in substance use in response to reported levels of depression.

#### 1.7.2.2 Hypothesis 4

The relationship between bullying, depression and substance use is moderated by sex. In particular, the relationship of bullying and substance use through depression is more apparent in males.

## CHAPTER 2

### STUDY ONE

#### 2.1 Method

##### *2.1.1 Data Source*

The Health Behavior in School-Aged Children (HBSC) 2001-2002 [United States] epidemiologic database (available from the Substance Abuse and Mental Health Data Archive) was used to investigate health behaviors in adolescents. This database is the composite of respondents primarily between ages 11 and 17 across the United States as a regional component of an international World Health Organization initiative (United States Department of Health and Human Services, 2008a). Questionnaire items from this survey collected a variety of health influencing variables, including but not limited to substance use, eating habits, and bullying dynamics. As the aims of the current research were to determine the influence of victimization and sex differences through depression on substance use, and similarly, how substance use is influenced by bullying and sex differences through depression, in Study One, only the following variables were selected for analyses: victimization, bullying, sex, depression, and substance use.

##### *2.1.2 Measurements*

All measurements were operationalized by the use of specific questionnaires or items within a specific questionnaire. In the following subsections, each measurement has been detailed in its quantification, the number of missing responses, and a table displaying the distribution of scores. In addition, Appendix A has been provided to show how the questions were given to participants.



Regarding victimization and bullying, it was particularly noteworthy that the survey explicitly stated conditions of bullying dynamics consistent with Solberg and Olweus (2003). The codebook for the HBSC dataset also explains that Olweus had been consulted for the scale he developed (United States Department of Health and Human Services, 2008b). Essentially, respondents were given a statement before items that assessed bullying dynamics, that bullying is “nasty and unpleasant”, and that bullying is not when “students of about the same strength or power argue or fight” or when the behavior is teasing in a “friendly and playful way” (United States Department of Health and Human Services, 2008b). The wording appeared to be sound with verification of research perspectives on bullying dynamics (Nansel et al., 2001) and how adolescents legitimately consider bullying dynamics (Vaillancourt et al., 2008b).

#### 2.1.2.1 Victimization Measure

Victimization was assessed by the 5-point Likert-type scaled item, “How often have you been bullied at school in the past couple of months?” which offered responses ranging from (1) “I haven’t been bullied at school in the past couple of months” to (5) “Several times a week”. There were 164 missing data points for this item; see Table 2.1 for distribution of valid cases.

Table 2.1 Distribution of Victimization Scale by Sex

	(1)	(2)	(3)	(4)	(5)	Total
Female	1017	247	47	21	18	1350
Male	794	211	49	31	57	1142
Total	1811	458	96	52	75	2492

#### 2.1.2.2 Bullying Measure

Bullying was assessed by the 5-point Likert-type scaled item, “How often have you taken part in bullying another student(s) at school in the past couple of months?” which offered responses ranging from (1) “I haven’t bullied another student(s) at school in the past couple of

months” to (5) “Several times a week”. For this measurement, there were 194 missing data points. See Table 2.2 for distribution of valid responses.

Table 2.2 Distribution of Bullying Scale by Sex

	(1)	(2)	(3)	(4)	(5)	Total
Female	936	311	38	29	20	1334
Male	655	266	87	50	70	1128
Total	1591	577	125	79	90	2462

#### 2.1.2.3 Depression Measure

Depression was inferred through depressive symptoms which were assessed by the 5-point Likert-type scaled item, “In the last 6 months: how often have you had the following ...Feeling low[?]” which offered responses ranging from (1) “About every day” to (5) “Rarely or never”. This item was reverse coded to target levels of depressive symptoms, operationalized as “feeling low”. Additionally, there were 127 missing data points for this item. See Table 2.3 for distribution of valid responses.

Table 2.3 Distribution of Reverse-Coded Depressive symptom Scale by Sex

	(1)	(2)	(3)	(4)	(5)	Total
Female	543	281	188	165	171	1348
Male	661	226	117	88	89	1181
Total	1204	507	305	253	260	2529

#### 2.1.2.4 Substance Use Measure

All substance use measurements were assessed by Likert-type scaled items, asking the frequency of days in which the subject engaged in the specific substance use behaviors. Substance use items selected for analyses were based on current use (smoking and alcohol) and within the last 12 months (marijuana, inhalants and other drugs) at the time of data

collection. Some items necessitated reverse-coding such that all measurements of substance use would be in the same direction of not using to heavy use. A composite index of substance use was created and then eventually dichotomized into groups of no-use and reported use, as all items were collected from self-report questionnaires. Items and questionnaires were manipulated in the aforementioned manner for each specific substance: (a) smoking, (b) alcohol, (c) marijuana, (d) inhalants, and (e) other drugs.

Smoking was originally assessed by a four point Likert-type scale ranging from (1) “Every day” to (4) “I do not smoke”. This item was then reverse-coded to reflect a scale of (0) “I do not smoke” to (3) “Every day”. There were 222 missing responses for smoking. Refer to Table 2.4 for distribution of valid responses regarding smoking.

Table 2.4 Distribution of Reverse-Coded Smoking Scale by Sex

	No	Less than a week	At least once a week, but not everyday	Everyday	Total
Male	828	107	62	117	1114
Female	1080	97	58	85	1320
Total	1908	204	120	202	2434

Alcohol use was itemized into: (a) beer (248 missing responses), (b) wine (267 missing responses), (c) liquor/spirits (277 missing responses), and (d) alcopops (267 missing responses), where each of the four items were assessed using a five point Likert-type scale of (1) “Every day” to (5) “Never”. Additionally, a high level of reliability was found regarding these items, Cronbach’s  $\alpha=.889$ . To get a measurement of total alcohol use, each item was recoded to a scale of (0) “Never” to (4) “Every day”, and then computed into a sum score, in order to provide a basis for total alcohol use. Refer to Table 2.5 for a distribution of valid responses regarding the four items related to alcohol consumption on a continuum of (0) “Never” to (4) “Every day use”.

Table 2.5 Distribution of Reverse-Coded Alcohol Items by Sex

Item	Never	Rarely	Every month	Every week	Every day	Total
<b>Beer</b>						
Male	617	226	90	98	66	1097
Female	877	278	90	54	12	1311
Total	1494	504	180	152	78	2408
<b>Wine</b>						
Male	667	274	66	45	35	1087
Female	834	356	77	24	11	1302
Total	1501	630	143	69	46	2389
<b>Spirits</b>						
Male	661	171	111	83	54	1080
Female	812	284	122	71	10	1299
Total	1463	455	233	154	64	2379
<b>Alcopops</b>						
Male	663	215	100	63	45	1086
Female	700	381	120	89	13	1303
Total	1363	596	220	152	58	2389

Regarding marijuana, inhalants and other drug use, each were assessed on a seven point Likert-type scale from (1) "Never" to (7) "40 times or more". There were 407 missing responses for marijuana use, 291 missing responses for inhalant use, and 417 missing responses for other drug use. Responses were recoded to be consistent with previous scales, thus, the scale was recoded to a scale of (0) "Never to (6) "40 times or more". See Table 2.6 for distribution of Marijuana, Inhalants and Other drug use presented in the recoded scale.

Table 2.6 Distribution of Other Substance Use Items by Sex

Item	Never	1 or 2 times	3 to 5 times	6 to 9 times	10 to 19 times	20 to 39 times	40 or more times	Total
Marijuana								
Female	927	120	50	33	23	27	61	1241
Male	665	99	43	36	35	29	101	1008
Total	1592	219	63	69	58	56	162	2249
Inhalants								
Female	1208	47	15	10	5	5	8	1298
Male	953	43	17	17	5	3	29	1067
Total	2161	90	32	27	10	8	37	2365
Other Drug Use								
Female	1092	63	35	16	12	9	12	1239
Male	857	47	19	11	18	10	38	1000
Total	1949	110	54	27	30	19	50	2239

All measurements of smoking, alcohol use, marijuana, inhalant and other drugs were recoded into respective dichotomous variables. The newly recoded dichotomous variables for substance use were then computed into a summed index of substance use, ranging from 0 to 6. A score of “0” would indicate that the participant had not reported any engagement in substance use in any form, and scores of “6” would indicate the maximum value for substance use (reported use for all substances). Looking at the distribution of the substance use index revealed that this variable was very positively skewed and the variable was not normally distributed (See Figure 2.1).

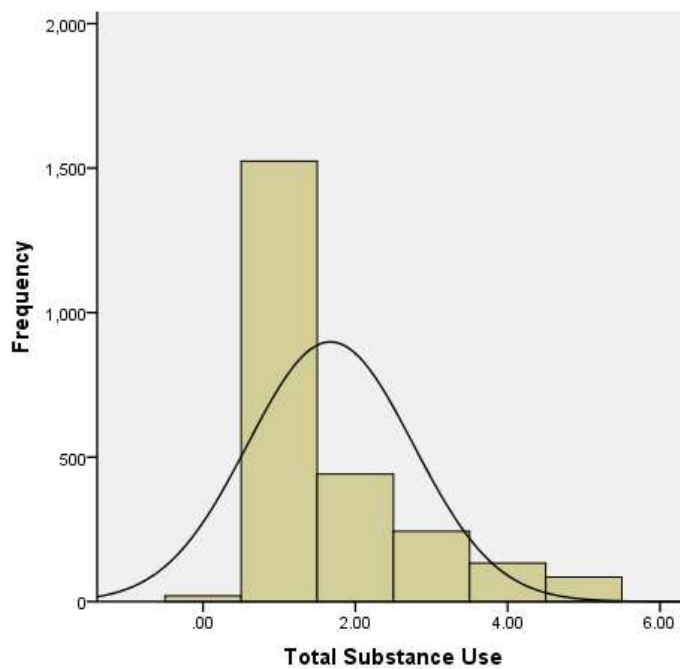


Figure 2.1 Distribution of scores on Total Substance Use

As such, the index measure of substance use was then dichotomized from frequency data to no reported use and any reported use. This manner of quantifying substance use is consistent with the method employed by Wu, Pilowsky and Patkar (2008).

### 2.1.3 Study Sample Selection

The sample selected for the current study was a subsection of the entire United States HBSC survey. This study was designed with a strategic sampling method utilizing a respondent

universe and strata composed of school districts. The intention of such a sampling method was to produce data that were representative across geographic regions and urbanicity. The respondent universe consisted of public schools and private schools within the 50 states and the District of Columbia, where at least 14 students were enrolled (United States Department of Health and Human Services, 2008a). School districts were split or joined to form arbitrarily coded units to be randomly selected. The final sample consisted of randomly selected classes from a random selection of school district units.

For this study, data were subsequently restricted to respondents aged 15 years ( $N = 2656$ ) of which 1250 were male. Regarding self-identification of race respondents were: (a) American Indian or Alaska Native,  $n = 74$ ; (b) Asian,  $n = 94$ ; (c) Black or African American,  $n = 555$ ; (d) Native Hawaiian or Other Pacific Islander,  $n = 21$ ; (e) White,  $n = 1475$ ; (f) Two or more races,  $n = 109$ ; and (g) no race reported,  $n = 328$ . Regarding Hispanic or Latino identification, 533 identified as Hispanic or Latino, and 44 responses were not entered. Participants in the study sample did provide responses about urbanicity (see Table 2.7), and as there was no

Table 2.7 Frequency of Urbanicity of Respondents in Total and by Sex

	Urban	Suburban	Rural	Missing	Total
Male	523	371	333	23	1250
Female	676	348	361	21	1406
Total	1199	719	694	44	2656

direct assessment of socioeconomic status (SES), items relating to SES included: (a) the number of cars in the household, (b) how many computers are in the home, (c) whether the participants had their own bedroom, and (d) how “well off” they perceived their family. Responses to these items are included within Table 2.8 on the following page.

Table 2.8 Self-reported items relating to socioeconomic status

Item	Scale						Total	
	None	One	Two	More than Two	Missing			
# of Computers								
	Male	144	597	304	203	2	1250	
	Female	167	685	372	180	2	1406	
	Total	311	1282	676	383	4	2656	
# of Cars		No	One	Two or more	Missing			
	Male	50	206	868	126		1250	
	Female	47	264	1022	73		1406	
	Total	97	470	1890	199		2656	
Own Bedroom		No	Yes	Missing				
	Male	234	894	122		1250		
	Female	301	1032	73		1406		
	Total	535	1926	195		2656		
Family Well Off		Very	Quite	Average	Not very	Not at all	Missing	Total
	Male	281	319	428	56	40	126	1250
	Female	278	339	576	106	26	81	1406
	Total	559	658	1004	162	66	207	2656



While race/ethnicity, urbanicity, and socioeconomic related characteristics were not used as variables in the study, these demographic parameters were included to provide information about the representativeness of the sample.

#### 2.1.4 Data Analyses

Analyses were performed with IBM SPSS (Release 19.0.0.1) using the PROCESS for SPSS (Release 120212) macro (Hayes, 2012a; Hayes, 2012b) on a mediation model and a moderated-mediation model per specific aim. PROCESS was used due to its ability to incorporate linear regression models and logistic regression models synergistically. In total, four models were completed: (a) mediation of victimization on substance use by depression, (b) mediation of bullying on substance use by depression, (c) moderated-mediation of victimization on substance use, as mediated by depression and moderated by sex differences; and (d) moderated-mediation of bullying on substance use, as mediated by depression and moderated by sex differences. Mediation models were tested by total effects, direct effects and indirect effects, whereas moderated-mediation models were tested by direct effects and the conditional indirect effects by levels of the moderator (all effects were generated by the PROCESS macro). See Figure 2.2 for a graphical representation of mediation analyses adopted from MacKinnon, Lockwood and Williams (2004).

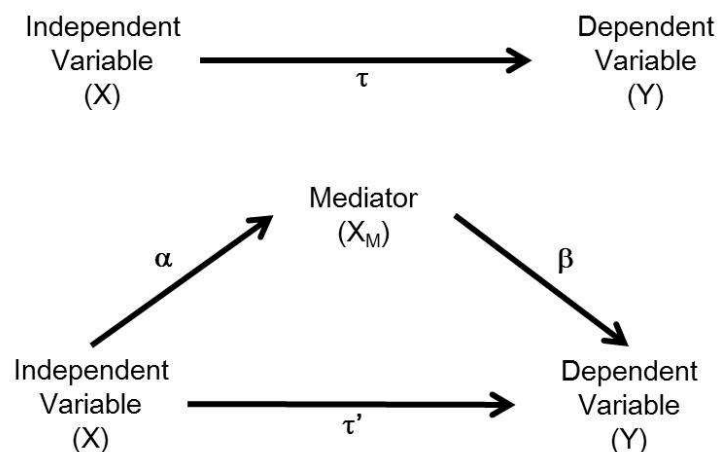


Figure 2.2 Mediation as Adapted from MacKinnon, Lockwood and Williams (2004).

Regarding the estimation of effects, as logistic regression and ordinary least squares (OLS) regression operate on different scales (as  $\alpha$  is computed in OLS and  $\beta$  in logistic regression), the PROCESS macro adjusts for this. Specifically, normal theory tests cannot be performed (such as the Sobel test where  $\alpha\beta$  represents the indirect effect), bootstrap confidence intervals are computed using the product of  $\tau'\beta$  and the total effect may not equal the sum of the indirect and direct effects (Hayes, 2012b). For more information about mediation analyses with categorical outcomes, please see MacKinnon and Dwyer (1993). In regards to this specific study, indirect effects were additionally estimated using bias-corrected bootstrapped 95% confidence intervals on 5000 resamples. As the output for PROCESS does not indicate significance for indirect effects, significance of the indirect effects were determined by computing a z-score from the estimated indirect effect divided by the bootstrapped standard error. This computed z-score for the indirect effects was then compared to the normal distribution in order to provide significance. In logistic regression modeling, PROCESS is unable to specify the indicator group in a categorical variable, thus output regarding categorical predictors defaults to the last group in the sequence. In this study, sex was coded as 0 for females and 1 for males, so sex in the models presented were in reference to males. As victimization, depression, and bullying were highly skewed, transformations were attempted but disregarded as they were ineffective. Additionally, victimization, bullying, and depression were mean centered and all results were evaluated at  $p < .025$ . See Appendix B for full SPSS syntax.

#### 2.1.4.1 Mediation Models for Victimization and Bullying.

To investigate victimization on substance use, a mediation model was produced to determine if depression mediated the relationship. Consistent with Baron and Kenny (1986), the mediation analysis tested four paths, See Figure 2.3 for a model of mediation specifically tailored to victimization in this study.

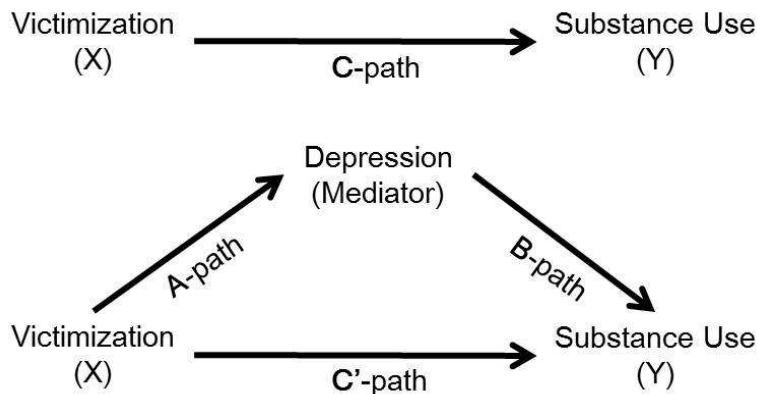


Figure 2.3 Mediation Model of Victimization on Substance Use. Victimization as the predictor (X) on the outcome (Y) of substance use, both directly and indirectly through depression.

The four paths tested were: (a) the total effect of victimization on substance use (C-path), (b) the effect of victimization on depression (A-path), (c) the effect of depression on substance use, while controlling for victimization (B-path), and (d) the direct effect of victimization on substance use (C'-path). The total effect of victimization on substance use (C-path) was required to be significant in order to proceed with the mediation analyses. The effect of victimization predicting depression (A-path), and the effect of depression predicting substance use while controlling for victimization (B-path) were requisite to determine mediation. Specifically, the mediating effect or indirect effect was the combination of the A-path and B-path as portrayed in the previous figure. Finally, the path for the direct effect of victimization on substance use (C'-path) was used to determine if mediation was partial or full for the relationship.

#### 2.1.4.2 Sex-Moderated-Mediation Models for Victimization and Bullying.

Testing moderating influences by sex differences in the mediation model of victimization was accomplished by redefining the model as a simple mediation with sex potentially moderating the effects of victimization on depression (A-path) and/or moderating the effects of depression on substance use while controlling for victimization (B-path). See Figure 2.4 for conceptual representation of the moderated-mediation model.

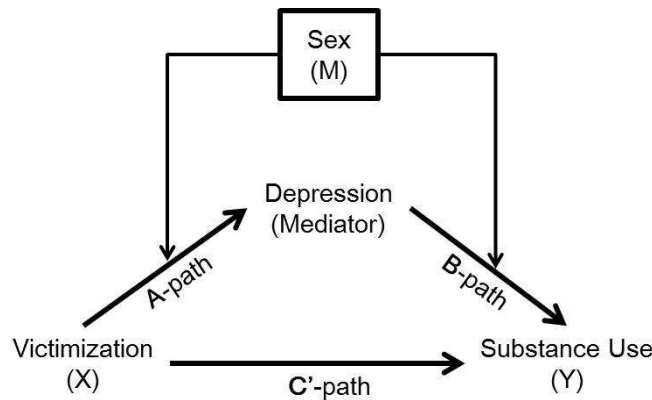


Figure 2.4 Moderated-Mediation Model of Victimization on Substance Use. Victimization as the predictor (X) on the outcome (Y) of substance use, both directly and indirectly through depression, and effects influenced by the moderator (M) sex.

Estimates of indirect effects (graphically represented by the combination of A-path and B-path in the previous figure) were calculated on conditional levels of the moderator, where specifically an effect for males and an effect for females were produced. This was due to having a dichotomous moderator, where PROCESS produces estimates of conditional indirect effects (Hayes 2012b). Additionally, sex, the interaction of sex and victimization, and the interaction of sex and depression, were introduced as predictors in the model. It is important to note that the significant interactions of either victimization by sex or depression by sex would indicate moderation, and the lack of any such significance would indicate that moderation could not be concluded.

Addressing the influence of sex differences on the bullying mediation model, the same mediated model was redefined to incorporate sex as a moderating factor on both the A-path and B-path. See Figure 2.5 for conceptual representation. Consistent with the analyses for

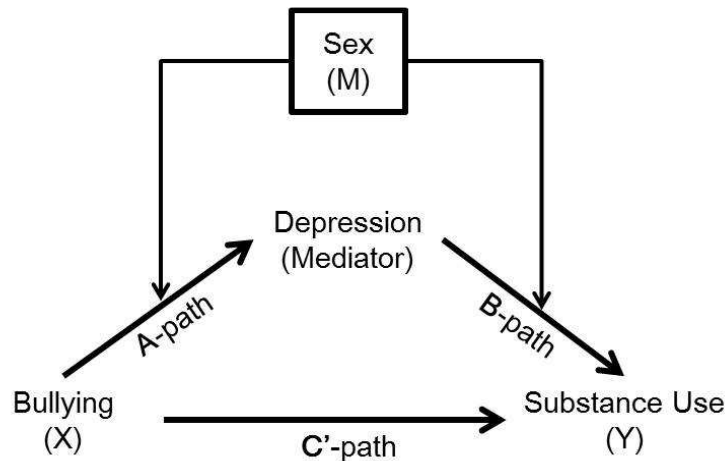


Figure 2.5 Moderated-Mediation Model of Bullying on Substance Use. Bullying as the predictor (X) on the outcome (Y) of substance use, both directly and indirectly through depression, and effects influenced by the moderator (M) sex.

victimization, indirect effects (represented by the combination of A-path and B-path in the previous figure) were calculated on conditional levels of the moderator, specifically generating an effect for males and an effect for females. Also sex, the interaction of sex and bullying, and the interaction of sex and depression, were introduced as predictors in the model. Again, it is important to note that the lack of any significant interactions of either victimization by sex and/or depression by sex would fail to indicate moderation.

## 2.2 Results

Mediation and moderated-mediation models were produced for victimization and bullying. As results consisted of linear and logistic regression coefficients, in addition to mediation path coefficients, tabulated results are provided per section for clarification. Where logistic regression coefficients were produced, odds-ratios were computed from the inverse natural log of a coefficient. These odds-ratios were provided to help explain the findings where applicable.

### *2.2.1 Mediation Models on Substance Use*

In determining if depression was a mediator of victimization on substance use (refer to Figure 2.3), the total effect of victimization on substance use was significant, Maximum Likelihood = 8.8490, Nagelkerke  $R^2 = .0051$ , victimization,  $Z = 2.9063$ ,  $b = .1482$ ,  $p = .0037$ . As

expected, increasing levels of victimization predicted a 1.160 times greater likelihood of substance use. Subsequently, increasing levels of victimization also significantly predicted greater depression,  $F(1,2341) = 165.4018$ ,  $p < .0001$ ,  $R^2 = .0660$ . See Table 2.9 for unstandardized linear regression coefficients.

Table 2.9 Linear Regression Coefficients for A-path of Victimization Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	.0259	.0276	.3494	-.0283	.0800
Victimization	.3994	.0311	<.0001	.3385	.4603

The relationship between depression and substance use, while controlling for victimization, was significant, Maximum Likelihood = 38.8729, Nagelkerke  $R^2 = .0224$ ; where greater depression significantly predicted a 1.198 times greater likelihood of substance use,  $Z = 5.3885$ ,  $b = .1802$ ,  $p < .0001$ . Furthermore, the indirect effect was found to be significant,  $Z = 4.768$ ,  $SE = .0151$ ,  $p < .0001$ ; substantiating the evidence for depression being a mediating factor in victimization on substance use. Furthermore, victimization was no longer found to be a significant predictor,  $Z = 1.4964$ ,  $b = .0788$ ,  $p = .1345$ ; indicating that depression mediated the effects of victimization on substance use. See Table 2.10 for unstandardized logistic regression coefficients.

Table 2.10 Logistic Regression Coefficients for B-path of Victimization Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	.5254	.0432	<.0001	.4407	.6100
Depression	.1802	.0334	<.0001	.1147	.2457
Victimization	.0788	.0527	.1345	-.0244	.1821

An examination of the combined effects revealed that the contribution of the direct path was not reduced to zero, thus partial mediation was concluded. This meant that a portion of the effect of

victimization on substance use was explained by victimization leading to depression which in turn, leads to substance use. Refer to Table 2.11 for model coefficients.

Table 2.11 Mediation Effects Coefficients for Victimization Model

	Effect	SE	Z	P	LLCI	ULCI
Total (C-path)	.1482	.0510	2.906	.0037	.0483	.2482
Direct (C'-path)	.0788	.0334	1.496	.1345	-.0244	.1821
Indirect (A and B-paths)*	.0720	.0151	4.768	<.0001	.0451	.1051

\*Note: Indirect effects were calculated with a bias corrected bootstrap of 5000 samples.

Determining if depression was a mediator of bullying on substance use (see Figure 2.4), the total effect of bullying on substance use, was first verified to be a significant predictor, Maximum Likelihood = 152.8711, Nagelkerke  $R^2 = .0861$ , bullying,  $Z = 10.4838$ ,  $b = .6739$ ,  $p < .0001$ , 95% CI [.5479,.7998]. Thus, the rationale was substantiated that increases in reported bullying behavior predicted a 1.962 times greater likelihood of substance use. Second, supporting the A-path of bullying to depression, bullying significantly predicted greater depression,  $F(1,2342) = 29.9107$ ,  $p < .0001$ ,  $R^2 = .0126$ . See Table 2.12 for unstandardized linear regression coefficients.

Table 2.12 Linear Regression Coefficients for A-path of Bullying Mediation Model

	B	SE	p	LLCI	ULCI
Constant	.0151	.0284	.5955	-.0406	.0707
Bullying	.1575	.0288	<.0001	.1010	.2140

The relationship between depression and substance use while controlling for bullying (B-path of Figure 2.4) was found to be significant, Maximum Likelihood = 177.6199, Nagelkerke  $R^2 = .0995$ ; indicating that greater depression significantly predicted substance use,  $Z = 4.9047$ ,  $b = .1646$ ,  $p < .0001$ , 95% CI [.0988,.2303]; and greater bullying was also found to predict an

increased likelihood of substance use,  $Z = 10.1167$ ,  $b = .6490$ ,  $p < .0001$ , 95% CI [.5233,.7748]. Specifically, those who were higher in levels of depression were 1.179 times more likely to engage in substance use and those who were bullies were 1.927 times more likely to engage in substance use also. The indirect effect was found to be significant,  $Z = 3.453$ ,  $SE = .0075$ ,  $p = .0006$ ; substantiating the evidence for depression being a mediating factor in bullying on substance use. See Table 2.13 for unstandardized logistic regression coefficients.

Table 2.13 Logistic Regression Coefficients for B-path of Bullying Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	.5953	.0465	<.0001	-.6209	-.2374
Depression	.1646	.0336	<.0001	.0988	.2303
Bullying	.6490	.0642	<.0001	.5233	.7748

As the indirect effect of bullying on substance use was significant, but the direct effect of bullying on substance use retained significance, depression was considered to be a partial mediator of bullying and substance use. This meant that a portion of the effect of bullying on substance use was explained by engaging in bullying leading to depression, which in turn lead to a greater likelihood of substance use. Refer to Table 2.14 for model coefficients and 95% confidence intervals.

Table 2.14 Mediation Effects Coefficients for Bullying Model

	Effect	SE	<i>Z</i>	<i>P</i>	LLCI	ULCI
Total (C-path)	.6739	.0643	10.484	<.0001	.5479	.7998
Direct (C'-path)	.6490	.0642	10.117	<.0001	.5233	.7748
Indirect (A/B-paths)*	.0259	.0075	3.453	.0006	.0137	.0443

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.



2.2.2 Moderation Models on Substance Use.

Addressing the previous mediation model of victimization on substance use through depression while now incorporating sex as a moderating factor in the mediated relationship (refer to Figure 2.2), victimization to depression (A-path) still produced a significant model  $F(3,2339) = 85.5579, p < .0001, R^2 = .0989$ . Both greater victimization,  $b = .4835, t(2339) = 9.8369, p < .0001, 95\% \text{ CI } [.3871, .5798]$ ; and being female (sex),  $b = -.5023, t(2339) = -9.1585, p < .0001, 95\% \text{ CI } [-.6099, -.3948]$ ; were significant predictors of greater levels of depression. Contrary to expectations, the interaction of victimization and sex was not significant,  $b = -.0922, t(2339) = -1.4662, p = .1427, 95\% \text{ CI } [-.2155, .0311]$ . This would indicate that sex failed to moderate the relationship of victimization to depression. See Table 2.15 for unstandardized linear regression coefficients.

Table 2.15 Linear Coefficients for A-path of Victimization Moderated-Mediation Model

	B	SE	P	LLCI	ULCI
Constant	.2572	.0369	<.0001	.1848	.3297
Victimization	.4835	.0491	<.0001	.3871	.5798
Sex	-.5023	.0548	<.0001	-.6099	-.3948
Sex by Victimization	-.0922	.0629	.1427	-.2155	.0311

The relationship between depression and substance use while controlling for victimization (B-path of Figure 2.4), was also significant, Maximum Likelihood = 42.4509, Nagelkerke  $R^2 = .0245$ . As expected, greater depression significantly predicted a 1.240 times greater likelihood of substance use,  $Z = 5.0123, b = .2151, p < .0001, 95\% \text{ CI } [.1310, .2993]$ . In contrast, the expected effects of sex,  $Z = 1.5004, b = .1336, p = .1335, 95\% \text{ CI } [-.0409, .3081]$ ; victimization,  $Z = 1.3364, b = .0713, p = .1814, 95\% \text{ CI } [-.0333, .1759]$ ; and the interaction of sex by depression,  $Z = -.9584, b = -.0647, p = .3379, 95\% \text{ CI } [-.1970, .0676]$ ; were not significant predictors. The lack of a significant interaction of sex and depression on substance use would indicate that the relationship between victimization and substance use as mediated through

depression could not be concluded as moderated by sex. See Table 2.16 for unstandardized logistic regression coefficients.

Table 2.16 Logistic Regression Coefficients for B-path of Victimization Moderated-Mediation

	B	SE	P	LLCI	ULCI
Constant	.4586	.0586	<.0001	.3457	.5737
Depression	.2151	.0429	<.0001	.1310	.2993
Victimization	.0713	.0534	.1814	-.0333	.1759
Sex	.1336	.0890	.1335	-.0409	.3081
Sex by Depression	-.0647	.0675	.3379	-.1970	.0676

As the mediation of victimization of substance use through depression was previously substantiated, the primary interest in this model was the conditional indirect effects of victimization on substance use by sex. However, as rationale was not substantiated for the moderation of this relationship by sex, this model merely determines if the depression mediated relationship between victimization and substance use would persist after accounting for sex. The conditional indirect effects that were reported by PROCESS are included for informative purposes and should not be interpreted as meaningful regarding the sex-based moderation of the mediated relationship. Refer to Table 2.17 for model coefficients.

Table 2.17 Moderated-Mediation Effects Coefficients for Victimization Model

	Effect	SE	Z	P	LLCI	ULCI
Direct (C'-path)	.0713	.0534	1.336	.1814	-.0333	.1759
Indirect (A/B-paths)*						
Male	.0589	.0234	2.517	.0118	.0175	.1088
Female	.1040	.0239	4.351	<.0001	.0618	.1574

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

Incorporating sex as a moderating factor into the depression mediated relationship between bullying and substance use (see Figure 2.5), bullying to depression (A-path) still produced a significant model,  $F(3,2340) = 36.3055$ ,  $p < .0001$ ,  $R^2 = .0445$ . Both greater bullying,  $b = .2331$ ,  $t(2340) = 4.7640$ ,  $p < .0001$ , 95% CI [.1372,.3291]; and being female (sex),  $b = -.5043$ ,  $t(2340) = -8.8278$ ,  $p < .0001$ , 95% CI [-.6479,-.2203]; significantly predicted a greater likelihood of depression. However, the interaction of bullying and sex was not significant and therefore no evidence of moderation was observed for this path,  $b = -.0445$ ,  $t(2340) = -.7334$ ,  $p = .4628$ , 95% CI [-.1632,.0743]. See Table 2.18 for unstandardized linear regression coefficients.

Table 2.18 Linear Regression Coefficients for A-path of Bullying Moderated-Mediation Model

	B	SE	P	LLCI	ULCI
Constant	.2481	.0387	<.0001	.1722	.3239
Bullying	.2331	.0489	<.0001	.1372	.3291
Sex	-.5043	.0571	<.0001	-.6163	-.3923
Sex by Bullying	-.0445	.0606	.4628	-.1632	.0743

The relationship between depression and substance use while controlling for victimization (B-path of Figure 2.4), was significant, Maximum Likelihood = 179.2385, Nagelkerke  $R^2 = .1004$ . Greater depression,  $Z = 4.4088$ ,  $b = .1917$ ,  $p < .0001$ , 95% CI [.1065,.2769]; as well as increased bullying,  $Z = 10.1248$ ,  $b = .6560$ ,  $p < .0001$ , 95% CI [.5290,.7830] significantly predicted a greater likelihood of substance use. Specifically, greater levels of depression predicted a 1.211 times greater likelihood of substance use, and greater levels of bullying predicted a 1.927 times greater likelihood of substance use. However, sex,  $Z = -.7048$ ,  $b = -.0647$ ,  $p = .4809$ , 95% CI [-.2446,.1152]; and the interaction of sex by depression,  $Z = -1.1462$ ,  $b = -.0798$ ,  $p = .2517$ , 95% CI [-.2163,.0567]; were not significant predictors. As the interaction of sex by depression was not a significant predictor in the model, moderation could

not be concluded in this step of the model either. See Table 2.19 for unstandardized logistic regression coefficients.

Table 2.19 Logistic Regression Coefficients for B-path of Bullying Moderated-Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	.6162	.0626	<.0001	.4935	.7388
Depression	.1917	.0435	<.0001	.1065	.2769
Bullying	.656	.0648	<.0001	.5290	.7830
Sex	-.0647	.0918	.4809	-.2446	.1152
Sex by Depression	-.0798	.0696	.2517	-.2163	.0567

As the mediation of bullying to substance use through depression was previously substantiated, the primary interest in this model was the conditional indirect effects of bullying on substance use through depression by sex. However, as moderating effects of sex on this mediated relationship were not found, this model simply determines if the depression mediated relationship between bullying and substance use would persist after accounting for sex.

Conditional indirect effects were reported by PROCESS, but should not be interpreted as meaningful regarding the sex-based moderation of the mediated relationship, because moderation could not be concluded. Refer to Table 2.20 for model coefficients and 95% confidence intervals.

Table 2.20 Moderated-Mediation Effects Coefficients for Bullying Model

	Effect	SE	Z	<i>P</i>	LLCI	ULCI
Direct (C'-path)	.6560	.0648	10.125	<.0001	.5290	.7830
Indirect (A/B-paths)*						
Male	.0211	.0114	1.851	.0642	.0022	.0489
Female	.0447	.0154	2.922	.0035	.0205	.0800

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

## 2.3 Discussion

### *2.3.1 Summary of Findings*

The relationship from victimization to substance use was revealed to be partially mediated by depression, such that increased victimization predicted increased depression which in turn predicted an increased likelihood of substance use. Unanticipated, this relationship was not found to be moderated by sex. Regarding the models of bullying, increased bullying behavior predicted an increased likelihood of substance use which was revealed to be mediated in part by increased levels of depression. However, similar to the victimization models, no moderating effects for sex were discovered. Findings as they relate to the victimization predictive models and the bullying predictive models will be briefly discussed in the following sections. Greater discussion regarding the implications, limitations, reconsiderations, and future directions will be provided in Chapter 4: General Discussion.

### *2.3.2 Victimization*

Recalling the first hypothesis that victimized adolescents engaging in substance use could be accounted for by depression mediating this effect, support was found for this hypothesis. Victimized adolescents were more likely to engage in substance use, and this was found to be mediated by depression such that victimized adolescents with symptoms of depression were more likely to engage in substance use. These findings were consistent with previous findings (Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor et al., 2009; Ford et al., 2010). These findings indicate that victimized adolescents who develop symptoms analogous to depression, are more likely to engage in substance use.

Factoring sex into the model to address the second hypothesis that being female would account for greater substance use in the mediation model, it was revealed that females were significantly more likely to report greater depressive symptoms overall (Refer to Table 2.4). This was consistent with previous literature (Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor et al., 2009). However, as sex moderated effects were not discovered, these results failed to support

this hypothesis and were inconsistent with previous findings (Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor et al., 2009). In other words, as victimized adolescents developing symptoms analogous to depression were more likely to engage in substance use (as outlined in the first hypothesis), these findings failed to indicate that this phenomenon would be more prevalent in females.

### *2.3.3 Bullying*

Partial support was found for the third hypothesis, that bullying adolescents would be more likely to engage in substance use in response to concomitant depression. Over all, bullies were more likely to engage in substance use, and of those who bullied others while also depressed were more likely to engage in substance use. While this only accounts for a small proportion of bullies engaging in substance use, this still gives insight into the pathology of adolescent bullies and the possible long-term problematic behaviors that could manifest. These results were congruent with previous findings (Kim et al., 2011; Kim et al., 2005; Van der Wal et al., 2003, Klomek et al., 2007; Nansel et al., 2004; Nansel et al., 2001). In speculation, these results may in fact be a revelation of those who are victimized and bullying others while still showing depression and in turn engaging in substance use. Further research would be warranted to identify if this relationship is valid.

Finally, addressing the fourth hypothesis that male bullies would be more likely to engage in substance use behaviors, as mediated through depression, the results failed to support this hypothesis. Unfortunately, no sex moderated effects were revealed, and rather the partially mediated relationship between bullying and substance use through depression was still found to be significant when controlling for sex, thus males and females are equally likely to bully and also equally likely to engage in substance use. These results, however, were congruent with previous findings that: (a) females were more likely to report depression, (b) bullying has been associated with depression, and (c) bullies are more likely to engage in substance use (Kim et al., 2011; Kim et al., 2005; Van der Wal et al., 2003, Klomek et al., 2007;

Nansel et al., 2004; Nansel et al., 2004; Bond et al., 2001; Kaltiala-Heino et al., 2000; Poulin et al., 2005; Hodgins et al., 2008). In speculation, this could also emphasize a reason to uncover how differences between bullies and bully-victims could influence the relationships.

## CHAPTER 3

### STUDY TWO

#### 3.1 Method

##### *3.1.1 Data Source*

These data used were produced by the Eunice Kennedy National Institute of Child Healthcare and Development (NICHD). Specifically the database used was NICHD Study of Early Child Care and Youth Development: Phase IV, 2005-2008 [United States] from the Inter-University Consortium for Political and Social Research, University of Michigan, was used to investigate health behaviors in adolescents (NICHD, 2007c). This database is the composite of respondents between 12 and 15.5 years of age, in continuation of three previous phases of a longitudinal study of child care and youth development in the United States. Questionnaire items served to account a variety of health influencing variables such as substance use, eating habits, physical development and bullying dynamics. Since the aims of the current research were to identify the influence on substance use by depression, bullying dynamics and sex differences, only a few variables were selected for analyses: victimization, bullying, depression and substance use.

##### *3.1.2 Measurements*

All measurements were operationalized by the use of specific questionnaires or items within a specific questionnaire. Each measurement has been detailed in its quantification, number of missing responses, and distribution within each sex, under the following subsections. Additionally, Appendix C contains questionnaire items presented to respondents and supplemental text from the NICHD documentation; these have been provided for illustrative purposes.



### 3.1.2.1 Victimization Measure

Victimization was assessed by four items to comprise a scale of peer victimization (Cronbach's  $\alpha=.848$ ). Respondents were asked by 5-point Likert-type scaled items, ranging from (0) "Never" to (4) "7 or more times", how often their peers: (a) picked on them, (b) made fun of them, (c) called them names, and (d) hit/pushed them. Each item was standardized and then the mean was computed to produce a scale for peer victimization. Additionally, there were 408 missing data points from the dataset regarding this measurement. See Figure 3.1 for the distribution of the standardized scale of victimization in males and Figure 3.2 for the distribution of the standardized scale of victimization in females.

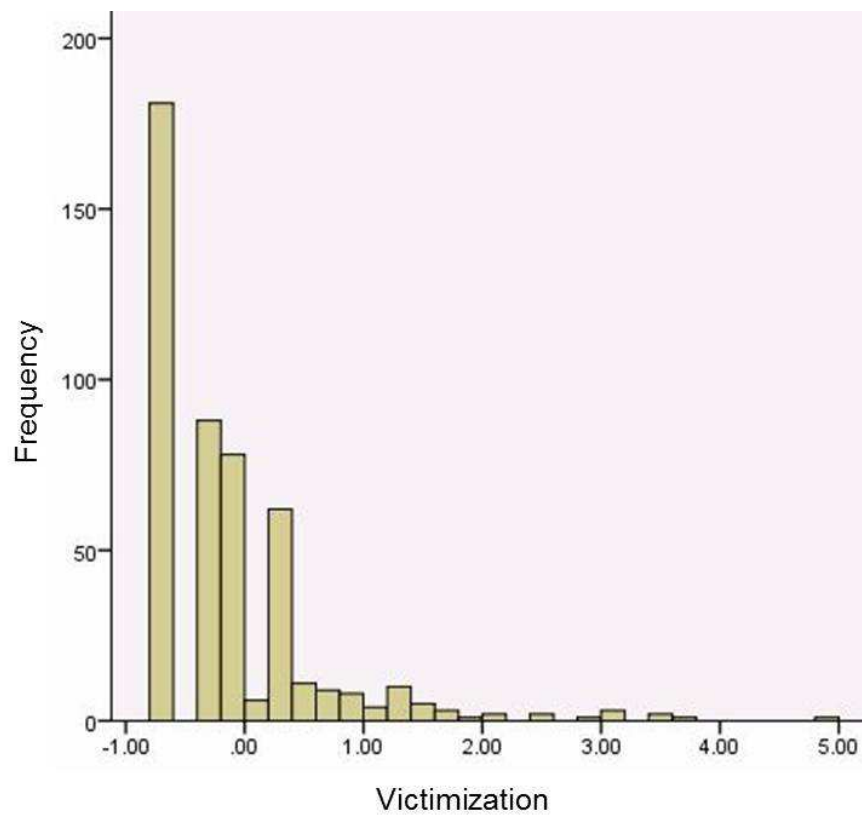


Figure 3.1 Distribution of the Standardized Scale of Victimization in Males.

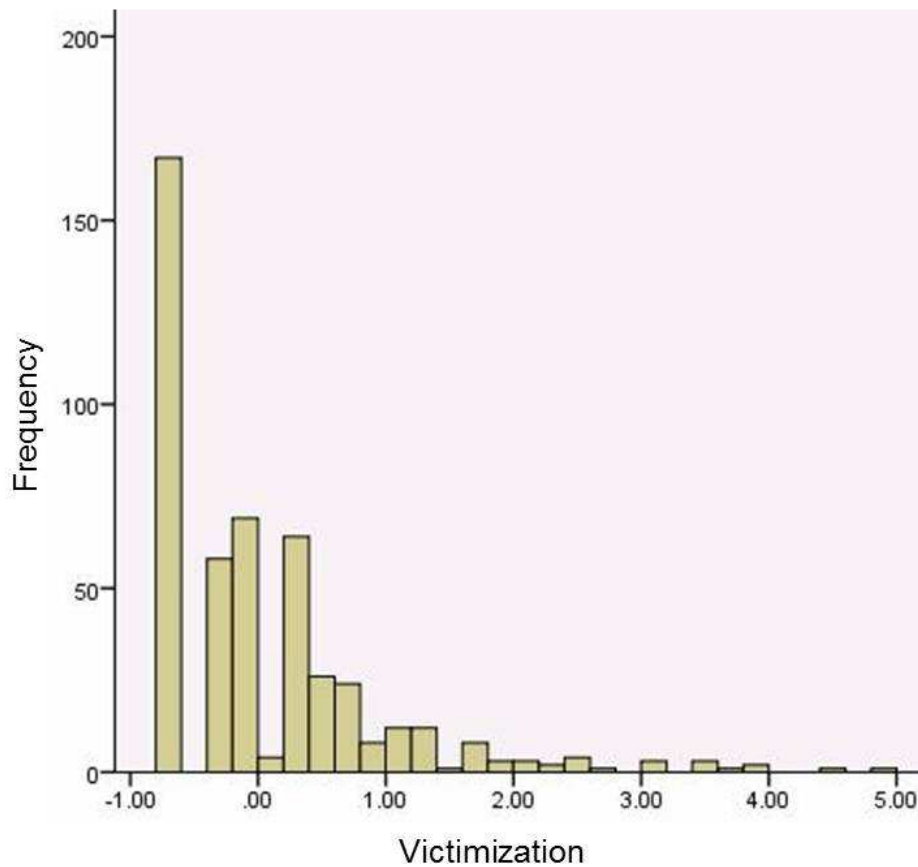


Figure 3.2 Distribution of the Standardized Scale of Victimization in Females.

### 3.1.2.2 Bullying Measure

Bullying was assessed by eighteen items used to compile a scale representative of peer aggression (Cronbach's  $\alpha=.886$ ). Respondents answered 4-point Likert-type scaled items, ranging from (1) "Not at all true" to (4) "Completely true", regarding what types of aggression they would engage on their peers. Each item was then standardized and used to compute a mean score for peer aggression, which served as a scale to operationalize bullying. In total, 412 responses were missing from the dataset regarding this measurement. See Figure 3.3 for the distribution of the bullying scale in males and Figure 3.4 for the distribution of the bullying scale in Females.

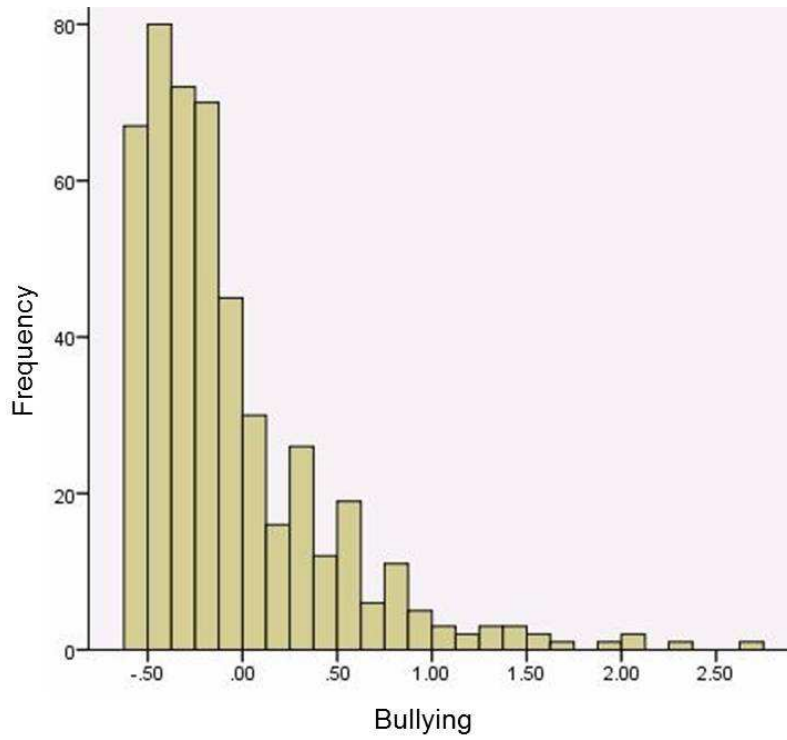


Figure 3.3 Distribution of the Standardized Scale of Bullying in Males.

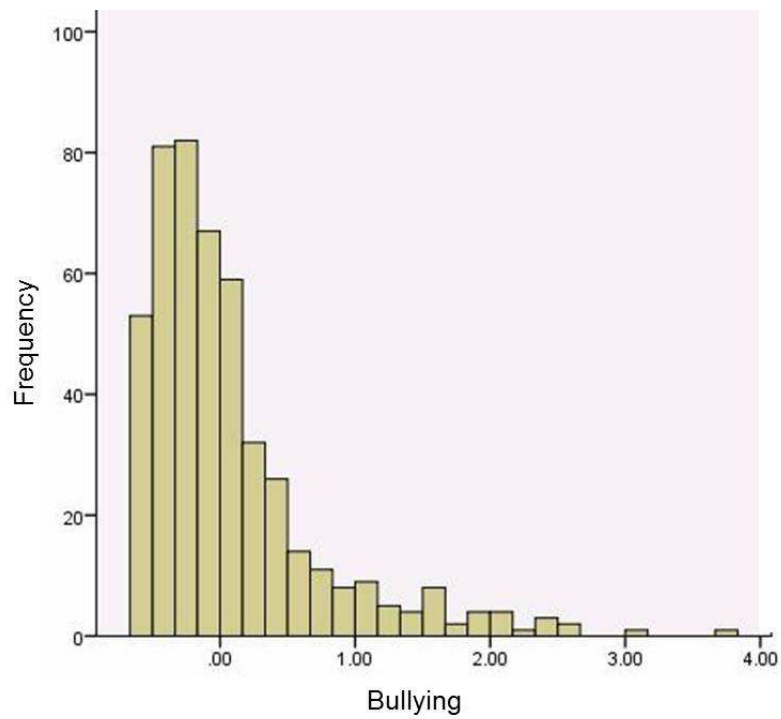


Figure 3.4 Distribution of the Standardized Scale of Bullying in Females.

### 3.1.2.3 Depression Measure

Depression was assessed by the ten-item Child Depression Inventory which was administered as a questionnaire entitled, “How I Feel Sometimes” (Cronbach’s  $\alpha=.810$ ). Each of the ten items were quantified by a 3-point Likert-type scale ranging from (1) to (3) with directionality dependent upon item. For example, for one item the range was (1) “I look OK” to (3) “I look ugly”, and conversely for another, the range was (1) “Nothing will ever work out for me” to (3) “Things will work out for me”. Following the procedure outlined by the NICHD in Child Care Data Report – 782 (NICHD, 2007a), items were re-coded from a 1 to 3 scale to a 0 to 2 scale, with reverse coding for specific items (2, 4, 5, 6, and 10). The items were used to create a summed score ranging from 0 to 20 with higher scores indicating greater levels of depression. See Figure 3.5 for distribution of the depression score in males and Figure 3.6 for distribution of the depression score in females.

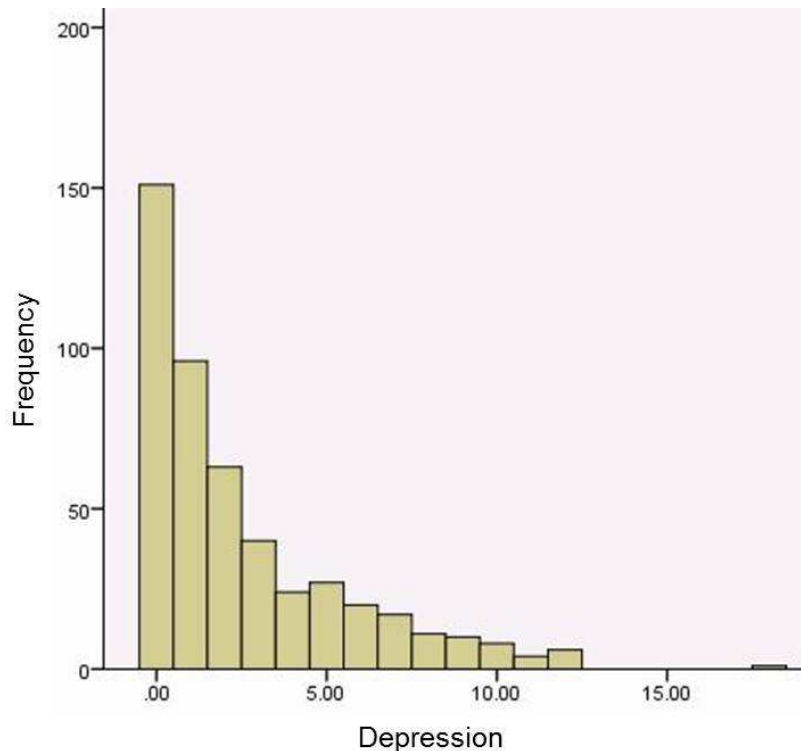


Figure 3.5 Distribution of Depression Scores in Males.

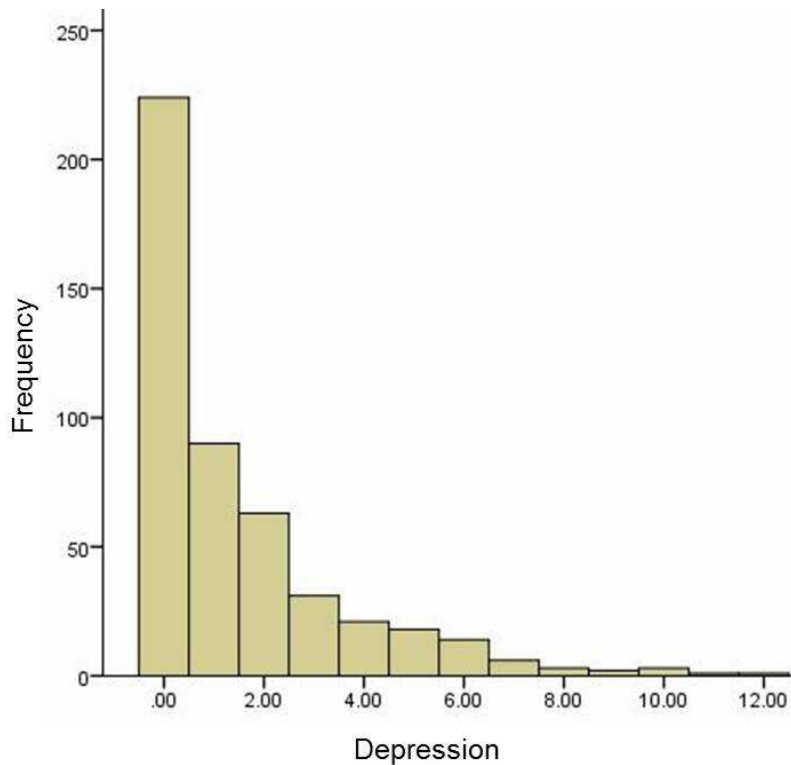


Figure 3.6 Distribution of Depression Scores in Females.

#### 3.1.2.4 Substance Use Measure

All substance use measurements were assessed by the frequency in which the subject engaged in a specific substance use behavior within the past year (12 months) via 3-point Likert-type scaled items, consisting of responses of (0) “Never”, (1) “Once or twice”, or (2) “More than twice”. Tobacco, alcohol, and marijuana were available to produce a composite measure of substance use, but the percentage of respondents that reported engaging in use of these substances was low: (a) 11.9% for tobacco use, (b) 24.4% for alcohol use, and (c) 10% for marijuana use. Responses to the aforementioned items were dichotomized from the frequency data to reported use and no reported use for all three substances. A total substance use variable was compiled from the summed scores of all dichotomized substances of use and this variable was then dichotomized into reported or absent substance categories. This method of assessment for substance use is consistent with previous research (Wu, Pilowsky & Patkar, 2008).

### *3.1.3 Study Sample Selection*

The sample from the dataset was restricted to respondents aged 15 years ( $N = 1364$ ) of which 705 were male. Regarding race, respondents were: (a) American Indian or Alaska Native,  $n = 5$ ; (b) Asian,  $n = 22$ ; (c) Black or African American,  $n = 176$ ; (d) White,  $n = 1097$ ; and (e) other,  $n = 64$ . Regarding Hispanic or Latino identification, 83 identified as Hispanic or Latino. Information on urbanicity was only available for 928 participants, but the breakdown is reported as: (a) 10.67% urban, (b) 75.22% suburban, and (c) 14.12% rural (NICHD, 2007d). According to documentation for the NICHD, the median household income was estimated at \$75,000 per year for the 942 valid responses provided (NICHD, 2007b). While race/ethnicity, urbanicity, and household income characteristics were not used as variables in the study, these demographic parameters were included to provide information about the representativeness of the sample.

### *3.1.4 Data Analyses*

Similar to study one, analyses were performed with IBM SPSS (Release 19.0.0.1) using the PROCESS for SPSS (Release 120212) macro (Hayes, 2012a; Hayes, 2012b) on a mediation model and a moderated-mediation model per specific aim. As with Study One (see 2.1.4 Data Analyses), the path to the mediator was completed using linear regression and the path to the outcome was assessed by logistic regression, simultaneously analyzed by the PROCESS macro. Four models were constructed: (a) mediation of victimization on substance use by depression, (b) moderated-mediation of victimization on substance use, as mediated by depression and moderated by sex differences; (c) mediation of depression on bullying and substance use, and (d) moderated-mediation of bullying on substance use, as mediated by depression and moderated by sex. Mediation models were evaluated by total effects, direct effects and indirect effects, and moderated-mediation models were evaluated by direct effects and the conditional indirect effects by levels of the moderator. All effects evaluated were generated by the PROCESS macro. Indirect effects were estimated using bias-corrected bootstrapped 95% confidence intervals on 5000 resamples. As the output for PROCESS does

not indicate significance for indirect effects, significance of the indirect effects were determined by computing a z-score from the estimated indirect effect divided by the bootstrapped standard error. This computed z-score for the indirect effects was then compared to the normal distribution in order to provide significance. In logistic regression modeling, PROCESS is unable to specify the indicator group in a categorical variable, thus output regarding sex in those models was referenced to males (the last group in the sequence), as females were coded as 0 and males were coded as 1 in this study. As victimization, depression, and bullying were highly skewed, transformations were attempted but disregarded as they were ineffective. Additionally, depression was mean centered and all results were evaluated at  $p < .025$ . See Appendix D for full SPSS syntax.

#### 3.1.4.1 Victimization on Substance Use.

To investigate victimization on substance use, a mediation model was produced to test four paths: (a) the total effect of victimization on substance use (C-path), (b) the effect of victimization on depression (A-path), (c) the effect of depression on substance use, while controlling for victimization (B-path), and (d) the direct effect of victimization on substance use (C'-path). Refer back to Figure 2.2 for conceptual illustration of model and paths. The total effect of victimization on substance use (C-path) was required to be significant in order to proceed with the mediation analyses. The effect of victimization predicting depression (A-path), and the effect of depression predicting substance use while controlling for victimization (B-path) were requisite to determining mediation, as the mediating effect or indirect effect was the combination of the A-path and B-path. Finally, the path for the direct effect of victimization on substance use (C'-path) was used to determine if mediation was partial or in full for the relationship.

In order to test the moderating influences due to sex differences in the mediation model, the simple mediation model was redefined with sex moderating the effects of victimization on depression (A-path) and of depression predicting substance use while controlling for victimization (B-path). Refer back to Figure 2.5 for conceptual representation of

the moderated-mediation model of victimization. Indirect effects were then calculated by the PROCESS macro on conditional levels of the moderator, specifically generating an indirect effect for males and an indirect effect for females. Additionally, sex, the interaction of sex and victimization, and the interaction of sex and depression, were introduced as predictors in the model.

#### 3.1.4.2 Bullying on Substance Use.

Investigating the relationship of bullying on substance use, a mediation model and a moderated-mediation model were produced. Similar to the mediation analyses regarding victimization, the four paths tested for mediation were: (a) the total effect of bullying on substance use (C-path), (b) the effect of bullying on depression (A-path), (c) the effect of depression on substance use, while controlling for bullying (B-path), and (d) the direct effect of bullying on substance use (C'-path). Refer back to Figure 2.4 for conceptual representation of bullying on substance use mediation model and paths. The total effect of bullying on substance use (C-path) was required to be significant in order to proceed with the mediation analyses. The effects of bullying predicting depression (A-path), and depression predicting substance use while controlling for bullying (B-path) were requisite to determine mediation, as the indirect effect is the combination of the A-path and B-path. Finally, the path for the direct effect of bullying on substance use (C'-path) was used to determine if mediation was partial or in full for the relationship.

Incorporating sex differences, the same mediated model was redefined with sex as a moderating factor on both the A-path and B-path. See Figure 2.6 for conceptual representation of the moderated-mediation model of bullying on substance use. Consistent with the analyses for victimization, indirect effects were calculated on conditional levels of the moderator, specifically an effect for males and an effect for females. Also sex, the interaction of sex and bullying, and the interaction of sex and depression, were introduced as predictors in the model.



### 3.2 Results

As with study one, results have been grouped by target aim, and tabular output has been provided for each set of regression output. Additionally, where logistic regression coefficients were produced, odds-ratios were computed from the inverse natural log of a coefficient. These odds-ratios were provided to help explain the findings where applicable, such that the reported odds-ratio indicates the likelihood of individuals from specific parameters being correctly classified into the group of interest. For example, the odds-ratio for a predictor of victimization would indicate that an individual having reported being victimized would be so many times more or less likely to be correctly classified as engaging in substance use.

#### 3.2.1 Victimization on Substance Use

Identifying the influence of victimization on substance use, the total effect of victimization on substance use was found to be significant, Maximum Likelihood = 5.3278, Nagelkerke  $R^2 = .0081$ , Victimization,  $Z = 2.34$ ,  $b = .1939$ ,  $p = .0193$ , 95% CI [.0315,.3564]. As anticipated, increasing levels of victimization predicted a 1.214 times greater likelihood of engaging in substance use. To determine the effect of depression mediating this relationship, first the path of victimization to depression (the A-path) was tested and revealed to be a significant model, where increasing levels of victimization predicted greater levels of depression,  $F(1,953) = 97.1287$ ,  $p < .0001$ ,  $R^2 = .0925$ . See Table 3.1 for unstandardized regression coefficients.

Table 3.1 Linear Regression Coefficients for A-path of Victimization Mediation Model

	B	SE	$p$	LLCI	ULCI
Constant	.0005	.0813	.9951	-.1590	.1600
Victimization	.9665	.0981	<.0001	.7740	1.1589

Finally, testing the relationship between depression and substance use, while controlling for victimization (the B-path), a significant model was produced, Maximum Likelihood

= 23.1578, Nagelkerke  $R^2 = .0347$ ; where greater depression significantly predicted a 1.124 times greater likelihood of substance use,  $Z = 4.2436$ ,  $b = .1165$ ,  $p < .0001$ , 95% CI [.0627,.1703]. Furthermore, the indirect effect was found to be significant,  $Z = 3.497$ ,  $SE = .0322$ ,  $p = .0005$ ; substantiating the evidence for depression being a mediating factor in victimization on substance use. Victimization, however, was no longer a significant predictor,  $Z = .9323$ ,  $b = .0831$ ,  $p = .3512$ , 95% CI [-.0915,.2576]; indicating that in models of victimization on substance use through depression, levels of victimization no longer predicted substance use. See Table 3.2 for unstandardized regression coefficients.

Table 3.2 Logistic Regression Coefficients for B-path of Victimization Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	-1.0005	.0741	<.0001	-1.1508	-.8602
Depression	.1165	.0274	<.0001	.0627	.1703
Victimization	.0831	.0891	.3512	-.0915	.2576

An examination of the combined effects revealed that the contribution of the direct path was not reduced to zero, thus partial mediation was concluded. This meant that a portion of the effect of victimization on substance use was explained by victimization leading to depression which in turn, leads to substance use. Refer to Table 3.3 for model coefficients and 95% confidence intervals.

Table 3.3 Mediation Effects Coefficients for Victimization Model

	Effect	SE	<i>Z</i>	<i>P</i>	LLCI	ULCI
Total (C-path)	.1939	.0829	2.340	.0193	.0315	.3564
Direct (C'-path)	.0831	.0891	.9323	.3512	-.0915	.2576
Indirect (A and B-paths)*	.1126	.0322	3.497	.0005	.0586	.1851

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

Addressing the same model with sex as a moderating factor in this mediated relationship, victimization to depression retained a significant model,  $F(3,951) = 55.7276$ ,  $p < .0001$ ,  $R^2 = .1495$ . With sex in this step of the model, both greater victimization,  $b = 1.2777$ ,  $t(951) = 9.8369$ ,  $p < .0001$ , 95% CI [.9841,1.5712]; and being female (sex),  $b = -1.2281$ ,  $t(951) = -7.7526$ ,  $p < .0001$ , 95% CI [-1.5390,-.9172]; were significant predictors, but not the interaction of victimization and sex,  $b = -.3975$ ,  $t(951) = -2.0448$ ,  $p = .0411$ , 95% CI [-.7791,-.0160]. The lack of significance of the interaction of victimization and sex would indicate that sex failed to moderate the relationship of victimization to depression. See Table 3.4 for unstandardized regression coefficients.

Table 3.4 Linear Regression Coefficients for A-path of Victimization Moderated-Mediation Model

	B	SE	$p$	LLCI	ULCI
Constant	.6307	.1120	<.0001	.4108	.8506
Victimization	1.278	.1496	<.0001	.3871	1.571
Sex	-1.228	.1584	<.0001	-1.539	-.9172
Sex by Victimization	-.3975	.1944	.0411	-.7791	-.0160

Testing the relationship between depression and substance use, while controlling for victimization and incorporating sex as a moderating factor, a significant model was also retained, Maximum Likelihood = 27.2795, Nagelkerke  $R^2 = .0408$ . Greater depression significantly predicted a 1.163 times increased likelihood of substance use,  $Z = 4.4457$ ,  $b = .1512$ ,  $p < .0001$ , 95% CI [.0845,.2178]; while, sex,  $Z = -.2175$ ,  $b = -.0337$ ,  $p = .8278$ , 95% CI [-.3373,.2699]; victimization,  $Z = 1.2393$ ,  $b = .1138$ ,  $p = .2152$ , 95% CI [-.0662,.2938]; and the interaction of sex by depression,  $Z = -1.9949$ ,  $b = -.1181$ ,  $p = .0461$ , 95% CI [-.2341,-.0021]; were not significant predictors. As the interaction between depression and sex was not significant, moderation by sex could not be concluded in this step of the model. See Table 3.5 for unstandardized regression coefficients.

Table 3.5 Logistic Regression Coefficients for B-path of Victimization Moderated-Mediation

	B	SE	<i>p</i>	LLCI	ULCI
Constant	-1.021	.1089	<.0001	-1.234	-.8073
Depression	.1512	.0340	<.0001	.0845	.2178
Victimization	.1138	.0918	.2152	-.0622	.2938
Sex	-.0337	.1549	.8278	-.3373	.2699
Sex by Depression	-.1181	.0592	.0461	-.2341	-.0021

As mediation was previously substantiated, the primary interest in this model was the conditional indirect effects of victimization on substance use by sex. However, as rationale was not substantiated for the moderation of this relationship by sex in either path, this sex-moderated-depression-mediated model of victimization merely determines that the depression mediated relationship between victimization and substance use does in fact persist after accounting for sex. The conditional indirect effects that were reported by PROCESS are included for informative purposes and should not be interpreted as meaningful regarding the sex-based moderation of the mediated relationship. Refer to Table 3.6 for model effect coefficients and 95% confidence intervals.

Table 3.6 Moderated-Mediation Effects Coefficients for Victimization Model

	Effect	SE	Z	<i>P</i>	LLCI	ULCI
Direct (C-path)	.1138	.0918	1.239	.2152	-.0662	.2938
Indirect (A/B-paths)*						
Male	.0291	.0458	.6354	.5252	-.0566	.1226
Female	.1931	.0603	3.202	.0014	.1000	.3423

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

### 3.2.2 Bullying on substance use.

To determine the role of depression in mediating bullying and substance use, first, the total effect of bullying on substance use was found to be significant, Maximum Likelihood = 49.5884, Nagelkerke  $R^2 = .0735$ , bullying,  $Z = 6.7915$ ,  $b = .8501$ ,  $p < .0001$ , 95% CI [.0315,.3564]. Specifically, greater bullying behavior predicted a 2.340 times greater likelihood of substance use. Testing the path of bullying to depression (A-path), a significant model was produced,  $F(1,951) = 64.6108$ ,  $p < .0001$ ,  $R^2 = .0636$ ; such that greater levels of bullying predicted greater levels of depression. See Table 3.7 for unstandardized regression coefficients.

Table 3.7 Linear Regression Coefficients for A-path of Bullying Mediation Model

	B	SE	P	LLCI	ULCI
Constant	-.0019	.0827	.9821	-.1641	.1604
Bullying	1.145	.1425	<.0001	.8658	1.425

Determining the path between depression and substance use, while controlling for bullying (B-path), a significant model was also produced, Maximum Likelihood = 59.1853, Nagelkerke  $R^2 = .0873$ . Depression significantly predicted substance use,  $Z = 3.1401$ ,  $b = .0862$ ,  $p = .0017$ , 95% CI [.0324,.1400]; and bullying also predicted substance use,  $Z = 5.9340$ ,  $b = .7615$ ,  $p < .0001$ , 95% CI [.5100,1.0131]. Specifically, those who were higher in levels of depression were 1.090 times more likely to engage in substance use and those who were bullies were 2.141 times more likely to engage in substance use also. The indirect effect was found to be significant,  $Z = 2.878$ ,  $SE = .0343$ ,  $p = .004$ ; substantiating the evidence for depression being a mediating factor in bullying on substance use. See Table 3.8 for unstandardized regression coefficients.

Table 3.8 Logistic Regression Coefficients for B-path of Bullying Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	-1.035	.0762	<.0001	-1.184	-.8855
Depression	.0862	.0275	.0017	.0324	.1400
Bullying	.7615	.1283	<.0001	.5100	1.013

As the indirect effect of bullying on substance use was significant, but the direct effect of bullying on substance use retained significance, depression was implicated in the partial mediation of bullying and substance use. This meant that a portion of the effect of bullying on substance use was explained by engaging in bullying that lead to depression which in turn would lead to a greater likelihood of substance use. Refer to Table 3.9 for bullying mediation model effect coefficients.

Table 3.9 Mediation Effects Coefficients for Bullying Model

	Effect	SE	Z	<i>p</i>	LLCI	ULCI
Total (C'-path)	.8501	.1252	6.792	<.0001	.6048	1.096
Direct (C-path)	.7615	.1283	5.934	<.0001	.5100	1.013
Indirect (A and B-paths)*	.0987	.0343	2.878	.0040	.0341	.1691

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

Addressing the previous mediation model of bullying, depression and substance use, sex was introduced as a moderating factor. Testing the path from victimization to depression while incorporating sex revealed a significant model,  $F(3,949) = 41.7485$ ,  $p < .0001$ ,  $R^2 = .1166$ . Regarding the predictors within this step of the model, both increased incidence of bullying,  $b = 1.2873$ ,  $t(949) = 5.6422$ ,  $p < .0001$ , 95% CI [.8396,1.7351]; and being female (sex),  $b = -1.2214$ ,  $t(949) = -7.7526$ ,  $p < .0001$ , 95% CI [-1.5392,-.9036]; were significant predictors, but not the interaction of bullying and sex,  $b = -.0307$ ,  $t(951) = -.1065$ ,  $p = .9152$ , 95% CI [-.5965,.5352]. As

the interaction between bullying and sex was not found to be significant, moderation could not be concluded on this path. See Table 3.10 for unstandardized regression coefficients.

Table 3.10 Linear Regression Coefficients for A-path of Bullying Moderated-Mediation Model

	B	SE	<i>p</i>	LLCI	ULCI
Constant	.6094	.1147	<.0001	.3843	.8345
Bullying	1.287	.2282	<.0001	.8396	1.735
Sex	-1.221	.1619	<.0001	-1.539	-.9036
Sex by Bullying	-.0307	.2883	.9152	-.5965	.5352

Testing the relationship between depression and substance use, while controlling for bullying and accounting for moderating effects of sex, a significant model was produced, Maximum Likelihood = 71.7727, Nagelkerke  $R^2 = .1052$ . Depression,  $Z = 3.9847$ ,  $b = .1347$ ,  $p = .0001$ , 95% CI [.0685,.2010]; bullying,  $Z = 1.2393$ ,  $b = .1138$ ,  $p = .2152$ , 95% CI [-.0662,.2938]; and the interaction of sex by depression,  $Z = -3.22$ ,  $b = -.2070$ ,  $p = .0013$ , 95% CI [-.3330,-.0810]; all significantly predicted substance use. Specifically, a greater likelihood to engage in substance use was found where: (a) greater depression was 1.144 times more likely, (b) increasing incidence of bully was 2.431 times more likely, and (c) depressed females were 1.230 times more likely. Sex was the only predictor in the final model that was not significant,  $Z = -1.3999$ ,  $b = -.2264$ ,  $p = .1615$ , 95% CI [-.5433,.0906], but moderation could be determined. See Table 3.11 for unstandardized regression coefficients.

Table 3.11 Logistic Regression Coefficients for B-path of Bullying Moderated-Mediation Model

	B	SE	<i>P</i>	LLCI	ULCI
Constant	-.9886	.1113	<.0001	-1.207	-.7705
Depression	.1347	.0338	.0001	.0685	.2010
Bullying	.8882	.1357	<.0001	.6223	1.154
Sex	-.2264	.1617	.1615	-.5433	.0906
Sex by Depression	-.2070	.0643	.0013	-.3330	-.0810

As mediation was previously substantiated, the primary interest in this model was the conditional indirect effects of bullying on substance use by sex. Conditional indirect effects were found for females, ( $Z = 2.876$ ,  $p = .004$ , bootstrap 95% CI [1.308,5.294]) but not in males, ( $Z = 1.089$ ,  $p = .2762$  bootstrap 95% CI [-3.325,.597]). Refer to Table 3.12 for model effect coefficients and 95% confidence intervals.

Table 3.12 Moderated-Mediation Effects Coefficients for Bullying Model

	Effect	SE	Z	P	LLCI	ULCI
Direct (C'-path)	.8882	.135	6.547	<.0001	.6223	1.154
Indirect (A/B-paths)*						
Male	-.0908	.0834	-1.089	.2762	-.2773	.0498
Female	.1734	.0603	2.876	.0040	.0789	.3192

\*Note: Indirect effects were calculated with bias corrected bootstrap of 5000 samples.

### 3.3 Discussion

#### *3.3.1 Summary of Findings*

In the current study, a partially-mediated model of victimization on substance use through depression was produced, and the effects of this model were not found to also be moderated by sex. Additionally, a partially-mediated model of bullying behaviors on substance use through depression was also revealed. The effect of the model of bullying behavior was also found to be moderated by sex, specifically by females.

#### *3.3.2 Victimization*

Addressing the first hypothesis that victimized adolescents engaging in substance use could be explained by depression mediating this effect, support was found for this hypothesis. In general, victimized adolescents were more likely to engage in substance use, and it was found that depression mediated this effect, such that victimized adolescents with greater levels of depression were more likely to engage in substance use (refer to Tables 3.2 and 3.3). These findings are consistent with previous research (Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor



et al., 2009; Ford et al., 2010). The results of the sex-moderated-depression-mediated model of victimization on substance use failed to support the second hypothesis that sex should influence this relationship where females would be more likely to explain the relationship of victimization on substance use as mediated through depression. Interestingly, females were significantly more likely to report depression (refer to Table 3.4), but these effects could not be concluded as being moderated by sex. Additionally, these findings are congruent with previous literature with regards to females being more likely to engage in substance use, but these findings were inconsistent with the same literature in that sex was not moderating this relationship (Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor et al., 2009).

### *3.3.3 Bullying*

Partial support was found for the third hypothesis, that bullying adolescents would be more likely to engage in substance use in response to concomitant depression. It was found that bullies were more likely to engage in substance use, and that this effect was mediated through depression such that those who bullied others and were depressed were more likely to engage in substance use (Refer to Tables 3.8 and 3.9). These results are congruent with previous research (Kim et al., 2011; Kim et al., 2005; Van der Wal et al., 2003, Klomek et al., 2007; Nansel et al., 2004; Nansel et al., 2004). Even though the effect was minimal for bullying leading to substance use as mediated through depression, these findings may still shed light on an overlooked component of the bullying dynamic. In other words, further investigation is necessary to determine if this relationship could be explained by the bully-victim category of the bullying dynamics.

Lastly, addressing the fourth hypothesis that the depression-mediated relationship between bullying and substance use would be moderated by sex, support was found, however, in the opposite direction of what was predicted. It was predicted that male bullies would be more likely to engage in substance use behaviors, as mediated through depression, but it was in fact females moderating this relationship. Females were found to be more likely to engage in

substance use behaviors when they were a bully and subsequently depressed. These results are congruent with previous findings, such that: (a) females are more likely to report depression, (b) bullies have been found to be associated with depression, and (c) bullies overall are more likely to engage in substance use (Kim et al., 2011; Kim et al., 2005; Van der Wal et al., 2003, Klomek et al., 2007; Nansel et al., 2004; Nansel et al., 2004; Bond et al., 2001; Kaltiala-Heino et al., 2000; Poulin et al., 2005; Hodgins et al., 2008). What appears to be novel is the finding that female bullies that are depressed are more likely to engage in substance use behaviors. Perhaps, this could be due to a bias of females being more likely to report depression more often than males, which could be further compounded by differences between bullies and bully-victims. Nevertheless, further research is necessary to understand these differences.

## CHAPTER 4

### GENERAL DISCUSSION

The goal of the present studies was to identify substance use propensities within an at-risk population – 15- year-old boys and girls - by identifying relationships between victimization, bullying, depression, sex and substance use in two national datasets, the HBSC and the NICHD. To investigate the applicability of causative models, mediation and moderated-mediation analyses were applied to the two datasets and relationships were probed between victimization, depression, and substance use, as well as relationships between bullying, depression, and substance use. Because previous studies have identified sex differences in: (a) substance use (Substance Abuse and Mental Health Services Administration, 2011; Substance Abuse and Mental Health Services Administration, 2010; Milani et al., 2004; Isralowitz & Rawson, 2006; Svensson, 2003; Poulin, et al., 2005; Schepis et al., 2011), (b) depression (Lin et al., 2004; Back et al., 2010; Conway, Compton, Stinson, & Grant, 2006; Green et al, 2009; Poulin, et al., 2005), (c) bullying (Klomek et al., 2007; Kumpulainen & Rasanen, 2000; Wolke et al., 2001; Morris, Zhang, & Bondy, 2006; Juvonen, Graham, & Schuster, 2003; Carlyle & Steinman, 2007; Forero et al., 1999), and (d) conjunctions (but not comprehensive models) of substance use, depression and/or bullying behaviors (Luk et al., 2010; Fleming & Jacobsen, 2009; Ford et al., 2010; Kilpatrick et al., 2000; Tharp-Taylor et al., 2009; Morris et al., 2006) amongst adolescents, analyses were performed to understand how an individual's sex factored into these models. Thus, the variable sex was added to each model as a moderator. Overall, the results suggest that: (a) increasing victimization leads to increased depression, which leads to an increased likelihood of substance use; (b) increasing bullying behaviors leading to depression can account for an increased likelihood of substance use, and (c) sex factors very little with regards to these relationships within these datasets.

## 4.1 Consistency and Summary of Findings

### *4.1.1 Specific Aim I: The role of substance use as influenced by victimization, depression and sex differences.*

The main goal of Specific Aim 1 was to better understand how victimization, depression and an individual's sex would influence patterns of substance use in 15 year old adolescents. While, previous studies have established that adolescent exposure to victimization is a vulnerability factor for depression and substance use, the influence of an individual's sex on these three variables within a mediation model has remained, until now, unexamined.

Adolescents in both national datasets who reported episodes of victimization also reported engaging in substance use. These results are comparable to the published literature on victimization and substance use behavior, which report higher substance use in individuals who have been victimized (Luk et al., 2010; Mitchell, Ybarra, & Finkelhor, 2007; Ford et al., 2010; Kilpatrick et al., 2000; Forero, McLellan, Rissel, & Bauman, 1999; Kaltiala-Heino et al., 2000; Kim, Catalano, Haggerty, & Abbott, 2011; Nansel et al., 2001; Tharp-Taylor, Haviland, & D'Amico, 2009). Together, these studies provide several lines of evidence which demonstrate that victimization is a risk factor for substance use disorder.

Adolescents who reported victimization were found to also report increased levels of depressive symptoms within both datasets. These results are congruent with previous literature on victimization and depression, which have reported higher depressive symptoms in individuals who had reported being victimized (Luk, Wang, & Simmons-Morton, 2010; Bond, Carlin, Thomas, Rubin, & Patton, 2001; Baldry, 2004; Fekkes, Pijpers, & Verloove-Vanhorick, 2004; Fleming & Jacobsen, 2009; Hawker & Boulton, 2000; Kaltiala-Heino, Rimpela, Rantanen, & Rimpela, 2000; Kim, Koh, & Leventhal, 2005; Klomek et al., 2007, Kumpulainen & Rasanen, 2000; Park, Schepp, Jang, & Koo, 2006; Tharp-Taylor et al., 2009; Turner, Finkelhor, & Ormrod, 2006; van der Wal, de Wit, & Hirasing, 2003; Williams et al., 1996; Solberg & Olweus, 2003;

Iyer, Dougall, & Jensen-Campbell, 2011). These results offer further evidence to the established findings which have already found a link between victimization and depression.

In both databases, adolescents who reported increased levels of depressive symptoms were also found to be at an increased risk of substance. These results are congruent with previous literature on depression and substance use, which have reported greater levels of substance use in individuals who had reported greater depressive symptoms (Rao et al., 1999; Rao, Daley, & Hammen, 2000; Armstrong & Costello, 2002; Ziyadeh et al., 2007; Shrier et al., 2001; Tetrault et al., 2008; Fleming & Jacobsen, 2009; Back et al., 2010; Subramaniam & Stitzer, 2009; Ford et al., 2010; Green et al., 2011; Chiang et al., 2007; Conway, Compton, Stinson & Grant, 2006; Lin et al., 2004). Adding to the body of literature, the findings further substantiate the idea that increased substance use can be accounted for by increased depressive symptoms.

Addressing the pathway of victimization leading to depression which in turn leads to an increased likelihood of substance use, the results of both datasets supported the hypothesis that victimized adolescents reflect a greater likelihood of substance use accounted for by depressive symptoms. This was congruent with previous literature that found this in other datasets (Natishyn, Jensen-Campbell, Dougall, & Perrotti, unpublished; Luk, et al., 2010; Bond et al., 2001; Tharp-Taylor et al., 2009; Ford et al., 2010). These findings expand the growing body of literature which reflects this path to substance use within victimized adolescents. By using a mediation model of this form, evidence has been substantiated that in some cases of victimization leading to an increased likelihood of substance use, the intermediate causal variable could be increased depressive symptoms. In speculation, this could provide insight into how substance use may be employed as a maladaptive form of coping in direct response to the psychological distress which resulted from the increased victimization reported by adolescents. This could add to the body of literature regarding substance use by exemplifying a causal

pathway that identifies a potent risk factor which could increase the risk for substance use disorders.

Addressing the hypothesis that sex would influence the pathway of victimization leading to depression which in turn leads to an increased likelihood of substance use, specifically in females, the results of both datasets failed to reveal any sex differences within the mediated pathway. Instead, the present research found that male and female victimized adolescents were equally likely to engage in substance use, despite the fact that more males than females reported victimization (see ancillary analyses in Appendix E). The finding that males and females reporting victimization were equally likely to engage in substance use is similar to the findings of Nansel and colleagues (2001). Their study, which used data from a previous version of the HBSC (1997-1998), found that while males were more likely to report bullying and victimization, no sex differences were implied in how bullying or victimization explicitly predicted substance use variables. However, these results are incongruent with previous research which has found that the path from victimization to substance use through depression was driven primarily by females (Natishyn, Jensen-Campbell, Dougall, & Perrotti, unpublished; Luk, et al., 2010; Ford et al., 2010). The results failed to support the hypothesis that females would be more likely to engage in substance use in response to victimization through concomitant depressive symptoms. In fact, the only sex difference the results substantiated was that females reflect greater levels of depression in both models, but not greater levels of substance use, subsequent to depression. These results were consistent with previous findings that females reflected greater levels of depressive symptoms (Green et al, 2009; Macintyre, Hunt, & Sweeting, 1996; Natishyn, Jensen-Campbell, Dougall, & Perrotti, unpublished; Luk, et al., 2010; Ford et al., 2010; Lin et al., 2004; Back et al., 2010; Conway, Compton, Stinson, & Grant, 2006; Poulin, et al., 2005). An alternate explanation which could be offered to the lack of sex influencing the path from victimization to substance use through depressive symptoms was that the model was still valid when controlling for sex. These findings add to the growing body of

literature regarding these models in that there may be other factors which influence how sex influences these relationships. Specifically, the present research may provide the implication that other factors should be considered to determine how or how not a sex differentiated effect would be found. For example, as males and females mature at different rates, age could influence how sex differences within these pathways could be found.

*4.1.2 Specific Aim II: The role of substance use as influenced by bullying, depression and sex differences.*

The main goal of Specific Aim 2 was to better understand how bullying, depression and an individual's sex would influence patterns of substance use in 15 year old adolescents. While, previous studies have established that adolescent bullying behaviors are a possible vulnerability factor for depression and substance use, how these three variables could be applied to a potentially causal model, and how sex could influence such a mediation model has remained, until now, unexamined.

Adolescents in both national data sets who reported bullying behavior also reported a greater likelihood of engaging in substance use. These results are comparable to the published literature on bullying behaviors and substance use, which report higher substance use in individuals who engage in bullying (Kim et al., 2011; Nansel et al., 2004; Nansel et al., 2001; Kaltiala-Heino et al., 2000; Tharp-Taylor et al., 2009; Morris et al., 2006). Together, these studies emphasize evidence which demonstrates that bullying is a potential risk factor for substance use disorder.

Adolescents who reported bullying were found to also report increased levels of depressive symptoms within both datasets. These results are congruent with previous literature regarding bullying and depression, which have reported higher depressive symptoms in individuals who had reported bullying (Klomek et al., 2007; Kaltiala-Heino et al., 2000; Kim et al., 2005; van der Wal et al., 2003; Wolke et al., 2001). These results offer evidence to the expanding body of literature which have identified this relationship. Furthermore, this also offers

the implication that bullies may also experience depressive symptoms which, in speculation, could account for the manifestation of aggression in some cases.

Regarding the hypothesis that adolescents who bully reflect a greater likelihood of substance use accounted for by depressive symptoms, the findings from both datasets offered support. While this did not apply to all bullies, the results indicated that the pathway from bullying to depressive symptoms to substance use was valid for some adolescents. This was congruent with previous literature that found associations in adolescents regarding bullying, depressive symptoms, and substance use (Kaltiala-Heino et al., 2000). These findings expand the developing body of literature which reflects this path to substance use within bullying adolescents could be explained by levels of depression in some cases. Furthermore, in speculation, this could also provide insight into how substance may be a maladaptive form of coping in bullies in addition to those who reported victimization. In other words, those who bully and have higher levels of depressive symptoms may self-medicate their depression in addition to reinforcing the positive feelings they may experience from bullying others. Additionally, while the present research did not include this, further research should investigate if the relationship could be depression leading to bullying behaviors which lead to substance use propensity. It is entirely possible that the relationship could in fact be bidirectional, and further analyses are needed to probe this relationship.

Regarding the hypothesis that males would be more likely to engage in substance use in response to bullying through concomitant depressive symptoms, the findings from both datasets failed to offer support. Similar to the victimization model, the results substantiated that females reflect greater levels of depressive symptoms in both models. However, in the NICHD dataset, but not the HBSC dataset, a significant relationship, contrary to what was hypothesized, was revealed in females as opposed to males. This would indicate that female bullies who are depressed are more likely to engage in substance use behaviors compared to males within the same model. While this finding is novel, it must be taken with caution, as no



sex differences were uncovered in the HBSC dataset, which found that males and females were equally likely to bully and also equally likely to engage in substance use within those data. The result from the HBSC is consistent with a previous study using a prior version of the HBSC which implied no sex differences for bullying and substance use (Nansel et al., 2001). While further analyses confirmed that more males bully compared to females in both datasets (see ancillary analyses in Appendix E) and even though this is consistent with previous research (Carlyle & Steinman, 2007; Craig & Harel, 2004; Forero et al., 1999; Klomek et al., 2007; Williams et al., 1996; Wolke et al., 2001; Juvonen, Graham, & Schuster, 2003), the finding that females drive the relationship between bullying and substance use mediated through depression is presently a novel finding. The implication of such a finding is that while males are more likely thought to be bullies, when it comes to possible maladaptive coping behaviors such as substance use, the female bully interested in substance use has been somewhat overlooked. Perhaps with regards to the idea that males are more likely the school-yard bully, the sophisticated and complex mind of female bullies have been overshadowed by the obvious. Therefore, the finding in female bullies also sets precedence for investigation into further bullying behaviors within females.

#### *4.1.3 Summary of Findings in Brief*

To summarize, increasing victimization leads to increased depression, which leads to an increased likelihood of substance use. In a similar fashion, increasing bullying behaviors leading to depression can account for an increased likelihood of substance use. Males and females are equally likely to be accounted for in these models, with the exception of the one model revealing the effect of females bullying and leading to depression having a greater likelihood of substance use in the NICHD dataset.

#### 4.2 Limitations

The implications of these findings pique curiosity, in that if differences exist between males and females regarding victimization, bullying, and depression, then how were they not

uncovered in all of the models? This could possibly be due to the limitations within the present research. First of all, the present results lack generalizability, as both studies failed to include representative samples of race/ethnicity demographics. Furthermore, the analyses were restricted to only those aged 15 years; therefore, the findings are also not generalizable to all adolescent age ranges. Second, as the majority of variables analyzed were self-report measurements, there is a question to the reliability of these assessments. Third, limitations may have existed due to classifications of substance use parameters as both the HBSC and the NICHD datasets had limited measurements of substance use. As neither dataset included an item for prescription drug use, it is possible a major grouping of substance use was overlooked. Additionally, sex-specific limitations may have occurred due to biased behaviors or elements of self-report.

#### *4.2.1 Sex, Gender, and Gender-Roles*

Further complicating sex as a factor, distinctions must be made between sex, gender, and gender roles: (a) sex is the biological determinant of male or female, (b) gender is the identity of male or female, and (c) gender roles are the stereotypic behaviors that are associated with males or females. With that stated, the NICHD dataset determined males and females from birth (sex) and the HBSC dataset asked respondents if they are male or female (gender). As the majority of respondents were unlikely transgendered, this variable was treated as sex in the analyses. Where this becomes problematic is that gender role nonconforming behaviors have been found to be strongly associated with victimization and depression in adolescents (Friedman et al., 2006). While these behaviors are more prevalent in lesbian, gay, bisexual, and transgender (LGBT) youths, even non-LGBT youth can exhibit gender role nonconforming behaviors. Perhaps a better moderating factor to investigate would be gender conforming behaviors in these relationships.

#### *4.2.2 Sex Differences in Self-reporting*

Previous research has identified that females are more likely to engage in substance use in response to stress and negative affect, whereas males are more likely to use substances to enhance positive emotions or conform to a group (Annis & Graham, 1995). However, this could be influenced by female adolescents being more likely to report depression (Lin et al., 2004; Green et al, 2009; Williams et al., 2005). The pertinent question then becomes why males would not report depression. In most studies, depression measurements are collected by self-report questionnaires, however, Poteat and Espelage (2007) found that depression in victimized males targeted by homophobic bullying was significant after controlling for previous time points in depression. Their explanation given was that perhaps males underreport depression to try to “save face” and appear “tough”. Further investigation into this area is warranted to get a better understanding if depression is really more prevalent in females or if males are simply not reporting it.

### 4.3 Future Directions

Given the findings, their implications, and possible limitations of the presented research, there are multiple directions in which to apply future efforts into understanding adolescent substance use within the bullying and victimized populations. The following section attempts to address those directions that may be most relevant. Future studies regarding models of victimization and bullying behaviors should focus on the replication of previous findings, reconsideration of the existing variables included within the studies, and additional factors of interest to incorporate into future studies.

#### *4.3.1 Replication*

Findings in the current research need further replication. As the HBSC is a recurrent cross-sectional study and the NICHD is a longitudinal study, further time points for evaluation are available within these existing datasets. Other cross-sectional databases could be tested and/or the same analyses could be tested within differing age groups. Furthermore, laboratory

replication studies incorporating additional objective measures of substance use, such as drug screening, would be an excellent step in determining the overall validity and reliability of the findings presented in the current research.

#### *4.3.2 Reconsideration of Existing Variables*

As bullying can be categorized into physical bullying, verbal bullying, indirect (relational) bullying, or cyber bullying (Nansel, et al., 2001; David-Ferdon & Hertz, 2009), the acts of bullying that the victims are subjected to may account for differences in depression and subsequent substance use found in the moderated-mediated relationships presented in the current research.. In other words, these relationships could differ depending on the bullying behavior experienced. As sex differences have been found between the categories of bullying behaviors (Nansel, et al., 2001), the differing behaviors may potentially identify where sex could moderate these relationships and further expand the current research.

Additionally, the incorporation of categories of bullying dynamics could further explain patterns in substance use by comparing bullies, victims, and bully-victims to those who had no involvement in bullying dynamics. As previous literature has suggested sex differences within bullying dynamic categories (Klomek et al., 2007; Kumpulainen & Rasanen, 2000; Wolke et al., 2001; Morris, Zhang, & Bondy, 2006; Juvonen, Graham, & Schuster, 2003; Carlyle & Steinman, 2007; Forero et al., 1999), perhaps sex moderation of the models presented within the present research could be better investigated by reconsidering these bullying dynamic categories with the proposed moderated-mediation models.

Finally, as specific substances have been linked to sex differences in victimization and bullying (Morris et al., 2006; Tharp-Taylor et al., 2009; Ford et al., 2010; Kilpatrick et al., 2000; Natishyn, Jensen-Campbell, Dougall, & Perrotti, unpublished), the current models could be tested for efficacy with individual substances, or differences between polysubstance users and single substance users.

#### *4.3.3 Additional Factors for Consideration*

Many additional factors could be considered to better understand bullying dynamics, substance use, depression, and sex differences. After the reconsideration of the existing variables and possible differences within, four areas to be considered may be: (a) cortisol, (b) SLC6A, (c) sexual orientation, and (d) disordered eating behaviors.

##### *4.3.3.1 Cortisol*

Regarding the specific stressors of victimization, studies have found that bullied students reflect lower cortisol concentrations (Ouellet-Morin et al., in press; Vaillancourt et al., 2008a). Further analyses have found that gender moderated the relationship between victimized adolescents and cortisol, such that males had greater cortisol levels than females (Vaillancourt et al., 2008a). Additionally, the link between victimization and overall health appears to be mediated by cortisol levels (Knack, Jensen-Campbell, & Baum, 2011). In a similar fashion, Vaillancourt et al. (2011) found that adolescents who were victimized reflected greater depression, decreased cortisol levels, and decreased memory performance, consistent with the hallmarks symptoms of depression. Essentially, cortisol appears to be a central component of the biological substrates of stress or trauma-induced depression. Additionally, at least one study has found an effect of cortisol levels increasing in response to drug specific cues in addicted adolescents (Fatseas et al., 2011). As cortisol has been implicated in victimization, depression, and substance use, perhaps it could serve as a new variable of interest within these paradigms.

##### *4.3.3.2 SLC6A Genotyping*

Gene polymorphism studies have become a research focus in substance abuse studies, ranging from nicotine, alcohol, psychostimulants, opiates, and marijuana use (Ray & Hutchinson, 2004; Olsson et al., 2005; Hutchinson et al., 2007; Covault et al., 2007; Corley et al., 2008; Dlugos et al., 2009; Filbey et al., 2010). In particular, three genes of the solute carrier protein family 6 (SLC6A) have been implicated in substance use behaviors: (a) SLC6A2, the norepinephrine transporter; (b) SLC6A3, the dopamine transporter; and (c) SLC6A4, the

serotonin transporter (Little et al., 1998; Covault et al., 2007; Corley et al., 2008; Dlugos et al., 2009). All three of these genes are also thought to influence susceptibility to depression (Haenisch et al., 2009; Stein, Campbell-Sills, & Gelernter; 2009; Opmeer et al., 2010; Iyer, Jensen-Campbell and Dougall, 2011). Of particular interest are the findings of Covault and colleagues (2007), that those with homozygous s-alleles for the serotonin transporter promoter polymorphism, who had higher numbers of negative life events, reflected greater substance use. Other gene variants did not show this same effect, and in some of these models there was a gene by environment effect revealed for women, but not men. Inclusion of these gene variants within the existing models may provide further insight into understanding risk factors for engaging in substance use in response to victimization.

#### 4.3.3.3 Sexual Orientation

Using a differential scale of sexual orientation, Ziyadeh (2006) found that males and females who reported themselves as “mostly heterosexual” were at a greater risk of alcohol use compared to their completely heterosexual counterparts. Furthermore, sexual minorities are at greater risk for victimization, and the relationship between sexual orientation and psychosocial adjustment appears to be mediated by social support and victimization (Williams et al., 2005). Despite this, another study found that although a significant association between LGBT-directed victimization and depression was found, there was no association with victimization and substance use (Russell et al., 2010). Another study found that in men, victimization was more strongly associated with substance use than in women, and these effects were much greater in sexual minority groups. As sexual minorities are more likely to be subjected to victimization (Friedman et al., 2006; Williams et al., 2005; Ziyadeh, 2006; Russell et al., 2010), perhaps including this demographic could expand further on the relationships identified in the current research.

#### 4.3.3.4 Disordered Eating

Disordered eating behaviors are another element for further consideration in victimization models. Using the Youth Risk Behavior Surveillance System (YRBSS), Pietsky and colleagues (2008) performed analyses regarding eating disorders and substance use comorbidity in adolescents. They found that eating disorders were more prevalent in females than males, but there were no differences between ages. They also found that substance use differences related to disordered eating, such that males used steroids and marijuana, whereas females smoked or used cocaine, which they presumed were attempts to gain weight and lose weight, respectively. Disordered eating behaviors are likely another form of maladaptive coping in response to peer victimization through depression, and inclusion of these behaviors in future research could assist in a more complete understanding of these relationships.

#### 4.4 Conclusion

The present research has produced significant models of both victimization on substance use through depression and bullying on substance use through depression. While only subsets of the victimized and bullying populations are accounted for in these models, insights into at-risk populations have been revealed. Contrary to what was hypothesized, sex could not be implicated as a factor influencing any of the models, with the exception of one. That specific exception was found in the NICHD database where female bullies reporting greater depression were more likely to engage in substance use, which is a novel finding that could give insight into the pathology of female bullies.

APPENDIX A  
STUDY ONE QUESTIONNAIRE ITEMS



## **2001 World Health Organization Study of Health Behaviors in School-aged Children**

This survey asks about your health. It is being given to thousands of young people throughout the U.S. and in many other countries. The information you give will be used to develop better programs for young people like yourself.

This survey is anonymous. DO NOT write your name anywhere on this survey booklet. No one will know what you write. A computer will record the answers. Answer the questions based on what you really do, think, and feel. There are some questions to describe the types of students answering this survey. We do not want anyone's name. Completing the survey is voluntary. Whether or not you answer the questions will not affect your grade in this class.

Make sure you read every question. You do not have to answer any question that makes you feel uncomfortable. Fill in the circles completely. When you are finished, follow the instructions of the person giving you the survey.

### **INSTRUCTIONS FOR COMPLETING THE SURVEY**

- Read all the printed answers before marking your choice.
- Mark the circle for the one answer that best fits your situation.
- Use a No. 2 pencil.
- Make heavy marks that fill the circle for your answer.
- Erase cleanly any answer you wish to change.
- Please do not make stray marks of any kind.
- For all the questions, except question number 6, you should mark only one circle for your answer in the column below the question, as shown here:

Figure A.1 Instructions to Participants in the HBSC.

1. **Are you a boy or a girl?**
  - Boy
  - Girl
  
2. **What month were you born?**
  - January
  - February
  - March
  - April
  - May
  - June
  - July
  - August
  - September
  - October
  - November
  - December
  
3. **What year were you born?**
  - 1991
  - 1990
  - 1989
  - 1988
  - 1987
  - 1986
  - 1985
  - 1984
  - Other:  
Write it here  
\_\_\_\_\_
  
4. **What grade are you in?**
  - 5th grade
  - 6th grade
  - 7th grade
  - 8th grade
  - 9th grade
  - 10th grade
  - 11th grade
  - 12th grade
  - Ungraded
  - Other:  
Write it here  
\_\_\_\_\_
  
5. **Are you Hispanic or Latino?**
  - No, I am not Hispanic or Latino.
  - Yes, I am Hispanic or Latino.
  
6. **What is your race?** *(You may choose one answer, or more than one)*
  - American Indian or Alaska Native
  - Asian
  - Black or African American
  - Native Hawaiian or Other Pacific Islander
  - White

Figure A.2 Sample Demographic questions from the HBSC.

41. In the last 6 months: how often have you had the following . . . ? (Please mark one circle for each line)

	Rarely or never	About every month	About every week	More than once a week	About every day
a. Headache	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Stomach-ache	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Back ache	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Feeling low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. Irritability or bad temper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. Feeling nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. Difficulties in getting to sleep	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. Feeling dizzy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.3 Depression assessment via “Feeling low”.

Here are some questions about bullying. We say a student is **BEING BULLIED** when another student, or a group of students, say or do nasty or unpleasant things to him or her. It is also bullying when a student is teased repeatedly in a way he or she does not like or when they are deliberately left out of things. But it is **NOT BULLYING** when two students of about the same strength or power argue or fight. It is also not bullying when the teasing is done in a friendly and playful way.

66. How often have you been bullied at school in the past couple of months?

- I haven't been bullied at school in the past couple of months
- It has only happened once or twice
- 2 or 3 times a month
- About once a week
- Several times a week

Figure A.4 Instructions to participants and assessment of peer-victimization.

69. How often have you taken part in bullying another student(s) at school in the past couple of months?
- I haven't bullied another student(s) at school in the past couple of months
  - It has only happened once or twice
  - 2 or 3 times a month
  - About once a week
  - Several times a week

Figure A.5 Assessment of bullying behaviors.

83. How often do you smoke tobacco at present?
- Every day
  - At least once a week, but not every day
  - Less than once a week
  - I do not smoke

Figure A.6 Assessment of smoking frequency.

85. At present, how often do you drink anything alcoholic, such as beer, wine, or spirits like . . . ? Try to include even those times when you only drink a small amount. (Please mark one circle for each line)

	Every day	Every week	Every month	Rarely	Never
a. Beer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Wine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Liquor/Spirits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Alcopops (wine coolers, Bacardi Breezers, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.7 Assessment of alcohol consumption.

89. Have you ever used or taken one or several of these drugs in the last 12 months? (Please mark one circle for each line)

	40 times or more	20 to 39 times	10 to 19 times	6 to 9 times	3 to 5 times	Once or twice	Never
a. Marijuana (pot, weed)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Inhalants (includes huffing or sniffing glue, aerosol cans, or paint to get high)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Any other drug	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure A.8 Other assessments of substance use.

APPENDIX B  
SPSS SYNTAX FOR STUDY ONE

```

**Thesis STUDY ONE.
*Select respondents aged 15 years.
DATASET ACTIVATE DataSet21.
DATASET COPY HBSC_15.sav.
DATASET ACTIVATE HBSC_15.sav.
FILTER OFF.
USE ALL.
SELECT IF (AGE=15).
EXECUTE.
DATASET ACTIVATE DataSet21.

*PROCESS.sps is run prior to any of this syntax file.
DATASET ACTIVATE DataSet2.

*Recode variables.
*Recode Victimization.
RECODE Q66 (MISSING=SYSMIS) (ELSE=Copy) INTO Vict.
VARIABLE LABELS Vict 'Peer Victimization'.
EXECUTE.
*Recode Bullying.
RECODE Q69 (MISSING=SYSMIS) (ELSE=Copy) INTO Bull.
VARIABLE LABELS Bull 'Peer Bullying'.
EXECUTE.
*Recode depression.
RECODE Q41D (MISSING=SYSMIS) (5=1) (4=2) (3=3) (2=4) (1=5) INTO Depr.
VARIABLE LABELS Depr 'Depression'.
EXECUTE.
*Substance Use recoding.
*Smoking.
RECODE Q83 (MISSING=SYSMIS) (4=1) (3=2) (2=3) (1=4) INTO Smoke.
VARIABLE LABELS Smoke 'Smoking'.
EXECUTE.
RECODE Smoke (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dSmoke.
VARIABLE LABELS dSmoke 'Smoking 0/1'.
*EtOH.
RECODE Q85A (MISSING=SYSMIS) (5=1) (4=2) (3=3) (2=4) (1=5) INTO Ei1.
VARIABLE LABELS Ei1 'EtOH-Item1'.
EXECUTE.
RECODE Q85B (MISSING=SYSMIS) (5=1) (4=2) (3=3) (2=4) (1=5) INTO Ei2.
VARIABLE LABELS Ei2 'EtOH-Item2'.
EXECUTE.
RECODE Q85C (MISSING=SYSMIS) (5=1) (4=2) (3=3) (2=4) (1=5) INTO Ei3.
VARIABLE LABELS Ei3 'EtOH-Item3'.
EXECUTE.
RECODE Q85D (MISSING=SYSMIS) (5=1) (4=2) (3=3) (2=4) (1=5) INTO Ei4.
VARIABLE LABELS Ei4 'EtOH-Item4'.
EXECUTE.
COMPUTE EtOH=SUM(Ei1,Ei2,Ei3,Ei4).
EXECUTE.
RECODE EtOH (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dEtOH.
VARIABLE LABELS dEtOH 'Alcohol 0/1'.
EXECUTE.

```

```

*MJ.
RECODE Q89A (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dMJ.
VARIABLE LABELS dMJ 'Marijuana 0/1'.
EXECUTE.
*Inhalants.
RECODE Q89B (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dInhal.
VARIABLE LABELS dInhal 'Inhalants 0/1'.
EXECUTE.
*Other Drugs.
RECODE Q89C (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dODs.
VARIABLE LABELS dODs 'Other Drugs 0/1'.
EXECUTE.

*Total Substance Use.
COMPUTE TSU=SUM(dSmoke,dEtOH,dMJ,dInhal,dODs).
EXECUTE.
RECODE TSU (MISSING=SYSMIS) (0=0) (ELSE=1) INTO dTSU.
VARIABLE LABELS dTSU 'Substance Use 0/1'.
EXECUTE.
*Recode gender/sex.
RECODE Q1 (1=1) (2=0) (-9=SYSMIS) INTO sex.
VARIABLE LABELS sex 'Sex w/female ref 0/1'.
EXECUTE.

***Frequency data.
FREQUENCIES VARIABLES=sex
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Vict Bull Depr
  /STATISTICS=STDDEV MEAN MEDIAN MODE
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Smoke Ei1 Ei2 Ei3 Ei4 EtOH MJ Inhal ODs TSU Q5 Q6_COMP
Q7 Q11 Q76 Q77 Q78
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
SORT CASES BY sex.
SPLIT FILE LAYERED BY sex.
FREQUENCIES VARIABLES=Vict Bull Depr
  /STATISTICS=STDDEV MEAN MEDIAN MODE
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Smoke Ei1 Ei2 Ei3 Ei4 EtOH MJ Inhal ODs TSU Q5 Q6_COMP
Q7 Q11 Q76 Q77 Q78
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
SPLIT FILE OFF.

***Transformations.
COMPUTE SQRTVict=SQRT(Vict).
COMPUTE SQRTBull=SQRT(Bull).
COMPUTE SQRTDepr=SQRT(Depr).
COMPUTE LG10Vict=LG10(Vict).

```



```
COMPUTE LG10Bull=LG10(Bull).
COMPUTE LG10Depr=LG10(Depr).
COMPUTE InvVict=1/Vict.
COMPUTE InvBull=1/Bull.
COMPUTE InvDepr=1/Depr.
EXECUTE.
```

```
*SQRT Distributions.
FREQUENCIES VARIABLES=SQRTVict SQRTBull SQRTDepr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

```
*LG10 Distributions.
FREQUENCIES VARIABLES=LG10Vict LG10Bull LG10Depr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

```
*Inv Distributions.
FREQUENCIES VARIABLES=InvVict InvBull InvDepr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

```
***Center IVs for process.
COMPUTE cDepr=Depr - 2.153024911032026.
EXECUTE.
COMPUTE cVict=Vict - 1.4438202247191014.
EXECUTE.
COMPUTE cBull=Bull - 1.5783915515840765.
EXECUTE.
FREQUENCIES VARIABLES=cVict cBull cDepr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

```
***Test assumptions for linear regression portion of mixed-model.
CORRELATIONS
/VARIABLES=cBull cVict cDepr dTSU
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
```

```
*Test regression assumptions for victimization to depression.
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA F
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT cDepr
/METHOD=ENTER cVict
/SCATTERPLOT=(cDepr, cVict) (*resid, *pred) (*resid, cVict) (*ZPRED, *ZRESID)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

```
*Test regression assumptions for bullying to depression.
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA F
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
```

```
/DEPENDENT cDepr
/METHOD=ENTER cBull
/SCATTERPLOT=(cDepr, cBull) (*resid, *pred) (*resid, cBull) (*ZPRED, *ZRESID)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

\*\*\*\*Now, to the analyses.

\*\*\*\*Victimization to SU.

\*Testing using Model 4 (Mediation only).

```
process vars = cVict cDepr dTSU/y = dTSU/x = cVict/m = cDepr/MODEL = 4/BOOT =
5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.
```

\*Testing Model 58 (Mediation with Moderator W on both A and B paths).

```
process vars = cVict sex cDepr dTSU/y = dTSU/x = cVict/m = cDepr/w = sex/MODEL =
58/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.
```

\*\*\*\*Bullying to SU.

\*Testing using Model 4 (Mediation only).

```
process vars = cBull cDepr dTSU/y = dTSU/x = cBull/m = cDepr/MODEL = 4/BOOT =
5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.
```

\*Testing Model 58 (Mediation with Moderator W on both A and B paths).

```
process vars = cBull sex cDepr dTSU/y = dTSU/x = cBull/m = cDepr/w = sex/MODEL =
58/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.
```

\*\*\*Ancillary analyses.

\*\*Dichotomous Substance Use Parameters.

\*EtOH.

```
RECODE EtOH (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dEtOH.
```

```
VARIABLE LABELS dEtOH 'Alcohol 0/1'.
```

```
EXECUTE.
```

\*MJ.

```
RECODE Q89A (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dMJ.
```

```
VARIABLE LABELS dMJ 'Marijuana 0/1'.
```

```
EXECUTE.
```

\*Inhalants.

```
RECODE Q89B (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dInhal.
```

```
VARIABLE LABELS dInhal 'Inhalants 0/1'.
```

```
EXECUTE.
```

\*Other Drugs.

```
RECODE Q89C (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dODs.
```

```
VARIABLE LABELS dODs 'Other Drugs 0/1'.
```

```
EXECUTE.
```

```
RECODE Smoke (MISSING=SYSMIS) (1=0) (ELSE=1) INTO dSmoke.
```

```
VARIABLE LABELS dSmoke 'Smoking 0/1'.
```

\*Diffs in IVs.

```
T-TEST GROUPS=sex(0 1)
```

```
 /MISSING=ANALYSIS
```

```
 /VARIABLES=cVict cDepr cBull
```

```
 /CRITERIA=CI(.95).
```

\*Diffs in SU.

```
T-TEST GROUPS=sex(0 1)
```

```
 /MISSING=ANALYSIS
```

```
 /VARIABLES=dTSU dSmoke dEtOH dMJ dInhal dODs
```

```
 /CRITERIA=CI(.95).
```

\*Relationships between variables.

```

CORRELATIONS
/VARIABLES=cVict cBull cDepr dTSU sex
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
CORRELATIONS
/VARIABLES=sex dSmoke dEtOH dMJ dInhal dODs
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
*stratified relationships by sex.
SORT CASES BY sex.
SPLIT FILE LAYERED BY sex.
*Sex specific relationships.
CORRELATIONS
/VARIABLES=Vict Bull cDepr dTSU
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
CORRELATIONS
/VARIABLES=dTSU dSmoke dEtOH dMJ dInhal dODs
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
* If ever used a substance.
USE ALL.
COMPUTE filter_$=(dTSU = 1).
VARIABLE LABELS filter_$ 'dTSU = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
*Frequencies of those that have used a substance.
FREQUENCIES VARIABLES=dTSU dSmoke dEtOH dMJ dInhal dODs
/ORDER=ANALYSIS.
*Redefine cases to those that are polysubstance users:.
USE ALL.
COMPUTE filter_$=(TSU > 2).
VARIABLE LABELS filter_$ 'TSU > 2 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
*Frequencies of those that have used more than one substance.
FREQUENCIES VARIABLES=dTSU dSmoke dEtOH dMJ dInhal dODs
/ORDER=ANALYSIS.

```

APPENDIX C  
STUDY TWO QUESTIONNAIRE ITEMS

### THE KIND OF PERSON I AM

This questionnaire is about the kind of person you are when you get into conflicts. For each statement, say how true it is for you.

	Not at all true	A little true	Somewhat true	Completely true
1. I'm the kind of person who tells my friends to stop liking someone.	1	2	3	4
2. When I'm hurt by someone, I often fight back.	1	2	3	4
3. I often start fights to get what I want.	1	2	3	4
4. I'm the kind of person who tells others I won't be their friend anymore.	1	2	3	4
5. When I'm threatened by someone, I often threaten back.	1	2	3	4
6. I often threaten others to get what I want.	1	2	3	4
7. I'm the kind of person who keeps others from being in my group of friends.	1	2	3	4
8. When I'm hurt by others, I often get back at them by saying mean things to them.	1	2	3	4
9. I often hit, kick or punch others to get what I want.	1	2	3	4
10. I'm the kind of person who says mean things about others.	1	2	3	4
11. If others make me upset or hurt me, I often put them down.	1	2	3	4
12. To get what I want, I often put others down.	1	2	3	4
13. I'm the kind of person who ignores others or stops talking to them.	1	2	3	4
14. If others have angered me, I often hit, kick or punch them.	1	2	3	4
15. To get what I want, I often say mean things to others.	1	2	3	4
16. I'm the kind of person who gossips or spreads rumors.	1	2	3	4
17. If others make me mad or upset, I often hurt them.	1	2	3	4
18. To get what I want, I often hurt others.	1	2	3	4

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FLV04X5 May 04, 2005

Figure C.1 Assessment of bullying behaviors.

Adolescent Depression - Age 15  
(Form FLV06X5, How I Sometimes Feel)

At Age 15 study children were asked to complete a questionnaire designed to assess their level of depression for the past two weeks. The administration of How I Sometimes Feel involved a 10-item scale (Children's Depression Inventory, CDI, Short Form; Kovacs, 1992). Ten sets of three statements were presented and the adolescent selected the one that best describes the way she/he felt over the last two weeks. The items tap dysphoric mood, lack of pleasure, and low self-esteem. The goal was to obtain a brief screening measure of depressive symptoms. Raw scores above 8 for girls and above 10 for boys are considered "well above average." This short form of the CDI is based on the 10 best discriminating and most internally consistent items from the longer 27-item form. The short form has an internal consistency of .80 and correlates .89 with the long form, according to normative data reported in the test manual (N= 1,266). The original response items ranged from 1 to 3 but were recoded to a 0 to 2 scale where 0=normative behavior, 1=a middle statement, and 2=a depressive symptom. Items 2, 4, 5, 6, and 10 were reflected prior to creating the composite variable discussed below. This questionnaire is identical to the one administered at Fifth (CCDR 596) and Sixth (CCDR 626) grade.

Figure C.2 Information provided with NICHD documentation on copyrighted depression scale.

**How many times IN THE PAST YEAR have YOU....**

	Never	Once or twice	More than twice
37. Beat up someone without using a weapon	0	1	2
38. Beat up someone using a weapon	0	1	2
39. Been arrested	0	1	2
40. Skipped school without permission	0	1	2
41. Purposely set a fire in a building or in any other place	0	1	2
42. Hurt an animal on purpose	0	1	2
43. Smoked cigarettes or used tobacco	0	1	2
44. Drunk a bottle or a glass of beer or other alcohol	0	1	2
45. Used or smoked marijuana (pot, grass, weed)	0	1	2

Figure C.3 Assessment of substance use behaviors.

### PEER RELATIONSHIPS

**Think about the past month of your life and answer the following questions: How often did the following things happen?**

	Never	1 or 2 times	3 or 4 times	5 or 6 times	7 or more times
1. Other students picked on me.	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
2. Other students made fun of me.	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
3. Other students called me names.	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
4. I got hit and pushed by other students.	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>

Figure C.4 Assessment of peer-victimization.

APPENDIX D  
SPSS SYNTAX FOR STUDY TWO

```

DATASET ACTIVATE DataSet1.
*prepare bullying/Vict.
DESCRIPTIVES VARIABLES=L04X5001 L04X5002 L04X5003 L04X5004 L04X5005
L04X5006 L04X5007 L04X5008
    L04X5009 L04X5010 L04X5011 L04X5012 L04X5013 L04X5014 L04X5015 L04X5016
L04X5017 L04X5018 L13X5001
    L13X5002 L13X5003 L13X5004
/SAVE
/STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.

*recoding depression.
RECODE L06X5001 L06X5003 L06X5007 L06X5008 L06X5009 (MISSING=SYSMIS) (1=0)
(2=1) (3=2) INTO di1 di3 di7 di8 di9.
EXECUTE.
RECODE L06X5002 L06X5004 L06X5005 L06X5006 L06X5010 (MISSING=SYSMIS) (3=0)
(2=1) (1=2) INTO di2 di4 di5 di6 di10.
EXECUTE.
COMPUTE Depr=SUM(di1,di3,di7,di8,di9,di2,di4,di5,di6,di10).
*Centering Depression.
COMPUTE cDepr=Depr - 2.003134796238243.

*Bullying computation.
COMPUTE
Bull=MEAN(ZL04X5001,ZL04X5002,ZL04X5003,ZL04X5004,ZL04X5005,ZL04X5006,
ZL04X5007,ZL04X5008,ZL04X5009,ZL04X5010,ZL04X5011,ZL04X5012,ZL04X5013,
ZL04X5014,ZL04X5015,ZL04X5016,ZL04X5017,ZL04X5018).

*Victimization computation.
COMPUTE Vict=MEAN(ZL13X5001,ZL13X5002,ZL13X5003,ZL13X5004).
*Recoding gender: female reference group - 0.
RECODE SEX01 (MISSING=SYSMIS) (1=1) (2=0) INTO sex.
EXECUTE.

*Substance Use.
RECODE L12X5043 (MISSING=SYSMIS) (0=0) (1=1) (2=2) INTO Tabac.
RECODE L12X5044 (MISSING=SYSMIS) (0=0) (1=1) (2=2) INTO EtOH.
RECODE L12X5045 (MISSING=SYSMIS) (0=0) (1=1) (2=2) INTO MJ.
EXECUTE.
*dichotomizing substances and total substance use (dTTSU).
RECODE Tabac (MISSING=SYSMIS) (0=0) (1=1) (2=1) INTO dTabac.
RECODE EtOH (MISSING=SYSMIS) (0=0) (1=1) (2=1) INTO dEtOH.
RECODE MJ (MISSING=SYSMIS) (0=0) (1=1) (2=1) INTO dMJ.
COMPUTE TSU=SUM(dTabac,dEtOH,dMJ).
RECODE TSU (MISSING=SYSMIS) (0=0) (ELSE=1) INTO dTTSU.
EXECUTE.

*Look at distributions.
DESCRIPTIVES VARIABLES=Vict Depr Bull
/STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
FREQUENCIES VARIABLES=Vict Bull Depr
/STATISTICS=STDDEV MEAN MEDIAN MODE
/HISTOGRAM NORMAL

```



/ORDER=ANALYSIS.

\*\*\*Transformations.

```
COMPUTE SQRTVict=SQRT(Vict).
COMPUTE SQRTBull=SQRT(Bull).
COMPUTE SQRTDepr=SQRT(Depr).
COMPUTE LG10Vict=LG10(Vict).
COMPUTE LG10Bull=LG10(Bull).
COMPUTE LG10Depr=LG10(Depr).
COMPUTE InvVict=1/Vict.
COMPUTE InvBull=1/Bull.
COMPUTE InvDepr=1/Depr.
EXECUTE.
```

\*SQRT Distributions.

```
FREQUENCIES VARIABLES=SQRTVict SQRTBull SQRTDepr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

\*LG10 Distributions.

```
FREQUENCIES VARIABLES=LG10Vict LG10Bull LG10Depr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

\*Inv Distributions.

```
FREQUENCIES VARIABLES=InvVict InvBull InvDepr
/HISTOGRAM NORMAL
/ORDER=ANALYSIS.
```

\*\*\*Test assumptions for linear regression portion of mixed-model.

```
CORRELATIONS
/VARIABLES=Bull Vict cDepr dTSU
/PRINT=TWOTAIL NOSIG
/MISSING=PAIRWISE.
```

\*Test regression assumptions for victimization to depression.

```
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA F
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT cDepr
/METHOD=ENTER Vict
/SCATTERPLOT=(cDepr, Vict) (*resid, *pred) (*resid, Vict) (*ZPRED, *ZRESID)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

\*Test regression assumptions for bullying to depression.

```
REGRESSION
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA F
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT cDepr
/METHOD=ENTER Bull
/SCATTERPLOT=(cDepr, Bull) (*resid, *pred) (*resid, Bull) (*ZPRED, *ZRESID)
/RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
```

\*\*\*\*Now, to the analyses.

\*\*\*\*Victimization to SU.

\*Testing using Model 4 (Mediation only).

process vars = Vict cDepr dTSU/y = dTSU/x = Vict/m = cDepr/MODEL = 4/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.

\*Testing Model 58 (Mediation with Moderator W on both A and B paths).

process vars = Vict sex cDepr dTSU/y = dTSU/x = Vict/m = cDepr/w = sex/MODEL = 58/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.

\*\*\*\*Bullying to SU.

\*Testing using Model 4 (Mediation only).

process vars = Bull cDepr dTSU/y = dTSU/x = Bull/m = cDepr/MODEL = 4/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1.

\*Testing Model 58 (Mediation with Moderator W on both A and B paths).

process vars = Bull sex cDepr dTSU/y = dTSU/x = Bull/m = cDepr/w = sex/MODEL = 58/BOOT = 5000/CONF = 95/COEFFCI = 1/TOTAL = 1/DETAIL = 1

\*Ancillary analyses.

\*Diffs in IVs.

T-TEST GROUPS=sex(0 1)

/MISSING=ANALYSIS

/VARIABLES=Vict cDepr Bull

/CRITERIA=CI(.95).

\*Diffs in SU.

T-TEST GROUPS=sex(0 1)

/MISSING=ANALYSIS

/VARIABLES=dTSU dTabac dEtOH dMJ

/CRITERIA=CI(.95).

\*Relationships between variables.

CORRELATIONS

/VARIABLES=Vict Bull cDepr dTSU sex

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

CORRELATIONS

/VARIABLES=sex dTabac dEtOH dMJ

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

\*stratified relationships by sex.

SORT CASES BY sex.

SPLIT FILE LAYERED BY sex.

\*Sex specific relationships.

CORRELATIONS

/VARIABLES=Vict Bull cDepr dTSU

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

CORRELATIONS

/VARIABLES=dTSU dTabac dEtOH dMJ

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

SPLIT FILE OFF.

\* If ever used a substance.

USE ALL.

```
COMPUTE filter_$(dTSU = 1).
VARIABLE LABELS filter_$ 'dTSU = 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
*Frequencies of those that have used a substance.
FREQUENCIES VARIABLES=dTSU dTabac dEtOH dMJ
/ORDER=ANALYSIS.
*Redefine cases to those that are polysubstance users:.
USE ALL.
COMPUTE filter_$(TSU > 1).
VARIABLE LABELS filter_$ 'TSU > 1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
*Frequencies of those that have used more than one substance.
FREQUENCIES VARIABLES=dTSU dTabac dEtOH dMJ
/ORDER=ANALYSIS..
```

APPENDIX E  
ANCILLARY ANALYSES

To provide further clarity and specification about existing differences within the HBSC and NICHD datasets, further analyses were conducted for informative purposes in reference to each dataset. First, analyses were completed to identify any specific sex differences prior to inclusion into any model. Second, to identify if substance use preferences exist between the sexes, further analyses and frequency distributions were compiled.

E.1 Differences in Victimization, Depression, and Bullying by Sex

To compare females to males on victimization, bullying, and depression, independent samples *t*-tests were conducted to see if males and females differed in levels of the independent variables in each dataset. In the HBSC dataset, significant differences were detected for all three variables, such that females reported significantly greater depression levels than males,  $t(2526.103) = 8.317, p < .001$ ; and females reported significantly lower levels of victimization,  $t(2011.142) = -5.382, p < .001$ ; and bullying,  $t(1920.408) = -8.769, p < .001$ , see Figure E.1.

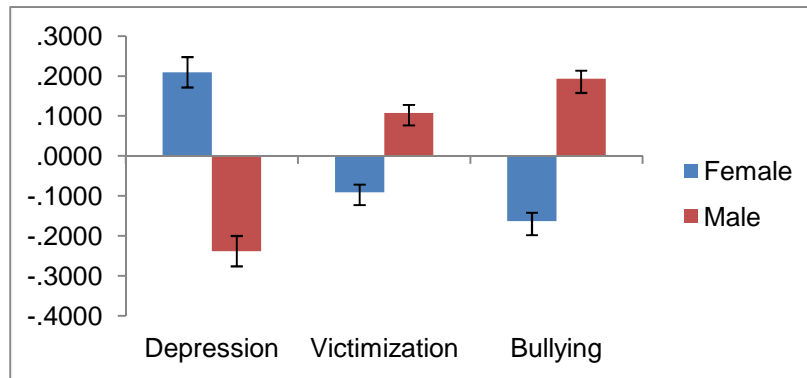


Figure E.1 Differences by Sex in the HBSC Dataset on Predictors.

In the NICHD dataset, these differences were analogous to those findings in the HBSC dataset, in that females were also reported significantly greater levels of depression,  $t(856.621) = 6.221, p < .001$ ; and females reported significantly lower levels of victimization,  $t(922.610) = -3.187, p = .001$ ; and bullying,  $t(892.342) = -3.726, p < .001$ , see Figure E.2.

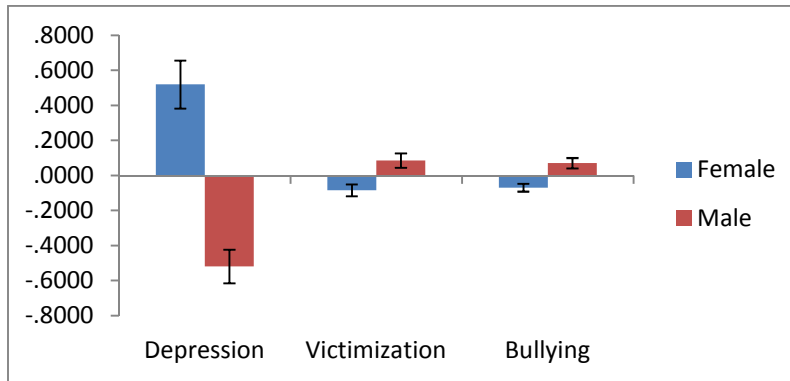


Figure E.2 Differences by Sex in the NICHD Dataset on Predictors.

Additionally, see Table E.1 for the descriptive statistics of the predictor variables in both datasets.

Table E.1 Descriptive Statistics of Predictors in Both Studies.

		HBSC		NICHD	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Depression	Female	.2090	1.42970	.5188	2.99075
	Male	-.2385	1.27637	-.5199	2.09690
Victimization	Female	-.0912	.74273	-.0846	.74477
	Male	.1078	1.04686	.0854	.89834
Bullying	Female	-.1631	.78141	-.0696	.49835
	Male	.1929	1.15866	.0700	.64937

Differences across both datasets are consistent with previous findings for depression (Green et al, 2009; Lin et al., 2004; Conway et al., 2006; Back et al., 2010; Green et al, 2009; Poulin, et al., 2005). Previous research has suggested that no sex differences occur in victimization and that bullying is preferential for males, therefore, these sex differences across both datasets are consistent with bullying, but inconsistent regarding victimization (Klomek, et al., 2007; Williams et al., 1996; Wolke et al., 2001; Nolin, Davies, & Chandler, 1996; Nansel et al., 2001; Carlye & Steinman, 2007; Craig & Harel, 2004; Forero, McLellan, Rissel, & Bauman, 1999; Morris,

Zhang, & Bondy, 2006; Tharp-Taylor, Haviland, & D'Amico, 2009). Further examination into other datasets would facilitate a better understanding as to why these inconsistencies exist.

### E.2 Differences in Substance Use Variables by Sex

To compare females to males on substance use measures, independent samples *t*-tests were conducted within each dataset. In the HBSC dataset, significant differences were revealed for: (a) smoking,  $t(2240.745) = -4.444, p < .001$ , such that females ( $M = .1818, SE = .0106$ ) smoked less than males ( $M = .2567, SE = .0131$ ); (b) marijuana use,  $t(2069.215) = -4.504, p < .001$ , such that females ( $M = .2530, SE = .0124$ ) used less than males ( $M = .3403, SE = .0149$ ); and (c) inhalant use,  $t(2057.787) = -3.239, p = .002$ , such that females ( $M = .0693, SE = .0071$ ) used less than males ( $M = .1068, SE = .0095$ ) see Figure E.3.

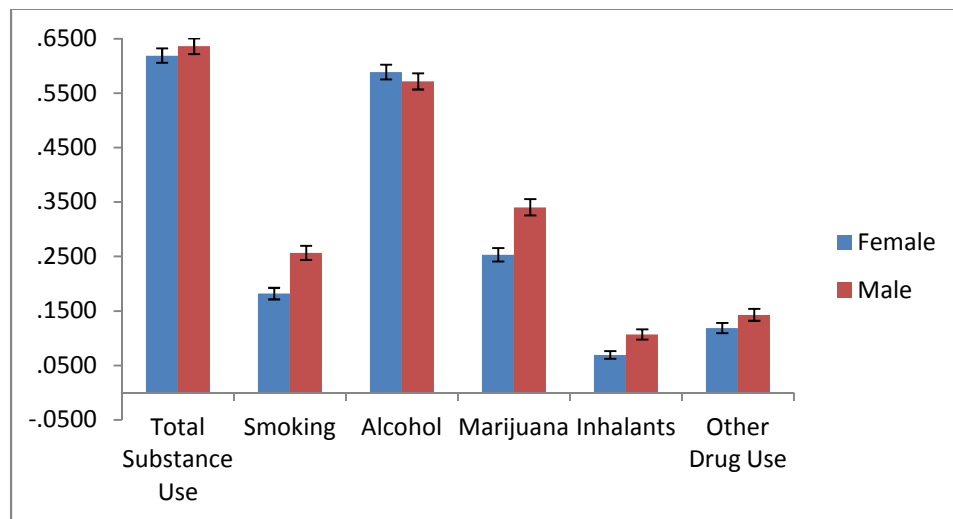


Figure E.3 Substance Use Parameters by Sex in the HBSC Dataset.

In the NICHD dataset, no sex differences were found in any substance use classification: (a) total substance use,  $t(952.086) = .997, p = .319$ ; (b) tobacco use,  $t(953) = .387, p = .699$ ; (c) alcohol use,  $t(949.071) = 1.546, p = .122$ ; and (d) marijuana use,  $t(953) = -.551, p = .582$ ; see Figure E.4.

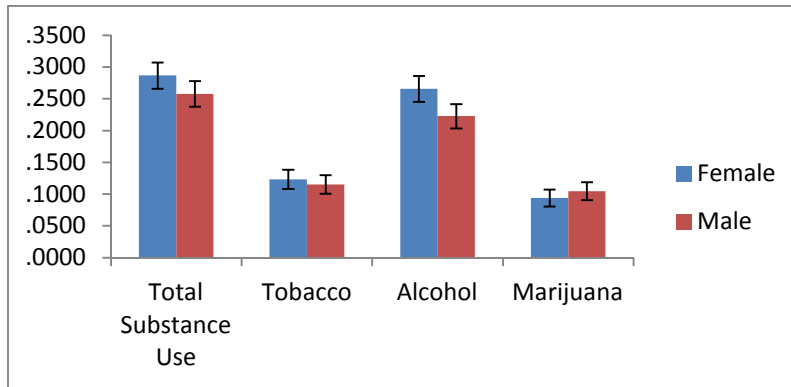


Figure E.4 Substance Use Parameters by Sex in the NICHD Dataset.

To better facilitate an understanding of how many students were using substances and which substances were being used, frequency data were produced for all students that have used at least one substance. In the HBSC dataset ( $N = 2,656$ ), cases were selected for those who had admitted to using at least one substance ( $n = 1,533$ ), and then reported frequencies of use or no use were compiled for smoking, alcohol, marijuana, inhalants and other drug use, see Figure E.5.

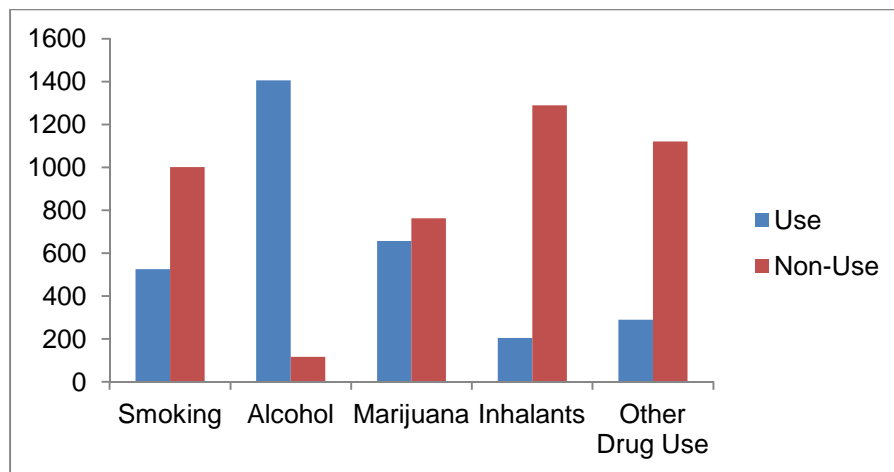


Figure E.5 Frequencies of Substances for Reported Substance Use in the HBSC Dataset.

For determining the frequencies of polysubstance use and the specific substances used for polysubstance users, cases were selected for those respondents that have engaged in more



than one substance of use ( $n = 441$ ), and then frequencies of specific substances were calculated on reported use or non-use, see Figure 4.6.

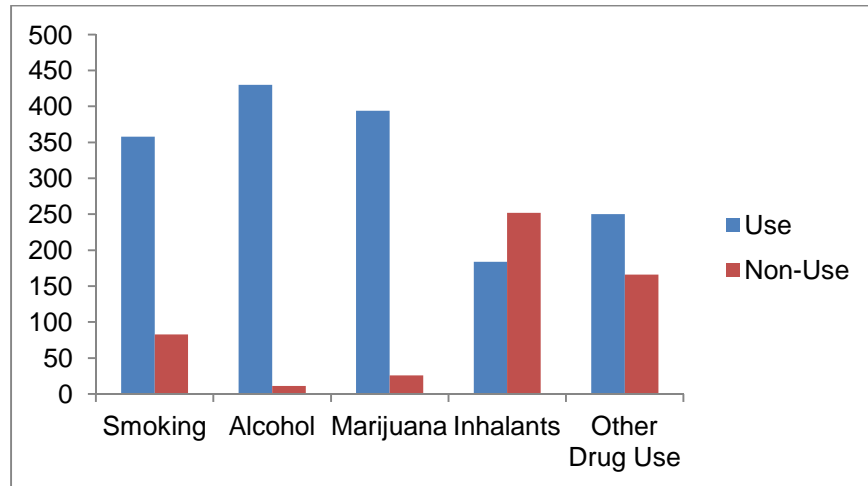


Figure E.6 Frequencies of Substances for Polysubstance Use in the HBSC Dataset.

In the NICHD database ( $N = 1,364$ ), cases were selected for those who had admitted to using at least one substance ( $n = 260$ ), and then reported frequencies of use or no use were compiled on tobacco, alcohol, and marijuana use, see Figure E.7.

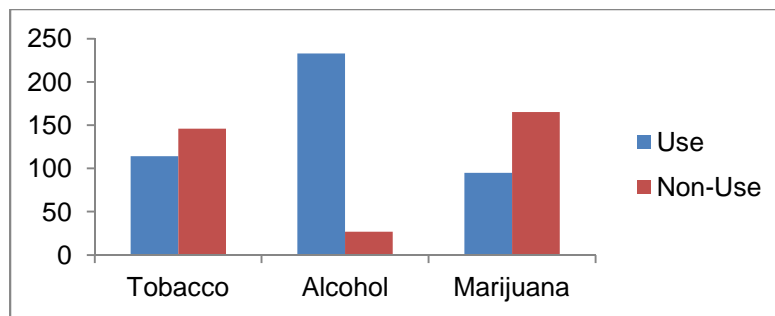


Figure E.7 Frequencies of Substances for Reported Substance Use in the NICHD Dataset.

For determining the frequencies of specific substances used by polysubstance users, cases were selected for those respondents that have engaged in more than one substance of use ( $n = 126$ ), and then frequencies of specific substances were calculated on use or non-use; see Figure E.8.

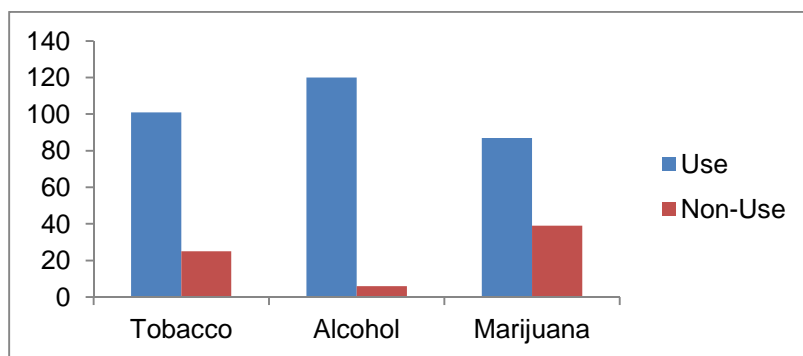


Figure E.8 Frequencies of Substances for Polysubstance Users in the NICHD Dataset.

Additionally, see Table E.2 for descriptive statistics on substance use variables in both datasets.

Table E.2 Descriptive Statistics of Substance Use Variables in Both Studies

		HBSC		NICHD	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total Substance Use	Female	.6189	.48585	.2866	.45265
	Male	.6360	.48135	.2579	.43792
Smoking/Tobacco	Female	.1818	.38584	.1234	.32928
	Male	.2567	.43703	.1153	.31972
Alcohol	Female	.5886	.49228	.2657	.44216
	Male	.5714	.49510	.2227	.41649
Marijuana	Female	.2530	.43492	.0941	.29233
	Male	.3403	.47404	.1048	.30665
Inhalants	Female	.0693	.25412	-	-
	Male	.1068	.30906	-	-
Other Drug Use	Female	.1186	.32350	-	-
	Male	.1430	.35025	-	-

Frequencies of substance use in the HBSC dataset, but not in the NICHD dataset, were congruent with previous studies (Milani et al., 2004; Pissetsky et al., 2008; Isralowitz & Rawson, 2005; Svensson, 2003), in that sex differences existed between substances of use.

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