

ADHD SYMPTOMS PREDICTING CHANGES IN FRIENDSHIP STABILITY AND  
QUALITY OVER TIME

by

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## **ABSTRACT**

Research has identified friendship and friendship quality as important variables in predicting positive outcomes concurrently and longitudinally for children and adolescents. This work has identified friendship as a developmental construct that changes over time; however, not all children develop these abilities at the same rate, and some children struggle in navigating the social world. In particular, children with ADHD present with difficulty obtaining and maintaining friendships beginning in childhood and extending through young adulthood. Current literature has identified these difficulties but has yet to examine how friendship stability and quality may change over time for children with ADHD symptoms. The present study sought to explore the stability of friendships over time and the growth of friendship quality over time. In particular, we were interested in how the presence of ADHD symptoms predicts both friendship stability and friendship quality over time. It was hypothesized that children with more ADHD symptoms would show less friendship stability over time and a slower rate of development of friendship quality over time relative to children with fewer ADHD symptoms. ADHD symptoms were not a significant predictor of friendship social support over time, but they were a significant predictor of friendship negative interactions over time.

## **DEDICATION**

This thesis is dedicated to everyone who helped me and guided me through the creation of this manuscript. In particular, I would like to recognize and thank my family and close friends for their support throughout the time taken to complete this manuscript.

## LIST OF ABBREVIATIONS AND SYMBOLS

$\alpha$	Cronbach's alpha, an index of internal consistency
ADHD	Attention-deficit/hyperactivity disorder
BASC	Behavioral Assessment System for Children
BRIEF	Behavior Rating Inventory of Executive Function
$M$	Mean: the sum of a set of measurements divided by the number of measurements in the set
MLE	Maximum Likelihood Estimation
$p$	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
$r$	Pearson product-moment correlation
SD	Standard Deviation
<	Less than
>	Greater than
=	Equal to

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## **CHAPTER 1**

### **INTRODUCTION**

Friendship and friendship closeness are important for children's social and emotional development and are associated with a range of short- and long-term outcomes, such as engagement in class at school (Berndt & Keefe, 1995), school achievement (Ladd, Kochenderfer, & Coleman, 1996), reduced loneliness (Berndt & Keefe, 1995; Nangle, Erdley, Newman, Mason, & Carpenter, 2003; Parker & Asher, 1993), fewer internalizing and externalizing problems (Hymel, Rubin, Rowden, & LeMare, 1990), self-esteem (Franco & Levitt, 1998), and positive adjustment (Rubin, Bukowski, & Parker, 2006). Friendship is a mutual relationship based on reciprocity (Bagwell, Schmidt, Newcomb, & Bukowski, 2001) and has been operationally defined as a relationship where both parties confirm that a friendship exists, agree that the relationship is mutual in nature, and enjoy each other's company. Additionally, the primary motivation is not for personal gain, and the relationship is completely voluntary (Rubin, Bukowski, & Bowker, 2015). Research has identified key friendship functions including support, validation, serving as examples for future relationships, and giving children another place outside of the family to learn and explore their environment and their social world (Rubin, Fredstrom, & Bowker, 2008).

Most children describe friendships as relationships with reciprocity or as a mutual relationship (Bukowski & Hoza, 1989), although that definition changes somewhat over time. For example, children in early and middle childhood characterize friends as partners to play with; children in late childhood describe friendship as helping each other out, loyalty, and having

shared values; early adolescents identify shared interests, working to understand each other and sharing more intimate things about themselves as characteristics of friendship (Bukowski & Hoza, 1989; Schneider & Tessier, 2007). Researchers have not yet discovered the mechanisms for the change in developmental concepts of friendship; however, some have hypothesized that certain factors may explain developmental differences, such as changes in perspective taking (Selman & Schultz, 1990), shifts in understanding of reciprocity (Youniss, 1980), and cognition and understanding of relationships that develop from more social experiences and changes in social needs (Rubin, Fredstrom, & Bowker, 2008). Notably, friendships tend to be less stable across transition periods; thus, considering the developmental context is important in this area (Meter & Card, 2016).

Close friendship is essential in peer predicting victimization and social maladjustment in children (Bagwell & Schmidt, 2011; Ladd, Kochenderfer-Ladd, Eggum, Kochel, & McConnell, 2011) and is related to higher levels of self-esteem, lower reports of loneliness, and higher levels of engagement in school (Erath, Flanagan, & Bierman, 2008). Further, it has been shown to act as a buffer for peer victimization and is related to internalizing and externalizing problems (Erath, Flanagan, & Bierman, 2008). Those children who are friendless tend to have higher levels of anxiety, depression, loneliness, and are rated by peers, teachers, and parents as being more deficient in social skills (Bowker et al., 2010; Ladd & Troop-Gordon, 2003). Interestingly, even the brain structures of children with mutual best friends differ from those who do not have a mutual friend, according to a neuroimaging study examining peer relations in children with severe traumatic brain injury (Yeates et al., 2013).

Beyond predicting concurrently, close friendship has also been shown to predict psychopathology, delinquency, and overall life adjustment in adulthood (Bagwell, Newcomb, &

Bukowski, 1998; Marton, Wiener, Rogers, & Moore, 2015). Research has shown that having a mutual friend at age 10 predicted self-worth at age 23 (Bagwell et al., 1998). In assessing the quality of children's friendships, positive aspects of friendships (e.g., validation, companionship, intimacy) have been found to predict longitudinal levels of loneliness, depression, anxiety, peer victimization, and academic adjustment (Nangle et al., 2003). Best friendships appear to have the most stability when children reported more commitment, satisfaction, and investment in the relationship (Branje, Frijns, Finkenauer, Engels, & Meeus, 2007), when both children were lower in aggression and victimization (Hektner, August, & Realmuto, 2000; Bowker, Rubin, Burgess, Booth-LaForce, & Rose-Krasnor, 2006), and when children were of the same sex and race (Ellis & Zaratany, 2007; McDonald et al., 2013).

Children who experienced peer-rejection, the process measured by how the peer group likes a child, in elementary school were shown to have more externalizing problems, delinquency, attentional problems, and substance abuse problems in high school (Juvonen & Gross, 2005; Prinstein, Rancourt, Guerry, & Browne, 2009). Even when baseline aggression and externalizing problems were controlled, early peer rejection (1<sup>st</sup> grade) still predicted later antisocial behavior (3<sup>rd</sup> and 4<sup>th</sup> grade; Miller-Johnson, Coie, & Maumary-Gremaud, & Bierman, 2002). Researchers have suggested a developmental pathway in peer rejection in which early peer rejection leads to more negative information processing, which further leads to aggressive responses (Dodge et al., 2003).

Taken together, it is critical to address friendship and peer difficulties in children to promote more positive development and adjustment (Mikami, 2010; Parker & Asher, 1987).

## **Attention-Deficit/Hyperactivity Disorder and Friendship**

As reviewed above, friendship is an important factor for all children; however, there are some children who may struggle more within the social domain than others. About 50-80% of children with attention-deficit/hyperactivity disorder (ADHD) experience social difficulties, and much of the research to date has focused on social skills deficits (Huang-Pollock, Mikami, Piffner, & McBurnett, 2009; Uekerman et al., 2010) and peer rejection (Bagwell et al., 2001; Hinshaw & Melnick, 1995; Hoza, 2007; Wiener & Mak, 2009). More recent studies have examined close friendships in the context of ADHD and those with ADHD symptoms (Glass, Flory, Martin, & Hankin, 2011; Marton et al., 2015; Normand et al., 2013).

Regarding the characteristics of friendship in children with ADHD, researchers have found that children with ADHD tend to have fewer close friends and more difficulty maintaining friendships (Bagwell et al., 2001; Barkley et al., 2006; Marton et al., 2015). One study that examined trajectories of friendship in children with ADHD showed that friends of children with ADHD reported worse friendship quality and more conflict. Consequently, it is more common for children with ADHD to experience more loss of friendship than their typically developing peers (Normand et al., 2013). On average, the friendships of children with ADHD last 9-14 months shorter than typical children's friendships, which highlights the differences in stability of their friendships (Marton et al., 2015). Children with ADHD spend less time with their friends outside of school, although they do not differ on the amount of contact with friends over the phone (Marton et al., 2015). Additionally, they tend to have friends with more ADHD symptoms and oppositional behavior. Some suggest this is because they have common interests such as sensation-seeking activities or because both children may lack age-appropriate social behavior needed for typical friendships (Normand et al., 2011). In peer nomination tasks, children with

ADHD did not nominate fewer people as friends but fewer of their friends were verified by parents or teachers, when compared to typically developing children (Heiman, 2005; Marton et al., 2015). In negotiation tasks with friends, children with ADHD presented more selfish and insensitive proposals and showed more dominance in the relationship compared to typically developing children (Normand et al., 2011).

Friendship intimacy has emerged as another important variable in peer relations and predicts less peer victimization and better social adjustment (Bagwell & Schmidt, 2011; Ladd et al., 1996). Friendship intimacy was found to moderate the relation between ADHD symptoms and teacher-rated social problems during a one-year follow-up study controlling for baseline social problems, such that the relation between ADHD symptoms and social problems was not significant for children who reported higher friendship intimacy (Becker, Fite, Luebbe, Stoppelbein, & Greening, 2013). This may be one aspect that can be targeted in interventions to help in the maintenance of friendships for children with ADHD (Becker et al., 2013).

Social difficulties appear to persist for children with ADHD into adolescence and young adulthood (Bagwell et al., 2001; Barkley, Fischer, Smallish, & Fletcher, 2006). In fact, childhood ADHD predicts more social impairment and peer rejection into adolescence even when adolescents no longer meet the diagnostic criteria for ADHD (Bagwell et al., 2001; Lee & Hinshaw, 2006; Lee, Lahey, Owens, & Hinshaw, 2008). One study with girls with ADHD found that five years later childhood ADHD predicted more peer rejection, fewer close friendships, difficulty maintaining friends, and less involvement in conventional activities with friends (e.g., school or community activities) in adolescence and young adulthood (Bagwell et al., 2001; Barkley et al., 2006). Similarly, another study found that most girls with ADHD still had difficulty with social problems and peer acceptance in adolescence (Owens, Hinshaw, Lee, &

Lahey, 2009). Children who no longer meet *DSM-5* criteria for ADHD in adolescence still show significant impairment in social and peer functioning domains (Lee et al., 2008).

While these studies have examined social impairments over time, very few studies have examined friendship stability or friendship quality changes over time. Only one study to date has examined friendship characteristics in children with ADHD over time, but only had two time points spanning 6 months (Normand et al., 2013). Additional studies are needed with longer timeframes and multiple friendship indicators.

### **Current Study**

The proposed study sought to further previous research by examining mutual friendships and friendship quality over a longer period of time and examining how symptoms of ADHD predict friendship stability concurrently and friendship quality over time. First, we examined concurrent relations among demographic variables (e.g., age, gender), ADHD symptoms, externalizing symptoms, and friendship quality. We predicted that ADHD symptoms and externalizing problems would be related to lower levels of friendship quality. Second, we planned to examine friendship stability from 5<sup>th</sup> grade to 6<sup>th</sup> grade by examining the stability of a mutual friendship over time. We predicted that ADHD symptoms would uniquely predict less friendship stability over time after controlling for covariates (including externalizing problems). Finally, we examined friendship quality changes from 5<sup>th</sup> grade through the high school years. Based on past research, we hypothesized that friendship social support would increase over time across all participants, but we predicted that ADHD symptoms would uniquely predict less growth in friendship social support over time after controlling for key covariates (e.g., age, gender, externalizing problems). Similarly, we predicted friendship negative interactions would decline over time across all participants, but that ADHD symptoms would uniquely predict a less

steep decline of negative interactions over time. We examined symptoms of ADHD as a continuous variable, and in doing so, had more variability in prediction compared to studies that have examined such symptoms as a categorical variable (e.g., a diagnosis of ADHD).

## CHAPTER 2

### METHOD

#### Participants

The current study used participants who were recruited from the Washington D.C. Metropolitan Area who took part in a larger longitudinal study about friendships. Adolescents participated in multiple time points spanning the fall of fifth grade through twelfth grade. Those who nominated a mutual best friend were recruited to participate in lab tasks with their best friend. Data were gathered in the 5<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, and 12<sup>th</sup> grades across one to three cohorts (n = 148). Friendship stability was only assessed from the 5<sup>th</sup> to 6<sup>th</sup> grade (n = 653). The sample was comprised of 47.8% male participants. Mothers and fathers' highest level of education ranged from Elementary School (2.3% and 2.8%, respectively) to obtaining a Graduate degree (27.8% and 31.1%, respectively), with the majority of mothers and fathers reporting that they completed a University degree (29.7% and 29.5%, respectively).

#### Measures

**Demographics.** Child gender and age were collected and included as covariates in the main analyses. Their parents' highest level of education was also collected to describe the sample.

**Friendship Stability.** Children were asked to nominate their "very best friend" and their "second best friend." The friends had to be of the same sex and in their grade in school. Mutual friendships were identified if their friend also rated the participant as their very best or second best friend (Parker & Asher, 1993). These mutual friendships were examined to measure

friendship stability over time from 5<sup>th</sup> grade to 6<sup>th</sup> grade. A friendship stability variable was created to reflect whether or not each participant maintained at least one mutual friend across 5<sup>th</sup> and 6<sup>th</sup> grade (i.e., 1 = stable; 0 = not stable).

**Relationship Quality.** Children completed the Network of Relationships Inventory (NRI; Furman & Buhrmester, 1985) which measured their perception of their relationship with their best friend, mother, and father. It assesses 12 positive and negative qualities of relationships: companionship, conflict, instrumental help, satisfaction, intimacy, nurturance, affection, punishment, admiration, power, reliability, and social support. Composite variables were created to represent two factors from the 12 scales: Social Support and Negative Interactions. The NRI has been shown to be a reliable measure of relationship quality ( $\alpha = .80$ ; Furman, 1996). Participants completed this measure every year of data collection (5<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup>, 12<sup>th</sup> grade). For the current study, we only considered ratings about the child's best friend.

**Child Behavior Checklist (CBCL/6-18; Achenbach & Rescorla, 2001).** The CBCL/6-18 is a 113-item questionnaire that assesses problem behaviors and competencies in youth between 6 and 18 years old. Items are rated on a scale of 0-2 (0 = never true, 1 = sometimes true, and 2 = often true) and are completed by the primary caretaker. This study considered the Attention Problems construct which is made up of seven items reflecting inattention and hyperactivity/impulsivity (e.g., "can't concentrate", "can't sit still"). This construct has been shown to have strong internal consistency ( $\alpha = .86$ ; Achenbach & Rescorla, 2001) and convergent and discriminant validity for identifying children with ADHD (Chen, Faraone, Biederman, & Tsuang, 1994; Pelham, Fabiano, & Massetti, 2005). The current study also used the Externalizing Problems subscale (e.g., "gets in many fights") as a covariate in the final

analyses to control for this domain, a common correlate of ADHD symptoms and friendship problems.

### **Data Analysis Plan**

**Preliminary Analyses.** Data were screened for outliers and distributional characteristics. Zero-order correlations were run among all variables to examine bivariate relationships and check for collinearity.

**Main Analysis.** Zero-order correlations were first explored among our variables of interest. As noted earlier, it was predicted that Attention Problems and Externalizing Problems would correlate with less friendship social support and more negative interactions at Time 1 (i.e., 5<sup>th</sup> grade).

To examine friendship stability from 5<sup>th</sup> grade to 6<sup>th</sup> grade, a logistic regression was initially proposed for predicting stability (i.e., coded as 0 = not stable and 1 = stable) using our predictor variables of interest (i.e., age, gender, Externalizing Problems, Attention Problems). A composite variable for friendship stability was created to represent whether or not each participant had at least one mutual friend from 5<sup>th</sup> to 6<sup>th</sup> grade. We calculated a stability variable in which participants received a 1 if they had at least one mutual friend maintained from 5<sup>th</sup> grade to 6<sup>th</sup> grade and a 0 if they did not. Coding this variable resulted in a sample size of 205 participants. However, when examining these data along with the CBCL Attention Problems data, we found that there were not enough participants to run a logistic regression ( $n = 10$ ). Instead, we reported on the descriptive data from the friendship stability variables.

For our second set of analyses on friendship quality, a growth curve modeling approach was used to examine trajectories of friendship quality. Maximum likelihood estimation (MLE) was used to estimate missing data for the growth curve analysis and is an accepted method for

estimation (Garson, 2013). First, we entered the variables without predictors to examine the unconditional growth model in which both the intercepts and slopes can vary. Then, the predictors were added to examine their impact on intercepts and slopes. The final model was tested with age, gender, CBCL Externalizing Problems, and CBCL Attention Problems entered as variables in the prediction of NRI intercepts and slopes over time. Separate analyses were conducted for each of the two friendship quality domains (i.e., Social Support, Negative Interactions) as the dependent variable

## CHAPTER 3

### RESULTS

#### Data Analysis

Preliminary data analyses examined distributional characteristics and outliers using SPSS statistical software. We did not find any atypical distributional characteristics or significant outliers. Thus, we did not need to correct for any outliers or abnormal distributions. We examined descriptive statistics and correlations among the study variables. The descriptive statistics and bivariate correlations are reported in Table 1. Bivariate correlations revealed age was only correlated with social support at grade 8 ( $r = -.24, p < .05$ ) and grade 12 ( $r = -.31, p < .05$ ), showing that younger participants at each of these time points demonstrated more social support. Gender was significantly correlated with social support across all time points except 12<sup>th</sup> grade; in all these cases, girls tended to have better social support compared to boys. Attention Problems in 5<sup>th</sup> grade was positively correlated with Externalizing Problems in 5<sup>th</sup> grade ( $r = .56$ ) and negative interactions in 5<sup>th</sup> grade ( $r = .26$ ). It was also negatively correlated with social support in 12<sup>th</sup> grade ( $r = -.46$ ) indicating that more attention problems related to less social support in 12<sup>th</sup> grade. Externalizing Problems in 5<sup>th</sup> grade was negatively related to social support in 5<sup>th</sup> grade ( $r = -.20$ ) and positively related to negative interactions in 8<sup>th</sup> grade ( $r = .41$ ). Unsurprisingly, social support in 5<sup>th</sup> grade was negatively related to negative interactions in 5<sup>th</sup> grade ( $r = -.17$ ). It was also positively correlated with social support in 6<sup>th</sup> grade ( $r = .61$ ) and 8<sup>th</sup> grade ( $r = .55$ ). Negative interactions at 5<sup>th</sup> grade related to more negative interactions in 6<sup>th</sup> grade ( $r = .42$ ). Social support in 6<sup>th</sup> grade was negatively related to negative interactions in 6<sup>th</sup>

grade ( $r = -.17$ ) and 8<sup>th</sup> grade ( $r = -.22$ ), and was positively related to social support in 8<sup>th</sup> grade ( $r = .42$ ). Negative interactions in 6<sup>th</sup> grade was only related to negative interactions in 8<sup>th</sup> grade ( $r = .32$ ). Social support in 8<sup>th</sup> grade was positively related to social support in 9<sup>th</sup> grade ( $r = .63$ ) and 12<sup>th</sup> grade ( $r = .45$ ). Surprisingly, social support in 8<sup>th</sup> grade was positively related to negative interactions in 9<sup>th</sup> grade ( $r = .48$ ). Negative interactions in 8<sup>th</sup> grade was positively related to negative interactions in 9<sup>th</sup> grade ( $r = .34$ ) and 12<sup>th</sup> grade ( $r = .33$ ). Social support in 9<sup>th</sup> grade interestingly was positively related to negative interactions in 9<sup>th</sup> grade ( $r = .71$ ) and social support in 12<sup>th</sup> grade ( $r = .53$ ). Negative interactions in 9<sup>th</sup> grade was related to social support ( $r = .45$ ) and negative interactions ( $r = .26$ ) in 12<sup>th</sup> grade. All other variables indicated in Table 1 did not demonstrate significant correlations ( $ps > .05$ ).

Table 1.  
Zero-order correlation, means, and standard deviations.

	N	M (SD)	Min.- Max.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	269	10.34 (.53)	9-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Gender	268	1.52 (.50)	1-2	-.01	-	-	-	-	-	-	-	-	-	-	-	-	-
3. CBCL Attention Problems (5 <sup>th</sup> grade)	148	2.91 (3.31)	0-16	.08	-.03	-	-	-	-	-	-	-	-	-	-	-	-
4. CBCL Externalizing Problems (5 <sup>th</sup> grade)	148	6.07 (5.20)	0-23	-.04	-.03	.56*	-	-	-	-	-	-	-	-	-	-	-
5. NRI SSP (5 <sup>th</sup> grade)	164	3.95 (.64)	2.19- 5	.03	.27*	-.10	-.20*	-	-	-	-	-	-	-	-	-	-
6. NRI NGI (5 <sup>th</sup> grade)	164	1.75 (.52)	1- 4.17	.001	-.01	.26*	.16	-.17*	-	-	-	-	-	-	-	-	-
7. NRI SSP (6 <sup>th</sup> grade)	319	3.90 (.63)	1.81- 5	.19	.31*	-.02	-.03	.61*	.10	-	-	-	-	-	-	-	-
8. NRI NGI (6 <sup>th</sup> grade)	319	1.66 (.51)	1-4	.11	.03	-.10	-.17	-.18	.42*	-.17*	-	-	-	-	-	-	-
9. NRI SSP (8 <sup>th</sup> grade)	352	4.00 (.57)	1.86- 4.95	-.24*	.41*	-.07	-.10	.55*	.01	.42*	-.09	-	-	-	-	-	-
10. NRI NGI (8 <sup>th</sup> grade)	353	1.67 (.55)	1- 4.75	.11	-.12	.05	.41*	-.18	-.004	-.22*	.32*	-.05	-	-	-	-	-
11. NRI SSP (9 <sup>th</sup> grade)	299	3.48 (.50)	1.90- 4.57	.06	.54*	-.29	.06	.31	.19	.05	.09	.63*	.15	-	-	-	-
12. NRI NGI (9 <sup>th</sup> grade)	299	2.80 (.51)	1-4	-.30	.20	-.45	.13	.02	-.09	.003	.13	.48*	.34 *	.71*	-	-	-
13. NRI SSP (12 <sup>th</sup> grade)	195	3.90 (.62)	1.67- 4.86	-.31*	.27	-.46*	-.22	.15	-.19	.20	-.10	.45'	-.07	.53*	.45 *	-	-
14. NRI NGI (12 <sup>th</sup> grade)	196	1.63 (.49)	1- 3.17	.13	.13	-.08	.004	-.35	-.26	-.08	.10	.05	.33 *	.16	.26 *	.004	-

\* =  $p < .05$ . Gender was coded 1 = male, 2 = female. SSP = social support. NGI = negative interactions.

## Main Data Analyses

First, we examined the friendship stability variable within our sample. We found that 165 participants (80.5%) maintained at least one mutual friend from 5<sup>th</sup> to 6<sup>th</sup> grade. On the other hand, 40 participants (19.5%) did not maintain a mutual friend across this time. Due to the small sample size when combining this variable with CBCL Attention Problems ( $n = 10$ ), we could not utilize the proposed logistic regression approach or even a correlational analysis.

Next, we investigated change in friendship social support and negative interactions over time. We utilized latent growth curve analyses with maximum likelihood estimation (MLE) to correct for missing data. This approach, using individual growth curves, hypothesizes the outcome variable for each individual is a function of time with error. This individual growth trajectory is a linear function of time with an intercept and a slope, which are unknown growth parameters. Both the intercept and the slope characterize the growth over time. The intercept represents the starting point of the trajectory, while the slope illustrates the rate at which change occurs over time.

We used growth curve modeling to investigate change in friendship social support and negative interactions over time with predictors to take into account individual differences in change over time. The longitudinal analyses were performed in Mplus with MLE using robust standard errors to handle missing data (Garson, 2013). First, we examined change in social support over time without predictors (i.e., unconditional growth model) in which we investigated a linear trajectory. The intercepts and slopes were allowed to vary. In this model, the estimated linear slope was not significant, indicating there was not a significant change over time (Estimate =  $-.02$ ,  $p = .11$ ). There was, however, significant variance in the intercept and slope ( $ps < .05$ ). We also tested the unconditional growth model with a quadratic term. We found the linear slope

(Estimate = 4.003,  $p < .001$ ) and the quadratic slope (Estimate = .02,  $p < .001$ ) were both significant. In the model with the quadratic term, there was significant variance in the intercept but not within the slope. Direct model comparison was not possible with a chi squared test due to the level of missing data. Considering the quadratic term was significant, we carried the quadratic effect into the following models. See Figure 1 for a visual display of social support changes over time.

We continued with our proposed analyses by adding age, gender, attention problems, and externalizing problems as predictors. Child gender was the only significant predictor of intercept (Estimate = .33,  $p < .001$ ). Gender was significantly related to greater social support in that girls rated their friendships as having more social support in 5<sup>th</sup> grade. There were no significant predictors of linear or quadratic slope with age, gender, attention problems, and externalizing problems in the model. Given that externalizing problems and attention problems were related, we tried running the model with these predictors separately. The results remained the same as reported above. Thus, as previously proposed, our final model included both attention problems and externalizing problems as predictors. See Tables 2 and 3 for the full model results.

Table 2.  
*Estimates for the social support model without predictors*

Means	Estimate	Significance
Intercept	4.003	< .001
Linear Slope	-.14	< .001
Quadratic Slope	.02	< .001
<hr/>		
Variances		
Intercept	.38	< .001
Linear Slope	.04	.12
Quadratic Slope	.000	.997

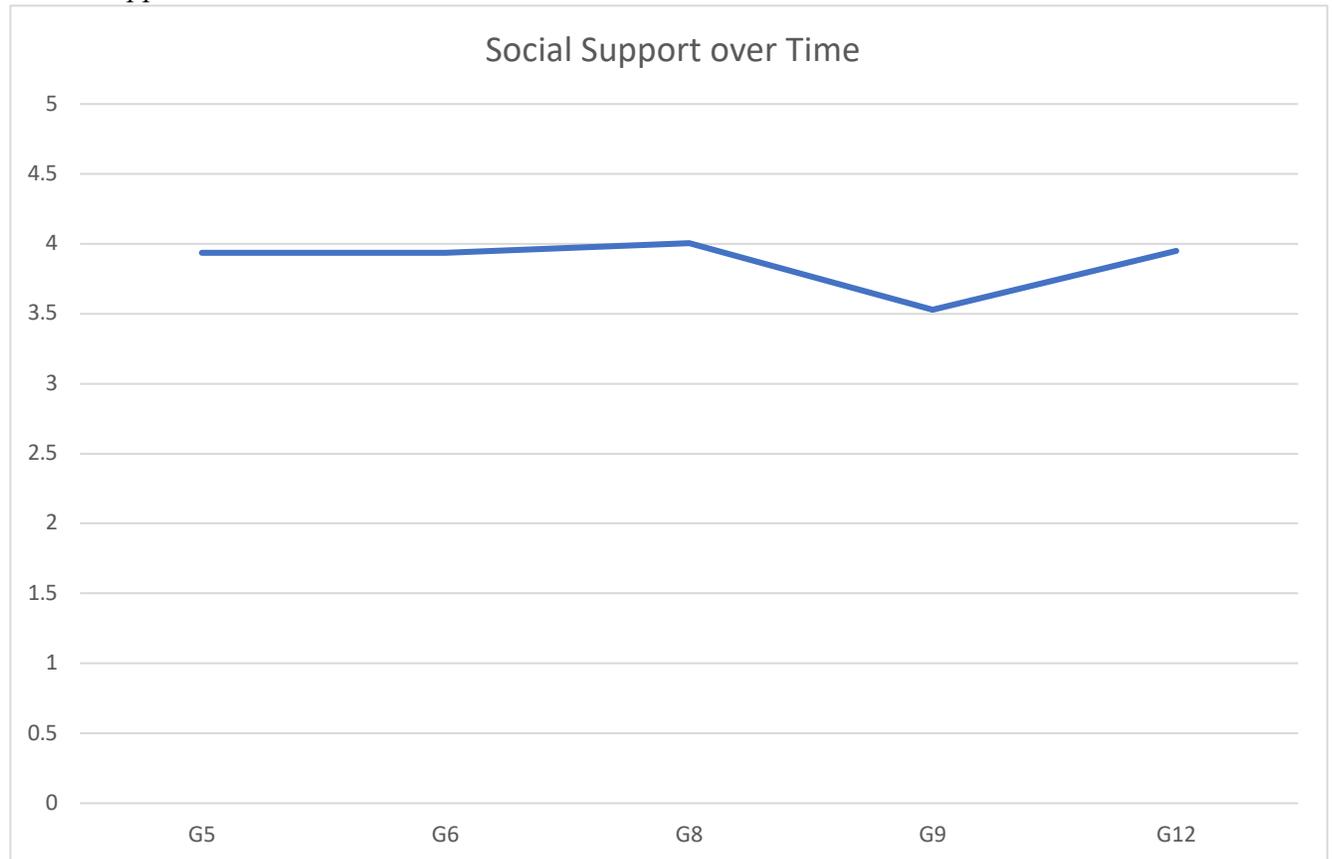
Table 3.

*Estimates for the social support model with predictors*

Intercept on	Estimate	Significance
Child age	.04	.62
Child sex	.33	.001
Attention Problems 5 <sup>th</sup> grade	.000	.99
Externalizing Problems 5 <sup>th</sup> grade	-.02	.06
<b>Linear Slope on</b>		
Child age	.03	.69
Child sex	.04	.54
Attention Problems 5 <sup>th</sup> grade	.002	.86
Externalizing Problems 5 <sup>th</sup> grade	.01	.67
<b>Quadratic Slope on</b>		
Child age	-.02	.35
Child sex	-.01	.36
Attention Problems 5 <sup>th</sup> grade	-.001	.68
Externalizing Problems 5 <sup>th</sup> grade	.000	.97

Figure 1.

*Social Support Growth over Time*



Secondly, we examined change in negative interactions over time without predictors (unconditional growth model) and hypothesized a decreasing linear trajectory. In this model, the intercepts and the slopes were allowed to vary. The estimated linear slope was not significant (Estimate =  $-.004$ ,  $p = .63$ ), suggesting there was not a significant change in negative interactions over time. However, the intercept was significant (Estimate =  $1.76$ ,  $p < .001$ ) and there was significant variance within the intercept and slope ( $ps < .05$ ). We then tested the unconditional growth model with a quadratic term. These results revealed a significant linear (Estimate =  $.13$ ,  $p = .003$ ) and quadratic slope (Estimate =  $-.02$ ,  $p = .003$ ). This model also showed significant variance within the intercept ( $ps < .05$ ). We initially elected to keep the significant quadratic term due to the nonsignificant linear term in the first model. We attempted to run the quadratic model with predictors, but the model did not converge. We adjusted various parameters to try and resolve the convergence issue, but our attempts were unsuccessful. Thus, we reported the results from the linear model with the predictors (age, sex, externalizing problems, and attention problems) that converged. None of the predictors were significant in this model. Attention problems appeared to be trending in the expected direction for both intercept (Estimate =  $.04$ ,  $p = .08$ ) and slope (Estimate =  $-.01$ ,  $p = .053$ ). We again considered that attention problems and externalizing problems were too highly correlated and ran a separate model excluding externalizing problems. In this model, child age and child sex remained nonsignificant, but attention problems emerged as a significant predictor of intercept (Estimate =  $.04$ ,  $p = .02$ ) and slope (Estimate =  $-.01$ ,  $p = .048$ ). Greater attention problems in 5<sup>th</sup> grade were related to more negative interactions in 5<sup>th</sup> grade. In relation to slope, although negative interactions declined over time for the group of participants, attention problems were associated with a less steep decline in negative interactions over time. The full model results are in Tables 4 and 5. See

Figure 2 for a visual display of negative interactions change over time and Figure 3 for both social support and negative interactions graphed together.

Table 4.

*Estimates for the negative interactions model without predictors*

Means	Estimate	Significance
Intercept	1.74	< .001
Linear Slope	-.004	.63
Variances		
Intercept	.16	< .001
Linear Slope	.009	.01

Table 5.

*Estimates for the negative interactions model with predictors*

Intercept on	Estimate	Significance
Child age	-.04	.66
Child sex	-.04	.61
Attention Problems 5 <sup>th</sup> grade	.04	.02
Linear Slope on		
Child age	.03	.56
Child sex	-.01	.70
Attention Problems 5 <sup>th</sup> grade	-.01	.048

Figure 2.  
*Negative Interactions Growth over Time*

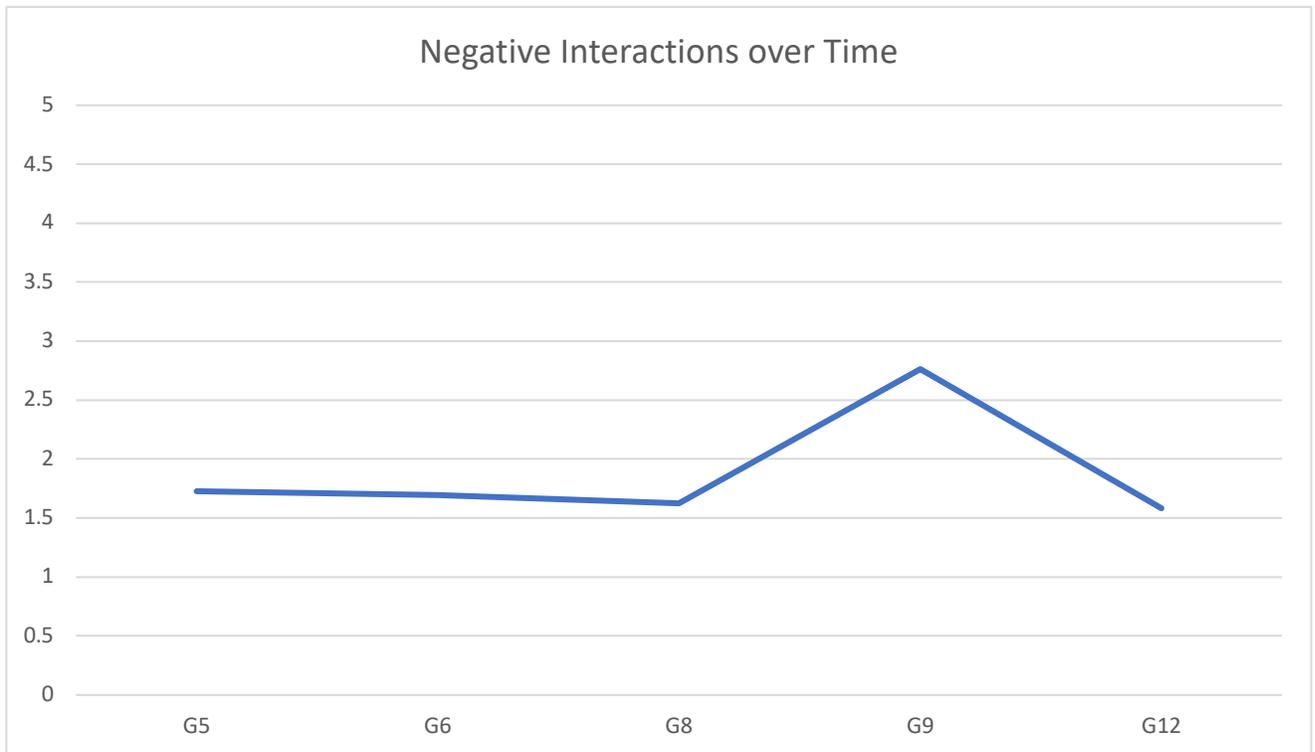
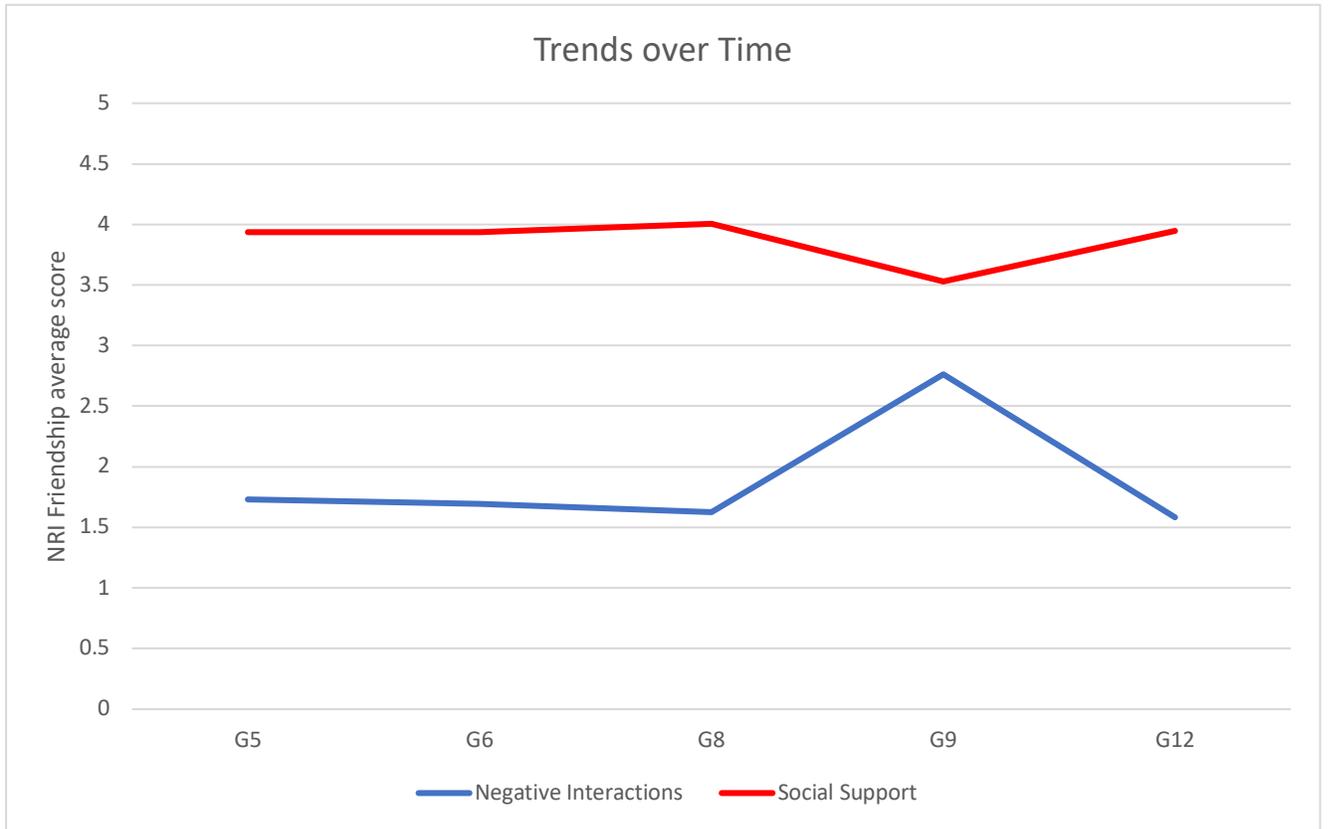


Figure 3.  
*Social Support and Negative Interaction Growth over Time*



## CHAPTER 4

### DISCUSSION

Previous literature has indicated that friendship quality and stability are important in predicting positive outcomes for children and adolescents (Bagwell & Schmidt, 2011). Further, children with ADHD have been shown to have more difficulty in obtaining and maintaining friendships (Marton et al., 2015; Normand et al., 2013). However, studies have not shown how friendship characteristics may change over time in children with ADHD symptoms. The current study sought to explore this by examining the role of ADHD symptoms in predicting friendship stability and examining changes in the quality of friendships when considering ADHD symptoms. We predicted that children with more symptoms of ADHD would be less likely to show friendship stability. We also predicted children with more ADHD symptoms would show a slower rate of increasing social support over time and a slower rate of decreasing negative interactions over time.

Our first question of friendship stability was examined descriptively rather than with regression analyses due to missing data. Thus, we were unable to examine the role of ADHD symptoms in the prediction of friendship stability. We found that the majority of adolescents who participated in the friendship nomination task maintained at least one mutual friend from 5<sup>th</sup> to 6<sup>th</sup> grade. This is somewhat inconsistent with previous research indicating difficulty in maintaining friendships across transition periods, such as middle school (Meter & Card, 2016). Future studies need to examine this construct in a larger sample to further evaluate the relation

between friendship stability and ADHD symptoms, especially given children with ADHD tend to maintain friendships for shorter periods of time (Marton et al., 2015).

Correlational analyses revealed that although ADHD symptoms were not related to social support in 5<sup>th</sup> grade, there appeared to be an increasing relationship over time with a significant relation in 12<sup>th</sup> grade. This may suggest that ADHD symptoms appear more normative in friendships when children are younger but become more impactful as children age and their friendships change (Rubin, Fredstrom, & Bowker, 2008). Additionally, ADHD symptoms were related to more negative interactions in 5<sup>th</sup> grade but were not significantly related to negative interactions at future time points according to correlational analyses.

We predicted that children with more ADHD symptoms would be slower in developing social support over time. Our results indicated that ADHD symptoms were not a significant predictor of slope in this model. We considered the possibility that ADHD symptoms were too highly correlated with externalizing problems and thus ran separate models with only attention problems or externalizing problems. We found that either way, ADHD symptoms were not a significant predictor of the change in slope of social support. It was surprising that ADHD symptoms were not a significant predictor of change in slope because research has suggested children with ADHD often show more dominance in friendships and less friendship intimacy (Becker et al., 2013; Normand et al., 2011). However, it may make more sense when considering there was not much variance in slope within this sample. Although it was not a predictor in this model, ADHD symptoms were significantly related to social support in 12<sup>th</sup> grade indicating ADHD symptoms may still be important to consider. Gender emerged as a significant predictor of social support intercept, indicating that girls tend to show greater social support than boys in

5<sup>th</sup> grade. This aligns with previous research showing girls more often exhibit social support in peer relationships (Rose & Rudolph, 2006).

Similarly, we predicted that children with more ADHD symptoms would be slower in decreasing negative interactions over time. Our results revealed that ADHD symptoms were a significant predictor of slope in the final model. These results supported our hypotheses. Children with more ADHD symptoms in 5<sup>th</sup> grade tended to show less of a decrease in negative interactions over time. Although we were unable to run the quadratic model, it would be interesting to see if the data better fit a quadratic term with the predictors. The current results suggest that children with more ADHD symptoms tend to have more negative interactions, which has been found cross-sectionally (Normand et al., 2011). However, the difficulties they experience may also become more developmentally nonnormative as they become older and the goals and ideas about friendships shift.

Taken together, our results somewhat supported our hypotheses. There are many possible reasons for the results we found in this study. It may be that ADHD symptoms are not as strong of a predictor of change in friendship quality over time or this sample did not provide enough variance in ADHD symptoms to fully explore this question.

Our analyses used well studied methods to handle missing data; however, this is still considered a limitation of this study. We used maximum likelihood estimation which uses trends in the available data to estimate missing data. In this way, the data which is predicted tends to be similar to that of the other data in the dataset. Given this study had a significant amount of missing data, it is possible that MLE influenced the data's variance that could have shown changes in friendship quality. Future research should utilize larger sample sizes to examine these relationships. Additionally, assessing friendship stability across middle and high school could

demonstrate more changes across time as in the friendship quality data. Previous research has found differences in friendship quality for children with ADHD in cross-sectional data. Future studies could measure friendship quality in a clinical sample of children with ADHD and measure changes across time to further extend the literature in this area. Another limitation to consider is the reliance on parent report measures for all reports of behavioral problems. Future studies should elicit reports from children's teachers as well, given that ADHD symptoms and similar externalizing symptoms are often evident in the school setting. In addition to reports of behavioral problems and friendships, it may be beneficial to use observational studies to code children's interactions with friends for a more objective measures of friendship interactions. This data may be useful especially in considering treatment methods for children with ADHD who struggle with close friendships.

This study sought to examine the stability and quality of children's friendships and how attention problems may play a role in these relationships. We found results somewhat supported our hypotheses in that attention problems may be important when considering social support and negative interactions in children's friendships, especially in the later years of schooling. Future studies should include measures of attention problems at multiple time points and with a larger sample of children. Additionally, it may be of interest to examine friendship stability and quality in a clinical sample rather than a community sample to further investigate this relationship in children with and without ADHD.

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## APPENDIX

THE UNIVERSITY OF  
**ALABAMA**

Office of the Vice President for  
Research & Economic Development  
Office for Research Compliance

March 26, 2019

Nicole Ferretti  
Department of Psychology  
Box 870348

Re: IRB # EX-19-CM-044: "ADHD Symptoms Predicting Changes in Friendship Stability and Quality over Time"

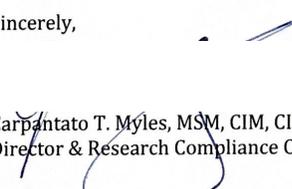
Dear Ms. Ferretti,

The University of Alabama Institutional Review Board has granted approval for your proposed research. Your application has been given exempt approval according to 45 CFR part 46. Approval has been given under exempt review category 4(ii) as outlined below:

*(4) Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if: (ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects.*

The approval for your application will lapse on March 25, 2020. If your research will continue beyond this date, please submit the annual report to the IRB as required by University policy before the lapse. Please note, any modifications made in research design, methodology, or procedures must be submitted to and approved by the IRB before implementation. Please submit a final report form when the study is complete.

Sincerely,

  
Carpentato T. Myles, MSM, CIM, CIP  
Director & Research Compliance Officer

cc: Dr. Matthew Jarrett