

ABSTRACT

Title of Thesis: CHILDHOOD ATTENTION PROBLEMS
AND THE DEVELOPMENT OF COMORBID
SYMPTOMS AT THE TRANSITION TO
HIGH SCHOOL: THE MEDIATING ROLE OF
PARENT AND PEER RELATIONSHIPS

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Children with Attention-Deficit/Hyperactivity Disorder (ADHD) are at increased risk for the development of depression and delinquent behavior. Children and adolescents with ADHD also experience difficulty creating/maintaining high quality friendships and parent-child relationships, and these difficulties may contribute to the development of co-morbid internalizing and externalizing symptoms in adolescence. However, there is limited research examining whether high quality friendships and parent-child relationships mediate the relation between ADHD and the emergence of these co-morbid symptoms at the transition to high school. This study examines the mediating role of relationship quality in the association between ADHD and depressive symptoms/delinquent behaviors at this developmentally significant transition point. Results revealed significant indirect effects of grade 6 attention problems on grade 9 depressive symptoms through friendship quality and quality of

the mother-child relationship in grade 8. Interventions targeting parent and peer relationships may be valuable for youth with ADHD to promote successful transitions to high school.

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COMORBID SYMPTOMS AT THE TRANSITION TO HIGH SCHOOL: THE
MEDIATING ROLE OF PARENT AND PEER RELATIONSHIPS

by

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Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Science
2016

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Dedication

To my family.

Acknowledgements

I would first like to thank my advisor and mentor, Dr. Andrea Chronis-Tuscano for her endless support and guidance throughout my time at UMD. I would also like to thank my committee members, Drs. Ken Rubin, and Julia Felton for their feedback and for their invaluable teaching and advice on how to tackle this project. Finally, a big thank you to my cohort and friends/fellow students in the Maryland ADHD Program lab for always being there, whether for a laugh or support.

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Introduction

The Transition to High School

A critical point of development for any youth is the transition from junior high to high school. For those who successfully navigate this transition, grade nine often marks the beginning of a similar trend of success throughout the rest of high school. However, the beginning of high school is also a period of development during which many difficulties associated with mental health and behavioral outcomes emerge.

Beyond the expected academic and social difficulties that may come with the transition to high school, this developmental period is also associated with a marked increase in rates of depression. In fact, the prevalence of major depressive disorder (MDD) increases from 2-5% in childhood (Reynolds & Johnston, 1994) to 10-15% in adolescence (Lewinsohn, Clarke, Seeley, & Rohde, 1994; Reynolds & Johnston, 1994). In a study of community adolescents 14 to 18 years old, the mean reported age of onset for a first depressive episode was 14.9, the age at which most adolescents are in their first year of high school (Lewinsohn et al., 1994). Adolescent depression has serious implications, as those who experience a depressive episode during adolescence are significantly more likely to go on to experience a recurrence of depression in adulthood (Fergusson & Woodward, 2002; Weissman et al., 1999) , as well as other adverse outcomes such as suicide attempts, academic underachievement and adult unemployment (Fergusson & Woodward, 2002).

Further emphasizing the significance of this point in adolescence is the rate of delinquent behavior in youth at the age of the transition to high school. Extensive

literature has demonstrated the trend of a sharp increase in these behaviors at mid-adolescence and a peak in late adolescence for both males and females (Blonigen, 2010; Moffitt, 1993). While this increase in antisocial behavior in adolescence has been shown to be developmentally normative to an extent, and the majority of adolescents will cease any delinquent behavior as they become young adults, a number of these youth will be persistently deviant continuing into adulthood (Moffitt, 1993). Moreover, the consequences of adolescent delinquency could remain throughout the adult years even for those who discontinue any delinquent activities, as early arrest records or reputations may have enduring and damaging effects.

Considering these significant challenges associated with the first year of high school, the presence of attention-deficit/hyperactivity disorder (ADHD) symptoms may compound these challenges. The association between ADHD and depression is well-documented (Chronis-Tuscano et al., 2010; Meinzer et al., 2013), and ADHD symptoms have been connected to the persistence of delinquent behavior throughout and beyond adolescence (Beauchaine, Hinshaw, & Pang, 2010; Moffitt, 1993; Molina et al., 2007; Rabiner, Coie, Miller-Johnson, Boykin, & Lochman, 2005; Sibley et al., 2011). However, the transition to high school has not yet been examined within the ADHD literature as a focal point for the development of adverse outcomes.

ADHD in Adolescence

Though ADHD has long been considered a childhood disorder, follow-up studies of hyperactive children estimate symptomatic persistence of ADHD into adolescence to be at least 65% (Biederman, Petty, Evans, Small, & Faraone, 2010; Faraone, Biederman, & Mick, 2006). Compared to the general population, those with a history of ADHD will

also continue to display higher numbers of ADHD symptoms regardless of whether or not they continue to meet full diagnostic criteria for ADHD (Faraone, Biederman, & Mick, 2006; Langberg et al., 2008; Ramtekkar, Reiersen, Todorov, & Todd, 2010). Moreover, even subthreshold levels of ADHD symptoms are associated with social and functional impairments continuing into adulthood (Biederman et al., 2006).

As the child enters adolescence, the challenges associated with ADHD may also contribute to the development of comorbid conditions. ADHD has been associated with many co-occurring disorders across development, including mood disorders (Chronis-Tuscano et al., 2010; Meinzer et al., 2013; Seymour, Chronis-Tuscano, Iwamoto, Kurdziel, & MacPherson, 2014), and externalizing disorders such as conduct disorder and oppositional defiant disorder (Beauchaine et al., 2010; Connor, Steeber, & McBurnett, 2010). Children with ADHD are also more likely to engage in delinquent and risky behaviors (Pratt, Cullen, & Blevins, 2002) as they move into adolescence and adulthood.

Indeed, research suggests that only one third of adolescents with a history of ADHD (compared to 79% of controls) are well adjusted at ages 11-14 when considering academics, internalizing and externalizing symptoms, social skills and peer domains (Lee, Lahey, Owens, & Hinshaw, 2008). Moreover, these adolescent outcomes may persist well beyond the course of middle school and high school, as many of the disadvantages documented among adults with ADHD first emerge during adolescence (R. G. Klein et al., 2012). Given this critical period of development, we must therefore closely examine the adolescent years when assessing long-term outcomes for individuals with ADHD, and consider what processes or mechanisms might explain why some

adolescents with ADHD successfully navigate these years while others develop more serious impairments.

The Role of Social Support

Comprising multiple components, such as the perception of instrumental and emotional support, companionship, intimacy and friendship (Cohen, 2004; Cyranowski et al., 2013; House, Kahn, McLeod, & Williams, 1985), social relationships have been found to have both positive and negative effects at any age. Perceived social support, for example, has been linked to increased self-efficacy and self-esteem, lower levels of depression and even better physical health (Cohen & Wills, 1985; Symister & Friend, 2003; Uchino, Bowen, Carlisle, & Birmingham, 2012). On the other hand, social distress, such as loneliness, rejection, hostility and relationship strain or dissatisfaction is associated with more negative outcomes such as psychopathology, stress and poorer physical health (Bagwell, Newcomb, & Bukowski, 1998; Cacioppo et al., 2000; Hawkley, Burleson, Berntson, & Cacioppo, 2003; Schuster, Kessler, & Aseltine, 1990).

The Parent-Child Relationship

A child's relationship with his or her parents can act as either a risk or protective factor, depending on the quality of the relationship (Greenberg, Siegel, & Leitch, 1983). For example, parental warmth in childhood and early adolescence was negatively associated with adolescent drug use in a longitudinal study, while parental rejection was positively associated with later drug use in the same sample (Pires & Jenkins, 2007). In a similar study, the children of parents who displayed greater hostility and less warmth

during the middle school years were at greater risk for depressive symptoms and conduct problems in 10th grade (Ge, Best, Conger, & Simons, 1996).

The importance of the parent-child relationship is evident in the presence of childhood ADHD symptoms as well, and understood to be impacted by a transactional process (Johnston & Chronis-Tuscano, 2014). Children with ADHD elicit harsh and negative responses from parents through misbehavior and inattention (Pelham & Lang, 1999), while parents may adopt more critical or strict parenting practices in response to the often trying temperament and behavior of children with ADHD. This process has implications for the parent-child relationship itself, with families of children with ADHD often reporting lower quality parent-child relationships, poorer communication between parents and their child with ADHD, and elevated conflict in family interactions (Edwards, Barkley, Laneri, Fletcher, & Metevia, 2001; Johnston & Chronis-Tuscano, 2014; Johnston & Mash, 2001).

When considering the specific outcomes of depression and delinquent behavior, negative parenting, including high levels of hostility and rejection, is associated with later conduct problems/antisocial behavior (Eberhart & Hammen, 2006; Jenness, Hankin, Abela, Young, & Smolen, 2011; Patterson, DeBaryshe, & Ramsey, 1989; D. S. Shaw, Owens, Giovannelli, & Winslow, 2001), and children with ADHD who rated their parents as less warm and more power assertive also reported higher numbers of depressive symptoms (Gerdes et al., 2007). On the other hand, positive parenting and close parent-child relationships have been shown to predict fewer conduct problems over time for children with ADHD (Chronis et al., 2007) and to predict behavioral adjustment in both children with ADHD and controls (Latimer et al., 2003). Parents therefore play an

important role in ensuring healthy developmental outcomes for children with ADHD, but their positive influence may be compromised in the presence of conflict and stress in the parent-child relationship.

Peer Relationships and Friendships in Adolescence

During the adolescent years, peer relationships increase in importance. Though youth continue to rely on their parents in many ways, they also begin to spend more unsupervised time with peers and less time with parents outside of the home (Claes, 1992; Eccles, 1999). This is reflected in the perception of social support as well, with perceived social support from parents either decreasing or remaining the same in early adolescence, while perceived social support from peers increases (Furman & Buhrmester, 1992; Helsen, Vollebergh, & Meeus, 2000). This coincides with the development of the ability and desire to engage in the intimate exchange of thoughts and feelings with friends (Engels, Deković, & Meeus, 2002) and an increasing need for autonomy (Laible, 2007). The influence of peer relationships therefore cannot be ignored during this developmental stage. In fact, friendship quality has tremendous power in predicting later outcomes, with high quality friendships in grade 6 predicting more successful adjustment during the transition to junior high (Berndt, Hawkins, & Jiao, 1999), and having a reciprocal best friend in grade five protecting against negative outcomes twelve years later (Bagwell et al., 1998). Conversely, peer rejection and the absence of friendship predict negative outcomes such as a higher number of symptoms of psychopathology in young adulthood (Bagwell et al., 1998).

This is important to consider for ADHD populations due to the well-established social deficits associated with the disorder. Children and adolescents with ADHD are

more often rejected by peers, less likely to have reciprocal friendships and have more difficulty maintaining their friendships (Blachman & Hinshaw, 2002; Gresham, MacMillan, Bocian, Ward, & Forness, 1998; Hoza, 2007; Hoza et al., 2005; Normand, Schneider, & Robaey, 2007). For those with ADHD, these social difficulties are strongly associated with many of the negative outcomes commonly predicted by ADHD (Mikami & Hinshaw, 2006; Miller-Johnson, Coie, Maumary-Gremaud, & Bierman, 2002; Mrug et al., 2012). More specifically, peer rejection in childhood predicts mood disorders, lower academic achievement, cigarette smoking, delinquency, anxiety, and global impairment during adolescence among those with ADHD (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; Mikami & Hinshaw, 2006; Mrug et al., 2012). Peer rejection was also found to partially mediate the relation between early ADHD symptoms and later conduct disorder in a sample of over 600 children considered at high risk for conduct problems (Miller-Johnson et al., 2002).

Fortunately, there is encouraging research indicating that close friendships likely function as a protective factor for those with ADHD (Mikami, 2010). For example, Becker et al. (2013) found that friendship intimacy exchange buffered the effect of baseline ADHD symptoms on social problems one year later. Specifically, the relation between ADHD and social problems was no longer significant for children with high levels of reported friendship intimacy, potentially further affecting the outcomes of these individuals indirectly. Additional research has found that merely having a mutual friend does not protect against the long-term effects of peer rejection in children with ADHD on its own, suggesting that the quality of the friendship (as opposed to simply having a

friend) may be more important in accounting for any buffering effects of friendship for these children (Mrug et al., 2012).

Consistent with other research on sources of social support, the ADHD literature suggests that friendship is a construct separate from peer rejection or social deficits and should be considered independently of these other measures of social relationships (Mikami, 2010). More research should therefore be done to further investigate the potential benefits of friendship for children with symptoms of ADHD. In particular, the quality of friendships should be more closely examined as a potential protective factor for the negative outcomes associated with ADHD, focusing especially on the trying time of early adolescence, and specifically the transition to high school.

Parent-Child and Peer Relationships Predicting Depression in Youth with ADHD

Despite the amount of research described that illustrates a significant impact of parent-child and peer relationships on the outcomes of children with symptoms of ADHD, to our knowledge only one study in the ADHD literature has investigated the mediating effect of both the parent-child relationship and peer relationships on adolescent outcomes. In this study, Humphreys et al. (2013) tested both peer and parent-child difficulties as mediators of the association between ADHD and depression. Results showed an indirect effect of early attention problems on later depression through peer and parent-child problems. However, this study simply measured peer rejection vs. acceptance (as reported by the parents) and did not include any measures of friendship or friendship quality. Similarly, the parent-child relationship was measured by parent-reported parental stress on the Parent-Child Dysfunctional Interaction subscale of the Parenting Stress Index (Abidin, 1995), and the child's perspective of the parent-child

relationship was not considered. Furthermore, while this study provides insight into depression as an outcome in these children, risk for delinquency also increases during this developmental stage, particularly for children with ADHD.

Current Study

The current study addresses gaps in the literature in several important ways. First, limited research has been done to examine the role that friendship and parent-child relationship quality together play in the healthy adjustment of adolescents with ADHD. This study intends to investigate this relation, with the added benefit of using multi-source longitudinal data following children throughout early adolescence. Second, our definition of adjustment incorporates both depression and delinquent behavior. There is no research examining the relation between ADHD symptoms and these outcomes when incorporating the quality of both friendship and the parent-child relationship as possible mediators. Third, we use a continuous measure of ADHD symptoms rather than limiting the sample to those with a formal diagnosis of ADHD. This allows us to observe any associations between symptom severity and maladjustment in this context, and includes youth who may be excluded from other studies of ADHD due to a sub-threshold number of symptoms. Indeed past research has found positive associations between ADHD symptoms and depressive symptoms, even in samples with few participants meeting full criteria for ADHD diagnoses (Seymour et al., 2014). This approach also provides a more comprehensive view of the association between ADHD symptoms and the outcomes of interest, in line with recent emphases on dimensional views of mental disorders (Cuthbert & Insel 2010). Finally, this study contributes to the ADHD literature by looking at a significant developmental transition point: the transition to high school in grade 9. This

can be a difficult time (both socially and emotionally) for any adolescent, and ADHD symptoms may make the transition particularly challenging. Yet, no previous research has examined adjustment during this transition period for youth with ADHD. This study therefore seeks to identify mechanisms of risk linking ADHD to depression and delinquency at the transition to high school.

Aim 1. To examine the prospective association between ADHD symptoms at grade 6 and maladaptive outcomes (i.e., depression and delinquent behavior) at the transition to high school (in grade 9).

Hypothesis: Based on prior literature examining developmental outcomes of children with ADHD (Biederman, Newcorn, & Sprich, 1991; Chronis-Tuscano et al., 2013; Chronis-Tuscano et al., 2010; Meinzer et al., 2013; Pratt et al., 2002; Seymour et al., 2014), we predict that ADHD symptoms in grade 6 will be associated with greater risk for maladaptive outcomes such as depression, and delinquent behavior at the transition to high school (grade 9).

Aim 2. To examine whether the quality of friendships and parent-child relationships in grade 8 mediate the relation between grade 6 ADHD symptoms and risk for maladaptive outcomes at the transition to high school in grade 9.

Hypothesis: ADHD is associated with difficulties in social relationships with peers (Hoza, 2007) as well as problematic parent-child relationships (Johnston & Mash, 2001), and these relationship characteristics have in turn been shown to contribute to the development of depressive symptoms and delinquent behavior in ADHD populations (Deault, 2010; Humphreys et al., 2013; Mrug et al., 2012). Therefore, we predict that reported quality of friendships and parent-child relationships will mediate the relation

between childhood ADHD symptoms and maladaptive outcomes at the transition to high school (i.e., depression and delinquent behavior).

Method

Participants

Participants were drawn from a National Institute of Mental Health (NIMH)-funded longitudinal study focusing on children's peer relationships and school transition points. The original study recruited students from 39 grade five classrooms in eight public elementary schools (which then fed into three middle schools) in the Washington DC metropolitan area. The present study used data collected at the grade six ($N = 388$), grade eight ($N = 363$) and grade nine ($N = 340$) years. The mean ages of the sample for those data collection points were 11.41 years, 13.43 years and 14.32 years, respectively; 52.2% of the sample was female. Participants were ethnically and racially diverse, with 53.9% of adolescents self-identifying as White, 15.9% as Black, 13.3% as Asian, 11.4% as Latino, and 5.5% as bi- or multiracial. The majority of the sample was classified as middle to upper-middle class.

Procedure

With parental consent, students participated in the first phase of the study. Consent was obtained for approximately 84% of all grade five students across selected schools. In this phase, children completed peer nomination measures for which they listed their close friends. Those children who were found to have mutual best friends were invited to participate in the second phase of the study, which included additional parent and self-report measures. Written parental consent and child assent were obtained for each participating family.

Students and their parents completed measures at time points across three school years: grade six, grade eight and grade nine. For this study, the measures of interest consisted of parental reports of child attention problems at grade six, child self-report of friendship quality and the parent-child relationship at grades six and eight as well as child report of depressive symptoms and delinquent behavior at grades eight and nine. For each follow-up year, participating families were contacted by phone and if the adolescent and his or her parent(s) were interested in participating, parental consent and adolescent assent documents were obtained. Depending on the cohort, follow-up year, and personal preference, measures were completed either in-school, in the lab, by mail or over the internet through a secure private link. There were no significant demographic differences between those who opted to complete measures in one context over the others.

Measures

Demographic information. Parents completed a demographic questionnaire at the initial visit and each following year of participation. The measure included questions related to age, ethnicity, education, occupation and marital status for each biological parent and step-parent, as well as information about others living in the household. Beginning at grade 8, adolescents also completed a self-report version of the demographics questionnaire.

ADHD symptoms. Attention problems at grade 6 were measured using the Child Behavior Checklist (CBCL; Achenbach, 1991; Achenbach & Rescorla, 2001). The CBCL (see Appendix A) is a widely-used parent-report measure assessing youth adjustment in the past 6 months. The measure includes 11 subscales, with responses ranging from 0 (not true) to 2 (very true or often true) for each item. The attention problems subscale (α

= .83) has been shown to correspond strongly with DSM diagnoses of ADHD, and is highly correlated with other ADHD rating scales (Ostrander, Weinfurt, Yarnold, & August, 1998; Pelham, Fabiano, & Massetti, 2005). Parent report of ADHD symptoms were chosen due to research demonstrating that children and adolescents may not provide unique or incrementally valid information regarding these symptoms beyond that afforded by parent or teacher reports (Sibley et al., 2012; Smith, Pelham, Gnagy, Molina, & Evans, 2000). Furthermore, as the research question for the current study was concerned with ADHD symptoms specifically, rather than meeting diagnostic criteria for a discrete diagnosis of ADHD, the full range of ADHD symptoms offered by the CBCL was used as a continuous measure. This is consistent with research suggesting that choosing continuous measures of psychopathology over discrete measures increases both reliability and validity across forms of psychopathology and samples (Markon, Chmielewski, & Miller, 2011) including ADHD (Barkley, Fischer, Smallish, & Fletcher, 2006; Nikolas & Burt, 2010; P. Shaw et al., 2011; Sonuga-Barke, 2005).

Friendship quality. We administered two measures of friendship quality and social support from friends. First, the Friendship Quality Questionnaire (FQQ; Parker & Asher, 1989, 1993a) was used to assess youths' perception of the quality of their relationship with their best friend at grades 6 and 8 (see Appendix B). This measure asks participants to name a specific friend and answer questions about the quality of their relationship with that person. Items are scored on a scale of 1 (not at all true) to 5 (really true) and fall into 6 subscales: companionship and recreation (e.g., ____ and I do fun things together a lot; 5 items; $\alpha = .72$), validation and caring (e.g., ____ and I make each other feel important and special; 10 items; $\alpha = .87$), help and guidance (e.g., When I'm

having trouble figuring out something, I usually ask ____ for help and advice; 9 items; $\alpha = .85$), intimate disclosure (e.g., ____ and I talk about the things that make us sad; 6 items; $\alpha = .85$), conflict resolution (e.g., If ____ and I get mad at each other, we always talk about how to get over it; 3 items; $\alpha = .70$), absence of conflict and betrayal (e.g., ____ and I get mad at each other a lot; 7 items; $\alpha = .72$), and a total composite score of total positive friendship, which is the score of interest for the current study. Within peer relationships, friendship quality is a construct distinct from other dimensions of social relationships such as the commonly measured peer acceptance (Parker & Asher, 1993b). The FQQ allows for a measure of perceived friendship quality apart from a child's social adjustment or acceptance among peers.

Second, the Network of Relationships Inventory (NRI; Furman & Buhrmester, 2009) was used as measure of the child's perceived social support in their relationship with a best friend at grades 6 and 8 (see Appendix C). Participants rated on a scale from 1 (none/not at all) to 5 (very much/almost always) how well each of 33 items described their relationships with their mother, father, friend and others. Participants' ratings of their relationship with the friend were used as a measure of friendship quality. NRI factor scores have been shown to correlate with ratings of observed interactions between adolescents and their friends (Furman & Buhrmester, 2009). Items are divided into 11 subscales (of three items each) which map onto three more general factors (Burk & Laursen, 2005; Furman, 1998): (a) social support (companionship, instrumental help, intimacy, nurturance, affection, enhancement of worth and reliability), (b) negative interactions (conflict and punishment), and (c) positive relationship or relative power

(social support and satisfaction with the relationship). The positive relationship factor ($\alpha = .85$) was used for the current study.

Third, as part of a school-administered friendship nomination measure (Bukowski, Hoza, & Newcomb, 1994), grade 8 students at participants' schools were asked to write the names of their "very best friend" or "second best friend" as well as three other good friends at school. They were instructed to choose friends of their own gender. Participants were considered to have a mutual "best friend" if they were listed as the first or second best friend of those youth they listed as they own very best or second best friends. If students were found to have any other reciprocated friendship nominations they were counted as mutual "good friendships." Mutual friendships could not be determined if students named friends who were not participants in the study. Of interest for the current study is the total number of mutual good friends. Research has shown that the presence of a mutual best friend alone may have protective benefits continuing throughout adolescence and into adulthood (Bagwell et al., 1998; Cardoos & Hinshaw, 2011) and in previous studies those found to be part of a mutual friendship using this method reported higher friendship quality in these relationships than in relationships with others who were not a mutual good friend (Bukowski, Hoza, & Boivin, 1994).

The quality of relationship with a best friend was operationalized as latent variable created based on youth report of perceived social support in a relationship with a best friend (the NRI Social Support: Friend composite), total perceived friendship quality in a relationship with a best friend (the FQQ Total score) for grades 6 and 8, and total mutual good friends in grades 6 and 8. These measures were significantly correlated for

both the grade 6 ($r=.771, p<.01$) and grade 8 ($r=.782, p<.01$) time points, suggesting a latent variable measurement approach was appropriate

Parent-child relationship quality. Youths' perception of the quality of their relationships with their parents was assessed using the mother and father sections of the NRI (Furman & Buhrmester, 1985) at grades 6 and 8. As in the friend sections, participants rated on a scale from 1 (none/not at all) to 5 (very much/almost always) how well each of 33 items described their relationships with their mothers and fathers. Construct validity of the NRI is evidenced by correlations between observed parent-adolescent interactions and NRI factor scores (Furman & Buhrmester, 2009). The positive relationship factor for the participant's relationship with his or her mother ($\alpha = .92$) and father ($\alpha = .92$) was used for the current study.

Depression. The Youth Self-Report (YSR; Achenbach & Rescorla, 2001) was used at grades 8 and 9 as a measure of youth-rated depressive symptoms (see Appendix E). While similar to the CBCL, the YSR is a self-report measure completed by the adolescent. The withdrawn/depressed subscale ($\alpha = .67$) contains 8 items and is also on the scale of 0 (not true) to 2 (very true or often true). The YSR has been widely used in child and adolescent research and has been shown to have good validity and reliability with multiple samples (Achenbach, 1991; Ebesutani, Bernstein, Martinez, Chorpita, & Weisz, 2011). Though it can be beneficial to get reports from multiple informants of symptoms of psychopathology, self-reports may be particularly important for depressive symptoms, as teachers and parents tend to under-report internalizing symptoms when compared to reports from the adolescents themselves (Jensen et al., 1999; D. N. Klein, Dougherty, & Olino, 2005). Moreover, discrepancies between parent-report and youth

self-report may be meaningful (De Los Reyes, 2011; De Los Reyes, Salas, Menzer, & Daruwala, 2013), and methods of creating composite or latent variables of multiple reporters may not adequately account for these discrepancies (De Los Reyes, Thomas, Goodman, & Kundey, 2013).

Delinquent behavior. Delinquent behavior was assessed at grade 9 using the YSR delinquent behavior subscale and aggression subscale, with data collected for this measure at grades 8 and 9. These subscales include 14 items on the same scale of 0 (not true) to 2 (very true or often true) for how true each item has been for the adolescent in the past six months. Youth self-report measures of delinquent behaviors have been found to be reliable in previous studies (Elliott & Huizinga, 1983) and good convergence has been found between the YSR delinquent behavior subscale and adolescent diagnoses of conduct disorder determined by structured interview (Doyle, Mick, & Biederman, 2007).

Delinquency at grades 8 and 9 was operationalized as latent variables created based on youth report of delinquent behaviors (the YSR delinquent behavior subscale) and aggression (the YSR aggression subscale). These measures were significantly correlated for both the grade 8 ($r=.610, p<.01$) and grade 9 ($r=.618, p<.01$) time points, suggesting a latent variable measurement approach was appropriate.

Data Analytic Plan

The independent variable was parent-reported child ADHD symptoms at grade 6, and the dependent variables were self-reported depressive symptoms and delinquent behaviors at grade 9. We created latent variables for the multiple self-report measures of delinquent behavior as described above. We also examined three mediators measured at grade 8: the child's relationship with the mother and father (self-reported perceived social

support/relationship quality with each parent) and the child's friendship with a best friend (self-reported friendship quality and perceived social support). Latent variables were created for the friendship quality mediator, using the multiple self-report measures and the friendship nomination measure. Analyses were conducted using structural equation modeling (SEM) in Mplus (Muthén & Muthén, 2010).

The first aim of the study was to examine the prospective association between attention problems in grade 6 and depressive symptoms and delinquent behavior in grade 9. To achieve this aim, we tested the direct paths from ADHD symptoms to the outcome variables in the mediation models created using Mplus. We also controlled for levels of these grade 9 outcome variables measured at the previous wave (grade 8).

The second aim of the study was to examine whether friendship and parent-child relationship quality in grade 8 mediate the association between childhood ADHD symptoms and maladaptive outcomes in grade 9. To achieve this aim, we examined the indirect paths from ADHD symptoms to each of the outcome variables (depressive symptoms and delinquent behavior at grade 9) through the mediators (quality of the parent-child relationships and friendship at grade 8). We continued to control for levels of these outcome variables as well as the mediators measured at the previous waves. We also tested the goodness of fit for the models.

Results

Analyses were conducted to test a structural model with multiple mediators, in which attention problems in grade 6 were proposed to predict depressive symptoms in grade 9 both directly, and indirectly through quality of relationships with the mother, father, and a best friend in grade 8. A second structural model was also examined, with delinquent behavior in grades 8 and 9, replacing depressive symptoms as the outcome variable.¹ See Table 1 for bivariate correlations between all measures included in the study.

These analyses were conducted using *Mplus* 7 (Muthén & Muthén, 1998-2012). A full information maximum likelihood (FIML) estimation method was used to address missing data, as it provides less biased parameter estimates than other methods (i.e., listwise and pairwise deletion), and is better suited to non-normal data (Little & Rubin, 1994). Indirect effects of grade 6 attention problems on grade 9 depressive symptoms/delinquent behavior through the relationship quality mediators were determined by calculating their confidence intervals, using the bootstrapping procedure recommended by Preacher and Hayes (2008). Bootstrapping procedures are more robust than traditional hypothesis testing methods, as they do not make the assumption of normality (Preacher & Hayes, 2008).

Three fit indices were used to estimate how well the model fit the data: the Comparative Fit Index (CFI; Bentler 1990), the Tucker-Lewis Index (TLI; Tucker and

¹ The originally hypothesized model proposed examining both outcome variables in a multiple outcome, multiple mediator model. However, fit statistics for this model indicated suboptimal fit (CFI=0.88; TLI=0.83; and RMSEA=0.05 [90 % CI=0.05–0.06]), and so the outcomes were examined in separate structural models.

Lewis 1973), and the Root Mean Square Error of Approximation (RMSEA; Steiger 1990). TLI values greater than 0.90 (Hu & Bentler, 1999), CFI values greater than 0.93 (Byrne, 1994) and RMSEA values less than 0.07 (Steiger 1990) suggest good fit.

Model of Depressive Symptoms

To examine the hypothesis that quality of relationships with the mother, father, and friend mediate the association between childhood attention problems and depressive symptoms at the transition to high school, we tested the fit of the proposed structural model, and, given acceptable fit, examined the paths between variables of interest. The grade 9 depression variable was regressed on each of the relationship mediators at grade 8, and on grade 6 attention problems. Mediators were also regressed on grade 6 attention problems. The model controlled for levels of depressive symptoms at the previous time points (i.e., grade 8), and for quality of relationships at grade 6. This allows for examination of the direct and indirect effects above those of depressive symptoms at grade 8 and poor relationship quality at grade 6.

When relationship quality with the father and mother were included as mediators in this multiple mediator model, as proposed based on the initial hypothesis of Aim 2, analyses indicated unacceptable model fit (CFI=0.93; TLI=0.82; and RMSEA=0.09 [90 % CI=0.06–0.11]). Relationship with the mother and relationship with the father were therefore examined in separate structural models for all subsequent analyses. After separating these mediators, fit statistics indicated that both models fit the data well.

Quality of relationships with the mother and a best friend as mediators. Fit statistics for the structural model that included the relationship with the mother and a best

friend indicated good model fit: CFI=0.94; TLI=0.90; and RMSEA=0.06 [90 % CI=0.04–0.08]. See Figure 1 for significance of path estimates for this model.

The bootstrapped estimates of the indirect effect of grade 6 attention problems on grade 9 depression through quality of relationship with the mother (.39, $SE=.13$, $p<.01$, [90 % CI=0.17–0.72]) and a best friend (.36, $SE=.16$, $p=.03$, [90 % CI=0.09–0.63]) at grade 8 were significant, suggesting that the quality of each of these relationships did mediate the association between grade 6 attention problems and grade 9 depression. These results support the hypotheses regarding the mediating effects of these relationships on the association between grade 6 ADHD and depressive symptoms at the transition to high school.

Quality of relationships with the father and a best friend as mediators. Fit statistics for the structural model that included the relationship with the father and a best friend indicated good model fit: CFI=0.94; TLI=0.90; and RMSEA=0.06 [90 % CI=0.04–0.08]. Results revealed no significant direct or indirect effects of grade 6 attention problems on other variables in the model (i.e., relationship mediators, or depressive symptoms at grades 8 and 9). Further, grade 9 depressive symptoms were not predicted by any of the variables in the model, though grade 8 depressive symptoms were predicted by quality of the relationship with a best friend (–.17, $SE=.09$, $p=.05$, [90 % CI=–0.34– –0.03]) and the father (–.14, $SE=.07$, $p=.05$, [90 % CI=–0.25– –0.02]) in grade 6.

Model of Delinquent Behavior

To examine the hypothesis that quality of relationships with the mother, father, and a best friend mediate the association between childhood attention problems and delinquent behavior at the transition to high school, we tested the fit of the proposed

structural model, and, given acceptable fit, examined the paths between variables of interest. The delinquency latent variable at grade 9 was regressed on each of the quality of relationship variables at grade 8, which were in turn regressed on grade 6 attention problems. Grade 9 delinquency was also regressed on grade 6 attention problems. The model also controlled for levels of delinquent behaviors at previous time points (i.e., grades 6 and 8), and for quality of relationships at grade 6.

Similar to the previously described models, when quality of relationship with the mother and the father were included as multiple mediators in the same model, the model did not meet acceptable fit standards. These mediators were therefore examined separately, and two structural models were evaluated.

Quality of relationships with the mother and a best friend as mediators. Fit statistics for the structural model that included the relationship with the mother indicated good fit: CFI=0.95; TLI=0.93; and RMSEA=0.05 [90 % CI=0.03–0.06]. Results revealed no significant direct or indirect effects of grade 6 attention problems on either relationship quality mediator at grade 8, or delinquent behavior at grades 8 or 9. Grade 9 delinquency was also not predicted by either of the relationship quality mediators in grade 8, though grade 8 delinquent behavior was significantly predicted by quality of the relationship with the mother in grade 6 ($-.21, SE=.10, p=.04$, [90 % CI=-0.33– -0.04]).

Quality of relationships with the father and a best friend as mediators. Fit statistics for the structural model that included the relationship with the mother indicated good fit: CFI=0.96; TLI=0.90; and RMSEA=0.06 [90 % CI=0.04–0.07]. Results revealed no significant direct or indirect effects of grade 6 attention problems on either relationship quality mediator at grade 8. Grade 9 delinquency was also not predicted by

either of the relationship quality mediators in grade 8, though grade 8 delinquent behavior was significantly predicted by quality of the relationship with the father in grade 6 ($-.22$, $SE=.08$, $p=.005$, [90 % CI= -0.38 – -0.06]).

Discussion

The purpose of the present longitudinal study was to examine the quality of adolescents' relationships with best friends and parents as potential mediators of the association between childhood attention problems and depressive and delinquent symptoms at the transition to high school. Results indicated that there was a significant indirect effect of childhood attention problems on adolescent depressive symptoms through the quality of relationships with the mother and the best friend. However, the indirect effect of childhood attention problems on adolescent delinquent behavior was not significant through the proposed mediators (quality of relationships with the mother, father, and best friend), nor was the indirect effect of childhood attention problems on adolescent depressive symptoms through the quality of relationship with the father. These results are described in turn.

Consistent with findings of previous studies of typically-developing children (Helsen et al., 2000), the quality of the relationship with a best friend (a latent factor comprised of perceived social support from the best friend, perceived friendship quality, and number of mutual good friendships) significantly predicted lower depressive symptoms at the transition to high school. Further, while the direct path from grade 6 ADHD symptoms to perceived friendship quality in grade 8 did not reach significance, the perceived quality of this friendship did significantly mediate the association between childhood attention problems and depressive symptoms at the transition to high school. This finding suggests that friendship quality may be one mechanism through which childhood ADHD leads to depression in adolescence, and is an important extension of the ADHD literature. The association between ADHD and later depression has been often

replicated in existing studies (Chronis-Tuscano et al., 2010; Meinzer et al., 2013), but the inclusion of peer relationships as potential predictors of this outcome has rarely been explored (see Humphreys et.al., 2013, for an exception). In examining peer relationships as a predictor of later outcomes, the ADHD literature has focused primarily on peer acceptance vs. rejection, which has been shown to be a construct separate from friendship quality (Parker & Asher, 1993a). In fact, studies of community samples have shown that those children who have a high quality, supportive friendship, have better outcomes than those without this type of friendship, even if they experience peer rejection (Hodges, Boivin, Vitaro, & Bukowski, 1999). Given the association between childhood ADHD and social difficulties throughout development, these findings support the inclusion of the construct of friendship in future studies of ADHD and depression.

Interestingly, perceived social support from the father did not emerge as a significant mediator of the association between ADHD and depressive symptoms. Several factors may have contributed to this finding. For example, perhaps gender moderates this mediation effect, such that social support from the father may be more important in linking childhood ADHD to depression in adolescence for boys than for girls. Previous research has indicated that the relationship with the same sex parent may be important in predicting outcomes (Branje, Hale, Frijns, & Meeus, 2010). Unfortunately the present study lacked the power to test the moderating effect of gender on the proposed indirect effects. Alternatively, quality of the relationship with the mother may play a large role for all children (Branje et al., 2010). One limitation of this study is that it does not account for divorce/custody agreements, or single motherhood as factors

that may impact the role of the father in the adolescents' lives. Ideally father involvement would be accounted for when considering the perceived quality of this relationship.

It is also important to note that one inclusion criterion for this study was the presence of a mutual friend on the classroom friendship nominations measure at the grade 6 time point (Bowker et al., 2010). In other words, those who were invited to participate in the laboratory portion of the study (the portion which involved the parent, and therefore also the collection of ADHD symptom data on the CBCL) were required to have mutual friendship between the child and a classmate at his/her school. While missing data in later waves can be accounted for by maximum likelihood estimation in Mplus, this method cannot estimate values for missing data on exogenous variables such as grade 6 ADHD scores. Thus the sample was limited to those who participated in the lab portion of the study in grade 6. This is significant, as children with ADHD are less likely to be accepted by peers, and to have mutual friends in school (Mikami, 2010; Mrug et al., 2012; Normand et al., 2007). The existing sample may therefore be limited in its range of ADHD symptoms (i.e., perhaps those with the most elevated ADHD symptoms were not included in the final sample), or those who were included may be a subset of children with ADHD who were able to form mutual friendships at that age. As a result, the generalizability of these findings to the childhood ADHD population may be impacted. However, as the social difficulties associated with ADHD tend to evolve with time, this limitation may not prevent us from examining those with elevated symptoms of ADHD in childhood whose social difficulties emerged or worsened in adolescence.

While this study does have its limitations, it also has a number of strengths that underscore its contribution to the literature. First, ADHD symptoms were measured

continuously and all participants with data for grade 6 attention problems were considered in the analyses. This method was chosen over other options such as using a cut-off for ADHD symptoms and limiting analyses to a subset of the sample or converting scores to a dichotomous measure reflecting the presence of an ADHD diagnosis. Subthreshold levels of ADHD symptoms alone have been shown to contribute to maladaptive outcomes and impairment (Bussing, Mason, Bell, Porter, & Garvan, 2010; Faraone, Biederman, Spencer, et al., 2006) and research suggests that a more dimensional assessment of ADHD may be superior to the traditional categorical model of the disorder (Marcus & Barry, 2011). Furthermore, the community sample in the current study allows for the examination of a broad range of ADHD symptoms, granting a more comprehensive view of the association between ADHD and the outcomes of interest than would be possible in a more extreme clinical sample.

Second, the data collection time points for the measures of each domain were chosen based on their developmental significance. The outcomes of depressive symptoms and delinquent behaviors were measured at grade 9, as this is an age at which they tend to increase (Moffitt, 1993; Reynolds & Johnston, 1994). Measuring the outcomes of interest at grade 9 also grants a closer look at the transition to high school which has not been previously explored in the ADHD literature. The mediator variables, the parent-child relationships and peer friendship, were measured at grade 8. This allows for a more sound analysis of mediation as these measures of social support and relationship quality precede the measured outcomes by at least one year for all participants. The measure of ADHD symptoms also precedes the mediators for all participants.

Third, analyses tested peer and parent-child relationships as mediators of the association between ADHD and the maladaptive outcomes, rather than as moderators of this association. Mediation analyses attempt to identify the processes that explain the association between a predictor variable and an outcome variable (Muller, Judd, & Yzerbyt, 2005). As a result, the mediator would necessarily be both predicted by childhood ADHD symptoms, and a predictor of the outcome of interest (Baron & Kenny, 1986; Muller et al., 2005; Wu & Zumbo, 2008). The prospective association between ADHD and adolescent depression and delinquent behavior is well-established (Beauchaine et al., 2010; Chronis-Tuscano et al., 2010; Mannuzza, Klein, Abikoff, & Moulton, 2004; Meinzer et al., 2013), as is the association between ADHD and relationship difficulties with peers (Hoza, 2007) and with parents (Johnston & Mash, 2001). These relationship characteristics also contribute to the maladaptive outcomes in ADHD populations (Deault, 2010; Humphreys et al., 2013; Mrug et al., 2012). Therefore, the investigation of peer and parent-child relationship quality as mechanisms through which ADHD leads to depression and delinquency is appropriate.

The null findings of the models predicting delinquent behavior are also informative. As described, mediation analyses provide information about mechanisms which may explain the association between constructs. In the present study, none of the proposed mediators of relationship quality significantly mediated the association between childhood ADHD symptoms and delinquent behavior at the transition to high school. However, previous studies have found links between social support and engagement in delinquent behavior (Claes & Simard, 1992). Perhaps, for those with elevated ADHD symptoms, high quality parent-child relationships and peer friendships act as moderators

(i.e., protective factors) rather than as mechanisms through which ADHD leads to delinquency in adolescence. Indeed, findings from this longitudinal study have shown that gender, ADHD symptoms, and perceived social support from a best friend interact to predict delinquency at the transition to high school, such that boys with elevated ADHD symptoms and low perceived social support from friends were most at risk for engagement in delinquent behavior in grade 9 (LeMoine, Felton, Chronis-Tuscano, & Rubin, 2014). However, while negative parenting and parental monitoring have emerged in the literature as factors predicting conduct problems in children with ADHD (Beauchaine et al., 2010; Beauchaine, Webster-Stratton, & Reid, 2005; LeMoine, Romirowsky, Woods, & Chronis-Tuscano, 2015), the moderating role of perceived social support from the mother and father in predicting this outcome has not yet been examined for this population.

Another important factor to consider when predicting delinquent behavior is that of the adolescent's friend group. For instance, if an adolescent has a high quality friendship with a peer who engages in delinquent behavior, the issue of "deviancy training" (Dishion, McCord, & Poulin, 1999) arises. Indeed, research suggests that those adolescents who are more closely tied to friends who engage in delinquent behavior are more likely to also engage in delinquent behavior themselves (Claes & Simard, 1992). Future research should therefore account for delinquency of the friends when examining friendship as a predicting factor of delinquency in youth with ADHD.

In conclusion, these findings advance the literature implicating the quality of social relationships as an important factor in the development of depressive symptoms among adolescents with elevated attention problems. To our knowledge this is the first

study examining friendship quality rather than peer rejection or acceptance as a mediator of the association between childhood ADHD and depression/delinquency in adolescence. Additionally, this is the first study in the ADHD literature to examine the transition to high school as a developmental focal point for these outcomes. These findings are therefore particularly relevant in the interest of prevention and treatment of depression and delinquent behavior, as results could have implications in targeting future interventions for youth with ADHD at and before the transition to high school.

Tables and Figures

Table 1

Correlations, means, and standard deviations for study variables

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|--------------------------------------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|------|------|
| 1. G9 YSR Aggression | 1.00 | | | | | | | | | | | | | | |
| 2. G9 YSR Delinquency | .61** | 1.00 | | | | | | | | | | | | | |
| 3. G8 YSR Aggression | .65** | .43** | 1.00 | | | | | | | | | | | | |
| 4. G8 YSR Delinquency | .36** | .53** | .62** | 1.00 | | | | | | | | | | | |
| 5. G9 YSR Withdrawn/Depressed | .45** | .31** | .37** | .22** | 1.00 | | | | | | | | | | |
| 6. G8 YSR Withdrawn/Depressed | .33** | .17* | .48** | .32** | .61** | 1.00 | | | | | | | | | |
| 7. G8 NRI Social Support: Mother | -.27** | -.35** | -.25** | -.32** | -.26** | -.24** | 1.00 | | | | | | | | |
| 8. G8 NRI Social Support: Father | -.39** | -.37** | -.28** | -.30** | -.33** | -.27** | .54** | 1.00 | | | | | | | |
| 9. G8 NRI Social Support: Friend | .03 | -.03 | -.12* | -.14* | -.23** | -.26** | .31** | .20** | 1.00 | | | | | | |
| 10. G6 NRI Social Support: Mother | -.26** | -.29** | -.17* | -.09 | -.10 | -.13 | .35** | .29** | .03 | 1.00 | | | | | |
| 11. G6 NRI Social Support: Father | -.21* | -.27** | -.22* | -.18* | -.03 | -.24** | .18* | .53** | -.02 | .55** | 1.00 | | | | |
| 12. G6 NRI Social Support: Friend | .17 | .10 | -.02 | .11 | .02 | -.16 | .06 | .09 | .42** | .19** | .18** | 1.00 | | | |
| 13. G8 FQQ | .03 | -.00 | -.16** | -.14** | -.14 | -.22** | .30** | .19** | .78** | .02 | .04 | .43** | 1.00 | | |
| 14. G6 FQQ | .04 | -.04 | -.02 | .11 | -.12 | -.10 | .10 | .15* | .40** | .19** | .20** | .77** | .45** | 1.00 | |
| 15. G6 CBCL Attention Problems | .14 | .20 | .13 | .15 | .14 | .07 | -.18* | -.06 | -.16 | -.07 | -.02 | -.13* | -.13 | -.07 | 1.00 |
| <i>M</i> | 2.26 | 1.64 | 2.29 | 1.56 | 1.81 | 1.81 | 3.97 | 3.95 | 3.98 | 4.17 | 3.95 | 3.89 | 3.91 | 3.91 | 2.57 |
| <i>SD</i> | 1.06 | 0.89 | 1.05 | 0.84 | 0.60 | 0.56 | 0.60 | 0.75 | 0.69 | 0.56 | 0.67 | 0.63 | 0.66 | 0.63 | 2.91 |
| <i>n</i> | 217 | 217 | 361 | 361 | 217 | 361 | 318 | 313 | 319 | 367 | 358 | 353 | 348 | 355 | 290 |

Note. G=Grade, YSR=Youth Self-Report, NRI=Network of Relationships Inventory, FQQ=Friendship Quality Questionnaire, CBCL=Child Behavior Checklist

* $p < 0.05$ ** $p < 0.01$

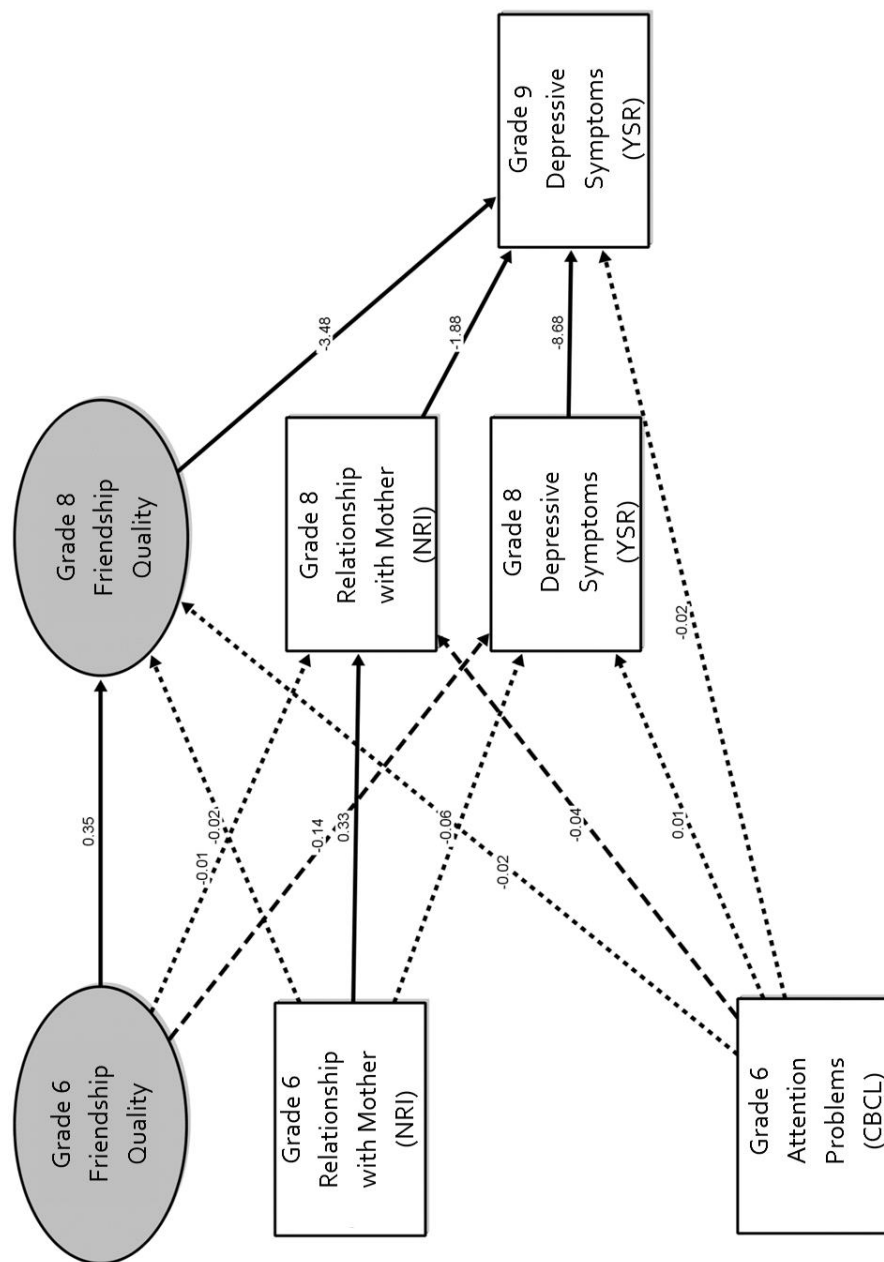


Figure 1. Path

Solid lines represent significant paths at $p < .05$. Bold dotted lined represent paths approaching significance at $p < .10$. Correlated residuals are not shown. G=Grade, YSR=Youth Self-Report, NRI=Network of Relationships Inventory, CBCL=Child Behavior Checklist

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