LEE, JESSICA, M.A. Early Pubertal Timing and Emotional Symptoms: The Protective Role of Friendship Quality. (2020)
Directed by Dr. Susan P. Keane. 71 pp.

The purpose of the current study was to examine the interaction between pubertal timing and friendship quality in predicting increases in emotional symptoms in adolescent boys and girls longitudinally. Participants included 361 adolescents (67.3% White/European American, 26.2% Black/African American, 5.6% mixed or other). It was hypothesized that earlier maturing girls with higher levels of friendship quality would display decreases in emotional symptoms across time, after controlling for prior levels of emotional symptoms. As part of an ongoing longitudinal study, mothers completed a pubertal development measure at age 10 and children/adolescents completed self-report measures of friendship quality at age 10 and emotional symptoms at age 15. A multi-group analysis was conducted to test the three-way interaction. Contrary to hypotheses, the proposed three-way interaction was not found. Findings of the current study are discussed, and future directions offered.

Keywords: pubertal timing, friendship quality, emotional symptoms

EARLY PUBERTAL TIMING AND EMOTIONAL SYMPTOMS:

THE PROTECTIVE ROLE OF FRIENDSHIP

QUALITY

by

Jessica Lee

A Thesis Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Greensboro
2020

Approved by

Susan Keane
Committee Chair

APPROVAL PAGE

This thesis, written by Jessica Lee, has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair Susan Keane

Committee Members Gabriela Livas Stein

Laurie Wideman

July 14, 2020
Date of Acceptance by Committee

July 8, 2020
Date of Final Oral Examination

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Adolescence is a critical developmental period requiring the management of a wide range of developmental tasks, including navigating new and challenging situations. These challenging situations can lead to increases in (social) stressors and internalizing symptoms. For example, the transition from middle school to high school may be stressful as academic expectations are higher and social demands increase as the nature of their peer relationships also become increasingly complex (Eccles & Midgley, 1989; Wigfield et al., 1991). This experienced stress makes it more challenging for adolescents to effectively manage these developmental tasks (Evans, Borriello, & Field, 2018; Felner et al., 1981). As a result, during this transition, adolescents are more vulnerable to experiencing decreases in self-esteem, increases in social stressors, and internalizing symptoms, especially those related to anxiety and depression (Hankin et al., 1998).

For the current paper, these stressors and internalizing symptoms that tend to increase or decrease in adolescence will be referred to as emotional symptoms. One of these stressors is social stressors, which is defined as experiencing distress in social situations. Social stressors can increase as adolescents spend more time with peers in high school given more opportunities (e.g. increased class size, involvement in clubs and/or other extracurricular activities, less monitored lunch sessions) arise for stressful peer

interactions (i.e. peer victimization, peer rejection; Rudolph, 2002). Furthermore, internalizing symptoms include increases in depressive and anxiety symptoms, such as low mood, increased worries, and fears of negative evaluation, also tend to occur during adolescence as underdeveloped coping and emotion regulation strategies make it challenging to effectively deal with all of the stressors associated with the developmental transitions required during adolescence (Graber & Sontag, 2009). In addition, low self-reliance, poor self esteem and sense of inadequacy, which is typically defined as the adolescent's low self-confidence in their ability to adequately solve problems and the perception that he or she is unable to achieve goals, are common symptoms of internalizing problems that adolescents are also susceptible to during this period (D'Esposito, Blake, & Riccio, 2011; Craun et al., 2017; Morales-Vives & Dueñas, 2018). While experiencing some emotional symptoms is considered developmentally normative for youth (Muris, Merckelbach, Gadet, & Moulaert, 2000), there are a concerning number of adolescents who report significantly higher levels of emotional symptoms, suggesting that for some, these challenges may be overwhelming.

Epidemiologically, increases in emotional symptoms from childhood to adolescence are consistently noted in the literature. For example, rates of depression and anxiety disorders significantly increase from childhood to adolescence (Costello, Copeland, & Angold, 2011). According to the National Institute of Mental Health (NIMH, 2017), 31.9% of adolescents from the general population reported clinically significant anxiety symptoms. Additionally, approximately 13% of adolescents reported experiencing at least one major depressive episode with adolescents at ages 15-16

reporting the highest levels of depression (NIMH, 2017). Notably, the prevalence rate has increased over the last four years for both anxiety and depression at least by 4% (NIMH, 2017). These increases have been attributed to both decreases in self-esteem (Biro et al., 2005) and the increases in the frequency of social stressors (i.e. peer rejection), especially for adolescents whose behaviors and/or physical appearance deviate from the social norm (Rudolph et al., 2014).

If untreated, emotional symptoms may contribute to detrimental consequences that can persist into adulthood (Graber et al., 2004). Poor academic functioning and impairments in social relationships, among family and friends, may be impacted by increased emotional symptoms (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998; Masten et al., 2005). In addition, low self-esteem and higher levels of social stressors, independently, contribute to increased depressive and anxiety symptoms in late adolescence that may also persist into adulthood (Steiger et al., 2014). Internalizing symptoms, such as low self-reliance, are also associated with higher suicide risk (Kovacs & Devlin, 1998; Morales-Vives & Dueñas, 2018; Thapar, Collishaw, Pine, & Thapar, 2012). Taken together, these consequences can significantly impact multiple domains within the adolescent's environment. However, while both boys and girls with higher levels of emotional symptoms confer risk for additional impairments, girls are at greater risk for developing increases in emotional symptoms.

Sex differences in the frequency and intensity of reported emotional symptoms also emerge during this developmental period. Prior to adolescence, little to no sex differences in internalizing symptoms and self-esteem in children have been reported (for

reviews, see Hankin & Abramason, 2001; Hammen & Rudolph, 2003). However, during mid-adolescence around the ages of 14-16, girls are more than twice as likely as boys to experience internalizing symptoms (Hankin, Mermelstein, Roesch, 2007; Merikangas et al., 2010). In fact, around the ages of 12-13, girls' reports of depressive symptomatology begin to sharply increase compared to boys (Hamilton et al., 2014). Moreover, girls' report of self-esteem begin to decrease around the ages of 11-12 (Brown et al., 1998; Zeiger-Hill & Myers, 2012). In addition, adolescent girls consistently have been found to report higher levels of anxiety at ages 14-16 as increases occur as early as ages 10-11 (Kessler et al., 2012; Merikangas et al., 2010). Sex differences also emerge during early adolescence for social stressors, with girls reporting higher levels of peer stress beginning around the ages of 12-13 (Ge, Conger, & Elder, 2001; Rudolph & Hammen, 1999).

There are several reasons why adolescent girls are more vulnerable to developing increased emotional symptoms compared to boys. Research on biopsychosocial factors has demonstrated that as female sex hormones, such as estrogen and progesterone, help regulate the cortisol response, a frequently activated hypothalamus-pituitary-adrenal (HPA) axis in response to experiencing frequent social stressors may overtax the stress reactivity system, especially as these hormones significantly increase or decrease during puberty, contributing to a dysregulated HPA axis (Gunnar et al., 2009; Stroud et al., 2008). As a result, a dysregulated HPA axis is associated with greater levels of emotional symptoms (Oldehinkel & Bourna, 2011; Rudolph, 2002). Furthermore, as society imposes the feminine gender role, which socializes girls to be passive, emotionally sensitive, relationship-driven, and compassionate (Holt & Ellis, 1998), girls are more

likely to adopt the passive, emotionally-focused ruminative coping style which involves the repeated, continuous thoughts about possible causes and effects of depressive cognitions (Nolen-Hoeksema, 1987; Nolen-Hoeksema, 2000). Rumination as well as co-rumination, ruminating with close, same-sex friends, is linked with increases in emotional symptoms for girls (Nolen-Hoeksema, 2000; Rose, 2002). Thus, these psychobiological factors and coping styles make it challenging to effectively manage (social) stressors, particularly among girls with higher levels of emotional symptoms.

Given the increasing prevalence rates and significant impact of emotional symptoms on the psychological functioning of an adolescent and its consequences, it is imperative that researchers examine the etiological factors that contribute to these symptoms (e.g. depression, self-esteem, social stress, anxiety) to identify relevant risk and protective factors. This information will serve to inform prevention and intervention programs. Thus, the primary goal of the current study is to examine how biological and social processes during the transition from childhood to adolescence contribute to increases in emotional symptoms by mid-adolescence. Thus, utilizing a developmental psychopathology framework and biosocial model to explore how the child's biological and social context interact to influence the child's developmental trajectory is crucial to understanding how these sex differences emerge in emotional symptoms. One salient developmental milestone and key biological risk factor that may contribute to the increase in emotional symptoms by adolescence is puberty.

Defining Puberty

Puberty is a multifaceted process in which a myriad of biological, physical, emotional, and social changes occurs (Graber, 2003). Morphological changes, including the growth of primary and secondary sexual characteristics, occur as a result of the initiation of the physiological processes known as adrenarche and gonadarche (Hayward, 2003). Adrenarche, which typically occurs between the ages of six and nine, stimulate the maturation of the HPA axis so that adrenal androgens (e.g. dehydroepiandrosterone) increase to activate the growth of secondary sexual characteristics (e.g. pubic and axillary hair). Gonadarche, which typically occurs between the ages of nine and eleven, stimulate the maturation of the hypothalamus-pituitary-gonadal (HPG) axis so that pubertal hormones (i.e. luteinizing hormone, follicle-stimulating hormone) are secreted via the pituitary gland to activate the ovary and testes. As a result, increases in estradiol and testosterone primarily stimulate breast and ovarian development in girls and testicular development in boys. Once these pubertal processes are initiated, a growth spurt, pubic and axillary hair growth, increased body fat, changes in skin tone (e.g. acne), breast budding and first menarche for girls, and changes in vocal tone for boys, are visible and non-visible signs puberty has begun.

According to epidemiological and experimental studies that utilized a nationwide database, the median age of pubertal onset for upper-middle class, boys and girls is 12.43 years old; approximately 10% of girls enter puberty before the age of 11 (Chumlea et al., 2003; Dorn et al., 2013). In order to capture pubertal development, the two most common methods researchers administer is either a physical exam utilizing the Tanner scale,

which is the gold-standard and includes staging for pubic hair and breast for girls, and pubic hair and genital for boys (Marshall & Tanner, 1970), or the most common and less invasive self-report questionnaire, which assesses the development of each primary and secondary sexual characteristic (e.g. voice changes). Although administering a physical exam provides objective results, utilizing a subjective or parent and/or child self-report measure may provide additional psychological insight as it represents how the child and other reporters perceive the child's level of physical maturity (Graber, 2003; Mendle, 2014). Given the complexity of measuring the pubertal process, developmental researchers have identified three constructs of importance to consider: pubertal status, pubertal timing, and pubertal tempo.

Pubertal status is defined as the current pubertal stage of the child at the time of measurement (i.e. advanced pubertal stage). Pubertal timing is defined as the age of onset of puberty relative to same-sex, same-age peers (i.e. earlier maturer). Lastly, pubertal tempo is defined as the rate at which one matures or transitions from stage to stage (i.e. faster or slower). Among these three pubertal constructs, research has indicated that pubertal timing is a significant predictor of psychopathology compared to pubertal tempo and pubertal status (Graber et al., 2004; Rhee, 2005, Mendle, 2014).

Pubertal Timing as a Risk Factor

Many early and recent studies indicated that pubertal timing may have stronger implications for psychological consequences than pubertal status (Mendle, 2019). For example, Ge et al. (2001) found that self-reported pubertal timing at grade 7 was significantly associated with maladjustment problems over time, such as low self-esteem

and depressive feelings, at grade 10, controlling for initial levels. By contrast, no longitudinal relationship between pubertal status and maladjustment was noted. One reason for this is that simply maturing each year may not create enough risk for adolescents especially when others begin to enter the pubertal process. Rather, the timing of achieving a more advanced pubertal status relative to peers may create more risk over time. In addition, a methodological limitation is that pubertal status is typically confounded by age because older children are more likely to have attained a more advanced pubertal status (Natsuaki, Samuels, & Leve, 2014) whereas pubertal timing accounts for the effects of age. To account for age, pubertal timing is calculated by regressing pubertal status on age to create a standardized residualized score which indicates how early the child is relative to their same-sex, same-age peers (Ge et al., 2001). By controlling for age, the association between pubertal timing and psychopathology can be attributed to the effects of pubertal maturation rather than the effects of age.

Moreover, pubertal timing is often operationalized as a continuous variable, which reflects a continuum of earlier to later pubertal timing as opposed to a trichotomized categorical variable, which describes a child as early, on-time, or late (Dorn et al., 2006; Ellis & Garber, 2000). Using a continuous variable is advantageous as it provides a wider range of values that is not truncated by cutoffs between the three categories to increase variability (Dorn & Biro, 2011; Dorn et al., 2006). Thus, the present study will utilize a dimensional approach to better examine the impact of pubertal timing on emotional symptoms over time.

Sex Differences in Pubertal Timing and Emotional Symptoms

Considerable research has examined the link between pubertal timing and emotional symptoms in girls and boys (Graber, 2013; Mendle, 2019). However, much of the early longitudinal research examining this association initially focused on girls. Studies that utilized a categorical pubertal timing variable in an all-female sample found that early pubertal timing reported at age 12 predicted internalizing symptoms (Caspi & Moffit, 1991; Hayward et al., 1997) and general psychological distress in mid-to late adolescence compared to their on-time and late peers (e.g. depression, anxiety, hostility; Ge, Conger, & Elder, 1996). However, in a follow-up study examining an all-male sample, Ge, Conger, and Elder (2001) found that boys who reported early puberty in 7th grade were more likely to report increases in internalizing problems by the 10th grade, even after controlling for earlier levels of internalizing problems. As research concluded that earlier pubertal timing may be a risk factor for emotional symptoms for girls and boys, separately, follow-up studies began to study this association in mixed-sex samples. Thus, studies with mixed-sex samples also found a significant association between pubertal timing and emotional symptoms, particularly in girls.

In fact, as previous and even current studies have mainly focused on girls, there is robust empirical evidence to support that earlier pubertal timing in girls is associated with concurrent and prospective links to emotional symptoms (for a review, see Mendle, Turkheimer, & Emory, 2007). Studies found that early maturing girls at ages 11-13 reported concurrent, lower levels of self-esteem (Williams & Currie, 2000; McCabe & Ricciardelli, 2004). One explanation for this relation is that peer teasing targeting

physical appearance, might elicit negative self-judgements regarding their developing bodies as early maturing girls are less satisfied with their body image (Stojković, 2013). As self-esteem is often highly correlated and contributes to depressive symptoms, previous reviews and meta-analyses noted that earlier maturing girls around ages 9-13 reported increases in depressive symptoms (Mendle, Turkheimer, & Emory, 2007) as well as an increased likelihood of anxiety symptoms and disorder in mid-adolescence (Reardon & Felder, 2009). One explanation for this finding is that as experiencing puberty earlier than one's peers can be stressful, the earlier maturing girl may have increased worries and/or feel sad as psychosocial consequences (i.e. body dissatisfaction) associated with earlier pubertal timing may impact multiple domains in her life (i.e. school, family and peer relationships) as well as increased social anxiety in anticipation of being negatively evaluated by her peers (Reardon & Felder, 2009). Thus, given a majority of the literature has primarily focused on girls, the finding that earlier maturing girls are at the greatest risk for emotional symptoms is particularly robust.

Developmental scientists have theorized several reasons for why earlier maturing girls may experience more challenges compared to her later maturing girls and boys. First, as the earlier maturing girl appears physically mature before anyone in her cohort, the girl may face unique challenges as they receive pressure from parents, family members, peers, and/or teachers to act "adult-like" as they may be expected to be academically successful, cognitively and emotionally more mature, and/or increasingly adept at solving complex problems independently (Natsuaki, Samuels, & Leve, 2014). Second, their female-specific morphological changes (i.e. breast development, curvier

body shape) are noticeable by peers and are among the first visible signs of pubertal maturation, yet, unlike changes in height or boys' voice changes, the development of these physical features may elicit more emotional and social challenges that contribute to psychosocial consequences. For example, girls around the ages of 8-12 who were more pubertally advanced than their peers reported higher levels of body dissatisfaction compared to boys as a result of higher body mass and peer-group physical comparisons (Hughes et al., 2018; Watzlawik, 2008). Lastly, as peer group conformity is argued to be important during adolescence, research suggests that earlier maturing girls may elicit feelings of discomfort and awkward reactions from peers; because of her physical development she no longer "fits in" with same-aged peers (Natsuaki, Samuels, & Leve, 2015), leaving her to feel alienated from her peers (Rudolph et al., 2014). Thus, entering the pubertal process earlier than peers may force a pre-adolescent girl to confront new stressors and environments as these challenges may evoke high emotional symptoms that may be mentally taxing (Ge, Conger, & Elder, 1996). However, emerging evidence indicating that earlier maturing boys are also at risk for emotional symptoms has come to light within the recent decade.

Early theories regarding the impact of earlier pubertal timing on outcomes were based on the notion that earlier maturing boys would have advantageous outcomes as their more mature physique enhanced their athletic ability and resembled the more desired, masculine figure. However, some empirical work has also demonstrated that earlier maturing boys are at risk for developing internalizing problems compared to later maturing boys (for a review, see Mendle & Ferraro, 2012). Like earlier maturing girls,

research has shed light on the phenomenon that earlier maturing boys may also have difficulty adjusting to their new physique and may experience psychosocial stressors (i.e. peer stress) compared to their later maturing peers (Rudolph et al., 2014; Rudolph, 2007). For example, Rudolph et al. (2014) conducted a longitudinal study that found that earlier pubertal timing predicted elevated levels of initial diagnostic-level depressive symptoms for girls, but not for boys at ages 12-13. However, both earlier maturing girls and boys reported increases in depressive symptoms by ages 15-16, after controlling for initial levels. Taken together, despite the robust finding that earlier maturing girls are at the greatest risk for psychopathology, there is some research indicating that earlier maturing boys may also experience psychosocial stressors that contribute to emotional symptoms (Mendle & Ferraro, 2012).

These inconsistent findings regarding sex differences in earlier pubertal timing may be due to measurement challenges and changes in the meaning of early puberty for girls and boys over the recent decade. While girls have thelarche (breast development) and menarche as valid indicators of pubertal onset, boys do not have equal indicators of puberty. Instead, testicular volume seems to be the best indicator of pubertal status given it is the first visible sign of pubertal onset (Dorn & Biro, 2011; Dorn et al., 2006). While girls are more likely to disclose reaching these biological milestones with their mother, boys may be less likely to discuss their testicular growth with their mother and may feel some discomfort in reporting it as well (Hayward, 2003; Mendle & Ferraro, 2012). Thus, parent-and self-reports for boys may be less valid compared to girls and, although physical exams provide a more accurate measure of testicular volume, they are expensive

and perceived as invasive (Dorn et al., 2006; Dorn & Biro, 2011). In addition, researchers speculate that the contrast from recent findings and the historical perspective on earlier puberty may be the result of secular declines in the age of onset of puberty. While it is difficult to determine for boys, as girls' age of menarche has declined approximately one year since these early studies (Parent et al., 2003), similar declines in age of pubertal onset may be true for boys as well. If this is the case, then there may be more boys entering puberty earlier relative to peers compared to a decade ago. As a result, like earlier maturing girls, earlier maturing boys would also be experiencing a longer duration of a "disparity period" in which their biological and social maturities are developing at mismatched rates (Mendle & Ferraro, 2012). Thus, as they are maturing earlier, they may not be equipped yet with adaptive cognitive and social strategies to deal with the social and emotional demands of early puberty. As the literature on how pubertal timing impacts psychopathology for boys is less understood and follows behind the research on girls (Mendle & Ferraro, 2012), further research including mixed-sex samples should continue to examine sex differences in this association to better understand how these relations may differ or are similar between earlier maturing boys and girls. While most of the literature suggests earlier pubertal timing confers the most risk, there are also inconsistent findings indicating whether later pubertal timing may also be a risk factor.

Results regarding later pubertal timing in boys and girls and psychopathology are less clear. As later maturers are the last among their peers to enter puberty, they may feel insecure about their physical appearance and feel left behind as they also do not appear physically similar. Thus, their insecurities and lack of belongingness may contribute to

increases in emotional symptoms over time (Mendle, 2014). For example, Natsuaki, Biehl, and Ge (2009) found in a longitudinal study that later maturing boys at age 12, who reported a later age of onset of puberty compared to his same-sex, same-age peers, also demonstrated concurrent, elevated levels of depressive symptoms at the age of 12 and increases in symptoms by the ages of 15-16. In addition, previous research has also indicated that later maturing boys at ages 11-13 reported concurrent, lower levels of self-esteem (Stojković, 2013; Williams & Currie, 2000). On the other hand, although mixed, a few meta-analyses found that most studies indicating there is no concurrent and longitudinal relationship between later pubertal timing around the ages of 9-13 and anxiety among girls or boys over time (Reardon & Feldner, 2009) as well as a internalizing problems at age 15-16 (Ullsperger & Nikolas, 2017). One explanation for these latter findings is that although later maturing children experience some initial stress, their emotional symptoms may dissipate by mid-adolescence as they physically catch-up with their peers and developed adaptive cognitive resources to navigate the emotional and social demands of adolescence (Natsuaki, Biehl, & Ge, 2009). Thus, as the most consistent finding is for earlier maturing girls, examining this association within the child's context may elucidate how earlier and/or later pubertal timing among boys and girls impacts the child's trajectory of emotional symptoms.

Early Puberty and the Child's Peer Context

As the adolescent transition involves a myriad of challenges and stressors the earlier maturing child must navigate, the discrepant findings emphasize the importance of examining specific contexts that might impact the child's psychosocial development.

Using a developmental psychopathology framework, the interactive processes between puberty and the child's context to predict psychopathology in adolescence is derived from the theoretical origin of the person-environment interaction perspective. Thus, the contextual amplification hypothesis states that contextual factors (i.e. peer relations) either exacerbate or ameliorate the negative effects of earlier pubertal timing to increase or decrease the risk of developing emotional and behavioral problems (Ge & Natsuaki, 2009; Ge et al., 2011; Rudolph, 2014). This theory is guided by the diathesis-stress model such that earlier pubertal timing is considered a "diathesis" as past research indicates the risk it confers for developing psychopathology (Ge et al., 2011). As earlier maturing children, especially girls, have an increased saliency for peer relationships beginning in middle childhood (Graber, 2003), stressful peer contexts can exacerbate the harmful impact of this diathesis whereas protective ones may mitigate it. Thus, the current study will focus on the peer context.

Much of the empirical work examining the contextual amplification hypothesis has studied how negative peer relations exacerbate the effects of pubertal timing. In fact, Conley and Rudolph (2009) found that both earlier maturing girls and later maturing boys at age 12 with higher levels of peer stress were more likely to report higher levels of diagnostic-level depressive symptoms concurrently and one year later, even after controlling for earlier levels of depressive symptoms. Thus, many studies examining negative peer relations as moderators have indicated the risk it confers for earlier maturers, and some for later maturers (i.e. peer victimization, peer problems) across time on diagnostic-level depressive symptoms (e.g. Conley & Rudolph, 2009; Rudolph &

Troop-Gordon, 2010) and internalizing problems (e.g. Winer, Parent, Forehand, & Breslend, 2016). As expected, most of the research examining the moderating role of peer stressors found it to be consistently significant in earlier maturing girls. However, there is little to no research examining positive peer relations, specifically friendships, and whether this positive peer context ameliorates the negative effects of earlier pubertal timing on emotional symptoms. Therefore, the current study seeks to explore the contextual amplification hypothesis by examining the protective nature of friendships and pubertal timing on emotional symptoms.

The Moderating Role of Friendship Quality

Positive peer relations that are supportive might protect the child from the psychological impact of being an earlier maturer. The friendship protection hypothesis states that having close friends might help to buffer against negative experiences and their subsequent outcomes (Boulton et al., 1999). The large majority of the literature exploring the protective nature of friendships against emotional symptoms is in adult populations, however, more researchers are exploring this phenomenon in children and adolescent populations as well (Kendrick, Jutengren, & Stattin, 2012; Way & Silverman, 2012). Having at least one close friend was associated with higher levels of self-esteem and better psychosocial adjustment in middle childhood (Bishop & Inderbitzen, 1995; La Greca et al., 2008). Although most children ages 10-11 tend to report an increase in the circle of friends compared to younger children (Jänsch & Pupeter, 2017), prior work suggests that the quality of friendship, rather than the quantity of friends, has also been theorized to protect children from negative outcomes (Way & Silverman, 2011).

Around the ages of 8-10, middle childhood is the developmental period when close dyadic relationships with friends begin to increase in saliency (Sullivan, 1953). Building from Sullivan's theory, prior research suggested that friendships at this age are characterized by intimacy and closeness as older children develop an increased value for their friends' opinion compared to younger children in addition to maintaining positive interactions within their relationship by attempting to manage their emotions (Jänsch & Pupeter, 2017; Ladd, 2005). They tend to focus on being socially accepted by their peers to avoid being rejected. Thus, a higher quality friendship is characterized by high levels of prosocial behavior, intimacy, support, and low levels of conflict. Having friends of high friendship quality can provide these children with a protective social environment to buffer negative experiences, especially during the transition between childhood to adolescence as school transitions and school adjustment can be stressful (Erath, Flanagan, & Bierman, 2008; Wentzel, Barry, & Caldwell, 2004). As friendship quality provides support for children who may be experiencing various stressors, this may provide mental health benefits reducing the risk of developing increases in emotional symptoms.

Previous research has showed friendship quality in childhood to reduce the risk of developing emotional symptoms, such as depression and anxiety in early adolescence. For example, in a study with a majority of children, Malcolm, Jensen-Campbell, Rex-Lear, and Waldrip (2006) found that children in fifth or sixth grade with higher levels of reciprocated friendship quality reported decreased levels of overt peer victimization and relational aggression one year later. In a follow-up study, children in fifth-eighth grade who reported higher levels of reciprocated friendship quality during the fall semester

predicted better teacher-reported adjustment outcome (i.e. internalizing and externalizing problems) by the end of the spring semester (Waldrip, Malcolm, & Jensen-Campbell, 2008). In addition, Brendgen et al. (2013) also found that in a sample of twins, children at the age of 10 with a genetic risk for depression with higher level of unilateral friendship quality reported concurrent lower levels of depressive symptoms, especially for girls. As research provides empirical support for the protective nature of friendship quality on concurrent and longitudinal emotional symptoms in middle childhood, there is also recent research examining the moderating role friendship quality.

Among the studies studying the friendship protection hypothesis, previous research has found that supportive friendships buffer negative experiences to predict decreases in emotional symptoms. Cross-sectional studies have indicated that higher friendship quality around the ages of 6-12 moderated the relationship between negative experiences, such as bullying victimization, and depressive symptoms (Healy & Sanders, 2018; Kendrick, Jutengren, & Stattin, 2012). Among the few longitudinal studies examining the moderating role of friendship quality, most were examined in adolescents (Aseltine, Gore, and Colten, 1998; Buck and Dix, 2012; Havewala, Felton, & Lejuez, 2019; Kamper and Ostrov, 2013). For example, Havewala, Felton, and Lejuez (2019) found that adolescents from the age of 14 to 18, positive friendship quality moderated the relation between maternal anxiety and initial internalizing symptoms but was not associated with changes in internalizing symptoms after three years. The authors speculated that the effects of friendship quality may be immediate and not long-lasting for adolescents (Havewala, Felton, & Lejuez, 2019). Thus, as there are few longitudinal

studies examining the moderating role of friendship quality across the childhood to adolescent transition, when friendship quality begins to increase, the current study will examine whether friendship quality will protect the child from the unique challenges of earlier pubertal timing, especially for girls, to predict changes in emotional symptoms.

Given that higher levels of friendship quality are associated with better psychological outcomes, a majority of studies have indicated that girls report overall higher levels of friendship quality than boys (Bagwell & Schmidt, 2011; La Greca & Harrison, 2005; Sharbany et al., 2008). Therefore, girls with higher levels of friendship quality may receive the most mental health benefits such as enhancement of self-esteem, preparation for relationships, and development of intimacy as children transition into adolescence and later into adulthood (for a review, see Rubin, Bukowski, & Laursen, 2011). Girls with stronger interpersonal caring orientations and concerns about peer evaluation perceive their close friendships as more salient beginning in childhood (for a review, see Rose & Rudolph, 2006) whereas boys report having multiple friends but do not yet develop close friendships of high quality until early to mid-adolescence (Way & Silverman, 2011). Taken together, given a majority of studies suggest girls report significantly higher levels of friendship quality and, as earlier pubertal timing has a significant negative impact on girls, the current study will include sex as a second moderator to examine whether friendship quality will be a stronger protective factor for girls in buffering the negative effects of earlier pubertal timing on emotional symptoms.

Potential Control Variables

Early emotional symptoms in childhood are robust predictors of later emotional symptoms in adolescence. Previous research suggests that childhood depressive symptoms are predictive of increases in depressive symptoms in adolescence (Black & Klein, 2012; Klein et al., 2009; Luby et al., 2009) as well as self-esteem predicting increases in depression and anxiety from initial levels (Sowislo & Orth, 2013). As earlier levels of emotional symptoms may contribute to increases in emotional symptoms at age 15, child report of emotional symptoms at age 10 will be examined as a potential control variable.

The Current Study

Prior research has established earlier pubertal timing to be a risk factor for developing increases in emotional symptoms, such as social stressors, low self-esteem, and internalizing symptoms, during the adolescent transition. As there is substantial research examining risky contexts (i.e. peer stress) that amplify the negative effects of earlier pubertal timing, especially for girls, to my knowledge, there are no studies examining how protective contexts, such as friendship quality, may mitigate the detrimental effects of early puberty to predict decreases in emotional symptoms during this critical adolescent transition period. Given the significant psychological impact earlier pubertal timing has on girls as well as their tendency to report higher levels of friendship quality, sex will be examined as a second moderator to determine whether friendship quality will be a stronger protective factor for girls than for boys. The purpose of the current study is to expand the puberty and friendship literature by considering how

these relations may support the contextual amplification hypothesis and the friendship protection theory.

It is hypothesized that friendship quality and sex will moderate the relation between earlier pubertal timing and emotional symptoms, such that earlier maturing girls at age 10 with higher levels of friendship quality at age 10 will predict decreases in emotional symptoms by the age of 15, after controlling for earlier levels of emotional symptoms at age 10 (see Figure 1). It is expected that this effect will be more robust for earlier maturing girls than for earlier maturing boys.

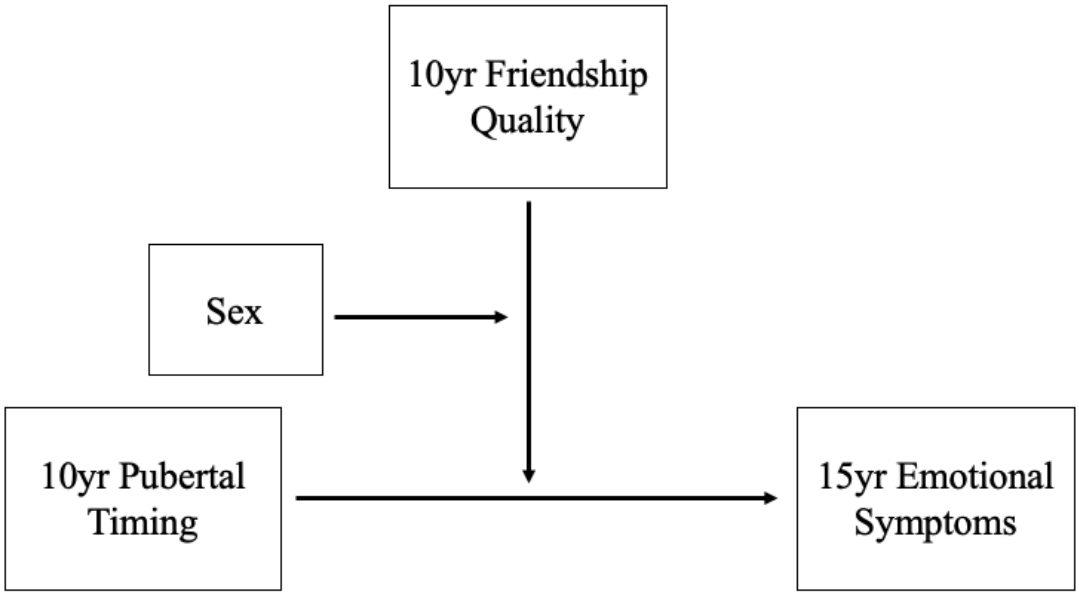

Figure 1. Conceptual Model. The Moderating Role of Sex on the Interaction between Pubertal Timing and Friendship Quality Predicting Emotional Symptoms.

CHAPTER II

METHODOLOGY

Participants

The current study utilized data from three cohorts of children who are part of an ongoing longitudinal study of social and emotional development. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems, and who were representative of the surrounding community in terms of race and socioeconomic status (SES). All cohorts were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants for cohorts 1 and 2 were recruited at 2-years of age (cohort 1: 1994-1996 and cohort 2: 2000-2001) and screened using the Child Behavior Checklist (CBCL 2-3; Achenbach, 1992), completed by the mother, in order to over-sample for externalizing behavior problems. Children were identified as being at risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of males and females. This recruitment effort resulted in a total of 307 children. Cohort 3 was initially recruited when infants were 6 months of age (in 1998) for their level of frustration, based on laboratory observation and parent report, and were followed through the toddler period (see Calkins, Dedmon, Gill, Lomax, & Johnson, 2002, for

more information). Children from Cohort 3 whose mothers completed the CBCL at two-years of age (N = 140) were then included in the larger study. Of the entire sample (N = 447), 37% of children were identified as being at risk for future externalizing problems. There were no significant demographic differences between cohorts with regard to gender, $\chi^2(2, N = 447) = .63$, p = .73, race, $\chi^2(2, N = 447) = 1.13$, p = .57, or two-year SES, F (2, 444) = .53, p = .59.

Of the 447 originally selected participants, six were dropped because they did not participate in any data collection at 2 years old. An additional 12 families participated at recruitment, did not participate at two-year, but did participate at later years. At age 10, 357 families participated, including 31 families that did not participate in the 7-year assessment. No significant differences were noted between families who did and did not participate in the 10-year assessment in terms of child gender, χ^2 (1, N = 447) = 3.31, p = .07; race, χ^2 (3, N = 447) = 3.12, p = .08; 2-year SES, t(432) = .02, p = .98; or 2-year externalizing T score, t (445) = -.11, p = .91. At age 15, 327 families participated, including 27 families that did not participate in the 10-year assessment. There were no significant differences between families who did and did not participate in the 15-year assessment in terms of race χ^2 (3, N = 447) = 3.96, p = .27; 2-year SES t(432) = -.56, p = .58; or 2-year externalizing T score t (445) = .24, p = .81. Boys were less likely to participate in the 15-year assessment χ^2 (1, N = 447) = 9.31, p = .002. In addition, four participants were dropped from the current study due to developmental delays.

The sample for the current study included 369 children/families (201 females, 168 males) who participated in the 10- and 15-year assessments. Children/families were

included in the current study if they had data on pubertal development at age 10 and measures of friendship quality and emotionally distressing symptoms at 15. The sample was diverse with 67.5% White/European American, 26.0% Black/African American, 5.6% mixed or other. Families were economically diverse based on Hollingshead (1975) scores at the 10-year assessment, with a range from 9 to 66 (M = 43.35, SD = 13.86), thus representing families from each level of social strata typically captured by this scale. Hollingshead scores that range from 40 to 54 reflect minor professional and technical occupations considered to be representative of middle class.

Procedures

Children and their mothers participated in an ongoing longitudinal study beginning at age 2. The current analysis used the data collected from two time-points: ages 10 and 15. Assent and consent from the child and the caregiver were obtained. At the age of 10, the child and the mother came to the laboratory where the mother and child completed a series of laboratory tasks designed to elicit emotional and behavioral responses as well as parent-child interactions. Self-report measures were also completed, including ones on friendship quality and pubertal development. At the age of 15, mothers and adolescents returned to visit the lab to complete another series of tasks as well as self-report measures, including ones on emotional symptoms. Only the measures relevant for the current study are reported here. The families were compensated for their participation after each visit.

Measures

Pubertal Timing at Age 10

The 6-item mother report of pubertal status was assessed at the age of 10 using the widely common Pubertal Developmental Scale (PDS; Peterson et al., 1988). It measures the current development of primary and secondary sexual characteristics for both girls and boys on a Likert rating scale of 1 (*no*) to 4 (*development completed*) for each item. For both sexes, the PDS assessed body hair development, height, and skin changes. For girls, development of breasts and the age of first menarche was included. For boys, the development of facial hair and voice changes was included. The PDS yields a composite score by averaging the five items within each sex, such that higher scores indicate more advanced pubertal development. The Cronbach's *a* for the current sample for girls was .764 and for boys was .628.

A pubertal timing variable was created following the work of Ge and colleagues (Ge, Conger, & Elder, 2001). Pubertal timing accounts for the effects of age by regressing pubertal status on age which creates a standardized residual to capture pubertal timing on a continuous level (M=0, SD=1; Ge, Conger, & Elder, 2001). Higher scores reflect earlier pubertal timing.

Friendship Quality at Age 10

Children completed the 40-item self-report Friendship Quality Questionnaire (FQQ; Parker & Asher, 1993). The FQQ assesses the child's perception of the quality of the relationship they had with a classmate they considered to be their best friend. The FQQ utilized a rating scale from 0 to 4, with 0 (*no*), 1 *(not very much*), 2 (*sometimes*), 3

(*a lot of times*), and 4 (*always*). The child completed the questionnaire in reference to a particular friend that was identified at the beginning of the questionnaire and whose name was written at the top. The FQQ also asked if the friend attended the same school/same class. An example item is "Do you and (friend's name) hang out together at lunch?" or "Do you and (friend's name) always tell each other about your problems?" The FQQ consists of six subscales: companionship and recreation, validation and caring, help and guidance, intimate disclosure, conflict resolution, and conflict and betrayal (reverse scored). Each subscale score is calculated by taking the average of the relevant items (unit weighting), with item 21 reverse scored. Item 1, the warm-up item, is not factored into any subscale score. The Total Friendship Quality is an average across all items, with a higher score reflecting higher friendship quality. Given the current study was interested in the overall quality of the close friendship, the Total Friendship Quality scale was utilized. The Cronbach's alpha for the current sample is .926.

Emotional Symptoms at Age 15

The 176-item adolescent self-report of the Behavioral Assessment Scale for Children, Fourth Edition (BASC-SRP-A; Reynolds & Kamphaus, 1992) was used to assess the level of emotional symptoms. The BASC-SRP-A is a multidimensional measure that assesses the adaptive and maladaptive behavior of adolescents from ages 12 to 21 on a rating scale from 0 to 3, with 0 (*never*), 1 (*sometimes*), 2 (*often*), and 3 (almost always). It contains 5 composites: Emotional Symptom Index, Inattention/Hyperactivity, Internalizing Problems, Personal Adjustment, and School Problems. The 61-item Emotional Symptom Index was utilized and includes items from six subscales: Social

Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance. An example item is “Nothing is fun anymore,” or “I feel like my life is getting worse and worse.” Raw scores were converted into general T scores which are based on normative data from a non-clinical sample representative of the U.S. population. The Cronbach’s alpha for the current sample is .858.

Emotional Symptoms at Age 10

The 139-item child self-report of the Behavioral Assessment Scale for Children, Fourth Edition (BASC-SRP-C; Reynolds & Kamphaus, 1992) was used to assess the level of emotional symptoms. The BASC-SRP-C is a multidimensional measure that assesses the adaptive and maladaptive behavior of children from ages 8 to 11on a rating scale from 0 to 3, with 0 (*never*), 1 (*sometimes*), 2 (*often*), and 3 (almost always). It contains 5 composites: Emotional Symptom Index, Inattention/Hyperactivity, Internalizing Problems, Personal Adjustment, and School Problems. The 42-item Emotional Symptoms Index was utilized and includes items from six subscales: Social Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance. An example item is “Nothing is fun anymore,” or “I feel like my life is getting worse and worse.” The emotional symptom index was utilized and includes items from six subscales: Social Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance. An example item is “Nothing is fun anymore,” or “I feel like my life is getting worse and worse.” Raw scores were converted into general T scores which are based on normative data from a non-clinical sample representative of the U.S. population. The Cronbach’s alpha for the current sample is .947.

Data Analytic Plan

Preliminary analyses were conducted using SPSS version 23. These analyses included calculating the internal consistency for each measure (reported above) as well as correlations, *t*-tests, and the descriptive statistics for all study variables. Independent-samples *t*-tests were calculated to indicate whether there were significant mean differences between females and males among the pubertal timing, friendship quality and emotional symptoms variables.

Mplus 8 (Muthén & Muthén, 2017) was utilized for the main analyses, which examined a three-way interaction using a structural equation modeling framework. Full Information Maximum Likelihood (FIML) was used to address missing data. This was the least biased method of including the maximum amount of data as it calculated the covariance and correlation matrices derived from the data from each study variable. A pubertal timing variable was computed by creating the standardized score, separately, for girls and boys each with a mean of 0 and a standard deviation of 1. Then, the girls' and boys' pubertal timing score, respectively, were combined into one pubertal timing score. Friendship quality was centered at the grand mean before computing the interaction term. To test the three-way interaction, a multi-group analysis was conducted by including all control variables, predictor variables and interactions simultaneously into the model. This tested the two-way interaction for pubertal timing and friendship quality on emotional symptoms between girls and boys, controlling for earlier emotional symptoms. In order to test for moderation, two models were compared using the chi-square difference test: an *unconstrained* model in which all paths between males and females were freely estimated

across sex and a *constrained* model in which all structural weights were set and estimated to equal across both sexes. Model fit was evaluated utilizing the comparative fit index (CFI; Marsh & Hau, 2007), the Tucker-Lewis index (TLI; Bentler, 1990), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA; Cole & Maxwell, 2003). The model was considered to be a good fit when the CFI and the TLI values were close to or greater than .95, the RMSEA value is less than or equal to .08, and the SRMR value is less than or equal to .08. Bootstrapping was used to estimate the effect of the 95% confidence intervals to determine the significance of the conditional effects with 10,000 draws. Then, a multi-group analysis was conducted to test the two-way interactions by comparing coefficients for the male and female models. A chi-square difference test was used to test whether the unconstrained model fit better than the constrained model. If there was a significant chi-square difference between the two models, this meant that one or more factor loadings were statistically significant, indicating moderation. If there was not, then this suggested that there was no difference in the model. In the latter case, Kline (2016) recommends the more parsimonious and theory-driven model should be chosen.

If traditional chi-square difference testing revealed poor or unacceptable fit indices, the modification indices were used to examine potential strain in parameters and to attain improved fit. Specifically, the modification index is an estimate of the amount by which the chi-square value would be reduced if one or more parameter restrictions, such as equality restraints, were to be removed from the model. Thus, if there was strain or restriction in the model that resulted in poor fit indices, this may have impeded the

ability of the model to reproduce the means, variances, and covariances that were observed in the model. In other words, this would undermine whether the hypothesized model was a valid representation of the population.

If there was not a significant moderation by sex, a two-way product-term regression analysis was conducted in Mplus, bootstrapping with 95% confidence intervals (10,000 draws; MacKinnon, Lockwood, & Williams, 2004). Significant interactions were probed using the Johnson-Neyman technique in Mplus (Johnson & Neyman, 1936), which identifies specific levels of the moderator where the relationship between the levels of the predictor variable and the moderator transitions into significance.

An a priori alpha level of .05 was used to determine the significance of all of these tests.

CHAPTER III

RESULTS

Preliminary Analyses

Descriptive statistics for all study variables are presented in Table 1 and descriptive statistics split by sex are presented in Table 2**.** When examining the study variables for normal distribution, the emotional symptoms T score variable was identified as significantly non-normal. The emotional symptoms index variable was positively skewed with a value of 1.2. The variable was log-transformed, resulting in significant improvement and a near normal distribution with a value of 0.512. All other study variables were assessed for normality and there were no issues with skewness or kurtosis. However, given the Friendship Quality Questionnaire has an item range of 1 to 4, the current sample's friendship quality had a mean that suggested that children at age 10 reported higher friendship quality scores (M=2.99, SD=-0.49) than other studies which tend to report means around 2.6-2.7 (Parker & Asher, 1993). In addition, descriptive statistics split by sex indicated that girls reported a higher mean (M=3.10, SD=0.45) which closely approached the maximum value of 3.90 for the entire sample (see Table 2). Thus, there was a ceiling effect in which an inflated mean estimate for the overall sample, as well as for girls only, and regardless of race, may have limited measurement variability.

Table 1

Descriptive Statistics in Overall Sample

Variable	N	Mean	SD	Min-Max	Skew	Kurtosis
Pubertal Status	297	1.73	0.62	1.00-3.80	.885	.116
Pubertal Timing	298	0.00	1.00	-1.25-2.66	.892	.093
Friendship Quality	301	2.99	0.49	1.48-3.90	-.603	-.082
ES	300	46.48	10.14	29.0-80.0	1.14	1.20
ES Transformed	300	1.66	0.08	1.46-1.90	.569	.049

Note. Total Study *N* = 361 (Girls *N* = 198; Boys *N* = 163). ES = Emotional Symptoms.

Table 2

Descriptive Statistics Split by Sex

Variable	N	Mean	SD	Min-Max	Skew	Kurtosis
			Girls			
Pubertal Status	167	1.99	0.64	1.00-3.80	.458	-.559
Pubertal Timing	158	0.00	1.00	-1.60-2.79	.450	.-.570
Friendship Quality	169	3.10	0.45	1.48-3.90	-.713	.607
ES	170	47.10	9.90	32.0-79.0	.909	.453
ES Transformed	170	1.66	0.08	1.51-1.90	.464	-.331
			Boys			
Pubertal Status	130	1.39	0.37	1.00-2.80	1.08	1.08
Pubertal Timing	121	0.00	1.00	-1.09-2.69	.936	.228
Friendship Quality	132	2.83	0.51	1.63-3.68	-.441	-.653
ES	129	45.66	10.42	29.0-80.0	1.40	2.28
ES Transformed	129	1.65	0.09	1.46-1.90	.624	.422

Note. Total Study *N* = 361 (Girls *N* = 198; Boys *N* = 163). ES = Emotional Symptoms.

Table 3

Independent-Samples T-Test

	Girls			Boys			
Variable	N	Mean	SD	N	Mean	SD	t test
Pubertal Status	167	1.99	0.64	130	1.39	0.37	-9.55**
Pubertal Timing	158	0.00	1.00	121	0.00	1.00	-.307
Friendship Quality	169	3.10	0.45	132	2.83	0.51	-4.971**
ES	170	47.10	9.90	129	45.66	10.42	-1.219
ES Transformed	170	1.66	0.08	129	1.65	0.09	-1.371

**p <.01.

T-tests were calculated to examine whether there were sex differences between the primary study variables and are presented in Table 3. Independent-samples *t*-test revealed sex differences in pubertal status, such that mothers of girls reported more advanced pubertal development (M=1.99, SD=0.64) than boys (M=1.39, SD=0.37), $t(297) = -9.55$, $p<.001$, and friendship quality at age 10, such that girls reported higher levels of friendship quality (M=3.10, SD=0.45) than boys (M=2.83, SD=0.51), $t(299) = -4.97$, $p<.001$. Contrary to expectations, there were no sex differences for emotional symptoms at age 15, $t(297) = -1.371$, $p=.172$.

Table 4

Bivariate Correlations among Study Variables and Potential Controls

Variable	*1*	*2*	*3*	*4*
1. Pubertal Timing	—	.020	.034	.007
2. Friendship Quality		—	-.052	-.270**
3. ES at age 15			—	.381**
4. ES at age 10				—

Note. Total Study N = 361 (Girls N = 198; Boys N = 163). ES = Emotional Symptoms.
*p < .05. **p <.01.

Correlations were run among all study variables and are reported in Table 4. Friendship quality at age 10 was negatively correlated with emotional symptoms at age 10 (r=-.270, p<.001), which is consistent with the literature. Contrary with expectations, there was no correlation between pubertal timing and emotional symptoms at age 15 (r=.034, p=.610) or for friendship quality and emotional symptoms at age 15 (r=-.052, p=.419). As expected, since emotional symptoms at age 10 was significantly correlated with emotional symptoms at age 15 (r=.381, p<.001), emotional symptoms at age 10 was included as a control variable in the final model to account for earlier levels of symptoms prior to the impact of pubertal development. Thus, emotional symptoms at age 15 represents a change score (e.g. decreased emotional symptoms above age 10).

Correlations were also calculated within sex as presented in Table 5. There were no sex differences in the correlations between friendship quality at age 10 and emotional symptoms at age 10 as well as between emotional symptoms at age 10 and at age 15.

Table 5

Bivariate Correlations Split by Sex

Variable	*1*	*2*	*3*	*4*
1. Pubertal Timing	—	.032	.046	-.046
2. Friendship Quality	.014	—	-.016	-.290**
3. ES at age 15	.002	-.169	—	.418**
4. ES at age 10	.085	-.307**	.336**	—

Note. Above diagonal = Girls. Below Diagonal = Boys. ES = Emotional Symptoms.
*p < .05. **p <.01.

Missing Data

Of the 447 participants in the current study, 86 participants had missing data on all study variables and were excluded from analyses. Thus, the final sample size for all analyses was *N*=361 (198 females, 163 males). Participants with partial data were included. Based on Little's MCAR test, data were missing at random, $\chi 2$ (9) = 7.936, $p > .05$.

Primary Analyses

The main study hypothesis was that across the pre-adolescent to mid-adolescent period, earlier maturing girls with higher levels of friendship quality would predict decreases in emotional symptoms compared to earlier maturing boys, after controlling for earlier levels of emotional symptoms. A multi-group analysis was conducted to examine this question; these results are presented in Table 6. Results showed that the unconstrained model showed excellent fit, indicating the data fit the model well: χ^2=0.961 (1), *p*=.327, RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.011. The constrained model also demonstrated excellent fit: χ^2=7.019 (5), *p*=.219, RMSEA=0.047, CFI=.947, TLI=.915, SRMR=0.044. In order to test for moderation, a chi-square difference test was conducted to determine whether the unconstrained model was a better fit than the constrained model. The chi-square difference test revealed that there was no difference between the constrained and the unconstrained model, $\Delta\chi^2$=6.058 (4), *p*=0.823. A non-significant indicates that the relationship between pubertal timing and friendship quality was not moderated by sex. As a follow-up to the traditional chi-square difference omnibus test, a theory-driven unconstrained model was tested by constraining all main

effect paths to equality and freeing the interaction path. Results showed that the theory-driven model showed excellent fit, indicating the data fit the model well: χ^2=3.918 (4), *p*=.417, RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.08. The model was run using bias-corrected bootstrapped confidence intervals (10,000 draws). Results revealed that the interaction paths for both females and males were not significant (β = -0.034, SE = 0.082, p = 0.488, 95% CI [-.192-.131]; β = 0.161, SE = 0.108, p = 0.138, 95% CI [-.066-.366], respectively). Thus, contrary to the study hypothesis, sex did not moderate the link between pubertal timing and friendship quality on emotional symptoms.

Table 6

Parameter Estimates for 3-Way Interaction between Pubertal Timing, Friendship Quality, and Sex Predicting Emotional Symptoms Controlling for Earlier Levels of Emotional Symptoms

Male Sample					
Full Model (N=369)	β	B	SE_B	*p*	R^2
ES at Age 10	.438	.343	.057	.000**	
Pubertal Timing	-.062	-.010	.014	.495	
Friendship Quality	.071	-.013	.026	.614	
PT X FQ	.198	.044	.033	.184	
					.173
Female Sample					
ES at Age 10	.450	.435	.065	.000**	
Pubertal Timing	.074	.006	.006	.338	
Friendship Quality	.151	.029	.017	.088	
PT X FQ	-.038	-.006	.015	.661	
					.176

Note. Model fit ($\chi2$ (1) = .961, *p* = .3270; CFI = 1.00; TLI = 1.00; RMSEA = .000; SRMR = .071). R^2 in MPLUS reflects the overall variance explained in a dependent variable by the set of independent variables entered altogether.
**p <.01.

As sex was not a significant moderator, a two-way product-term interaction was subsequently conducted to examine the relationship between pubertal timing and friendship quality on emotional symptoms, controlling for earlier levels of emotional symptoms (for results, see Table 7). Results indicated excellent fit for the model: χ^2=0.000 (0), *p*=.000, RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.000. The model was then run using bias-corrected bootstrapped confidence intervals (10,000 draws) to examine the two-way interaction in the overall sample. There was not a significant main effect for friendship quality on emotional symptoms at age 15 (β = 0.057, SE = 0.062, p = 0.354) or for pubertal timing on emotional symptoms at age 15 (β = 0.057, SE = 0.059, p = 0.334). There was also not a significant interaction (β = 0.051, SE = 0.061, p = 0.397). Consistent with prior research, emotional symptoms at age 10 was positively associated with concurrent emotional symptoms at age 10 (β = 0.391, SE = 0.057, p = 0.000). Given that this model explained 15.7% of the overall variance in emotional symptoms by the main effects and interaction entered altogether, other internal and external processes not captured in this model play an important role in the development of emotional symptoms in mid-adolescence. Post-hoc analyses were subsequently conducted in order to further explore the data.

Table 7

Parameter Estimates for 2-way Interaction between Pubertal Timing and Friendship Quality Predicting Emotional Symptoms in Overall Sample Controlling for Earlier Levels of Emotional Symptoms

Full Model (N=369)	β	B	SE_B	*p*	R^2
ES at Age 10	.442	.391	0.057	.000**	
Pubertal Timing	.057	.005	0.005	0.335	
Friendship Quality	.057	.011	0.011	0.355	
PT X FQ	.051	.011	0.011	0.398	
					.154

Note. Model fit ($\chi 2$ (0) = .000, p = .00; CFI = 1.00; TLI = 1.00; RMSEA = .000). R^2 in MPLUS reflects the overall variance explained in a dependent variable by the set of independent variables entered altogether.
**p <.01.

Post Hoc Analysis

Racial Differences

Data from community and national samples indicate that age of onset of puberty for Black/African American children occurs approximately one year ahead of White adolescents in the US (Chumlea et al., 2003; Biro et al., 2006; Butts & Seifer, 2010; Keenan et al., 2014). However, there is limited and mixed evidence suggesting whether earlier and/or later pubertal timing is associated with emotional symptoms among Black adolescents. Earlier pubertal timing in has been associated with internalizing problems (Carter et al., 2009; Carter, 2015; Ge, Brody, Conger, & Simons, 2006) whereas later timing has been associated with peer victimization and internalizing problems in Black adolescents (Hamlat et al., 2014). In studies comparing Black and White adolescents, some studies report that earlier maturing White girls reported higher levels of depressive symptoms problems than earlier maturing African American girls (Ge et al., 2001), while

others reported higher levels of depressive symptoms for both racial groups (Carter, Silverman, & Jaccard, 2013). Given these mixed findings race was examined as a second moderator to observe whether racial differences in the interaction between pubertal timing and friendship quality would predict changes in emotional symptoms.

Independent-samples *t*-test were computed to observe whether there were any racial differences among the study variables. There were racial differences only in pubertal timing at age 10 (see Table 8). Consistent with the above noted literature, mothers of Black children (M=0.48, SD=1.03) reported earlier pubertal timing than mothers of White children (M=-0.23, SD=0.89), $t(263) = -5.70$, $p<.001$. There were no racial differences in friendship quality at age 10 and emotional symptoms at age 15.

Table 8

Post Hoc: Independent-Samples T-Test by Race

	White			Black			
Variable	N	Mean	SD	N	Mean	SD	t test
Pubertal Timing	183	-.231	0.89	83	.482	1.03	-5.697**
Friendship Quality	196	2.99	0.47	89	2.95	0.52	0.658
ES Transformed	198	1.66	0.08	129	1.65	0.09	-.778

**p <.01.

Table 9

Bivariate Correlations Split by Race

Variable	*1*	*2*	*3*	*4*
1. Pubertal Timing	—	-.005	.093	.013
2. Friendship Quality	-.047	—	-.140	-.394**
3. ES at age 15	.008	.073	—	.470**
4. ES at age 10	-.095	-.071	.216	—

Note. Above diagonal = White. Below Diagonal = Black. ES = Emotional Symptoms.
*$p < .05$. **$p < .01$.

Correlations were run among all study variables and split by race which are reported in Table 9. Correlations for White children revealed similar relationships to the entire sample. However, contrary to expectations, unlike White children, there was a "marginal" correlation between emotional symptoms at age 10 and emotional symptoms at age 15 (r=.216, p=.052) and there was no correlation between friendship quality at age 10 and emotional symptoms at age 10 (r=-.071, p=.500) for Black children.

A multi-group analysis was conducted to examine whether friendship quality moderated the relationship between pubertal timing and emotional symptoms between White and Black children, controlling for earlier emotional symptoms at age 10 (see Table 10). Results showed that the unconstrained model showed good fit, indicating the data fit the model well: χ^2=3.475 (3), p=.324, RMSEA=0.030, CFI=.993, TLI=.967, SRMR=0.036. The constrained model also demonstrated excellent fit: χ^2=9.306 (7), p=.231, RMSEA=0.044, CFI=.965, TLI=.931, SRMR=0.089. In order to test for moderation, a chi-square difference test was conducted to determine whether the

unconstrained model was a better fit than the constrained model. The chi-square difference test revealed that there was no difference between the constrained and the unconstrained model, $\Delta\chi^2$=5.831 (4), *p*=0.231. A non-significant indicates that the relationship between pubertal timing and friendship quality was not moderated by race. As a follow-up to the traditional chi-square difference omnibus test, a theory-driven unconstrained model was tested by constraining all main effect paths to equality and freeing the interaction path. Results showed that the theory-driven model showed excellent fit, indicating the data fit the model well: χ^2=1.982 (2), *p*=.371, RMSEA=0.000, CFI=1.000, TLI=1.000, SRMR=0.05. The model was run using bias-corrected bootstrapped confidence intervals (10,000 draws). Results revealed that the interaction paths for both White and Black children were not significant (β = -0.112, SE = 0.215, p = 0.601, 95% CI [-.680-.200]; β = -0.048, SE = 0.256, p = 0.850, 95% CI [-.732-.378], respectively). Thus, contrary to expectations, race did not moderate the link between pubertal timing and friendship quality on emotional symptoms.

Table 10

Post Hoc: Parameter Estimates for 3-Way Interaction between Pubertal Timing, Friendship Quality, and Race Predicting Emotional Symptoms

White Sample					
Full Model (N=346)	β	B	SE_B	*p*	R^2
Pubertal Timing	-.015	-.001	.008	.862	
Friendship Quality	-.100	-.018	.017	.291	
PT X FQ	.103	.022	.021	.288	
					.007
Black Sample					
Pubertal Timing	.165	.016	.010	.106	
Friendship Quality	.024	.005	.025	.856	
PT X FQ	.042	.007	.022	.759	
					.009

Note. Model fit ($\chi2$ (3) = 3.475, p = .324; CFI = 0.93; TLI = 0.96; RMSEA = .03; SRMR = .03). R^2 in MPLUS reflects the overall variance explained in a dependent variable by the set of independent variables entered altogether.

CHAPTER IV

DISCUSSION

Adolescence is a critical developmental period in which adolescents, in particular girls, are vulnerable to developing increased emotional symptoms, such as internalizing problems and social stressors (Cicchetti & Rogosch, 2002; Hammen & Rudolph, 2003; Hankin et al., 1998; Hankin & Abramason, 2001). Previous research has established that earlier pubertal timing, especially among girls, may be a risk factor that contributes to these sex differences in emotional symptoms in mid-adolescence compared to later maturing children (Rudolph, 2014; Mendle, 2014). Utilizing a developmental psychopathology framework, the contextual amplification hypothesis provides a strong theoretical reason for how the child's peer context may exacerbate or ameliorate the negative effects of early puberty (Ge & Natsuaki, 2009; Rudolph, 2014). Much of the research studying the contextual amplification hypothesis has examined peer stressors as a risky context that exacerbates the negative effects of earlier pubertal timing to predict increases in emotional symptoms over time (e.g. Conley & Rudolph, 2009). However, little to no studies have examined whether friendships buffer the negative effects of earlier puberty. Thus, the friendship protection hypothesis, which states that having a close friend can protect the child from the harmful impact of negative experiences (Boulton et al., 1999), has implicated friendship quality as a protective factor against

various (peer) stressors in middle to late childhood, with most studies reducing concurrent levels of internalizing problems (e.g. Healy & Sanders, 2018) and very few examining the moderation on prospective links of internalizing problems in adolescence (e.g. Havewala, Felton, & Lejuez, 2019). Thus, the current student tested these theories as it was hypothesized that earlier maturing girls at age 10 with higher levels of friendship quality would report decreases in emotional symptoms at age 15, after controlling for earlier levels of emotional symptoms.

Surprisingly, the current study did not find support for the main hypothesis. More specifically, there were no sex differences in the moderation of friendship quality on the relationship between pubertal timing and emotional symptoms. This is surprising given vast literatures indicate that 1) earlier maturing girls are at the greatest risk for developing increases in emotional symptoms over time and 2) girls tend to report higher levels of friendship quality during middle childhood. One reason for this unexpected finding is that, in the current study, the friendship quality measure had a very restricted range. Approximately 72% of girls and boys and approximately 80% of girls reported a friendship quality mean estimate near the upper limits of the scale and above the typical mean of 2.56-2.77 found in other studies (Miller, Reavis, & Avila, 2018; Parker & Asher, 1993). In addition, while the present study did find mean-level differences in friendship quality at age 10, such that girls reported higher levels of friendship quality than boys, the mean for boys was also higher than the typical average found in other studies. Thus, all participants reported moderate to high friendship quality. Utilizing self-report measures may reflect social desirability bias and may not accurately capture the true nature of

friendship quality in the participants. As children ages 10-11 tend to report an increase in the circle of friends and as their friendships become increasingly salient during this period (Sullivan, 1953) they may wish to report these higher qualities to emphasize the fact that they have a supportive close friend with whom get along well with, showing themselves in a favorable light. Thus, future research may benefit from implementing more rigorous methods of measurement by utilizing multiple reporters (e.g. parent/caregiver), including reciprocated report from the friend to reduce these biases (Schwartze-Mette et al., 2013).

As the interaction between pubertal timing and friendship quality was not moderated by sex, the interactive effect on emotional symptoms was subsequently tested in the full sample. Contrary to hypotheses, the two-way interaction was also not significant. Thus, the current study did not support the contextual amplification hypothesis and the friendship protective theory. As most of the work examining the protective nature of friendship quality has been found to buffer the negative effects of peer stressors (e.g. Kendrick, Jutengren, & Stattin, 2012) or socially deviant behaviors (i.e. social withdrawal; Rudolph et al., 2014), this was surprising. It is possible that some of the items on this measure may be too vague and broad, such that it is not clear what the friend is providing support for. Some items refer to helping with schoolwork, however, an earlier maturer may be teased by a peer regarding their physical appearance. Thus, when the earlier maturer experiences this stressor, the measure does not capture whether the friend provides emotional support strategies (i.e. reflective listening), engages in

perspective-taking to better understand the unique challenges the earlier maturer is experiencing, or provides problem-solving strategies to mitigate this stress.

From another perspective, while the friendship quality measure includes only two aspects of negative friendship (e.g. conflict and betrayal and conflict resolution), it does not assess for co-rumination. Previous research has indicated that co-rumination is associated with higher friendship quality and intimate disclosure (Rose, 2002). If co-rumination is present in high quality friendships, the child may feel validated, but may still experience the negative effects of the stressor. Recent research has demonstrated that within higher qualities of friendships does co-ruminating with close friends predict increases in adolescent's depressive symptoms (Schwartze-Mette & Smith, 2018). Taken together, the measure may not capture important, more specific aspects of friendships that may further benefit and provide effective emotional support in addition to the current subscales. Future studies should consider these aspects of friendship by utilizing measures that assess for emotional support strategies and consider co-rumination as it may provide additional insight into how friendships can buffer stressful situations to reduce emotional symptoms.

Another measurement limitation is that the friendship quality scale only asked the child to report the quality of one close friend. As these earlier maturers may experience a myriad of stressors, having only one close friend may not be sufficient to reduce emotional symptoms. Rather, having child report on the quality of multiple close friendships may elucidate how a broader protective friend network may buffer or exacerbate the negative effects of early puberty as well as the stress associated with the

adolescent transition to predict changes in emotional symptoms over time. Thus, while research argues that simply knowing the quantity of friends does not explain how friendships protect children (Bishop & Inderbitzen, 1995; La Greca et al., 2008), it may be worthwhile to understand how quantity and quality, or, whether the friendship quality of multiple friends may mitigate stressors as the child may seek specific forms of support from each friend and whether this differs for boys and girls.

Furthermore, as a majority of research has explored friendships and positive peer relations within the school context, not much is known about how these friendships operate outside of school. Most items on the friendship quality measure referred to events at school, such as "do you help each other with schoolwork a lot?" In the present study, 14% of the children reported that their close friends did not attend the same school. Thus, it was not clear in which context these friendships take place (i.e. neighborhood, church) and whether these friendships occurred across more than one context. It is important to consider context as having a friend present in multiple stressful contexts to offer support may be the most beneficial in terms of reducing emotional symptoms. In fact, recent research examining this question in a racially diverse sample found that sixth grade children in a racially diverse school who connected with their intraracial friends inside and outside of school (at their homes) were more likely to report higher levels of friendship quality compared to those who only saw their friend at school (Lessard, Kogachi, & Juvonen, 2018). Thus, having a school-only friendship may restrict the opportunities to provide emotional support, to engage in positive interactions, and to initiate intimate discussions about personal struggles. More specifically, school

placements may limit opportunities to develop strong, high quality friendships if a child and their friend are no longer in the same classroom the following year or are assigned to different lunch periods. Thus, having a friend in multiple contexts may contribute to more robust decreases in emotional symptoms for earlier maturers. Future research should consider whether having one or multiple supportive relations across or within multiple contexts may be beneficial for children as stressors associated with the pubertal and adolescent transition extend to these macro and micro contexts.

There was not a significant main effect for friendship quality on emotional symptoms. One potential reason for null findings may be related to the lack of friendship stability throughout the developmental transition during this 5-year period. As friendship quality was assessed only at age 10, it is not known whether the child maintained the close friendship throughout the pubertal and adolescent transition. Developmental theorists suggested that among children with higher quality friendships, less than half of these friendships remained stable over time (for a review see, Meter & Card, 2016; Poulin & Chan, 2010). One possible reason might be due to school transitions as Ng-Knight et al. (2019) found that only a quarter of children at age 11 transitioning from elementary to middle school maintained their higher quality friendships one year later. Furthermore, immediately after the transition into middle school, Franken et al. (2016) found that pubertally advanced children in their first year of middle school were more likely to select peers as friends who were physically similar and who also engaged in similar externalizing behaviors (e.g. smoking) and deselect friends who did not have a similar level of externalizing behaviors. Thus, earlier maturing children may select new

friends who are physically similar and who also may be older (Stattin & Magnusson, 1990). Lastly, regardless of whether the child and the friend attended the same school, a high quality friendship may naturally dissipate over time due to a conflict or as they come to develop new interests and new friends (Meter & Card, 2016). Thus, these factors, and many others, may disrupt friendship stability over time, which may cause the long-lasting effects of a higher friendship quality to dissipate across developmental periods, especially for earlier maturers. Lastly, it is important to note that while emotional symptoms covers a broad range of symptoms, including social stress, a child experiencing lower friendship quality is also an aspect of social stress making it a potential confounding variable. Future longitudinal studies should explore whether stable, higher quality friendships and how maintaining these friendships and/or other supportive relationships may be able maintain this protective social context.

Lastly, contrary to expectations, there was no significant main effect between pubertal timing at age 10 and emotional symptoms at age 15. One reason may be that pubertal timing effects on psychopathology may be more observable in samples with clinically significant levels of symptomatology (Ullsperger & Nikolas, 2017). For example, even though Conley, Rudolph, and Bryant (2012) also had positively skewed depression data, their community sample consisted of at least 25% of adolescents who reported some depressive symptoms or a clinical diagnosis of depression. As most of the adolescents in the present sample reported a slightly lower mean at half a standard deviation below the nationally normed average score (M=50, SD=10; Reynolds & Kampus, 2004), there were not many adolescents who reported at-risk (T score > 60;

10%) or clinically significant scores (T score >75; 2%), even after transforming the variable. Thus, as only about 10% of adolescents in the current sample are experiencing emotional symptoms at the at-risk level or higher, the association between pubertal timing and emotional symptoms over time may only be significant for samples that include a sufficient number of adolescents reporting subclinical and clinical levels of emotional symptoms. Future work should consider whether protective social network may buffer the negative effects of early puberty to reduce emotional symptoms in clinical samples.

Measurement issues related to pubertal timing should also be considered. One limitation was that the pubertal timing was standardized relative to the community sample, rather than the national norms or the child's school. Thus, it is unclear how children may be perceived in reference to their peers in specific contexts, such as those who attend the same school. It is also important to consider the racial composition of the context as it can play a role in how earlier maturers are perceived and treated amongst their peers. In addition, pubertal timing was assessed via mother report only. Thus, pubertal timing was limited to the mother's perception of her child's physical development. Moreover, pubertal timing was assessed at age 10 to capture the earlier maturers when their physical discrepancies may be more noticeable as many of their peers have not yet entered puberty. However, while these earlier maturers' initial pubertal process marks them as earlier, this may change as other children begin to enter the pubertal process and who have a faster pubertal tempo as they catch up with the earlier maturers (Mendle et al., 2010; Winer et al., 2016). In the same vein, age constraints of the

present sample may have limited the range of development for girls and boys at age 10 whereas obtaining measures of puberty at each year from ages 8-13 may provide additional insight into how maintaining the status of an earlier maturer, when physical discrepancies are noticeable, and its psychosocial consequences may persist and impact the child's trajectory throughout the entire pubertal process. Thus, assessing pubertal timing at multiple timepoints including both mother and child reports to gain a more comprehensive, reliable assessment may help to better examine the influence of trajectories of puberty and its interactions with the child's context on emotional symptoms over time.

Lastly, as measures of pubertal development often examine the child's physical maturity, it does not capture the frequent increases and decreases in mood or mood fluctuations that may occur as a result of irregularity in hormonal levels. Although the literature is limited, a recent review indicated that higher levels of sex-specific pubertal hormones (e.g. FSH) is associated with more mood fluctuations or emotional instability, particularly in girls in late childhood and early adolescence (Bailen, Green, & Thompson, 2019). Thus, as girls tend to experience greater negative emotionality and emotional arousal during the pubertal transition (Angold et al., 1998; Petersen & Taylor, 1980), earlier pubertal timing indicated by greater mood fluctuations than their same-sex, same-aged peers may be a better predictor for increases in emotional symptoms over time. Future studies should include assessment of hormonal levels and mood fluctuations as indicators of pubertal timing to better understand how these emotional aspects of puberty may contribute to emotional symptoms.

Post Hoc Analysis

Racial Differences

Post hoc analyses examining the role of race in the interactive effects of pubertal timing and friendship quality on emotional symptoms did not reveal a significant three-way interaction. While there were mean-level differences in pubertal timing between White and Black adolescents in the current study, with Black children reporting an earlier onset of puberty compared to White children, the interaction between pubertal timing and friendship quality on emotional symptoms over time did not differ among White or Black children. In addition, although not the focus of the study, while friendship quality at age 10 was negatively correlated with emotional symptoms at age 10 for White children, it was not for Black children, even though there were no race differences in the mean-level of total friendship quality; Black children also reported a higher than the typical average mean. Compared to White children, friendships for Black children may hold a different meaning and may function differently.

Although the literature is limited, researchers examining friendships among racial/ethnic youth offer a few theoretical reasons for how and why friendships may operate differently for Black children compared to White children. From a homophily perspective, which is the selection of friends based off similar phenotypical and behavioral characteristics, Black children who have a intraracial friend tend to have a more intimate friendship, especially among Black children with strong racial identities (e.g. high racial centrality; Hoffman, Agi, Rivas-Drake, & Jagers, 2019). However, researchers have theorized that being a part of the minority group in a predominantly

White school and/or neighborhood may make it difficult to seek intraracial friends as Black youth tend to make more interracial friends (Kawabata & Crick, 2008). Although there are less intraracial peers to select as a friend when attending a predominantly White school, McGill, Way, and Hughes (2012) found that Black sixth graders who did have an intraracial friend reported higher self-esteem and less depressive symptoms compared to those with an interracial friend. Thus, the race/ethnicity of the friend and the racial composition of the school may be another variable that might influence the association between friendship quality and emotional symptoms as the quality of support they receive may differ between an intraracial friend compared to an interracial friend (Aboud, Mendelson, & Purdy, 2003; Hoffman, Agi, Rivas-Drake, & Jagers, 2019).

Moreover, although there were mean-level differences in friendship quality between Black and White children, the present study found that Black children reported lower levels of companionship compared to White children which is consistent with a few studies (e.g. Aboud, Mendelson, & Purdy, 2003). Thus, for children whose friend also attended the same school, Black children may primarily see their friend only within a school setting whereas White children may frequently see their friend and participate in enjoyable activities both inside and outside of school, such as their homes or parks (Lessard, Kogachi, & Juvonen, 2018). Lastly, while most of the Black children in the present study reported having a higher quality friendship, the combined stress of being an earlier or later maturer, experiencing race-related discriminatory events, and the typical stressors of the adolescent transition, may be too much for one high quality friendship to mitigate all of negative effects of these stressors, especially if that friend is of a different

race. This may be especially true for Black earlier maturers developing in a predominantly White school or neighborhood context where their physical discrepancies may be more noticeable as they tend to enter puberty earlier than their White peers (Chumlea et al., 2003). Furthermore, while adults (e.g. teachers, police officers) tend to overestimate the age of Black children compared to White children (Goff et al., 2014), a Black earlier maturer may be perceived to be much older compared to a non-earlier maturers which could contribute to additional race-related discriminatory experiences as well as internalizing problems (Carter, Seaton, Rivas-Drake, 2017). If, indeed, these Black children do not rely on their friends for support similarly to White children, Black children may prefer to seek support or have even closer, more intimate relationships with family members, community members, and/or church/religious groups as past research suggests that Black individuals tend to be more family- and community-oriented (Kawabata & Crick, 2008). Thus, as the meaning of friendship quality described by the study's measure may not be as relevant for Black children, future studies should select more appropriate measures that are race-specific (e.g. support for minority stress) as well examine whether other sources of social support (e.g. church groups) may be more protective for Black children.

Strengths

This study has a number of strengths, including the use of a prospective design with a racially diverse community sample of children and adolescents over time. As such, the longitudinal nature of the study was able to address the temporal patterns in the relations between pubertal timing and emotional symptoms over a 5-year period. As a

majority of the literature examining the moderating role of friendship quality has mostly consisted of cross-sectional studies or longitudinal studies assessing the moderation effects over a year, this is the first study to examine whether friendship quality mitigates the negative effects of earlier pubertal timing for more than one year. Although the current study did not find support for friendship quality as a protective factor for earlier pubertal timing over time, the lack of findings further emphasizes the need to explore how other types of positive peer relations, or interpersonal relations more broadly, might protect these adolescents. In addition, the large sample size of families provided sufficient power to examine sex as a second moderator. Lastly, pubertal timing was operationalized as a continuous variable as opposed to a categorical variable which provided a wider range of values that was not truncated by cutoffs by the three categories (early, on-time, late; Dorn & Biro, 2011; Dorn et al., 2006). This is advantageous as the present study was able to utilize a dimensional approach in examining these variables to increase variability.

Conclusion

In conclusion, the current study used a large, community sample that followed participants from middle childhood to mid-adolescence to examine the interaction between pubertal timing and friendship quality to predict decreases in emotional symptoms by mid-adolescence. The aim of the current study was to assess the contextual amplification hypothesis and the friendship protection hypothesis to see if higher friendship quality served as a protective context to buffer the negative effects of earlier puberty. As the current study's main hypotheses were not supported, this suggests that

friendship quality may not be a strong enough protective factor to buffer against the unique stressors associated with being an earlier matuerer (i.e. peer stress, expectations to act in an adult-like manner) as well as the stressors associated with the adolescent transition. Thus, future research should continue to explore whether other types of positive peer relations (e.g. church support) as well as multiple supportive relations, may better mitigate the effects of earlier puberty to promote a less socially stressful environment, reducing emotional symptoms by mid-adolescence. This developmental period can present as a challenging time for earlier maturers given they must navigate and adjust to their biological changes as it is constantly interacting with their environment. It is imperative for future research to continue exploring protective factors to reduce the risk and to promote a healthier psychological well-being.

REFERENCES

Achenbach, T. M. (1992). *Manual for the child behavior checklist/2-3 and 1992 profile*. Burlington, VT: University of VT Department of Psychiatry.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Angold, A., Costello, E. J., & Worthman, C. M. (1998). Puberty and depression: the roles of age, pubertal status and pubertal timing. *Psychological medicine*, *28*(1), 51-61.

Baker, J. R., & Hudson, J. L. (2013). Friendship quality predicts treatment outcome in children with anxiety disorders. *Behaviour research and therapy, 51*(1), 31-36.

Bagwell, C. L., & Schmidt, M. E. (2011). *Friendships in childhood and adolescence*. New York, NY: Guilford Press.

Biro, F. M., Huang, B., Crawford, P. B., Lucky, A. W., Striegel-Moore, R., Barton, B. A., & Daniels, S. (2006). Pubertal correlates in Black and White girls. *Journal of Pediatrics, 148*, 234 –240.

Bishop, J.A., & Inderbitzen, H.M. (1995). Peer acceptance and friendship: an investigation of their relation to self-esteem. *Journal of Early Adolescence*, 15, 476–489.

Black, S. R., & Klein, D. N. (2012). Early menarcheal age and risk for later depressive symptomatology: The role of childhood depressive symptoms. *Journal of Youth and Adolescence*, *41*(9), 1142–1150.

Boulton, M. J., Trueman, M., Chau, C., Whitehand, C., & Amatya, K. (1999). Concurrent and longitudinal links between friendship and peer victimization: implications for befriending interventions. *Journal of Adolescence, 22*(4), 461–466.

Brendgen, M., Vitaro, F., Bukowski, W. M., Dionne, G., Tremblay, R. E., & Boivin, M. (2013). Can friends protect genetically vulnerable children from depression? *Development and Psychopathology, 25*(2), 277–289.

Bailen, N. H., Green, L. M., & Thompson, R. J. (2019). Understanding emotion in adolescents: A review of emotional frequency, intensity, instability, and clarity. *Emotion Review*, *11*(1), 63–73.

Butts, S. F., & Seifer, D. B. (2010). Racial and ethnic differences in reproductive potential across the life cycle. *Fertility and Sterility*, *93*(3), 681-690.

Calkins, S. D., Dedmon, S. E., Gill, K. L., Lomax, L. E., & Johnson, L. M. (2002). Frustration in infancy: Implications for emotion regulation, physiological processes, and temperament. *Infancy, 3*, 175-197. doi:10.1207/S15327078IN0302_4

Carter, R., Jaccard, J., Silverman, W. K., & Pina, A. A. (2009). Pubertal timing and its link to behavioral and emotional problems among 'at-risk'African American adolescent girls. *Journal of adolescence*, *32*(3), 467-481.

Carter, R., Silverman, W. K., & Jaccard, J. (2013). Race and perceived pubertal transition effects on girls' depressive symptoms and delinquent behaviors. *Journal of Youth And Adolescence, 42(*8), 1155-1168. doi:10.1007/s10964-012-9885-1

Carter, R. (2015). Anxiety symptoms in African American youth: The role of puberty and biological sex. *The Journal of Early Adolescence, 35*(3), 281-307.

Carter, R., Seaton, E. K., & Rivas-Drake, D. (2017). Racial identity in the context of pubertal development: Implications for adjustment. *Developmental Psychology, 53*(11), 2170–2181.

Carter, R., Halawah, A., & Trinh, S. L. (2018). Peer exclusion during the pubertal transition: The role of social competence. *Journal of Youth And Adolescence, 47*(1), 121-134. doi:10.1007/s10964-017-0682-8

Chumlea, W. C., Schubert, C. M., Roche, A. F., Kulin, H. E., Lee, P. A., Himes, J. H., & Sun, S. S. (2003). Age at menarche and racial comparisons in U.S. girls. *Pediatrics*, *111*, 110 –113.

Conley, C. S., & Rudolph, K. D. (2009). The emerging sex difference in adolescent depression: Interacting contributions of puberty and peer stress. *Development and Psychopathology, 21*(2), 593-620. doi:10.1017/S0954579409000327b

Conley, C. S., Rudolph, K. D., & Bryant, F. B. (2012). Explaining the longitudinal association between puberty and depression: Sex differences in the mediating effects of peer stress. *Development and Psychopathology, 24*(2), 691-701. doi:10.1017/S0954579412000259

Crockett, L. J., Carlo, G., Wolff, J. M., & Hope, M. O. (2013). The role of pubertal timing and temperamental vulnerability in adolescents' internalizing symptoms. *Development and Psychopathology,* 25(2), 377–389

Dimler, L. M., & Natsuaki, M. N. (2015). The effects of pubertal timing on externalizing behaviors in adolescence and early adulthood: A meta-analytic review. *Journal of Adolescence,* 45, 160–170.

Dorn, L. D., Susman, E. J., & Ponirakis, A. (2003). Pubertal timing and adolescent adjustment and behavior: Conclusions vary by rater. *Journal of Youth and Adolescence, 32*, 157–167.

Dorn, L. D., Sontag-Padilla, L. M., Pabst, S., Tissot, A., & Susman, E. J. (2013). Longitudinal reliability of self-reported age at menarche in adolescent girls: Variability across time and setting. *Developmental Psychology*, 49(6), 1187-1193. doi:10.1037/a0029424

Eccles, J. S., Midgley, C., Ames, C., & Ames, R. (1989). Research on motivation in education. New York: Academic.

Evans, D., Borriello, G. A., & Field, A. P. (2018). A Review of the Academic and Psychological Impact of the Transition to Secondary Education. *Frontiers in psychology, 9,* 1482. https://doi.org/10.3389/fpsyg.2018.01482

Fanti, K. A., & Henrich, C. C. (2010). Trajectories of pure and co-occurring internalizing and externalizing problems from age 2 to age 12: findings from the National Institute of Child Health and Human Development Study of Early Child Care. *Developmental psychology, 46*(5), 1159.

Felner, R. D., Primavera, J., & Cauce, A. M. (1981). The impact of school transitions: A focus for preventive efforts. *American Journal of Community Psychology, 9*(4), 449-459.

Furman, W., McDunn, C., & Young, B. J. (2008). The role of peer and romantic relationships in adolescent affective development. *Adolescent emotional development and the emergence of depressive disorders*, 299-317.

Ge, X., Conger, R. D., & Elder Jr, G. H. (1996). Coming of age too early: Pubertal influences on girls' vulnerability to psychological distress. *Child development*, *67*(6), 3386-3400.

Ge, X., Conger, R. D., & Elder, G. H., Jr. (2001). Pubertal transition, stressful life events, and the emergence of gender differences in adolescent depressive symptoms. *Developmental Psychology, 37*(3), 404–417. https://doi-org.libproxy.uncg.edu/10.1037/0012-1649.37.3.404

Ge, X., Elder, C. J., Regnerus, M., & Cox, C. (2001). Pubertal transitions, perceptions of being overweight, and adolescents' psychological maladjustment: Gender and ethnic differences. *Social Psychology Quarterly, 64*(4), 363-375. doi:10.2307/3090160

Ge, X., Kim, I. J., Brody, G. H., Conger, R. D., Simons, R. L., Gibbons, F. X., & Cutrona, C. E. (2003). It's about timing and change: Pubertal transition effects on symptoms of major depression among African American youths. *Developmental Psychology, 39*(3), 430-439. doi:10.1037/0012-1649.39.3.430

Ge, X., & Natsuaki, M. N. (2009). In search of explanations for early pubertal timing effects on developmental psychopathology. *Current Directions in Psychological Science, 18*(6), 327-331. doi:10.1111/j.1467-8721.2009.01661.x

Ge, X., Natsuaki, M. N., Jin, R., & Biehl, M. C. (2011). A contextual amplification hypothesis: Pubertal timing and girls' emotional and behavioral problems. In M. Kerr, H. Stattin, R. E. Engels, G. Overbeek, A. Andershed, M. Kerr, ... A. 0. Andershed (Eds.) , *Understanding girls' problem behavior: How girls' delinquency develops in the context of maturity and health, co-occurring problems, and relationships* (pp. 11-29). Wiley-Blackwell. doi:10.1002/9780470977453.ch1

Goff, P. A., Jackson, M. C., Di Leone, B. A. L., Culotta, C. M., & DiTomasso, N. A. (2014). The essence of innocence: consequences of dehumanizing Black children. *Journal of personality and social psychology*, *106*(4), 526.

Graber, J. A. (2003). Puberty in context. In C. Hayward (Ed.), *Gender differences at puberty* (pp. 307–325). New York: Cambridge University Press.

Graber, J. A., Seeley, J. R., Brooks-Gunn, J., & Lewinsohn, P. M. (2004). Is Pubertal Timing Associated with Psychopathology in Young Adulthood? *Journal of the American Academy of Child & Adolescent Psychiatry, 43*(6), 718-726. doi:10.1097/01.chi.0000120022.14101.11

Graber, J. A. (2013). Pubertal timing and the development of psychopathology in adolescence and beyond. *Hormones and Behavior*, *64*(2), 262–269.

Hamilton, J. L., Hamlat, E. J., Stange, J. P., Abramson, L. Y., & Alloy, L. B. (2014). Pubertal timing and vulnerabilities to depression in early adolescence: Differential pathways to depressive symptoms by sex. *Journal of Adolescence, 37*(2), 165–174.

Hamlat, E. J., Shapero, B. G., Hamilton, J. L., Stange, J. P., Abramson, L. Y., & Alloy, L. B. (2015). Pubertal timing, peer victimization, and body esteem differentially predict depressive symptoms in African American and Caucasian girls. *The Journal of early adolescence*, *35*(3), 378-402.

Hammen, C., & Rudolph, K. D. (2003). Childhood mood disorders. *Child psychopathology*, *2*, 233-278.

Hankin, B. L., Abramson, L. Y., Moffitt, T. E., Silva, P. A., McGee, R., & Angell, K. E. (1998). Development of depression from preadolescence to young adulthood: Emerging gender differences in a 10-year longitudinal study. *Journal of Abnormal Psychology, 107*, 128–140.

Hankin, B. L., & Abramson, L. Y. (2001). Development of gender differences in depression: An elaborated cognitive vulnerability–transactional stress theory. *Psychological bulletin*, *127*(6), 773.

Hankin, B. L., Mermelstein, R., & Roesch, L. (2007). Sex Differences in Adolescent Depression: Stress Exposure and Reactivity Models. *Child Development, 78*(1), 279-295. doi:10.1111/j.1467-8624.2007.00997.x

Hayward, C. (2003). Gender differences at puberty. New York, NY, US: Cambridge University Press. doi:10.1017/CBO9780511489716

Hollingshead, A. D. B. (1975). *Four factor index of social status*. Yale University, Department of Sociology.

Horwitz, B. N., Reynolds, C. A., & Charles, S. T. (2015). Understanding associations among family support, friend support, and psychological distress. *Personal*

Relationships, *22*(1), 79–91. https://doi-org.libproxy.uncg.edu/10.1111/pere.12063

Healy, K. L., & Sanders, M. R. (2018). Mechanisms through which supportive relationships with parents and peers mitigate victimization, depression and internalizing problems in children bullied by peers. *Child Psychiatry and Human Development*, *49*(5), 800–813.

Ioannou, M., Kassianos, A. P., & Symeou, M. (2019). Coping with depressive symptoms in young adults: Perceived social support protects against depressive symptoms only under moderate levels of stress. *Frontiers in Psychology*, *9*.

Jänsch, A., & Pupeter, M. (2017). Friendships Among Peers. In *Well-being, Poverty and Justice from a Child's Perspective* (pp. 135-147). Springer, Cham.

Keenan, K., Culbert, K. M., Grimm, K. J., Hipwell, A. E., & Stepp, S. D. (2014). Timing and tempo: Exploring the complex association between pubertal development and depression in African American and European American girls. *Journal of abnormal psychology*, *123*(4), 725.

Kendrick, K., Jutengren, G., & Stattin, H. (2012). The protective role of supportive friends against bullying perpetration and victimization. *Journal of Adolescence*, *35*(4), 1069–1080.

Kessler, R. C., Avenevoli, S., Costello, E. J., Georgiades, K., Green, J. G., Gruber, M. J., ... Petukhova, M. (2012). Prevalence, persistence, and sociodemographic correlates of DSM-IV disorders in the national comorbidity survey replication adolescent supplement. *Archives of General Psychiatry, 69*(4), 372–380.

Klein, D. N., Shankman, S. A., Lewinsohn, P. M., & Seeley, J. R. (2009). Subthreshold depressive disorder in adolescents: Predictors of escalation to full syndrome depressive disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*, 703–710.

Kline, R. (2016). *Principles and practice of structural equation modeling* (Fourth ed., Methodology in the social sciences) [Fourth edition.]. New York: Guilford Press.

Kovacs, M., & Devlin, B. (1998). Internalizing disorders in childhood. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *39*(1), 47-63.

La Greca, A. M., & Harrison, H. M. (2005). Adolescent peer relations, friendships, and romantic relationships: do they predict social anxiety and depression?. *Journal of clinical child and adolescent psychology*, *34*(1), 49-61.

La Greca, A. M., Davila, J., & Siegel, R. (2008). Peer relations, friendships, and romantic relationships: Implications for the development and maintenance of depression in adolescents. In *Adolescent emotional development and the emergence of depressive disorders*. Cambridge University Press.

Lewinsohn, P. M., Gotlib, I. H., Lewinsohn, M., Seeley, J. R., & Allen, N. B. (1998). Gender differences in anxiety disorders and anxiety symptoms in adolescents. *Journal of abnormal psychology*, *107*(1), 109.

Luby, J. L., Si, X., Belden, A. C., Tandon, M., & Spitznagel, E. (2009). Preschool depression: Homotypic continuity and course over 24 months. *Archives of General Psychiatry, 66,* 897–905.

Masten, A. S., Roisman, G. I., Long, J. D., Burt, K. B., Obradović, J., Riley, J. R., ... & Tellegen, A. (2005). Developmental cascades: linking academic achievement and externalizing and internalizing symptoms over 20 years. *Developmental psychology*, *41*(5), 733.

McLean, M. Syed (Eds.), The Oxford handbook of identity development (pp. 389-405). New York, NY, US: Oxford University Press.

Merikangas, K. R., He, J. -p, Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., ... Swendsen, J. (2010). Lifetime prevalence of mental disorders in US adolescents: Results from the national comorbidity survey replication–adolescent supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry, 49(*10), 980–989.

Mendle, J., Turkheimer, E., & Emery, R. E. (2007). Detrimental psychological outcomes associated with early pubertal timing in adolescent girls. *Developmental Review, 27*(2), 151-171. doi:10.1016/j.dr.2006.11.001

Mendle, J., Harden, K. P., Brooks-Gunn, J., & Graber, J. A. (2010). Development's tortoise and hare: Pubertal timing, pubertal tempo, and depressive symptoms in boys and girls. *Developmental Psychology*, 46, 1341–1353.

Mendle, J., Harden, K. P., Brooks-Gunn, J., & Graber, J. A. (2012). Peer relationships and depressive symptomatology in boys at puberty. *Developmental Psychology, 48(*2), 429-435. doi:10.1037/a002642

Mendle, J., & Ferrero, J. (2012). Detrimental psychological outcomes associated with pubertal timing in adolescent boys. *Developmental Review, 32*(1), 49-66. doi:10.1016/j.dr.2011.11.001

Mendle, J. (2014). Beyond pubertal timing: New directions for studying individual differences in development. *Current Directions in Psychological Science*, *23*(3), 215-219.

Muthén, L. K., & Muthen, B. (2017). *Mplus User's Guide: Statistical Analysis with Latent Variables, User's Guide*. Muthén & Muthén.

National Institute of Mental Health. (2017, November). *Major Depression*. Retrieved from https://www.nimh.nih.gov/health/statistics/major-depression.shtml

Natsuaki, M. N., Biehl, M. C., & Ge, X. (2009). Trajectories of depressed mood from early adolescence to young adulthood: The effects of pubertal timing and adolescent dating. *Journal of Research on Adolescence, 19*(1), 47-74.

Natsuaki, M. N., Klimes-Dougan, B., Ge, X., Shirtcliff, E. A., Hastings, P. D., & Zahn-Waxler, C. (2009). Early pubertal maturation and internalizing problems in adolescence: Sex differences in the role of cortisol reactivity to interpersonal stress. *Journal Of Clinical Child And Adolescent Psychology*, *38*(4), 513-524. doi:10.1080/15374410902976320

Natsuaki, M. N., Samuels, D., & Leve, L. D. (2015). Puberty, identity, and context: A biopsychosocial perspective on internalizing psychopathology in early adolescent girls. In K. C. McLean, M. Syed, K. C.

Negriff, S., & Susman, E. J. (2011). Pubertal timing, depression, and externalizing problems: A framework, review, and examination of gender differences. *Journal of Research on Adolescence,* 21(3), 717–746.

Oland, A. A., & Shaw, D. S. (2005). Pure versus co-occurring externalizing and internalizing symptoms in children: The potential role of socio-developmental milestones. *Clinical Child and Family Psychology Review, 8(*4), 247-270.

Parker, J. G., & Asher, S. R. (1993). Friendship and friendship quality in middle childhood: Links with peer group acceptance and feelings of loneliness and social dissatisfaction. *Developmental Psychology, 29*(4), 611-621.

Pelkonen, M., Marttunen, M., & Aro, H. (2003). Risk for depression: a 6-year follow-up of Finnish adolescents. *Journal of Affective Disorders*, *77*(1), 41-51.

Petersen, A. C., Crockett, L., Richards, M., & Boxer, A. (1988). A self-report measure of pubertal status: Reliability, validity, and initial norms. *Journal of Youth And Adolescence, 17*(2), 117-133. doi:10.1007/BF01537962

Reardon, L. E., Leen-Feldner, E. W., & Hayward, C. (2009). A critical review of the empirical literature on the relation between anxiety and puberty. *Clinical psychology review*, *29*(1), 1-23.

Rhee, H. (2005). Relationships Between Physical Symptoms and Pubertal Development. *Journal of Pediatric Health Care, 19*(2), 95-103. doi:10.1016/j.pedhc.2004.10.004

Reynolds, B. M., & Juvonen, J. (2011). The role of early maturation, perceived popularity, and rumors in the emergence of internalizing symptoms among adolescent girls. *Journal of youth and adolescence*, *40*(11), 1407-1422.

Reynolds, C. R., & Kamphaus, R. W. (1992). Behavior assessment system for children. Parent rating scales. *American Guidance Service*.

Reynolds, C.R., & Kamphaus, R. W. (2004). BASC-2: Behavior Assessment System for Children manual, (2nd Ed.). Circle Pines, MN: AGS Publishing.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin, 132*, 98–131.

Rubin, K. H., Bukowski, W. M., & Laursen, B. (Eds.). (2011). *Handbook of peer interactions, relationships, and groups*. Guilford Press.

Rudolph, K. D., & Flynn, M. (2007). Childhood adversity and youth depression: Influence of gender and pubertal status. *Development and Psychopathology, 19*(2), 497-521. doi:10.1017/S0954579407070241

Rudolph, K. D., & Troop-Gordon, W. (2010). Personal-accentuation and contextual-amplification models of pubertal timing: Predicting youth depression. *Development and Psychopathology*, *22*(2), 433-451.

Rudolph, K. D., Troop-Gordon, W., Lambert, S. F., & Natsuaki, M. N. (2014). Long-term consequences of pubertal timing for youth depression: Identifying personal and contextual pathways of risk. *Development and psychopathology, 26*(4pt2), 1423-1444.

Sharabany, R., Eshel, Y., & Hakim, C. (2008). Boyfriend, girlfriend in a traditional society: Parenting styles and development of intimate friendships among Arabs in school. *International Journal of Behavioral Development*, 32(1), 66-75.

Sowislo, J. F., & Orth, U. (2013). Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychological Bulletin*, *139*(1), 213–240. https://doi-org.libproxy.uncg.edu/10.1037/a0028931

Stattin, H., & Magnusson, D. (1990). Paths through life: pubertal maturation in female development (Vol. 2). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Stojković, I. (2013). Pubertal timing and self-esteem in adolescents: The mediating role of body-image and social relations. *European Journal of Developmental Psychology, 10*(3), 359–377. https://doi-org.libproxy.uncg.edu/10.1080/17405629.2012.682145

Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet*, *379*(9820), 1056-1067.

Ullsperger, J. M., & Nikolas, M. A. (2017). A meta-analytic review of the association between pubertal timing and psychopathology in adolescence: Are there sex differences in risk?. *Psychological Bulletin*, *143*(9), 903-938. doi:10.1037/bul0000106

Waldrip, A. M., Malcolm, K. T., & Jensen-Campbell, L. A. (2008). With a little help from your friends: The importance of high-quality friendships on early adolescent adjustment. *Social development*, *17*(4), 832-852.

Way, N., & Greene, M. L. (2006). Trajectories of Perceived Friendship Quality During Adolescence: The Patterns and Contextual Predictors. *Journal of Research on Adolescence*, *16*(2), 293–320.

Way, N., & Silverman, L. R. (2011). The quality of friendships during adolescence. *Adolescence and beyond: Family processes and development*, 91-112.

Wigfield, A., Eccles, J. S., Mac Iver, D., Reuman, D. A., & Midgley, C. (1991). Transitions during early adolescence: Changes in children's domain-specific self-perceptions and general self-esteem across the transition to junior high school. *Developmental psychology, 27*(4), 552.

Williams, J. M., & Currie, C. (2000). Self-esteem and physical development in early adolescence: Pubertal timing and body image. *The Journal of Early Adolescence, 20*(2), 129–149. https://doi-org.libproxy.uncg.edu/10.1177/0272431600020002002

Winer, J. P., Parent, J., Forehand, R., & Breslend, N. L. (2016). Interactive effects of psychosocial stress and early pubertal timing on youth depression and anxiety: Contextual amplification in family and peer environments. *Journal of Child and Family Studies*, 25(5), 1375–1384.

Zhou, Y., & Liu, J. (2016). Preference-for-solitude and depression during middle childhood: Moderating effect of friendship. *Chinese Journal of Clinical Psychology*, *24*(3), 491–494.