

**Sex, Drugs, and Mental Health: The
Relationship Between Adolescent Internalizing
Problems and Engagement in Health Risk
Behaviors**

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Honors Thesis
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INTRODUCTION

Adolescence represents a period of development marked by significant life events including puberty, the transition to high school, and changes to one's role within peer and family relationships (Compas, 1987). These events are in part influenced by biological, psychosocial, emotional, and cognitive changes that present themselves during this formative period (National Academies of Science, 2019). The potential stress of these developmental events may make some adolescents become especially vulnerable to developing mental health issues (Twenge et al., 2019). This stress presents an opportunity for them to engage in health risk behaviors, particularly adolescents with depressive and anxious symptoms, which include individuals with and without a formal diagnosis (Bender, 2006).

The present study will use internalizing problems as a means for identifying for potential mental health issues in adolescents, focusing on mood disorders (Costello et al., 2006). This is primarily because a large portion of adolescents are underdiagnosed for these conditions and therefore using a standard measure of depressive and anxious symptoms based on the Youth Self Report will account for much of this misrepresentation (YSR; Achenbach, & Rescorla, 2001). This study will also use health risk behaviors as an indicator for future negative outcomes (Baranowski et al., 2000). Engagement in health risk behaviors is important for establishing a direct connection between health risk behaviors and preventable injuries and deaths in adolescents (Miniño, 2010).

While previous research has looked at many aspects of health risk behaviors and internalizing problems, there exists conflicting evidence related to the direct relationship between the two (King et al., 2004; Bardone et al., 1998; Marmorstein & Iacono, 2001). Additionally, no current studies propose that peer and parental attachment are potential

mediators of this relationship. Analyzing these potential predictors will help to gain insight about how researchers can predict engagement and what strategies would be most impactful for improving adolescent outcomes.

Literature Review

Adolescence: Period of Intense Development

The onset of puberty, typically between ages 8 and 14 years old, marks the beginning of adolescence and lasts until adulthood (Scherf et al., 2012). For girls, the onset of puberty is, on average, one to two years earlier than for boys, and full development is often faster (Marceau et al., 2011). The variance in biological maturity can cause significant individual differences in other areas during this developmental period. As a result, it is important to consider biological sex as a potential confounding variable, especially for younger adolescents (Ngun et al., 2011).

The challenges adolescents face during this period have been extensively studied and include social pressure from peers, navigation of autonomy, exploration of sexual identity, and significant hormonal differences (Brown et al., 1986; Peterson & Bush, 1999; Striepe & Tolman, 2003; Wigfield et al., 2005; Cherie & Berhane, 2012; Chan & Chan, 2013). Due to the implications of global chronic stressors being present in adolescence, many researchers have examined how they managed their perceived stress (Chandra & Batada, 2006). When adolescents can adequately manage their stress, more positive short and long-term outcomes are experienced (Franke, 2014). Adolescents who struggle to appropriately cope with their perceived stress often face negative consequences to their mental health, such as the development of depression and anxiety (Seiffge-Krenke, 2000). Some of the unhealthy coping strategies that are often utilized are engagement in health risk behaviors, which tend to begin during adolescence (Kann et al., 2016). These behaviors are often associated with adverse

consequences, both short and long-term (Mahalik et al., 2013). In response to this understanding of adolescent development, more research has focused on the clinical implications of addressing adolescent engagement in health risk behaviors.

Much of the literature that studies adolescents and their tendencies to engage in health risk behaviors focuses primarily on decision making and prevalence (Kim-Spoon et al., 2017; Kim-Spoon et al., 2016; Gerrard et al., 2008; Gibbons & Gerrard, 1995). While this area of developmental research is essential to understanding adolescents' propensity for adverse behaviors such as drug use, alcohol consumption, sexual activity, and violence, it does not capture key individual differences within the population. In addition to this body of research, many developmental and clinical psychologists work to deepen knowledge related to diagnosis and factors contributing to mental illness, namely depression and anxiety, in adolescents (Compas et al., 1993; Brady & Kendall, 1992).

Mental Health during Adolescence

Extensive work has been done within the field of mental health to understand areas that should be targeted for prevention and intervention. It has put a great deal of focus on adolescents because many hypothesize that mental health conditions stem from experiences during adolescence that later manifest into mental disorders during adulthood (McLafferty et al., 2017; Kessler et al., 2007). This seems to be especially true of substance use disorders which are commonly correlated with mood disorders like depression and anxiety (Poudel & Gautam, 2017; Smith & Book, 2008).

A significant component of mitigating the development or manifestation of certain mental health disorders is the use of evidence-based treatments and preventions. Plans must be able to identify individuals who need or may be at risk of needing help. One way of

accomplishing this is by diagnosing individuals based on specified criteria and presentations. While methods have improved over the years, contributing to more accurate methods of diagnosis, there are still many disorders that may present themselves during adolescence that are not accurately captured. Based on data from a 2010 survey, an estimated 46.2% of adolescents suffer with depression and anxiety disorders, and of that percentage 19.5% meet the DSM-IV criteria for severe mental health impairment or distress (Merikangas et al., 2010). Although these numbers are estimated to have increased in recent years, this still highlights the severity of mood disorders in the adolescent population and presents an opportunity for new strategies to be used to assess adolescents who experience subclinical symptoms of depression and anxiety.

Work done by Thapar et al. attempted to address some of the issues underlying the identification of mental health disorders (2012). They propose the use of questionnaires and interviews to encompass subthreshold levels of mental health disorders. By increasing the sensitivity of detection, adolescents who do not meet the DSM-5 criteria may still be identified as needing services. Though this suggestion was specific to depression, its implications may extend to addressing diagnosis limitations of depression and anxiety in adolescents. Without considering other methods for identifying struggling adolescents, there exists limited generalizability to younger populations who may present differently than the established criteria.

Another crucial component of an effective intervention is access to treatment. While disorders such as depression and anxiety are largely treatable mental health conditions, the propensity for individuals who need support to seek treatment varies greatly between age groups. For example, only half of adolescents who would benefit for mental health services

end up seeking treatment (Lipari et al., 2016). The large percentage of adolescents who do not receive appropriate services may be contributing to the number of individuals who develop a mental disorder in adulthood.

Early diagnosis, treatment, and prevention are all essential elements to limiting future negative outcomes, particularly for individuals suffering from anxiety and depression. These disorders are often linked to outcomes such as suicide, substance abuse, self-harm, and other forms of physical illness when left untreated (WHO, 2020). Therefore, careful consideration of these disorders during a vulnerable period of development is hugely important to mitigate potential negative outcomes during their lifetime.

Comorbidity of Depression and Anxiety

While the criteria for depression and anxiety is distinguishable for a DSM-5 diagnosis, individuals tend to have symptoms of both disorders, particularly for adolescents (Salcedo, 2018; Kendall, 1992). This lends many researchers to examine anxiety or depression together rather than differentiating them because they are known to be highly correlated. In fact, an estimated 50% or more of individuals who present with anxiety or depression also suffer from a second depressive or anxiety disorder (Hirschfeld, 2001). Some researchers suggest that the comorbidity of depression and anxiety is strongest at the symptom level or when the threshold of one disorder has already been met (Kendall & Brady, 1992; Preisig et al., 2001). This is significant because adolescents are likely to meet subthreshold levels of these disorder, therefore making it potentially unnecessary to differentiate the two (Kessler et al., 2007; Palmisano, 2018).

Although most researchers examine these disorders concurrently, which is expected because of their high comorbidity, it is important to consider studies that have differentiated

them. For example, one study hypothesized that certain interpersonal variables would be more significantly attributed to either depressive or anxious symptoms (Starr & Davila, 2008). Ultimately, they concluded that adolescents with mostly social anxiety symptoms showed higher correlations with peer variables such as low social competence, decreased trust and communication, and fewer closer friends. Conversely, adolescents with mostly depressive symptoms were more highly related with family variables including low parental trust, alienation, greater parental conflict, and relationship stress. These results were also significant in a study conducted by Wu & Fang who further concluded that these differences pose a threat to patient treatment when grouped together (2014). The results of these studies highlight potentially significant differences in moderators and mediators of these disorders. This ultimately suggests that different approaches may be necessary for treating adolescents struggling with a majority of one class of symptoms.

Internalizing Problems

Internalizing problems are a category of distressing emotional symptoms related to an individual's internal state (Achenbach et al., 2016). They are typically measured using the assessment method, Achenbach System of Empirically Based Assessment (ASEBA) (Achenbach, 1991; Achenbach, & Rescorla, 2001; Achenbach et al., 2016). There are two assessments that make up the ASEBA, a child assessment and a caregiver assessment. The child assessment, known as the Youth Self Report (YSR), is a multiple section questionnaire that identifies emotional and behavioral issues in children ages 11 to 18 (CBCL; Achenbach, & Rescorla, 2001). It consists of eight syndrome scales that can be broken into two categories referred to as internalizing problems and externalizing problems. The syndrome scales that specifically assess internalizing problems are somatic complaints, anxious/depressed, and

social withdrawal. The second aspect of the ASEBA is the caregiver assessment known as the Child Behavior Checklist (CBCL) (CBCL; Achenbach, & Rescorla, 2001). The CBCL identifies essentially the same scales as YSR but is reported by the caregiver about the child. This measure is collected for children in a larger age range, typically between the ages of 6 and 18.

Both the child and caregiver assessment are useful measures for assessing externalizing problems, however the same is not true for internalizing problems. Although measures of internalizing problems can be reported by more than just adolescents, most work indicates the need for multiple reporters to increase validity if child reports are not available (Pederson et al., 2019; Achenbach et al., 2016; Heiervang et al., 2007). This demonstrates that child self-reporting is the most accurate measure by itself and therefore, when available, should be used for analyses when solely examining internalizing problems.

Recent research has looked at the implications of internalizing problems in the development of mental health disorders (Achenbach et al., 2016). Although not all adolescents who exhibit internalizing problems have mood disorders, including depression and anxiety, presenting them has been shown to increase adolescents' risk for developing these disorders later in life (Lui et al., 2011). This may be the result of children not receiving supports when presenting with subclinical levels of depression and anxiety. Therefore, researchers suggest that internalizing problems can be used to capture the spectrum of adolescent mental health, thereby offering an opportunities for increased access to resources and supports (Thapar et al., 2012).

A significant body of research has examined anxious/depressed and social withdrawal symptoms outside of the context of internalizing problems. Studies that have examined it

within the contents of internalizing problems have tended to focus on somatic complaints (Egger et al., 1999; Janssens et al., 2010). Janssens et al.'s work specifically discusses the potential directionality of somatic complaints and the development of anxiety and depression. They highlight that anxiety and depression have a strong effect on the development of somatic complaints and not the reverse. Therefore, it suggests that somatic complaints may provide an indirect connection to known relationships involving anxiety and depression. Currently no studies have looked at applying internalizing subscales to differentially predicting specific outcomes, namely health risk behaviors.

Risk Taking during Adolescence

Risk taking involves two primary modes of thought; one in which an individual assesses both the positive and negative consequences of a behavior and deems the positive consequence more likely, and another in which an individual only considers the positive consequences and does not consider the potential or actual negative consequences (Steinberg, 2008). A common risk an adolescent may choose to engage in is a health risk behavior, such as drinking alcohol. They may consider the negative consequences of being caught by their caregiver or becoming incredibly sick and weigh it against being accepted by their peers. Conversely, they may only consider the positive consequence of being accepted by their peers.

During adolescence, empirical evidence indicates that there is an increased sensitivity to engaging in risk-taking behaviors, much greater than any other age group (Steinberg, 2008). However, evidence also indicates that differences in engaging in risky behaviors are not due to an inability to appropriately assess risk (Beyth-Marom et al., 1993). Rather, this difference has been attributed to peer related motivation (Albert et al., 2013). One study

determined that a primary motivator for risk taking behaviors is an adolescent's desire to avoid social rejection from peers (Sebastian et al., 2011). This study stipulates that, while an adolescent may be able to appropriately assess risk, such as the dangers of underage drinking, rejection by their peers is more important, and will ultimately engage in this behavior.

Health Risk Behaviors

The term "health risk behaviors" encompasses actions that adversely affect one's health and are inclusive of short and long-term impacts. It can consist of behaviors such as substance use, unsafe sexual practices, risky driving, violent behaviors, suicidal behaviors, unhealthy eating, physical inactivity, and disordered eating (Gibbons & Gerrard, 1995). Importantly, researchers have determined that individuals with mood disorders like depression and anxiety are particularly susceptible to engaging in these behaviors (Asarnow et al., 2014). This highlights the need to determine methods of screening individuals who make up this vulnerable group.

Each of these behaviors has a balance of positive and negative outcomes. For example, a positive consequence may be that it provides an individual with a way to relieve their stress. Similarly, behaviors such as substance use are often used to create an acceptable self-image, which can be important for social bonding and impressing others (Martin & Leary, 2001). Adolescents might be viewed by their peers as "cool", "brave", or "fun" for drinking or smoking. In fact, one study conducted by Martin & Leary found that nearly three fourths of college freshmen engaged in health risk behaviors primarily to impress their peers (2001).

Although these behaviors are not always linked to poor outcomes, a significant portion can result in addiction, illness, injury, and above all, death (Bender, 2006). While some of these outcomes may be unavoidable, a vast majority of these, particularly during adolescence,

are known to be preventable (Miniño, 2010). A preventable death could include suicide, car accidents caused by drunk, distracted, or unsafe driving practices, health issues related to physical inactivity or unhealthy eating, and overdosing. A preventable injury could similarly include car accidents, physical altercations due to violence, and the use of firearms.

To measure these behaviors within the adolescent population, previous studies focusing on health risk behaviors were reviewed (Kim-Spoon et al., 2016; Jones et al., 2016; Underwood et al., 2020). A number of these studies used the Youth Risk Behavior Survey. This is used to quantify and qualify health risk behavior engagement in adolescents (Kann et al., 2013). It consists of six categories of behaviors: sexual behaviors pertaining to unprotected sex, alcohol and other drug use, tobacco use, unhealthy eating behaviors, physical activity, and behaviors that extend to unintentional injury and violence (Kann et al., 2013). The questionnaire provides data that aims to indicate the prevalence and overall trends of certain behaviors to determine potential relationships.

The Current Study

Internalizing problems and its subscales have been implicitly linked to negative outcomes via their connection to mood disorders (Asarnow et al., 2014; Janssens et al., 2010). In response to this potential connection to negative outcomes, we examine how these measures are associated with health risk behaviors as they serve as early indicators of negative outcomes in adulthood (Bender, 2006).

Considering this, the first aim of this study was to determine the relationship between internalizing problems and health risk behaviors. We hypothesize that high levels of internalizing problems scores will positively correlate with health risk behaviors scores. This is largely because we assume the direct connection between internalizing problems and

depression and anxiety as well as the connection between depression and anxiety on health risk behaviors, will result in a similar, though indirect, relationship. We hypothesize this relationship will be the same for males and females, despite potential mean differences in internalizing problem scores (Leadbeater et al., 1999). Additionally, we hypothesize poor/near poor and non-poor families will show similar trends because internalizing problems cut across all family financial needs (Martinez et al., 2015).

Our second aim was to uncover which subscales of internalizing problems are differentially associated of health risk behaviors. We hypothesize that all subscales (anxious/depressed, social withdrawal, and somatic complaints) will show a positive relationship with health risk behaviors as these are all components of the larger internalizing problems measure. Specific attention will be paid to somatic complaints, which we hypothesize will make up the strongest correlations because of its implications associated with being physical symptoms of distress (Egger et al., 1999). For the same reasons as mentioned about, we hypothesize this relationship will be the same for males and females as well as for poor/near-poor and non-poor groups.

The final objective of this study is to identify whether internalizing problems and its subscales differentially predict specific health risk behaviors. We hypothesize that internalizing problems and its subscales will be correlated to substance use since there exists literature supporting this claim for overall internalizing problems (King et al., 2004; Lui et al., 2011). Because there is missing research identifying relationships between risky sex and internalizing problems, we cannot hypothesize a direction of its relationship for internalizing problems and its subscales. We again anticipate no gender and income-to-need ratio differences related to these correlations.

Significance

The leading causes of death in adolescents include three categories the CDC deems as preventable. These include accidental injury, suicide, and homicide (Miniño, 2010). Research in developmental and clinical psychology do not currently answer questions related to how findings related to health risk behaviors can be used to mitigate these numbers. By investigating some of these questions, adolescent's development could improve and stimulate more positive outcomes in the future. Therefore, a major function of this study is to understand what specific factors during adolescence contribute to these negative outcomes which could subsequently be targeted for intervention.

When breaking down preventable deaths in adolescents, particularly suicide and accidental injury, one underlying condition that is largely contributing to this is outcome is mental health issues (World Health Organization [WHO], 2020). Adolescents are particularly susceptible to developing mental health problems due to several biological, psychosocial, and cognitive stressors that present themselves during this period of development (Twenge et al., 2019; National Academies of Science, 2019). While rates have increased in recent years, a large portion of these conditions remain underdiagnosed in adolescents (Kessler et al., 2007; Palmisano, 2018). This presents a problem for adolescents and individuals who could provide services that might ensure more positive outcomes. Additionally, those who develop mood disorders may be more likely to engage in health risk behaviors than individuals that are not suffering (Bender, 2006). This includes behaviors such as drug and alcohol use, violence, unprotected sex, unhealthy diet, and physical inactivity (Jones et al., 2016). Thus, another function of this study is to determine other means of assessing risk and predicting outcomes as they relate to health risk behaviors.

Most research related to adolescents, especially those with anxious and depressive symptoms, fail to answer many of these questions. This presents an opportunity for the field to advance what is known about these issues and propose places for socially significant interventions. In the end, the hope is for adolescents to be given all the resources and support necessary to develop healthy, sustainable habits that lend themselves to positive outcomes, and to avoid vices directly associated with negative health consequences.

METHODS

Participants

Participants of the present study include a cohort of 167 adolescents and their primary caregivers who participated annually over the span of four years. Adolescents began the study around age 13-14 (Time Wave 1 $M = 14.13$, $SD = 0.54$) and continued until age 17 (Time Wave 4 $M = 17.00$, $SD = 0.05$). For the purposes of this study, only Wave 4 data was utilized. Additionally, of the 167 dyads that were recruited for the study, only 148 provided all measures necessary to perform data analysis at Wave 4. The remaining 19 dyads did not provide complete data for a variety of reasons including declining to participate, lost contact, or ineligibility to participate in tasks.

Based on data from the 2010 US Census, the sample was representative of the geographical area where data was collected, which was the Appalachian region of the United States. For the adolescent's race, the sample consisted of 77.4% who identified as Caucasian, 10.2% who identified as African American/Black, and 12.4% who identified as other, including those that identified with multiple races (Table 1). Ethnically, 97.8% of adolescents identified as being non-Hispanic and 2.2% identified as being Hispanic. To determine a family's economic status as poor (ITN <1), near-poor (ITN <2), or non-poor (ITN >2)

income-to-need ratio (ITN) was calculated using total household income divided by the poverty threshold for the size of each family. 21% of families were considered poor based on ITN, 17.5% were considered near-poor, and 61.6% were considered non-poor (Table 2). The present study combined dyads that fell within poor and near-poor ($ITN < 2$), so the sample sizes were similar when compared to non-poor.

In addition to the racial, ethnic, and economic breakdowns, the sample consisted of 46.6% female adolescents and 53.4% male adolescents as reported by the caregivers (Table 2). Caregivers included 81.2% mothers, 13% fathers, and 5.8% other, which consisted of grandmothers and other non-specified relations. The gender breakdown of the caregivers were 87% female and 13% male. Caregivers also reported their years of education with 22.5% completing between 3-12 years of school (some or all primary school), 30.4% completing between 13-15 years (some college), 23.2% completing 16 years (Bachelor's degree equivalent), and 23.9% completing 17 years or more (Master's degree or higher equivalent).

Procedure

Data used for the current study were previously collected at Virginia Polytechnic Institute and State University. The review board protocol/approval number from the UMass IRB for secondary data analysis of this deidentified dataset is #17-52 [exempt], titled: "Neurobehavioral Determinants of Risky Behavior in Adolescence" (Funded by NIDA, grant number DA 036017, led by Dr. Jungmeen. Kim-Spoon & Dr. Brooks King Casas, at Virginia Tech, Blacksburg, VA). Data provided was collected at Time Wave 4.

Recruitment of participants was conducted through e-mail, flyers, and recruitment letters. Adolescent-caregiver dyads participated in four annual sessions conducted in a

laboratory where behavioral measures were collected. All individuals that were eligible to participate consented to the protocols previously approved by the institutional review board.

Measures

Health Risk Behaviors

An electronic questionnaire adopted from the Youth Risk Behavior Survey was distributed to adolescents to determine frequency and initiation of health risk behaviors (Kann et al., 2014). These questions addressed adolescent's substance use related to cigarettes, marijuana, and alcohol. Adolescents reported on this using a 6-point scale – 1 being “never used” these substances to 6 being “usually use every day”. Therefore, a higher substance use score indicates more frequent and earlier use of marijuana, cigarette, and/or alcohol. They also informed about adolescent's risky sexual behaviors including the age they began having sex, how many partners they have had, how likely they were to use a form of contraceptive, and if substances were used before or during sexual activities. Scores were calculated such that answers that were deemed to be riskier (more sexual partners, less likely to use contraceptives, used substances before or during sex, and began at a younger age) resulted in a higher risky sexual behavior score.

All questionnaire items were standardized before calculating additional measures. Health risk behavior scores were then calculated by averaging all standardized questionnaire items related to substance use and risky sexual behaviors. For the purposes of this study, new scores were created to differentiate substance use from risky sexual activity. Standardized substance use scores were calculated by averaging all standardized items that pertained to substance use. Similarly, standardized risky sexual activity scores were calculated by averaging standardized items related to risky sexual behaviors. Because the standardized scores were used to calculate a new risky sexual activity and substance use scores, the

standard deviation was no longer 1. This, however, does not impact analysis of this data for the purposes of this study.

These additional measures offered an opportunity to look at substance use and risky sexual activity separately to determine if certain features of health risk behaviors were particularly predictive. In particular, the potentially confounding variables (gender and income-to-need ratio) may reflect individual differences in adolescent internalizing problems and health risk behaviors.

Internalizing Problems

Measures of adolescent's internalizing problems were collected using the Youth Self Report questionnaire which assesses externalizing and internalizing problems in children aged 11-18 (YSR; Achenbach, & Rescorla, 2001). Adolescents self-reported on internalizing problems using a 3-point scale ranging from 0 (not true) to 2 (very true) for anxious/depressed, social withdrawal, and somatic complaints questions. Therefore, higher scores for each subscale indicates worse or more severe internalizing problems. Scores from anxious/depressed, social withdrawal, and somatic complaints scales were added together to create the internalizing problems score. Raw and cumulative scores from the questionnaire were then translated to t-scores: internalizing problems, anxious/depressed, social withdrawal, and somatic complaints. Compared to z-scores, t-scores lack negative values by making the sample average 50 and the standard deviation 10. Each scale did not equate to the typical average and standard deviation because individual scores were rounded to the nearest whole integer after being standardized. This did not have any impact on analyses or interpretations of the data.

Parents also reported on adolescents internalizing problems using the Child Behavior Checklist, a questionnaire that similarly measures behavior problems for children between the ages of 6-18 years (CBCL; Achenbach & Rescorla, 2001). This survey gathered information regarding the same subscales as previously mentioned, however it was not used for analyses as we only considered the adolescent's perspective for their mental state.

Data Analysis

All analyses were conducted using Excel due to limitations in access to SPSS programming. This did not affect the ability to perform robust statistical analyses.

Prior to the analysis of Wave 4 data, it was cleaned for any incomplete information directly related to the abovementioned measures: internalizing problems, its subscales, and health risk behaviors. Participants that did not provide data for the purposes of analysis were therefore omitted ($n = 19$). Using the cleaned data set, we were able to conduct descriptive statistics of participant demographics, internalizing problems, somatic complaints, anxious/depressed, social withdrawal, health risk behaviors, risky sexual activity, and substance used. For measures of internalizing problems and health risk behaviors, two-sample t-tests were conducted to determine group differences for both gender and income-to-need ratio.

Following descriptive statistics, a series of bivariate Pearson correlations were run to determine if there was a relationship between internalizing problems and engagement in health risk behaviors ($n = 148$). Initial analyses assessed the correlations between overall internalizing problem scores against overall health risk behavior scores ($n = 148$). Next, analyses using each subscale separately (somatic complaints scores, anxious/depressed scores, and social withdrawal scores) were correlated with overall health risk behaviors scores ($n =$

148). Lastly, we ran correlations for both overall internalizing problem scores and its subscales against separate standardized substance use scores and risky sexual activity scores ($n = 148$).

To assess potential differences in child gender and income-to-need ratio, all previously mentioned correlations were run controlling for these variables (males $n = 79$, females $n = 69$; non-poor $n = 84$, poor/near poor $n = 52$). To compare these correlations for gender and income-to-need ratio, Fisher's R to Z transformations were conducted to test for statistical significance of all the computed correlations.

All Pearson correlations were tested for significance by calculating a t-stat (Equation 1). These values were compared to values in a t-table and correlations were assessed at the one-tail .05 α level.

RESULTS

Descriptive Statistics

Before answering questions related to our hypotheses, we reviewed the data by running descriptive statistics. The first of these were conducted on adolescent demographics (Table 1). The most notable of these are the gender breakdown, as this was controlled for in future analyses. Subsequently, they were done for family and caregiver demographics (Table 2). From these descriptive statistics, income-to-need ratio was controlled for in future analyses. After assessing the participant population, we examined the distribution of their responses to the Youth Self Report (YSR). Internalizing problem t-scores were normally distributed with a skewness of .01 ($SE = .20$) and a kurtosis of .02 ($SE = .40$). Although overall scores for somatic complaints, anxious/depressed, and social withdrawal scales were skewed, tests running using this questionnaire are robust for skewness and outliers and,

therefore, had no significant impact on our ability to interpret the results of analyses utilizing these measures (Figure 1). We proceeded to look at the distribution of their responses to the Youth Risk Behavior Survey. We found that health risk behaviors were also normally distributed with a skewness of $-.40$ ($SE = .20$) and a kurtosis of $.79$ ($SE = .40$). Risky sexual activity and substance use score were similarly distributed to health risk behaviors (Figure 2).

We then determined if there were group differences in scores between males and females. The results of the two-sample t-tests revealed statistically significant group differences between males and females for internalizing problems ($t(146) = -1.85, p = .03$), anxious/depressed ($t(146) = -1.63, p = .05$), social withdrawal ($t(146) = -2.16, p = .02$), and somatic complaint scores ($t(146) = -2.15, p = .02$). These results were expected for measures of internalizing problems as the literature highlights that adolescent females tend to present higher levels compared to males (Leadbeater et al., 1999). As previously noted, we hypothesize that gender differences will not impact the relationship between internalizing problems and health risk behaviors, despite there being mean differences in internalizing problem scores. We found no statistically significant differences between males and females for substance use ($t(146) = .42, p = .34$), risky sexual activity ($t(146) = -.03, p = .49$), and health risk behaviors scores ($t(146) = .23, p = .41$).

We looked to see if there were group differences in scores between poor/near poor and non-poor groups. Again, two-sample t-tests were used to compare the two groups and revealed only statistically significant income-to-need ratio differences for somatic complaints scores ($t(134) = -2.12, p = .02$). No previous literature was able to contradict nor confirm these differences. There were no statistically significant differences for internalizing problems ($t(134) = -1.01, p = .16$), anxious/depressed ($t(134) = .27, p = .39$), social withdrawal ($t(134)$

= -.21, $p = .42$), substance use ($t(134) = -1.57, p = .06$), risky sexual activity scores ($t(134) = -1.16, p = .12$), and health risk behavior scores ($t(134) = -1.59, p = .06$). The lack of statistically significant differences for these scores have been implicated in previous work regarding internalizing problems but contradict work regarding engagement in health risk behaviors (Martinez et al., 2015; Pampel et al., 2010).

Hypothesis 1: Internalizing Problems Predicting Health Risk Behaviors

Internalizing Problems v Health Risk Behaviors

The first aim of this study was to determine whether internalizing problems could predict health risk behavior engagement. As mentioned before, internalizing problems can be used as a measure of depression and anxiety, particularly in adolescents, and therefore this analysis will attempt to link depression and anxiety with engagement in health risk behaviors. To address the hypothesis that internalizing problems are positively correlated with health risk behavior engagement, we ran a Pearson correlation test using internalizing problem t-scores ($M = 52.94, SD = 9.72$) and standardized health risk behavior scores ($M = .01, SD = .83$). The result of the t-test for statistical significance of correlation coefficient was not statistically significant, which was different than we hypothesized, $r(146) = .12, p = .14$ (Table 3).

Controlling for Gender

Since we hypothesized that gender would not have an impact on the significance of the correlations, we conducted a set of Pearson correlation tests that assessed internalizing problems and health risk behaviors separate for males and females. Males showed no statistically significant correlations between these variables, $r(77) = .11, p = .34$ (Table 3). Females also showed no significant correlations for internalizing problems and health risk behaviors, $r(67) = .15, p = .23$ (Table 3). Neither result from the analysis supported our

hypothesis that internalizing problems would be positively correlated with health risk behaviors. Further analysis using Fisher's r -to- z transformation showed that these correlations were not significantly different from each other, $z = .71$, $p = .24$. This analysis did support our hypothesis that gender differences would not affect the observed relationship between internalizing problems and health risk behaviors.

Controlling for Income-to-Need ratio

To examine if this correlation was confounded by income-to-need ratio, additional Pearson correlations were run. We found there to be no statistically significant correlations between these variables for adolescents whose families were considered poor/near poor, $r(50) = .15$, $p = .28$ (Table 3). Similarly, adolescents whose families were considered non-poor did not show a significant relationship between internalizing problems and health risk behaviors, $r(82) = .03$, $p = .81$ (Table 3). Fisher's r -to- z transformation revealed that these correlations were not significantly different from each other, $z = .67$, $p = .25$. Again, these findings did not support our original hypothesis linking internalizing problems with health risk behaviors but did support our hypothesis that differences in income-to-need ratio would not impact this relationship.

Hypothesis 2: Subscales of Internalizing Problems Correlating with Health Risk Behaviors

We then examined the subscales of internalizing problems to determine if any were significantly predicting of engagement in health risk behaviors. Our original hypothesis stated that all subscales would be significantly correlated with health risk behaviors, but that somatic complaints will show the strongest correlations. This hypothesis was based on previous work that associated somatic complaints as a common consequence of depression and anxiety disorders (Janssens et al., 2010).

Anxious/Depressed v Health Risk Behaviors

We first ran a Pearson correlation test using anxious/depressed t-scores ($M = 55.63$, $SD = 6.76$) and standardized health risk behavior scores ($M = .01$, $SD = .83$). The results of the Pearson correlation test was not statistically significant and was inconsistent with our hypothesis, $r(146) = .01$, $p = .90$ (Table 4). We proceeded to look for differences in potentially confounding variables. We also found there to be no statistically significant correlations for males, $r(77) = .05$, $p = .67$, females $r(67) = .08$, $p = .51$, poor/near poor $r(50) = .07$, $p = .64$, and non-poor groups, $r(82) = .01$, $p = .91$ (Table 4). The comparison between correlations for gender using Fisher's r -to- z transformation indicated no statistically significant differences, $z = -.18$, $p = .43$. Similarly, income-to-need ratio had no statistically significant correlational differences, $z = .33$, $p = .37$. While the results of the Fisher's r -to- z transformation supported our hypothesis that there would be no group differences for the relationship between internalizing problem subscales and health risk behaviors, they do not support our hypothesis of there being a positive correlation between these variables.

Social Withdrawal v Health Risk Behaviors

We then used social withdrawal t-scores ($M = 56.99$, $SD = 7.91$) and standardized health risk behavior scores ($M = .01$, $SD = .83$) to run additional Pearson correlation tests. Again, we found the correlation was not statistically significant as we had expected, $r(146) = .05$, $p = .56$ (Table 4). Consistent with the previous correlations, further analysis controlling for gender showed no statistically significant correlations for males, $r(77) = .08$, $p = .51$, and females, $r(67) = .04$, $p = .75$ (Table 4). Additionally, the correlations were not significantly different from each other, $z = .24$, $p = .41$. These results were consistent with our hypothesis that there would be no correlational differences due to gender for subscales of internalizing problems and health risk behaviors. Also, controlling for income-to-need ratio did not

produce significant correlations for poor/near poor, $r(50) = .11, p = .46$, and non-poor groups, $r(82) = .03, p = .79$ (Table 4). Again, a comparison between these correlations did not result in significant differences, $z = .44, p = .33$, and therefore confirmed our hypothesis that there would be no income-to-need ratio differences in regard to this correlation.

Somatic Complaints v Health Risk Behaviors

Finally, we looked at somatic complaint t-scores ($M = 54.49, SD = 5.85$) and standardized health risk behavior scores ($M = .01, SD = .83$). Unlike the previous correlations for internalizing problems, anxious/depressed, and social withdrawal, the Pearson correlation test was deemed statistically significant, $r(146) = .33, p < .0001$ (Table 4). This finding was consistent with our hypothesis. Further analysis showed that somatic complaints were similarly significant for males, $r(77) = .35, p = .001$, and females, $r(67) = .34, p < .01$ (Table 4). Fisher's r -to- z transformation confirmed that these correlations were not significantly different from each other as hypothesized, $z = .07, p = .47$. Lastly, the correlations were also significant for adolescents whose families were considered poor/near poor, $r(50) = .38, p < .01$, but not for adolescents from the non-poor group, $r(82) = .18, p = .11$ (Table 4). The insignificance for non-poor groups was not hypothesized, however the comparison of the income-to-need ratio correlations were not significantly different, $z = 1.2, p = .12$, and therefore might highlight a lack of statistical power in sample size. Most of these correlations demonstrate that somatic complaints are significantly predictive of health risk behavior engagement and show similar predictability for males and females.

Hypothesis 3: Internalizing Problem Measures Predicting Substance Use and Risky Sex

To address our final hypothesis, which links internalizing problems and its subscales to specific subgroups of health risk behaviors, we used the newly calculated average standardized risky sexual activity scores and substance use scores.

Internalizing Problems v Substance Use and Risky Sexual Activity Separately

The first set of analyses which used Pearson correlation tests utilized internalizing problem t-scores ($M = 52.94$, $SD = 9.72$) and ran it against standardized substance use ($M = .01$, $SD = .93$) and standardized risk sexual activity scores separately ($M = .005$, $SD = .92$). Neither substance use, $r(146) = .14$, $p = .09$, nor risky sexual activity, $r(146) = .07$, $p = .40$ were correlated with internalizing problems (Table 3). The results of these analyses were contrary to our original hypothesis that substance use would be positively correlated with internalizing problems, however, they do suggest that these correlations may not present for risky sexual behavior and internalizing problems.

Controlling for Gender

Like previous analyses, we looked for significant differences in gender. We found there to be no statistically significant correlations between internalizing problems and substance use for males, $r(77) = .08$, $p = .48$, and females, $r(67) = .22$, $p = .07$, as well as risky sexual activity for males, $r(77) = .09$, $p = .44$ and females, $r(67) = .05$, $p = .67$ (Table 3). None of the substance use correlations supported our hypothesis of there being a positive correlation with internalizing problems. These results, however, may suggest there might not be relationship between internalizing problems and risky sexual activity. Fisher's r -to- z transformation revealed that correlation coefficient comparisons were not significantly different for substance use, $z = .85$, $p = .20$, or for risky sexual activity, $z = -.24$, $p = .41$. The

results of these tests, confirm there are no gender differences in the relationship between internalizing problems and health risk behaviors.

Controlling for Income-to-Need Ratio

Tests for significant correlations were also run for families considered poor/near poor and non-poor for both substance use and risky sexual activity. We did not find significant correlations between internalizing problems and substance use for poor/near poor, $r(50) = .19$, $p = .17$, and non-poor groups, $r(82) = .001$, $p = .99$, or risky sexual activity for poor/near poor, $r(50) = .05$, $p = .70$ and non-poor groups, $r(82) = .03$, $p = .78$ (Table 3). The results of the tests did not support our hypothesis that substance use would have a positive correlation with internalizing problems. These results, however, may suggest there is not a relationship between internalizing problems and risky sexual activity. Fisher's r -to- z transformation revealed that correlation coefficient comparisons were not significantly different for substance use, $z = 1.06$, $p = .14$, or for risky sexual activity, $z = .11$, $p = .46$. The results of these tests, confirm there are no income-to-need ratio differences for correlations involving internalizing problems and subscales of health risk behaviors.

Subscales of Internalizing and Subscales of Health Risk Behaviors

The second set of analyses looked at various subscales of internalizing problems (anxious/depressed, social withdrawal, and somatic complaints) and their predictability of engagement in substance use and risky sexual activity separately.

Anxious/Depressed v Substance Use

The first Pearson correlation test was run using anxious/depressed t-scores ($M = 55.63$, $SD = 6.76$) against standardized substance use scores ($M = .01$, $SD = .93$). Different than hypothesized, this did not produce a statistically significant correlation coefficient, $r(146) =$

.06, $p = .48$ (Table 4). When controlled for gender, males, $r(77) = .0002$, $p = 1.00$, and females, $r(67) = .13$, $p = .27$, did not present statistically significant correlations to support our hypothesis (Table 4). The differences between their correlations were not significant, which did support our hypothesis that there would not be gender differences, $z = .78$, $p = .22$. Additionally, we controlled for income-to-need ratio and found no significant correlations for families considered poor/near poor, $r(50) = .02$, $p = .90$, or non-poor, $r(82) = .05$, $p = .67$, again not supporting our original hypothesis (Table 4). Furthermore, these correlations were not significantly different from each other as hypothesized, $z = -.17$, $p = .43$.

Social Withdrawal v Substance Use

Within this set of analyses, we also examined correlations between social withdrawal and substance use. For this, we ran a Pearson correlation test using social withdrawal t-scores ($M = 56.99$, $SD = 7.91$) and standardized substance use scores ($M = .01$, $SD = .93$). Against our hypothesis, this revealed no significant correlation, $r(146) = .05$, $p = .52$ (Table 4). After controlling for gender, we deemed no significant correlations for males, $r(77) = .03$, $p = .82$, and females, $r(67) = .09$, $p = .45$, which was also not expected (Table 4). We did, however, find these correlations did not significantly differ from each other as we hypothesized, $z = -.36$, $p = .36$. Furthermore, there were no significant correlations of income-to-need ratio for poor/near poor, $r(50) = .08$, $p = .57$, and non-poor, $r(82) = .006$, $p = .86$, which was different than hypothesized (Table 4). Additionally, the comparison of these correlations was consistent with our hypothesis that there would be no income-to-need ratio differences for this relationship, $z = .41$, $p = .34$.

Somatic Complaints v Substance Use

The last set of analyses comparing substance use and a subscale of internalizing problems included somatic complaints. The Pearson correlation test which used somatic complaint t-scores ($M = 54.49$, $SD = 5.85$) and standardized substance use scores ($M = .01$, $SD = .93$) did result in a statistically significant correlation coefficient as hypothesized, $r(146) = .30$, $p < .001$ (Table 4). After controlling for gender, both correlations for males, $r(77) = .29$, $p < .01$, and females, $r(67) = .34$, $p < .005$, were deemed to be statistically significant (Table 4). This was consistent with our hypothesis. Additionally, the differences in their correlations were not statistically significant, which also affirmed our original hypothesis, $z = -.33$, $p = .37$. Lastly, there were also significant correlations for poor/near-poor families, $r(50) = .43$, $p = .001$, but not for non-poor families, $r(82) = .07$, $p = .53$. While this was inconsistent with our hypothesis, the differences between these correlations were significantly different from each other, $z = 2.15$, $p = .02$.

Anxious/Depressed v Risky Sexual Activity

The final set of tests which utilized internalizing problem subscales against risky sexual behavior started by running a Pearson correlation test using anxious/depressed t-scores ($M = 55.63$, $SD = 6.76$) and standardized risky sexual activity scores ($M = .005$, $SD = .92$). This test showed no statistically significant correlation as hypothesized, $r(146) = .04$, $p = .65$ (Table 4). To determine if there were statistically significant correlations from potentially confounding variables, we controlled for gender. Males, $r(77) = .10$, $p = .41$, and females, $r(67) = .02$, $p = .89$, did not produce significant results and were not consistent with our hypothesis (Table 4). These correlations did, however, confirm no gender differences in correlations, $z = .48$, $p = .32$. We then looked at income-to-need ratio for significant correlations and to determine if these correlations were significantly different from each other.

Adolescents from poor/near poor families, $r(50) = .15$, $p = .28$, and non-poor families, $r(82) = .02$, $p = .82$, showed no statistically significant correlations. This was inconsistent with our hypothesis (Table 4). Additionally, the differences in these correlations supported our hypothesis that there would be no income-to-need ratio differences, $z = .72$, $p = .24$.

Social Withdrawal v Risky Sexual Activity

We also looked for positive correlations between social withdrawal and risky sexual activity by running Pearson correlation tests. We used social withdrawal t-scores ($M = 56.99$, $SD = 7.91$) and standardized risky sexual activity scores ($M = .005$, $SD = .92$). The test revealed insignificant correlations and was inconsistent with what we hypothesized, $r(146) = .02$, $p = .77$. We controlled for gender and found our hypothesis was not supported that there would be significant correlations for males, $r(77) = .09$, $p = .43$, and females, $r(67) = .02$, $p = .86$. The difference in these correlations were however consistent with our hypothesis that there would be no gender differences, $z = .42$, $p = .34$. We also examined this for poor/near poor, $r(50) = .09$, $p = .54$, and non-poor groups, $r(82) = .06$, $p = .61$, and found no statistically significant results, which was not as hypothesized (Table 4). Finally, these correlations were not statistically different from each other and was consistent with what we hypothesized, $z = .17$, $p = .43$.

Somatic Complaints v Risky Sexual Activity

A final set of analyses comparing somatic complaints with risky sexual activity revealed additional significant findings. This was accomplished by using somatic complaint t-scores ($M = 54.49$, $SD = 5.85$) and standardized risky sexual activity scores ($M = .005$, $SD = .92$). The Pearson correlation test affirmed our hypothesis with statistically significant results for somatic complaints and risky sexual behavior, $r(146) = .28$, $p < .001$ (Table 4). We also

found statistically significant correlations for both males, $r(77) = .32, p < .01$ and females, $r(67) = .25, p = .04$, which further confirmed our original hypothesis. These correlations, as hypothesized, were not statistically different from each other, $z = .45, p = .33$. Surprisingly, income-to-need ratio produced only statistically significant correlations for the non-poor group, $r(82) = .24, p = .03$, but not the poor/near poor group, $r(50) = .24, p = .09$. This could again be a result of a lack of power from the sample size. These correlations were not significantly different from each other which was as hypothesized, $z = 0.00, p = .50$.

DISCUSSION

Conclusions

Contrary to our original hypothesis, we were not able to produce any statistically significant correlations between internalizing problems and health risk behaviors or its subscales. A potential explanation for the lack of significance may be due to the other subscales, which make up this measure, lacking significant correlations. Therefore, the additive effect of the internalizing problems measure via subscale scores led to a reduction in significant correlations. While the predictability of internalizing problems did not indicate a relationship with health risk behaviors, it was important that the insignificant correlations were persistent. This likely indicates that we were not missing a potentially significant correlation or relationship and that we did not falsely produce something significant. Since there is no literature to specifically contradict the results of the internalizing problems' relationship with health risk behaviors, we can assume that there is no direct link between the two.

It is also important to note that this was the first study to utilize subscales of internalizing problems to predict a relationship with health risk behaviors or its subscales.

Since the findings for anxious/depression and social withdrawal scales showed a similar pattern of statistical insignificance to internalizing problem, we are also able to conclude that there is no direct link between these scales and health risk behaviors. Although Fisher's *r*-to-*z* was not conducted to test for significant differences between each of the subscales, a visual inspection of the data did not indicate this was necessary. This was apparent as many of the subscales had correlations close near zero. It also affirms that we were not finding correlations that were not actually present. Their results may suggest that anxious/depressed and social withdrawal aspects of internalizing problems are not specific drivers of these behaviors. The literature on these subscales, although usually not in the contexts of being collected via Youth Self Report questionnaire, are frequently associated with limited or refrain from engagement in activities (Rubin et al., 2009). It is possible that these activities include those within health risk behaviors and therefore would have led to the insignificant results observed in this study. Ultimately, there does not seem to be an association between these specific subscales and health risk behaviors, and so we cannot attribute them to linking internalizing problems with predicting health risk behavior engagement in adolescents.

Despite the correlations not being significant for any of the other measures, the results which used somatic complaints were promising. Not only was its significance reproducible in several variations of its relationship with health risk behaviors, but they were also commonly present when controlled for gender and ITN variables. This highlights that somatic complaints offer a reliable indicator of health risk behavior engagement. Additionally, these results may reflect a novel mechanism linking somatic complaints to health risk behaviors that has yet to be studied. A potential mechanism of this relationship can be inferred from the literature on the known causal relationship between anxiety and depression and the development of

somatic complaints (Janssens et al., 2010). This work could potentially suggest that the consistent stress of headaches, muscle aches, and stomachaches, may lead adolescents to consider unhealthy coping strategies to relieve their physiological pain. Although this explanation may offer some way of understanding the novel relationship between somatic complaints and health risk behaviors, this study is not able to conclude specifically what this mechanism is.

It is also important to note that while the results for somatic complaints were significant, we did not find significant results for the other measures we hypothesized would be correlated with health risk behaviors. This indicates that the original question which attempts to link depression and anxiety to negative outcomes via internalizing problems and health risk behaviors cannot be determined by the results of this study. Since we were unable to find significant results for internalizing problems and only significant results for one subscale, this is not clear evidence that this specific relationship exists. Both a linked and unlinked connection between somatic complaints and depression and anxiety is possible for explaining engagement in health risk behaviors. For instance, if somatic complaints were directly linked to depression and anxiety, we would find that when examining the mechanisms of this relationship that these disorders establish this connection (Janssens et al., 2010). Conversely, it is just as likely that general features of poor health and wellness via the presence of somatic complaints are not specifically a reflection of having depression or anxiety and therefore would not contribute to the development of this relationship (Egger et al., 1999). This unlinked connection could explain why we did not find significant results for the other scales used to predict health risk behaviors. Regardless of interpretations, somatic

complaints did show persistently significant correlations for health risk behaviors and therefore are an important measure to consider.

Another aspect of the results that were noticeably unusual were the unpredictable trends in somatic complaints when controlling for ITN. For example, correlations were significant only for poor/near poor when run against health risk behavior and substance use. Conversely it did not produce significant results for when looking at risky sexual behavior. The opposite instances of significance were true for non-poor group: significant for risky sexual behaviors, but not for health risk behaviors or substance use. While it is difficult to determine the exact reason this trend occurred, it may simply reflect a lack of statistical power within this specific breakdown. Since the initial comparisons of all the scores revealed to statistically significant differences between the groups except for somatic complaints, it was unexpected that some correlations were going to be significant in some cases but not others. However, this unexpected results might reflect that the significance of the somatic complaints scores being significantly different between the groups before analysis, and therefore when specifically tested against health risk behaviors they produced a difference in correlations. Because these results were inconsistent and no specific literature highlights why this might have been the case, it is important to examine this relationship again with a larger, more ITN diverse sample.

None of the Fisher's r -to- z transformation for gender produced statistically significant differences when comparing their correlations. This was potentially unexpected because the literature highlights gender differences existing in the spread of internalizing scores (Leadbeater et al., 1999). Our study did find significant differences in internalizing problems and its subscales for gender before using them in analysis. Since the correlations themselves

were not significantly different it enables us to conclude that these relationships cut across gender. Conversely, we found most aspects of internalizing problems and health risk behaviors were not significantly different between the ITN groups. The only measure that was, however, and was not specifically hypothesized, was somatic complaints. All the other insignificant differences supported previously implicated research (Martinez et al., 2015; Pampel et al., 2010) Of the twelve correlation comparisons for ITN examined in this study, only one produced a statistically significant difference. This result was between somatic complaints and risky sexual activity. It is unclear what could explain the variation in results found with this measure, but could reflect a lack of sufficient statistical power or the original groups differences for somatic complaints.

Again, since so many of the findings did not support our original hypothesis, the indirect link between depression and anxiety disorder and health risk behaviors through internalizing problems may not necessarily be indicated. There could be other mechanisms of somatic complaints specifically that produce this effect that are unlinked from depression and anxiety. This highlights a need for the field to examine the specific mechanisms of this correlation and determine the causal nature of this relationship. Conversely, it may still be linked to depression and anxiety disorder, but somehow be entirely unlinked from the other scales that make up internalizing problems. Because this measure can show a range of mental state presentations, there may be other features of it that are similarly predictive to somatic complaints.

Implications

Adolescence is a vulnerable period of development, and therefore, any way to identify at-risk individuals is important, especially when considering negative outcomes. This

highlights why the result of this study may be particularly significant. Somatic complaints may be able to provide a new way for identifying at-risk adolescents, ultimately enabling them to receive more specialized assistance. The use of somatic complaints to identify and ultimately address these issues early in life are likely to significantly improve life outcomes, which may include better self-esteem, more prosocial behavior, and higher school attendance (Martinez et al., 2015). It also important to address issues early because early intervention and prevention measures are historically more cost effective compared to retroactive treatments (Patel et al., 2007). In conclusion, addressing potentially concerning issues early and robustly contribute to mitigating the development of future disease, which has other significant implications.

Limitations

The first limitation of this study was part of data collection. In the lab, the Youth Risk Behavior Survey was distributed to adolescents and asked them to report on their health risk behavior engagement. Although this survey generally provides a well-established method for measuring health risk behavior engagement in adolescents within this age range, the questionnaire used in this study was abbreviated to only include substance use and certain behaviors of risky sexual activity. It excluded many risky behaviors commonly associated with accidental injury and death including risky driving and violent behaviors. Inclusion of these items would have provided a more inclusive measure of health risk behavior engagement, thereby, enabling more generalizable results. In addition to missing categories of health risk behaviors, only a limited number of questions comprised each score. For example, both substance use and risky sexual activity were made up of four total scores. The validity of these measures when combined to make up overall health risk behaviors are substantial, but this was the first study to separate out the questionnaire items into new scores for each

category of behaviors. Separating substance use and risky sexual activity presented a potential problem for continued validity of the measure. Providing more questions relevant to each category in future research may mitigate this issue.

A second potential limitation of this study was in the spread of certain measures. Certain health risk behavior scores may have been binary because many adolescents may have yet to engage in certain behaviors at all, therefore limiting the variance of the sample itself. Fortunately, this age group produced normal skewness for overall health risk behaviors and its subscales and therefore were unlikely to be significantly affected by this. However, if studies were to be done using younger adolescents or that wanted to observe changes in engagement longitudinally, this may present a problem. Additionally, some measures, in particular internalizing problem subscales produced a floor effect. This is what motivated the use of t-scores for all internalizing problems and its subscales to minimize these effects.

Thirdly, there were limitations in the analysis itself. First and foremost, the sample size of the variables that were used as controls may have been too small to detect significant results. Therefore, the lack of sufficient statistical power may have caused certain combinations of relationships between internalizing problems and health risk behaviors to not be determined, despite being present. This could likely explain why many of the correlations for somatic complaints and health risk behaviors for ITN produced varying significant results. Second, a total of sixty correlational analyses were run and this may have caused effects to be present when they were not. For example, the subscales of internalizing problems had limited research connecting them specifically to health risk behavior engagement. Still, they were measures against subscales of health risk behaviors and further divided in control groups. This could have caused significant results to appear. With this said, the results which examined

somatic complaints with health risk behaviors and its subscales found statistically significant results for nearly every interaction, including most that were controlled for. This highlights that somatic complaints provided a persistent connection to health risk behavior engagement.

Future Directions

Given what we have concluded in the result of this study and what limitations arose because of the sampling, analysis, and specific measures, there presents additional opportunities for future work. First, as alluded to in the limitations section, longitudinal differences of health risk behavior engagement and their correlations with internalizing problems would provide significant information about when interventions or preventions would be most advantageous. Additionally, examining this over time could show trends in certain correlations that may also be useful in informing what preventions or interventions should be used.

Future research also needs to consider sampling a more racially and ethnically diverse population of adolescents. While this sample was representative of the area it was taken in, it does not extend to represent all areas of the US, nor does it extend to other geographical locations. Including a more racially and ethnically diverse sample presents an opportunity for researchers to examine racial/ethnic differences in some of the relationships analyzed in this study. Therefore, it is critically important to collect data that accounts for this missing diversity.

Since this study was not able to determine a causal connection between the significant results from somatic complaints, future research may benefit from examining the mechanisms of this relationships. Determining what elements of somatic complaints, their connections to depression and anxiety, and subsequent relationship with health risk behaviors and its

subscales, may provide essential information about adolescent development of these behaviors.

In addition to the mechanistic identity of these relationships, it will also be important to identify additional mediators and possible moderators of health risk behaviors. The mediators examined in this study included gender and income-to-need ratio. As mentioned earlier, race and ethnicity may be an additional mediator that shows differences in the relationship between internalizing problems and health risk behaviors. Another mediator that might be useful to examine is parental education. It may also be informative to look at gender and income-to-need ratio as moderators of this relationship via its interaction effects on predicting health risk behaviors. This analysis was not done in this study but should be examined in future work. Lastly, an important consideration that was preliminarily investigated post-hoc was the impact of peer and parental attachment on this relationship. This initial analysis provided an interesting consideration for these variables in future work. Ultimately, exploration of these variables will offer more definitive conclusions, thereby better informing intervention and prevention strategies.

Applications

The conclusions drawn from the results suggest numerous useful applications. First, the significant relationships measured with somatic complaints demonstrate its predictive capacity for engagement in health risk behaviors across gender, income-to-need ratio, and specific health risk behaviors. Furthermore, the results suggest somatic complaints being a useful measure in screenings. This could be utilized in multiple influential settings including schools and doctor's offices. Although the identification of individuals suffering from somatic complaints does not have complete predictive ability and the mechanisms of its connection to health risk behaviors are not established, they provide an important identification for

potentially at-risk adolescents. Being able to find, connect with, and intervene for adolescents at high risk accomplishes two important tasks. One, it enables individuals who can help to know *what* adolescents to look out for. Two, it narrows down which adolescents need more specialized consideration, and this can both save money and time. While some strategies could be universally provided to adolescents, additional knowledge related to who is at higher risk ensures that those individuals are receiving extra services required for their success.

Another application that these results highlight is that somatic complaints should be given more weight when identifying high risk mood disorders. Although it does not indicate that adolescents with high reports of somatic complaints have depression or anxiety disorder, they do indicate that their presence may lead to more significant negative outcomes. Therefore, in addition to screening, somatic complaints should inform professionals that these vulnerable adolescents are likely to need services and supports, even if they do not have a diagnosed mental illness.

Overall, the results of this study and its implications showcase the need for screening measures to be used to connect individuals with appropriate supports, regardless of a clinical diagnosis. Individuals, in particular adolescents, who fall just below these arbitrary thresholds should not be withheld interventions that could otherwise ensure healthy and happy development.

REFERENCES

Achenbach, T. M. (1991). *Manual for the Child Behavior Checklist/4-18 and 1991 Profile*. Burlington: University of Vermont, Department of Psychiatry.

- Achenbach, T. M., & Rescorla, L. (2001). *Manual for the ASEBA school-age forms and profiles*. Burlington, VT: Department of Psychiatry, University of Vermont.
- Achenbach, T. M., Ivanova, M. Y., Rescorla, L. A., Turner, L. V., & Althoff, R. R. (2016). Internalizing/Externalizing Problems: Review and Recommendations for Clinical and Research Applications. *Journal of the American Academy of Child & Adolescent Psychiatry*, 55(8), 647–656. <https://doi.org/10.1016/j.jaac.2016.05.012>
- Albert, D., Chein, J., & Steinberg, L. (2013). The Teenage Brain: Peer Influences on Adolescent Decision Making. *Current Directions in Psychological Science*, 22(2), 114–120. <https://doi.org/10.1177/0963721412471347>
- Armsden, G. C., & Greenberg, M. T. (1987). The inventory of parent and peer attachment: Individual differences and their relationship to psychological well-being in adolescence. *Journal of Youth and Adolescence*, 16(5), 427-454. <https://doi.org/10.1007/BF02202939>
- Asarnow, J. R., Zeledon, L. R., D'Amico, E., LaBorde, A., Anderson, M., Avina, C., Arslanian, T., Do, M.-C., Harwood, J., & Shoptaw, S. (2014). Depression and Health Risk Behaviors: Towards Optimizing Primary Care Service Strategies for Addressing Risk. *Primary Health Care: Open Access*, 4(1), 152. <https://doi.org/10.4172/2167-1079.1000152>
- Baranowski, T., Davis, M., Resnicow, K., Baranowski, J., Doyle, C., Lin, L. S., Smith, M., & Wang, D. T. (2000). Gimme 5 Fruit, Juice, and Vegetables for Fun and Health: Outcome Evaluation. *Health Education & Behavior*, 27(1), 96–111. <https://doi.org/10.1177/109019810002700109>

- Bardone, A. M., Moffitt, T. E., Caspi, A., Dickson, N., Stanton, W. R., & Silva, P. A. (1998). Adult physical health outcomes of adolescent girls with conduct disorder, depression, and anxiety. *Journal of the American Academy of Child & Adolescent Psychiatry*, 37(6), 594-601. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0890856709630690?via%3Dihub>
- Bender, B. G. (2006). Risk Taking, Depression, Adherence, and Symptom Control in Adolescents and Young Adults with Asthma. *American Journal of Respiratory and Critical Care Medicine*, 173(9), 953–957. <https://doi.org/10.1164/rccm.200511-1706PP>
- Beyth-Marom, R., Austin, L., Fischhoff, B., Palmgren, C., & Jacobs-Quadrel, M. (1993). Perceived consequences of risky behaviors: Adults and adolescents. *Developmental Psychology*, 3, 549. Retrieved from <http://silk.library.umass.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=edsgih&AN=edsgcl.14084400&site=eds-live&scope=site>
- Brady, E. U., & Kendall, P. C. (1992). Comorbidity of anxiety and depression in children and adolescents. *Psychological Bulletin*, 111(2), 244–255. <https://doi.org/10.1037/0033-2909.111.2.244>
- Brown, B. B., Clasen, D. R., & Eicher, S. A. (1986). Perceptions of peer pressure, peer conformity dispositions, and self-reported behavior among adolescents. *Developmental Psychology*, 22(4), 521–530. <https://doi.org/10.1037/0012-1649.22.4.521>
- Centers for Disease Control and Prevention (CDC). (2012). *Youth risk behavior survey*. Retrieved from <http://www.cdc.gov/Features/YRBS/>
- Centers for Disease Control and Prevention (2015). Youth Risk Behavior Surveillance. Retrieved from <http://www.cdc.gov/healthyyouth/data/yrbs/index.htm>

- Chan, S. M., & Chan, K.-W. (2013). Adolescents' Susceptibility to Peer Pressure: Relations to Parent-Adolescent Relationship and Adolescents' Emotional Autonomy From Parents. *Youth & Society*, 45(2), 286–302. <https://doi.org/10.1177/0044118X11417733>
- Chandra, A., & Batada, A. (2006). Exploring Stress and Coping Among Urban African American Adolescents: The Shifting the Lens Study. *Preventing Chronic Disease*, 3(2). Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1563979/>
- Cherie, A., & Berhane, Y. (2012). Peer Pressure Is the Prime Driver of Risky Sexual Behaviors among School Adolescents in Addis Ababa, Ethiopia. *World Journal of AIDS*, 2(3), 159. <https://doi.org/10.4236/wja.2012.23021>
- Costello, E. J., Foley, D. L., & Angold, A. (2006). 10-Year Research Update Review: The Epidemiology of Child and Adolescent Psychiatric Disorders: II. Developmental Epidemiology. *Journal of the American Academy of Child & Adolescent Psychiatry*, 45(1), 8–25. <https://doi.org/10.1097/01.chi.0000184929.41423.c0>
- Compas, B. E. (1987). Stress and life events during childhood and adolescence. *Clinical Psychology Review*, 7(3), 275–302. [https://doi.org/10.1016/0272-7358\(87\)90037-7](https://doi.org/10.1016/0272-7358(87)90037-7)
- Compas, B. E., Ey, S., & Grant, K. E. (1993). Taxonomy, assessment, and diagnosis of depression during adolescence. *Psychological Bulletin*, 114(2), 323–344. <https://doi.org/10.1037/0033-2909.114.2.323>
- Franke, H. A. (2014). Toxic Stress: Effects, Prevention and Treatment. *Children*, 1(3), 390–402. <https://doi.org/10.3390/children1030390>
- Gerrard, M., Gibbons, F. X., Houlihan, A. E., Stock, M. L., & Pomery, E. A. (2008). A dual-process approach to health risk decision making: The prototype willingness model. *Developmental Review*, 28(1), 29–61. <https://doi.org/10.1016/j.dr.2007.10.001>

- Gibbons, F. X., & Gerrard, M. (1995). Predicting young adults' health risk behavior. *Journal of Personality and Social Psychology*, 69(3), 505–517. <https://doi.org/10.1037/0022-3514.69.3.505>
- Gorrese, A. (2016). Peer Attachment and Youth Internalizing Problems: A Meta-Analysis. *Child & Youth Care Forum*, 45(2), 177–204. <https://doi.org/10.1007/s10566-015-9333-y>
- Heiervang, E., Stormark, K. M., Lundervold, A. J., Heimann, M., Goodman, R., Posserud, M.-B., Ullebø, A. K., Plessen, K. J., Bjelland, I., Lie, S. A., & Gillberg, C. (2007). Psychiatric Disorders in Norwegian 8- to 10-Year-Olds: An Epidemiological Survey of Prevalence, Risk Factors, and Service Use. *Journal of the American Academy of Child & Adolescent Psychiatry*, 46(4), 438–447. <https://doi.org/10.1097/chi.0b013e31803062bf>
- IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp
- Janssens, K. A. M., Rosmalen, J. G. M., Ormel, J., Oort, F. V. A. V., & Oldehinkel, A. J. (2010). Anxiety and depression are risk factors rather than consequences of functional somatic symptoms in a general population of adolescents: The TRAILS study. *Journal of Child Psychology and Psychiatry*, 51(3), 304–312. <https://doi.org/10.1111/j.1469-7610.2009.02174.x>
- Jones, S. E., Pezzi, C., Rodriguez-Lainz, A., & Whittle, L. (2016). Health Risk Behaviors by Length of Time in the United States among High School Students in Five Sites. *Journal of Immigrant and Minority Health / Center for Minority Public Health*, 18(1), 150–160. <https://doi.org/10.1007/s10903-014-0151-3>
- Kann, L., Kinchen, S., Shanklin, S. L., Flint, K. H., Hawkins, J., Harris, W. A., Lowry, R., O'Malley Olsen, E., McManus, T., Chyen, D., Whittle, L., Taylor, E., Demissie, Z.,

- Brener, N., Thornton, J., Moore, J., & Zaza, S. (2013). Youth risk behavior surveillance—United States, 2013. *Morbidity and Mortality Weekly Report: Center for Disease and Control*, 63(SS04), 1–168. Retrieved from <https://www.cdc.gov/mmwr/preview/mmwrhtml/ss6304a1.htm>
- Kann, L., McManus, T., Harris, W. A., Shanklin, S. L., Flint, K. H., Hawkins, J., Queen, B., Lowry, R., Olsen, E. O., Chyen, D., Whittle, L., Thornton, J., Lim, C., Yamakawa, Y., Brener, N., & Zaza, S. (2016). Youth Risk Behavior Surveillance - United States, 2015. *Morbidity and mortality weekly report. Surveillance summaries (Washington, D.C.: 2002)*, 65(6), 1–174. <https://doi.org/10.15585/mmwr.ss6506a1>
- Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., & Ustun, T. B. (2007). Age of onset of mental disorders: A review of recent literature. *Current Opinion in Psychiatry*, 20(4), 359–364. <https://doi.org/10.1097/YCO.0b013e32816ebc8c>
- Kim-Spoon, J., Deater-Deckard, K., Lauharatanahirun, N., Farley, J. P., Chiu, P. H., Bickel, W. K., & King-Casas, B. (2017). Neural Interaction Between Risk Sensitivity and Cognitive Control Predicting Health Risk Behaviors Among Late Adolescents. *Journal of Research on Adolescence*, 27(3), 674–682. <https://doi.org/10.1111/jora.12295>
- Kim-Spoon, J., Kahn, R., Deater-Deckard, K., Chiu, P., Steinberg, L., & King-Casas, B. (2016). Risky decision making in a laboratory driving task is associated with health risk behaviors during late adolescence but not adulthood. *International Journal of Behavioral Development*, 40(1), 58–63. <https://doi.org/10.1177/0165025415577825>
- King, S. M., Iacono, W. G., & McGue, M. (2004). Childhood externalizing and internalizing psychopathology in the prediction of early substance use. *Addiction*, 99(12), 1548–1559. <https://doi.org/10.1111/j.1360-0443.2004.00893.x>

- Leadbeater, B., Kuperminc, G., Blatt, S., & Hertzog, C. (1999). A Multivariate Model of Gender Differences in Adolescents' Internalizing and Externalizing Problems. *Developmental Psychology*, 35, 1268–1282. <https://doi.org/10.1037//0012-1649.35.5.1268>
- Li, M., Lauharatanahirun, N., Steinberg, L., King-Casas, B., Kim-Spoon, J., & Deater-Deckard, K. (2019). Longitudinal link between trait motivation and risk-taking behaviors via neural risk processing. *Developmental Cognitive Neuroscience*, 40, 1-9. <https://doi.org/10.1016/j.dcn.2019.100725>
- Lipari, R. N., Hedden, S., Blau, G., & Rubenstein, L. (2016). Adolescent Mental Health Service Use and Reasons for Using Services in Specialty, Educational, and General Medical Settings. *The CBHSQ Report, Substance Abuse and Mental Health Services Administration (US)*, 1–16. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/27195364/>
- Mahalik, J. R., Levine Coley, R., McPherran Lombardi, C., Doyle Lynch, A., Markowitz, A. J., & Jaffee, S. R. (2013). Changes in health risk behaviors for males and females from early adolescence through early adulthood. *Health Psychology*, 32(6), 685–694. <https://doi.org/10.1037/a0031658>
- Marceau, K., Ram, N., Houts, R. M., Grimm, K. J., & Susman, E. J. (2011). Individual Differences in Boys' and Girls' Timing and Tempo of Puberty: Modeling Development With Nonlinear Growth Models. *Developmental Psychology*, 47(5), 1389–1409. <https://doi.org/10.1037/a0023838>
- Marmorstein, N. R., & Iacono, W. G. (2001). An investigation of female adolescent twins with both major depression and conduct disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(3), 299-306.

- Martin, K. A., & Leary, M. R. (2001). Self-Presentational Determinants of Health Risk Behavior Among College Freshmen. *Psychology & Health, 16*(1), 17–27.
<https://doi.org/10.1080/08870440108405487>
- Martinez, S. M., Castillo, M., Lozoff, B., & Gahagan, S. (2015). Socioeconomic Status and Internalizing Symptoms in Chilean Children: Does Reserve Capacity Matter? *Journal of Child and Adolescent Behavior, 3*(5). <https://doi.org/10.4172/2375-4494.1000254>
- Masten, A. S., Roisman, G. I., Long, J. D., Burt, K. B., Obradović, J., Riley, J. R., Boelcke-Stennes, K., & Tellegen, A. (2005). Developmental Cascades: Linking Academic Achievement and Externalizing and Internalizing Symptoms Over 20 Years. *Developmental Psychology, 41*(5), 733–746. <https://doi.org/10.1037/0012-1649.41.5.733>
- McLafferty, M., Lapsley, C. R., Ennis, E., Armour, C., Murphy, S., Bunting, B. P., Bjourson, A. J., Murray, E. K., & O'Neill, S. M. (2017). Mental health, behavioural problems and treatment seeking among students commencing university in Northern Ireland. *PloS one, 12*(12), e0188785. <https://doi.org/10.1371/journal.pone.0188785>
- Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., Benjet, C., Georgiades, K., & Swendsen, J. (2010). Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication--Adolescent Supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry, 49*(10), 980–989. <https://doi.org/10.1016/j.jaac.2010.05.017>
- Miniño A. (2010). Mortality among teenagers aged 12-19 years: United States, 1999-2006. *NCHS data brief, (37)*, 1–8. Retrieved from
<https://www.cdc.gov/nchs/data/databriefs/db37.pdf>

- National Academies of Sciences, Engineering, and Medicine. (2019). The Promise of Adolescence: Realizing Opportunity for All Youth. *Washington, DC: The National Academies Press*, 37-76. <https://doi.org/10.17226/25388>.
- Ngun, T. C., Ghahramani, N., Sánchez, F. J., Bocklandt, S., & Vilain, E. (2011). The Genetics of Sex Differences in Brain and Behavior. *Frontiers in Neuroendocrinology*, 32(2), 227–246. <https://doi.org/10.1016/j.yfrne.2010.10.001>
- Palmisano, B. (2018, August 31). Depression in Youth: Underdiagnosed and Deadly. *Psychiatry Advisor*. Retrieved from <https://www.psychiatryadvisor.com/home/depression-advisor/depression-in-youth-underdiagnosed-and-deadly/>
- Patel, V., Araya, R., Chatterjee, S., Chisholm, D., Cohen, A., De Silva, M., Hosman, C., McGuire, H., Rojas, G., & van Ommeren, M. (2007). Treatment and prevention of mental disorders in low-income and middle-income countries. *The Lancet*, 370(9591), 991–1005. [https://doi.org/10.1016/S0140-6736\(07\)61240-9](https://doi.org/10.1016/S0140-6736(07)61240-9)
- Pedersen, M. L., Holen, S., Lydersen, S., Martinsen, K., Neumer, S.-P., Adolfsen, F., & Sund, A. M. (2019). School functioning and internalizing problems in young school children. *BMC Psychology*, 7(1), 88. <https://doi.org/10.1186/s40359-019-0365-1>
- Peterson, G. W., & Bush, K. R. (1999). Predicting Adolescent Autonomy from Parents: Relationship Connectedness and Restrictiveness. *Sociological Inquiry*, 69(3), 431–457. <https://doi.org/10.1111/j.1475-682X.1999.tb00880.x>
- Poudel, A., & Gautam, S. (2017). Age of onset of substance use and psychosocial problems among individuals with substance use disorders. *BMC Psychiatry*, 17. <https://doi.org/10.1186/s12888-016-1191-0>

- Raja, S. N., McGee, R., & Stanton, W. R. (1992). Perceived attachments to parents and peers and psychological well-being in adolescence. *Journal of Youth and Adolescence*, 21(4), 471–485. <https://doi.org/10.1007/BF01537898>
- Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social Withdrawal in Childhood. *Annual Review of Psychology*, 60, 141–171.
<https://doi.org/10.1146/annurev.psych.60.110707.163642>
- Salcedo, B. (2018). The Comorbidity of Anxiety and Depression. *National Alliance on Mental Illness*. Retrieved from <https://www.nami.org/Blogs/NAMI-Blog/January-2018/The-Comorbidity-of-Anxiety-and-Depression>
- Scherf, K. S., Behrmann, M., & Dahl, R. E. (2012). Facing changes and changing faces in adolescence: A new model for investigating adolescent-specific interactions between pubertal, brain and behavioral development. *Developmental Cognitive Neuroscience*, 2(2), 199–219. <https://doi.org/10.1016/j.dcn.2011.07.016>
- Sebastian, C. L., Tan, G., Roiser, J., Viding, E., Dumontheil, I., & Blakemore, S.-J. (2011). Developmental influences on the neural bases of responses to social rejection: Implications of social neuroscience for education. *NeuroImage*, 57, 686–694.
- Seiffge-Krenke, I. (2000). Causal links between stressful events, coping style, and adolescent symptomatology. *Journal of Adolescence*, 23(6), 675–691.
<https://doi.org/10.1006/jado.2000.0352>
- Smith, J. P., & Book, S. W. (2008). Anxiety and Substance Use Disorders: A Review. *The Psychiatric Times*, 25(10), 19–23. Retrieved from
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2904966/>

- Starr, L., & Davila, J. (2008). Differentiating Interpersonal Correlates of Depressive Symptoms and Social Anxiety in Adolescence: Implications for Models of Comorbidity. *Journal of Clinical Child & Adolescent Psychology*, 37(2), 337–349. <https://doi.org/10.1080/15374410801955854>
- Steinberg, L. (2008). A Social Neuroscience Perspective on Adolescent Risk-Taking. *Developmental Review: DR*, 28(1), 78–106. <https://doi.org/10.1016/j.dr.2007.08.002>
- Striepe, M. I., & Tolman, D. L. (2003). Mom, Dad, I'm Straight: The Coming Out of Gender Ideologies in Adolescent Sexual-Identity Development. *Journal of Clinical Child & Adolescent Psychology*, 32(4), 523–530. https://doi.org/10.1207/S15374424JCCP3204_4
- Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet*, 379(9820), 1056–1067. [https://doi.org/10.1016/S0140-6736\(11\)60871-4](https://doi.org/10.1016/S0140-6736(11)60871-4)
- Twenge, J. M., Cooper, A. B., Joiner, T. E., Duffy, M. E., & Binau, S. G. (2019). Age, period, and cohort trends in mood disorder indicators and suicide-related outcomes in a nationally representative dataset, 2005–2017. *Journal of Abnormal Psychology*, 128(3), 185–199. <https://doi.org/10.1037/abn0000410>
- Underwood, J. M., Brener, N., & Halpern-Felsher, B. (2020). Tracking Adolescent Health Behaviors and Outcomes: Strengths and Weaknesses of the Youth Risk Behavior Surveillance System. *NAM Perspectives*. <https://doi.org/10.31478/202010a>
- Wigfield, A., Lutz, S. L., & Wagner, A. L. (2005). Early Adolescents' Development across the Middle School Years: Implications for School Counselors. *Professional School Counseling*, 9(2). <https://doi.org/10.1177/2156759X0500900206>

World Health Organization. (2020). "Adolescent mental health." Retrieved

from <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health#:~:text=Half%20of%20all%20mental%20health,%2D19%2Dyear%2Dolds>

Wu, Z., & Fang, Y. (2014). Comorbidity of depressive and anxiety disorders: Challenges in diagnosis and assessment. *Shanghai Archives of Psychiatry*, 26(4), 227.

<https://doi.org/10.3969/j.issn.1002-0829.2014.04.006>

Relationship between Adolescent's Internalizing Problems and Engagement in HRB
Boudreau

Table 1. *Adolescent Demographics from Wave 4*

Variables	<i>M</i>	<i>SD</i>	n	%
Age (years)	17.0	.05	148	
Gender			148	100 %
Female			69	53.4 %
Male			79	46.6 %
Race			137	100 %
Caucasian			106	77.4 %
Black			14	10.2 %
Other/Mix			17	12.4 %
Ethnicity			138	100 %
Hispanic			3	2.8 %
Non-Hispanic			13	97.8 %

Relationship between Adolescent's Internalizing Problems and Engagement in HRB
Boudreau

Table 2. *Family/Caregiver Demographics from Wave 4*

Variables	n	%
Gender	138	100 %
Female	120	87 %
Male	18	13 %
Relation to Adolescent	138	100 %
Mother	112	81.2 %
Father	18	13 %
Other	8	5.8 %
Years of Education	138	100 %
≤ High School	31	22.5 %
Some College	42	30.4 %
Bachelor's	32	23.2 %
Master's+	33	23.9 %
Income-to-Need Ratio	138	100 %
Poor (< 1)	29	21.%
Near Poor (< 2)	24	17.4 %
Non-Poor (> 2)	85	61.6%

Relationship between Adolescent's Internalizing Problems and Engagement in HRB
Boudreau

Table 3. *Internalizing Problems Correlations with Health Risk Behaviors at Wave 4*

Variable 1	<i>Internalizing Problems</i>		
Variable 2	<i>HRB</i>	<i>v. RS</i>	<i>SU</i>
Overall (r)	.12	.07	.14
Gender (r)			
Male	.11	.09	.08
Female	.15	.05	.22
Income-to-Need Ratio (r)			
Poor/Near Poor	.15	.05	.19
Non-Poor	.03	.03	.001

Note. HRB = Health Risk Behaviors, RS = Risky Sexual Activity, SU = Substance Use, r = correlation coefficient. No statistically significant correlations found.

Relationship between Adolescent's Internalizing Problems and Engagement in HRB
Boudreau

Table 4. *Internalizing Problem Subscales Correlations with Health Risk Behaviors at Wave 4*

Variable 1	<i>Anxious/Depressed</i>			<i>Social Withdrawal</i>			<i>Somatic Complaints</i>		
Variable 2	<i>HRB</i>	<i>v. RS</i>	<i>SU</i>	<i>HRB</i>	<i>v. RS</i>	<i>SU</i>	<i>HRB</i>	<i>v. RS</i>	<i>SU</i>
Overall (r)	.01	.04	.06	.05	.02	.05	.33***	.28**	.30**
Gender (r)									
Male	.05	.10	< .00	.08	.09	.03	.35**	.32**	.29*
Female	.08	.02	.13	.04	.02	.09	.34**	.25*	.34**
Income-to-Need Ratio (r)									
Poor/Near Poor	.07	.15	.02	.11	.09	.08	.38**	.24	.43**
Non-Poor	.01	.02	.05	.03	.06	.006	.18	.24*	.07

Note. HRB = Health Risk Behaviors, RS = Risky Sexual Activity, SU = Substance Use, r = correlation coefficient. * $p < .05$, ** $p < .005$, *** $p < .0005$

Equation 1. *T-stat Equation for Correlation Coefficient Significance Test*

$$t = \frac{r\sqrt{n} - 2}{\sqrt{1 - r^2}}$$

Figure 1. *Boxplots of Internalizing Problems and its Subscales*

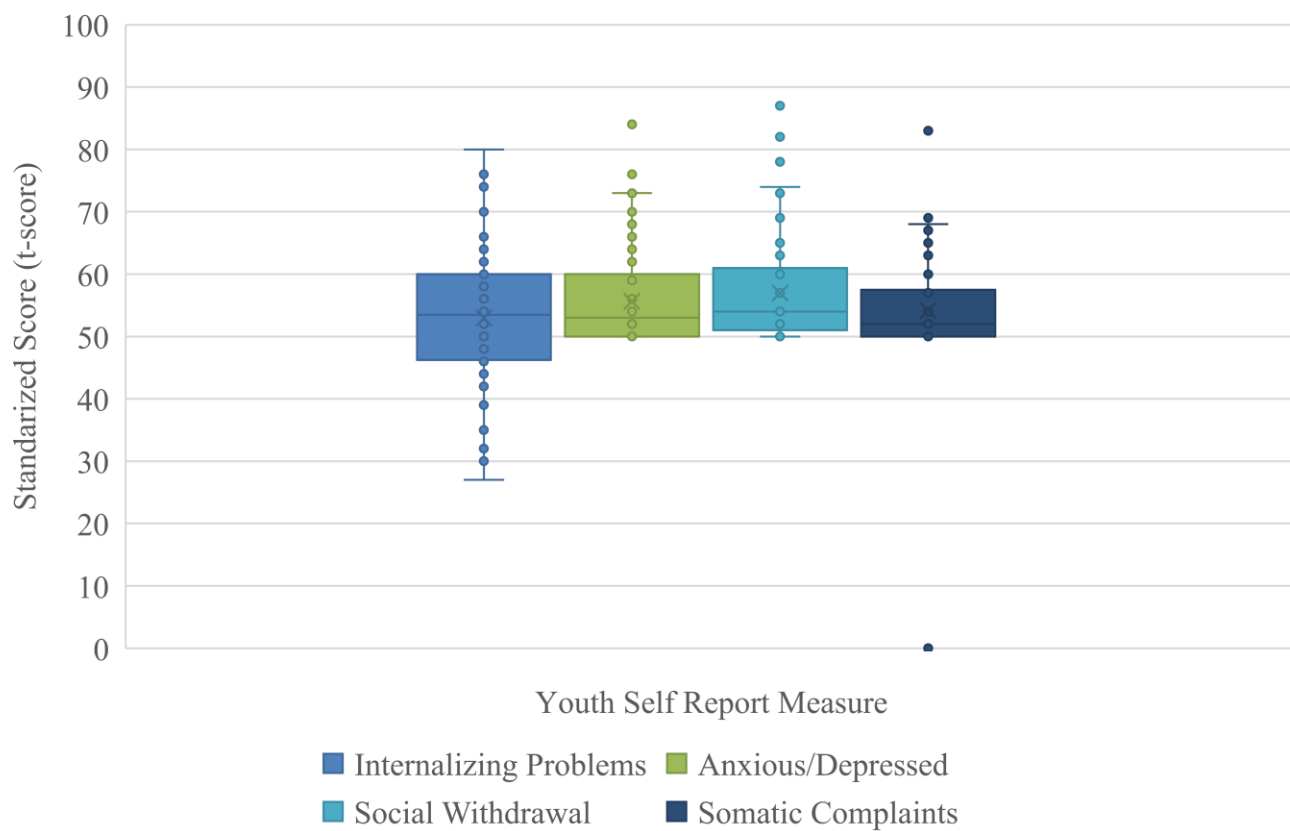


Figure 2. *Boxplots of Health Risk Behaviors and its Subscales*

