

TRAJECTORIES OF ADOLESCENT DATING ABUSE PERPETRATION AND
VICTIMIZATION: THE IMPACT OF PUBERTAL TIMING AND THE ROLE OF PEER
CONTEXT

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ABSTRACT

ASHLEY BROOKS RUSSELL: Trajectories of Adolescent Dating Abuse Perpetration and Victimization: The Impact of Pubertal Timing and the Role of Peer Context
(Under the direction of Vangie Foshee)

Although pubertal timing has been associated with many adolescent health risk behaviors, its relationship to dating abuse has rarely been considered. This dissertation utilized structural equation modeling to investigate associations between the pubertal timing of boys and girls and developmental trajectories of adolescent dating abuse perpetration and victimization from grades eight to 12 (Study 1), and examine theoretically-based processes through which pubertal timing influences the development of dating abuse (Study 2).

The data for these studies come from a multi-wave study of adolescents conducted from 2002 to 2005 in two rural counties in North Carolina. Three cohorts of students completed questionnaires in school beginning in sixth, seventh, and eighth grades, every six months for six waves, and one year later for a total of seven waves.

The first study (n=2,053) used two theoretical models, the *early maturation model* and the *off-time model*, to propose hypotheses about associations between pubertal timing and trajectories of dating abuse. After testing the relationships using two measures of pubertal timing and four dating abuse outcomes for boys and girls, one significant finding emerged. As hypothesized for girls, early pubertal timing versus all others was related to an increase in psychological dating abuse victimization in eighth grade. There were no significant associations between pubertal timing and dating abuse for boys after including control variables.

The second study (n=1,092) expanded on the first by utilizing social network data to characterize an adolescent's peer context and test if peer context, as well as individual characteristics, mediate the relationship between pubertal timing and psychological dating abuse victimization for girls. Pubertal timing was related to friend substance use and friend substance use and emotional distress were related to psychological dating abuse victimization, but none of the mediators accounted for a significant indirect effect.

The few significant findings limit implications for practice. Nonetheless, evidence from numerous other studies indicates the timing of puberty increases risk for several problems behaviors. Further research is needed to identify the processes through which pubertal timing impacts these risky behaviors, regardless if dating abuse is also implicated.

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CHAPTER 1: SPECIFIC AIMS

Although pubertal timing has been found to be associated with many adolescent health risk behaviors, the role of pubertal timing in the development of adolescent dating abuse has rarely been considered. Yet, it is reasonable to expect that pubertal timing would be related to dating abuse. Early pubertal timing has been associated with earlier and more sexual experience (Flannery, Rowe, & Gulley, 1993; Rosenthal, Smith, & de Visser, 1999; Zabin, Smith, Hirsch, & Hardy, 1986), which increase the opportunity for dating abuse to occur. In addition, non-normative pubertal timing has been associated with related behaviors including violence (Cota-Robles, Neiss, & Rowe, 2002; Felson & Haynie, 2002), being a victim of violence (Haynie & Piquero, 2006), and perpetrating and being a victim of sexual harassment (Craig, Pepler, Connolly, & Henderson, 2001; McMaster, Connolly, Pepler, & Craig, 2002). Violence and sexual harassment are not only conceptually relevant to dating abuse, but these behaviors have also been found to be precursors to adolescent dating abuse (Brendgen, Vitaro, Tremblay & Lavoie, 2001; Chiodo, Wolfe, Crooks, Hughes, & Jaffe, 2009; O'Donnell, Stueve, Myint, Duran, Agronick, & Wilson-Simmons, 2006). Given the high prevalence of adolescence dating abuse, with a third of all teens reporting that they have experienced dating abuse in the past year (Halpern, Oslak, Young, Martin, & Kupper, 2001), and the seriousness of the sequelae, ranging from increased substance use, to injury, to risk for suicide (Ackard, Eisenberg, & Neumark-Sztainer, 2007; O'Leary, Smith Slep, Avery-Leaf, & Cascardi, 2008; Roberts, Klein, & Fisher, 2003), there is ample need to address risk factors for adolescent dating abuse.

This dissertation utilized latent growth models to 1) investigate associations between the pubertal timing of boys and girls and developmental trajectories of adolescent dating abuse perpetration and victimization from eighth through 12th grade (Study 1), and 2) examine theoretically-based processes through which pubertal timing influences the development of dating abuse (Study 2). Both studies draw on two theoretical models, the early maturation model and the off-time model to propose hypotheses.

The *early maturation model* proposes that early maturers, as compared to on-time and late maturers are at increased risk for problems like dating abuse because they are thrust too quickly from childhood into adult-like roles and experiences. Early maturing teens adopt norm-violating behaviors and friends in an effort to match their early physical development to their perceptions of what signals maturity. This mismatch between precocious behaviors and lagging social development leaves the early maturing teen less prepared to negotiate and cope with the new adolescent experiences including dating relationships, which could lead to dating abuse perpetration or victimization. The *off-time model* proposes that early and late matures, who deviate from the normal on-time development, suffer social consequences for their deviant physical status. This results in difficulty with peer relationships and emotional distress. Off-time teens may perpetrate dating abuse in an effort to gain status and assert dominance or tolerate dating abuse victimization due to a desire to maintain a relationship and the approval of a dating partner.

Only one study has examined the association between pubertal timing and adolescent physical and psychological dating abuse (Foster, Hagan, & Brooks-Gunn, 2004) and that study was with girls, only examined victimization, only considered dating abuse victimization at one point in time, and did not test for mediators of the relationship between pubertal timing and dating abuse victimization. Thus, the two studies in this

dissertation research expand the literature in the following ways: 1) these studies examine the association between pubertal timing and dating abuse for both boys and girls; 2) include both perpetration and victimization outcomes; 3) examine associations of pubertal timing using trajectories as opposed to point estimates of dating abuse; 4) test for theoretically based mediators of the relationship between pubertal timing and dating abuse; 5) include more extensive measures of pubertal timing; and 6) control for differences in whether or not the teen has dated.

The data for the two studies in this dissertation come from a multi-wave study of adolescents conducted between 2002 and 2005 in two rural counties in North Carolina. Three cohorts of students completed surveys in school, beginning in sixth, seventh, and eighth grades, every six months for six waves, and then one year later for a total of seven waves of data. A total of 3,978 students participated in the original studies in two counties at any of the seven waves of data collection. The exclusion criteria for the first study resulted in an analysis sample of 2,053. The second study was limited to girls, and had an analysis sample of 1,092.

The dissertation is organized into five chapters. This chapter provides the specific aims. Chapters 2 and 3 provide further background information on teen dating abuse and an overview of the theoretical and empirical evidence for an association between pubertal timing and dating abuse. Chapter 2 tests hypotheses related to the relationship between pubertal timing and dating abuse perpetration and Chapter 3 tests hypotheses of the relationship between pubertal timing and dating abuse victimization. Chapter 4 tests if the peer context and individual characteristics mediate the relationship between pubertal timing and dating abuse. Chapter 5 summarizes the key results and discusses limitations and implications for future research.

Given the high prevalence of adolescent dating abuse and implications for negative health consequences and later intimate partner relationships, it is critical to

increase our understanding of the risk factors of dating abuse. Identifying the mediating mechanisms for the relationship between a potential risk factor, like pubertal timing, and dating abuse is an important step in continuing to improve prevention efforts.

CHAPTER 2: THE RELATIONSHIP BETWEEN PUBERTAL TIMING AND TRAJECTORIES OF ADOLESCENT DATING ABUSE PERPETRATION

INTRODUCTION

The purpose of this study is to investigate associations between the pubertal timing of boys and girls and developmental trajectories of adolescent dating abuse perpetration from grades eight to 12. There is robust evidence that the timing of pubertal development is salient for adolescents. Deviations from the normal timing of puberty have been associated with several adolescent externalizing behaviors including violence (Cota-Robles et al., 2002; Felson & Haynie, 2002), delinquency (Caspi & Moffitt, 1991; Felson & Haynie, 2002; Haynie, 2003), perpetration of sexual harassment (McMaster et al., 2002), and substance use (Dick, Rose, Viken, & Kaprio, 2000; Lanza & Collins, 2002; Tschann, Adler, Irwin, Millstein, Turner, & Kegeles, 1994; Westling, Andrews, Hampson, & Peterson, 2008). These behaviors, particularly violence and perpetrating sexual harassment, are not only conceptually relevant to dating abuse, but have also been found to be precursors to adolescent dating abuse (Brendgen et al., 2001; Chiodo et al., 2009; O'Donnell et al., 2006). Furthermore, early pubertal timing has been associated with early dating and sexual experience (Flannery et al., 1993; Rosenthal, et al., 1999; Zabin, et al., 1986), which would increase exposure to dating relationships and serious relationships, and therefore increase the opportunity for dating abuse to occur.

Despite the evidence linking pubertal timing with externalizing behaviors, very little attention has been given to the role of pubertal timing in the development of adolescent dating abuse perpetration. Only one study has examined the association

between pubertal timing and adolescent physical and psychological dating abuse (Foster et al., 2004). However, that study was limited to girls, only examined victimization, and did not include trajectories of behaviors as outcomes. This study will extend that research by 1) examining the association between pubertal timing and dating abuse perpetration, 2) including boys and girls, 3) examining associations of pubertal timing using trajectories of dating abuse as opposed to point estimates, 4) including more extensive measures of pubertal timing, and 5) controlling for differences in dating onset.

Adolescent Dating Abuse Perpetration Prevalence

No national studies report prevalence rates for adolescent dating abuse perpetration; however, a review of local studies by Foshee & Matthew (2007) found that prevalence of psychological dating abuse perpetration ranges from 14% to 82% and the prevalence of physical dating abuse perpetration ranges from 11% to 41%. Conventional wisdom and data from *adult* populations suggest that women are primarily victims of intimate partner abuse and men are primarily the perpetrators. However, for *adolescents*, psychological abuse and (non-sexual) physical abuse, which are the focus of this study, follow a different pattern. Studies have found that prevalence rates of psychological and physical dating abuse perpetration are either similar for boys and girls, or girls report slightly more dating abuse perpetration than boys (for a review, see Foshee & Matthew, 2007). Some evidence suggests that boys are more likely than girls to perpetrate severe physical abuse (Bennett & Fineran, 1998; Coker et al., 2000; Foshee et al., 2009), while other studies have found that girls are more likely to perpetrate severe physical abuse (Foshee, 1996; Lichter & McCloskey, 2004). Because of the significant level of dating abuse perpetration by both boys and girls, this study will include both when examining the relationship between pubertal timing and dating abuse

perpetration.

Trajectories of Dating Abuse

Although many studies have examined the prevalence of dating abuse at single points in time, very few have explored developmental trajectories of dating abuse over time. Trajectories allow for intra-individual change over time as well as inter-individual differences. Utilizing trajectories to examine relationships between risk factors and behaviors provides a better match to developmental research questions as compared with cross-sectional analyses or traditional methods of longitudinal analysis. Longitudinal data provide the opportunity to examine the complexity of how a risk factor affects a behavior over time; a risk factor can affect the baseline level of a behavior and/or its rate of change over time.

Foshee and colleagues found that trajectories of physical dating abuse perpetration were quadratic, increasing from eighth to 10th grade and then decreasing through 12th grade (Foshee et al., 2009; Reyes, 2009). The quadratic pattern seen with trajectories of physical dating abuse perpetration is similar to that of other adolescent problem behaviors such as delinquency (Farrington, 1986). Some have suggested this quadratic pattern reflects the increase in risk taking and sensation seeking behaviors that occurs during puberty and the lagging development of impulse control and emotional regulation that occurs later in adolescence and serves to dampen risk taking behaviors (Steinberg, 2007; Steinberg et al., 2008). Psychological dating abuse perpetration may follow a different pattern. Foshee et al. (2009) found that for both boys and girls trajectories of psychological dating abuse perpetration were linear, steadily increasing from eighth to 12th grade. Linear increases in psychological dating abuse perpetration could be due to an age-related increase in dating and seriousness of dating relationships. Given this literature, I expect that trajectories of psychological abuse

perpetration will follow a linear pattern and trajectories of physical abuse perpetration will be quadratic.

Pubertal Timing

During puberty levels of sex specific hormones like testosterone and estradiol rise, causing the development of secondary sex characteristics and fertility. In males, the increase in hormones results in the development of facial hair, a deepening of the voice, and an increase in muscle mass. In females the changes include an increase in body fat, breast development, and the start of menstruation. In both males and females there is growth of pubic hair, changes to the skin, and a growth spurt. Males and females differ in the age of onset for pubertal development and the length of time it takes to fully develop. In America, puberty begins around age nine for girls and approximately a year later, age 10 or 11, for boys (Beaver & Wright, 2005; Dubas, Graber, & Petersen, 1991). Male pubertal development occurs over a longer time period as compared to female development which, on average, has leveled off by 10th grade (Beaver & Wright, 2005).

A distinction is made between pubertal status and pubertal timing. Pubertal status refers to the absolute level of physical development whereas pubertal timing refers to relative physical development as compared to same-aged peers. As previously described, there is robust evidence that the timing of pubertal development is significant for adolescents and departure from the normal timing of puberty can have repercussions for a variety of relevant health risk behaviors. Longitudinal studies have found that the effects of pubertal timing can last through mid to late adolescence (Ge, Conger, & Elder, 1996; Petersen, Sarigiani, & Kennedy, 1991) and into young adulthood (Biehl, Natsuaki, & Ge, 2007; Graber, Seeley, Brooks-Gunn, & Lewinsohn, 2004). The empirical evidence for the relationship between pubertal timing and behaviors related to dating abuse perpetration will be described below for boys and girls separately.

STUDY HYPOTHESES

Two theoretical models, the early maturation model and the off-time model, are frequently used to explain the relationship between pubertal timing and problem behaviors. Although these models have more commonly been applied in studies of delinquency and substance use (for example, see Caspi, Lynam, Moffit, & Silva, 1993; Ge, Brody, Conger, Simons, & Murray, 2002; Haynie, 2003; Tschann et al., 1994; Westling et al., 2008; Williams & Dunlap, 1999), they can be extended to dating abuse.

Early Maturation Model

The early maturation model proposes that early pubertal timing, as compared to on-time and late pubertal timing, is a risk factor for adolescent problem behaviors because early maturing teens experience an accelerated transition from childhood to adolescence (Petersen & Crockett, 1985; Petersen & Taylor, 1980). To match their physical maturity, early developing teens tend to seek out friends and imitate behaviors that are perceived as more adult-like. At the same time the teen has less time to consolidate his/her self-identity and develop social skills like emotional regulation, decision-making skills and coping strategies. Due to the mismatch between physical maturity and the newly adopted precocious behaviors and friends on the one hand, and lagging social development on the other hand, early maturing teens may have difficulty managing the social situations in which they find themselves. For example, they may lack the skills needed to negotiate the dynamics of a dating relationship, which could lead to dating abuse perpetration as an inappropriate response.

An alternative but related explanation for the risks of early maturation is provided by the maturity gap hypothesis. This hypothesis proposes that in the U.S. there is a gap between when teens develop physically and when they are granted adult roles and responsibilities. This gap results in teens breaking rules and violating norms as a

rebellion and show of dissatisfaction with the lack of autonomy they are given (Moffitt, 1993). It follows that the earlier a teen develops, the greater the extent to which they would experience this maturity gap, and therefore, the greater their involvement in antisocial behavior. The maturity gap hypothesis is typically used to explain the increase in antisocial behaviors in adolescence like violence, delinquency, and drug use, but the rationale is consistent with dating abuse perpetration behaviors.

As childhood development is cut short, early maturing teens take on the developmental tasks of adolescence, which include distancing themselves from parents in favor of increased time spent with peers (Havighurst, 1948). The growing influence of peers during adolescence makes friends an important factor in the relationship between early pubertal timing and dating abuse. Teens choose friends like themselves and as consequence early maturing teens may seek out older friends and/or friends who are engaging in rule-breaking behaviors because those friends provide the appearance of maturity. Such behaviors may include dating, experimenting with tobacco, alcohol, and drug use, and acting in aggressive ways. A friendship group composed of norm-violating friends would not only provide more opportunity for the adolescent to have an unhealthy dating relationship, but these friends would also be more tolerant of such a relationship. To compound this risk, parents and other adults may allow early maturers more unsupervised time, mistaking the physical maturity for social maturity.

The Off-Time Model

The off-time model, also known as the deviance hypothesis (Petersen & Crockett, 1985; Petersen & Taylor, 1980) proposes that teens who develop earlier or later than their peers are at a greater risk for engaging in health risk behaviors because of psychosocial maladjustment resulting from deviant social status. This concept comes out of life-span and life-course theories which suggest there is a normal and expected

timing for life events (Brooks-Gunn, Petersen, & Eichorn, 1985; Neugarten, 1979). Events which are off-time can lead to emotional distress, lower self-concept, and poorer social adaptation. Additionally, off-time pubertal timing could lessen the teen's social status among his or her peers as evidenced by being less popular and socially isolated. These teens may have difficulty in romantic relationships due to the lack of experience with positive peer interactions, which serve as a model for behavior in romantic relationships. Limited research suggests that difficulty with peer relationships could lead to aggressive behaviors in dating relationships. In a study of elementary school students, peer rejection and poor peer acceptance was associated with increased aggressive behaviors against peers (Crick & Grotpeter, 1995). In studies with college students, peer rejection was associated with increased relational aggression (Werner & Crick, 1999) and peer alienation was associated with greater relational aggression in romantic relationships (Linder, Crick & Collins, 2002).

Hypothesis for Girls

There is strong evidence that early maturing as opposed to on-time or late maturing girls are at risk for problem behaviors. Early menarche is associated with earlier initiation and greater frequency of tobacco and alcohol use (Dick et al., 2000), and greater likelihood of ever trying alcohol, cigarettes, marijuana or having ever been drunk (Lanza & Collins, 2002; Tschann et al., 1994; Westling et al., 2008). Lynne, Graber, Nichols, Brooks-Gunn, & Botvin (2007) found that early pubertal timing was associated with an increase in delinquent and aggressive behaviors in the sixth through eighth grades. Haynie (2003) found for girls early pubertal timing was associated with higher levels of serious delinquency, which included participation in a physical fight, participation in a group fight, gang membership, and having shot/stabbed someone in the past year. McMaster and colleagues (2002) found that for middle school students,

early pubertal timing among girls (and boys) was associated with an increase in the perpetration of opposite-sex sexual harassment.

Early pubertal timing for girls is also linked to an increase in dating and sexual experience. Using data from the National Longitudinal Study of Adolescent Health (Add Health), researchers found that appearing older than most peers was associated with earlier sexual debut (Resnick et al., 1997) and that for White and Latina girls (but not African American girls) younger age at menarche was associated with earlier sexual debut (Cavanagh, 2004). Smaller studies have found that appearing more mature than same-age, same-sex peers, was associated with earlier sexual debut (Rosenthal et al., 1999) as was a younger age at menarche (Zabin et al., 1986). Flannery and colleagues (1993) found that early pubertal timing was associated with more sexual activity and delinquency for girls (and boys).

In addition to the dynamics proposed in the early maturation model, early maturing girls may be considered more physically attractive by potential romantic partners and may feel increased pressure to begin dating. Earlier dating and more physical development could also lead to more physically intimate romantic relationships, for which the early maturing girl is not psychologically or socially prepared to handle. As these early maturing teens attempt to cope with conflicts in dating relationships they may turn to abusive behaviors rather than negotiate with a romantic partner or express dissatisfaction or frustration in a healthy way.

Given the theoretical rationale and empirical support for behaviors related to dating abuse perpetration, it is hypothesized that: Hypothesis 2.1: For girls, early pubertal timing, as compared to on-time and late pubertal timing, will be associated with a higher mean level of physical and psychological perpetration in the eighth grade (intercept) and a higher mean growth (slope) through the 12th grade. It is expected that the trajectories of physical dating abuse perpetration will be positive quadratic and

trajectories of psychological dating abuse perpetration will be positive and linear.

Hypotheses for Boys

There is empirical evidence that both early and late maturing boys are at risk for externalizing behaviors. The explanations for why early maturing boys may be at risk could be based on processes of both the early maturation and off time models whereas the explanation for why late maturing boys may be at risk is based on processes explicated in the off-time model.

Research studies have found that early maturing boys, as compared with on-time or late maturing boys were more likely to use alcohol (Biehl et al., 2007; Tschann et al., 1994; Westling et al., 2008; Wichstrom, 2001), have heavy drinking trajectories (Biehl et al., 2007), and use cigarettes and marijuana (Tschann et al., 1994; Westling et al., 2008). For middle school boys, early pubertal timing was associated with aggression in the past month and delinquency in the past year (Lynne et al., 2007). A study using Add Health data and a multi-ethnic sample of boys (White, African American, and Mexican American) found that early pubertal timing was associated with higher levels of violent behavior such as engaging in a physical fight, injuring someone, threatening with or using a weapon, and taking part in a group fight, as well as non-violent behaviors including lying to parents about whereabouts, shoplifting, joyriding, and burglary (Cota-Robles et al., 2002). Another study using Add Health data also found that early pubertal timing was related to violence, theft and property offenses, drug use, ever having had sexual intercourse, and that early maturing boys were more strongly influenced by delinquent friends (Felson & Haynie, 2003). As previously mentioned, early pubertal timing among boys was related to more sexual activity, delinquency (Flannery et al., 1993) and perpetration of opposite-sex sexual harassment (McMaster et al., 2002).

Why early maturing boys are at risk of problem behaviors could be explained by

processes explicated by the early maturation model described above. As with girls, early maturing boys would feel pressure to begin dating earlier, increasing the opportunity for dating abuse. Boys may also feel pressures to act in ways that are concordant with their physical development such as acting dominant and aggressive. Being socially immature for their development, early maturing boys may lack the ability to constructively pursue their goals and may rely on aggressive behaviors to gain control of situations. Parents and peers may expect more dominant behaviors from early developers and so these teens may experience less disapproval for such actions.

The off-time model could also be used to explain why early maturing boys are at risk of problem behaviors. Early maturing boys may try to compensate for their feelings of social deviance by dating earlier. Due to their poorer social adaptation and emotional distress, such as feelings of anger and anxiety, early maturing boys may be more likely to engage in dating abuse perpetration.

Whereas for girls the evidence has consistently found earlier timing to be risky, several studies have found late pubertal timing for boys to be a risk factor for problem behaviors. Late maturation as measured at age 14 was associated with signs of alcohol abuse at ages 18 to 24 in a Swedish sample of males (Anderson & Magnusson, 1990). Williams & Dunlap (1999) found that late pubertal timing (as well as early pubertal timing) was associated with antisocial behaviors including theft, vandalism, crime, school opposition, smoking, drinking, and fighting. Late pubertal timing measured in high school was later associated with disruptive behavior disorders (attention-deficit/hyperactivity disorder and conduct and oppositional disorders) and substance abuse and dependence disorders at age 24 (Graber et al., 2004). Late maturation for boys has also been associated with lower school achievement (Dubas et al., 1991).

Processes of the off-time model may explain why late maturers are at risk for dating abuse perpetration. Late maturing boys who feel uncomfortable with their physical

status may act in ways to increase their social status. This could include dating and being aggressive or controlling of a dating partner. Late maturers may engage in dating abuse perpetration to compensate for their smaller stature, assert dominance, and gain social status. Based on the empirical and theoretical evidence I hypothesize that:

Hypothesis 2.2: For boys, early pubertal timing, as compared to on-time pubertal timing, will be associated with a higher mean level of physical and psychological perpetration in the eighth grade (intercept) and a higher mean growth (slope) through the 12th grade.

Hypothesis 2.3: For boys, late pubertal timing, as compared to on-time pubertal timing, will be associated with a higher mean level of physical and psychological perpetration in eighth grade (intercept) and higher mean growth (slope) in dating abuse through the 12th grade.

It is expected that the trajectories of physical dating abuse perpetration will be positive and quadratic and trajectories of psychological dating abuse perpetration will be positive and linear. Study 1 does not examine the process through which pubertal timing influences dating abuse (examined in Study 2); therefore, a conclusion cannot be made about which model is supported. However, examining the pattern of association between pubertal timing and dating abuse is an important first step in testing the two theoretical models.

Significance of Research

Pubertal timing is likely associated with dating abuse perpetration, given the associations between pubertal timing and related behaviors such as violence and perpetrating peer sexual harassment, as well as the association with other externalizing behaviors like substance use and delinquency. However, further research is needed to understand the effect of pubertal timing on dating abuse perpetration for both boys and girls.

Given the high prevalence of adolescent dating abuse perpetration, dating abuse is a critical topic for research. This study will contribute to a greater understanding of this significant public health problem by utilizing a large, longitudinal dataset to explore how the timing of pubertal development is associated with trajectories of dating abuse perpetration. Only one study has examined the relationship between pubertal timing and dating abuse victimization and no studies have looked at the relationship between pubertal timing and dating abuse perpetration, despite strong evidence to expect such a relationship.

METHODS

Study Design

The data for this study come from two linked longitudinal studies. In the first study, *The Context of Adolescent Substance Use* (NIDA R01 DA 13459; PI Susan Ennett), data were collected from three sequential cohorts of adolescents in the public school systems of three predominately rural North Carolina counties when students were in the sixth, seventh, and eighth grades. Students were surveyed every six months for a total of five waves of data collection. Additional funding was awarded in 2003 for a second study, *Violence Against Peers, Dates, and Self: A Developmental Focus* (CDC R49 CCV423114; PI Vangie Foshee), which included extensive dating abuse questions in waves four and five and followed students in two of the three counties for an additional two waves, until students were in 10th, 11th, and 12th grades, for a total of seven waves of data collection. Response rates ranged from 88% at wave one to 65% at wave seven.

This dissertation study only includes data from the two counties where students were followed for the full seven waves. Table 2.1 describes the waves, cohorts, and data collection timeline. Among those students who completed the survey at wave one, 85% completed a survey at least once during waves four through seven (when the dating

abuse questions were added).

Table 2.1 Study design: waves, cohorts, and timeline

N=3,978	Wave 1 Spring '02 (n=2,825)	Wave 2 Fall '02 (n=2,624)	Wave 3 Spring '03 (n=2,703)	Wave 4 Fall '03 (n=2,636)	Wave 5 Spring '04 (n=2,464)	Wave 6 Fall '04 (n=2,419)	Wave 7 Fall '05 (n=2,133)
Cohort 1	6 th grade	7 th grade	7 th grade	8 th grade	8 th grade	9 th grade	10 th grade
Cohort 2	7 th grade	8 th grade	8 th grade	9 th grade	9 th grade	10 th grade	11 th grade
Cohort 3	8 th grade	9 th grade	9 th grade	10 th grade	10 th grade	11 th grade	12 th grade

Note: sample sizes at each wave are for the two counties where students were followed for the full seven waves

All students enrolled in the grade cohorts of interest at each wave were eligible to participate in the study, except for students in special education classes or those unable to complete the questionnaire in English. Several weeks before data collection, parents of eligible students were mailed a letter explaining the study. Parents who did not want their child to participate were asked to return a signed form or call the research office. The data were collected using self-administered questionnaires. Each classroom had at least one trained research staff member to serve as a data collector. Students whose parents declined their participation were excused from the classroom. At the beginning of data collection, data collectors read a script and obtained written student assent to participate. Teachers were asked to remain in the classroom to maintain classroom order; however, they were instructed to not circulate about the classroom or answer questions about the survey. Students placed completed questionnaires in a sealed envelope and gave it to the data collector. Students were allowed approximately one hour to complete the questionnaire. There was no monetary incentive for students to participate. Data collectors returned to the school for several additional days to attempt to survey students who were absent on the day of data collection day. Students who could not be reached at school were asked to complete a mailed questionnaire. These

procedures were followed for each wave of data collection. The study and data collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, School of Public Health.

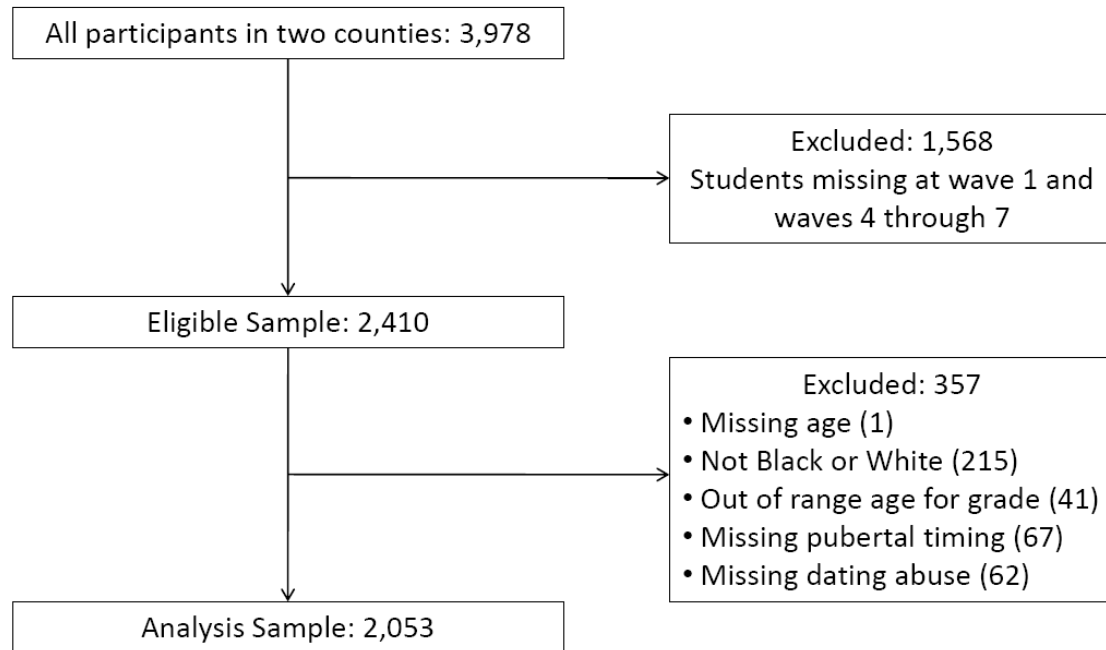
Study Sample

A total of 3,978 students participated in the original studies in the two counties at any of the seven waves of data collection. The participation ranged from 2,825 students at wave one to 2,133 students at wave seven (Table 2.1). The sample for the current study was limited to students who completed the first wave of data collection and at least one of waves four through seven. This is because the measure of pubertal timing comes from the first wave and the dating abuse questions were added to the survey during waves four through seven. This left a possible eligible sample of 2,410 students (Figure 2.1).

As will be described in more detail in the description of study measures, the measure of pubertal timing was standardized based on age, sex, and race/ethnicity. Therefore, if students were missing age ($n=1$), sex ($n=0$), or race/ethnicity ($n=0$), they were excluded from the analysis sample. There were not enough students who reported their race/ethnicity to be other than Black or White in order to standardize pubertal timing by a race/ethnicity other than Black or White. Therefore, students were excluded if they did not report their race/ethnicity to be Black or White ($n=215$). There were not enough students who reported their age at wave one to be less than 11 years old or older than 16 years old to standardize the pubertal timing measure for these age categories. Thus, students who reported their age to be outside of a three-year range of normal age for a grade at any wave were excluded from the analysis sample ($n=41$). Finally, students were excluded if they did not respond to the questions about pubertal status at wave one ($n=67$) or if they were missing responses to the dating abuse questions at all waves

(n=62). These exclusion criteria resulted in a final analysis sample of 2,053 (Figure 2.1).

Figure 2.1 Exclusion criteria and analysis sample



Of the final analysis sample, 87% of students completed wave four, 82% completed wave five, 77% completed wave six, and 69% completed wave seven. As stipulated by the inclusion criteria, 100% completed at least one of the waves four through seven; 50% completed all four waves, 23% completed three waves, 19% completed two waves, and 8% completed only one wave. At wave one, 47% of students were male, 55% were Black, 45% were White, and the average age was 13.1 years. Ninety one percent of students reported that at least one parent was a high school graduate and 10% of students reported they lived with one parent.

Missing Data

Students included in the final analysis sample (n=2,053) were compared to all students from the two counties (n=3978) to examine the generalizability of the sample. Students were coded as “1” if they were in the final analysis sample and coded as “0” if

they were excluded from the final analysis sample for any reason. Bivariate and multivariate analyses were conducted with SAS software, version 9.2 (SAS Institute, 2010). Chi-square tests and t-tests were used to examine key variables of interest, including the outcome variables, to determine how students in the final analysis sample differed from those who were excluded.

In bivariate tests, students who were excluded were significantly more likely to be male, older, have lower parental education, and come from a one parent household. Pubertal timing and dating abuse perpetration were not associated with exclusion from the study.

Measures

The measures used in this study were self-reported by the students and include pubertal timing (wave one), measures of dating and dating abuse (waves four through seven), and demographics (wave one). The Cronbach's alphas are from wave one unless otherwise noted.

Dating and Dating Abuse Measures

Dating onset: Before assessing dating abuse perpetration, students were asked, "Have you ever been on a date?" A date was defined as an "informal activity like meeting someone at the mall, a park, or at a basketball game as well as more formal activities like going out to eat or to a movie together." From this item I created an ordinal variable, based on the grade that a student was in when they reported dating for the first time. The variable ranged from zero to five, with a higher number indicating earlier dating. Students who reported they dated in the fall of 12th grade were coded as "1." Each successively younger grade was coded as a higher number until the fall of eighth grade, where students who reported ever dating for the first time were coded as "5". Students

that did not date during the study were coded as “0”.

Dating Abuse Perpetration: Students were asked to complete modified Safe Dates victimization and perpetration scales (Foshee, 1996). Students were asked to respond to the question, “During the past 3 months, how many times did you do each of the following things to someone you were dating or on a date with? Don’t count it if you did it in self-defense or in play.” Five items were used to assess psychological dating abuse perpetration: “said something to hurt their feelings,” “insulted them in front of others,” “made them describe where they were every minute of the day,” “threatened to hurt them,” and “would not let them do things with other people.” An additional item was included which asked, “During the past three months, about how many times have you threatened to hurt someone you were dating.” The reliability for the six items was $\alpha = .83$.

Six items from the Safe Dates scale were used to assess physical dating abuse perpetration: “slapped or scratched them,” “physically twisted their arm or bent back their fingers,” “pushed, grabbed, shoved, or kicked them,” “hit them with their fist or with something else hard,” “beat them up,” and “assaulted them with a knife or gun.” An additional item was included which asked, “During the past three months, about how many times have you hit someone you were dating.” The reliability for the seven items was $\alpha = .89$. The response options for all items described above were on a five point scale ranging from zero to four: none (0), 1-2 times (1), 3-5 times (2), 6-9 times (3), and 10 times or more (4). Items were summed at each wave and then transformed using the natural log to create continuous measures of physical abuse perpetration and psychological abuse perpetration for waves four through seven.

Pubertal Timing

Two measures of pubertal timing were used: pubertal timing with a biological

referent and pubertal timing with a peer referent. Previous work has found that the biological referent and peer referent measures of pubertal timing are only modestly to poorly correlated across adolescence and therefore may detect different aspects of pubertal timing (Cance, 2010). At the same time, the two measures have been shown to be comparable in the prediction of adolescent substance use (Cance, 2010). Given the potential similarity and differences of these measures, both were considered in the prediction of adolescent dating abuse.

Pubertal Timing with Biological Referent. The Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988) was used to measure pubertal status. The scale references three aspects of biological development for boys and girls (growth in height, body hair, and skin change) and two gender-specific items, facial hair and voice changes in males, and breast changes and menstruation in females. Self-reported responses using the scale correspond well to ratings provided by physicians and mothers (Brooks-Gunn, Warren, Rosso, & Gargiulo, 1987). The students ranked each aspect of development on a four-point scale from “not yet started” (1), to “seems complete” (4), except for menstrual status which was dichotomous, “no” (1), or “yes” (4). Responses to each question were averaged to provide a pubertal status score. Pubertal status was measured at wave one, when students were in sixth, seventh or eighth grade. The reliability for pubertal status at wave one was .71 for girls and .74 for boys.

To convert pubertal status into a measure of pubertal timing, scores were standardized for each year of age, sex (male or female), and race/ethnicity (Black or White). It was necessary to standardize by age because this study includes three cohorts of students that range in age from 11.0 to 15.9 years old at wave one. Previous research has found pubertal development differs by race, with Black adolescents developing slightly earlier than White adolescents (Cance, 2010), making it advisable to standardize by race.

The pubertal timing measure was standardized using all Black and White students who completed wave one (n=2,450; Table 2.2). By including as many students as possible when standardizing pubertal timing, the pubertal timing measure more accurately reflects the composition of the student population at the time when the students completed the questionnaire.

Table 2.2 Number of students available for standardizing the pubertal timing measure by age, gender, and race

<u>Age</u>	<u>Female</u>		<u>Male</u>		<u>Total</u>
	<u>White</u>	<u>Black</u>	<u>White</u>	<u>Black</u>	
11.0 – 11.9	100	101	72	95	368
12.0 – 12.9	177	217	179	180	753
13.0 – 13.9	168	240	191	206	805
14.0 – 14.9	78	124	89	147	438
15.0 – 15.9	5	29	12	40	86

Given the relatively small number of students who fell into the 15.0 to 15.9 age category, I examined the possibility that pubertal timing scores in that age category could be skewed by outliers. I combined the 14.0 to 14.9 age category with the 15.0 to 15.9 age category and re-standardized scores. Combining the last two age categories did not change pubertal timing scores so it was not necessary to combine the last two age categories during standardization.

The scores were standardized such that the pubertal timing scores for all students within an age category, gender, and race had a mean of zero and standard deviation of one. After standardizing the pubertal timing variable it was coded so that one standard deviation and above the mean was considered early timing, one standard deviation and below the mean was considered late timing, and scores in between were considered on-time pubertal timing. The trichotomized measure was converted into two dummy coded variables: 1) early pubertal timing coded as “1” versus on-time and late pubertal timing coded as “0”; and 2) late pubertal timing coded as “1” versus on-time and

early pubertal timing coded as “0”. This coding allows the flexibility of testing the hypothesis for girls that early pubertal timing versus all others is associated with increased risk, while also testing the hypotheses for boys that early versus on-time and late versus on-time pubertal timing is associated with increased dating abuse.

Table 2.3 Distribution of pubertal timing by grade, gender and race

	Pubertal Timing, biological referent (5-items) (n=2,053)			Pubertal Timing, peer referent (1-item) (n=1,952)		
	Early % (N)	On-Time % (N)	Late % (N)	Early % (N)	On-Time % (N)	Late % (N)
Total	14.1% (290)	69.5% (1427)	16.4% (336)	13.5% (265)	68.9% (1343)	17.6% (344)
Grade:						
6 th	15.8% (113)	62.5% (448)	21.8% (156)	13.5% (90)	66.1% (440)	20.4% (136)
7 th	12.3% (87)	73.3% (518)	14.4% (102)	15.2% (103)	68.1% (462)	16.7% (113)
8 th	14.3% (90)	73.3% (461)	12.4% (78)	11.8% (72)	72.5% (441)	15.6% (95)
Sex:						
Boy	13.1% (126)	71.1% (683)	15.98 (152)	13.4% (122)	69.8% (634)	16.8% (153)
Girl	15.0% (164)	68.1% (744)	16.9% (184)	13.7% (143)	68.0% (709)	18.3% (191)
Race:						
Black	13.3% (150)	71.8% (808)	14.8% (167)	18.6% (198)	64.1% (682)	17.3% (184)
White	15.1% (140)	66.7% (619)	18.2% (169)	7.6% (67)	74.4% (661)	18.0% (160)

Pubertal Timing with Peer Referent. The second measure of pubertal timing was a one item measure of pubertal timing as compared to one’s peers. Students were asked to respond to the question, “Compared to most others of your age and sex, do you think your development is...?”, with five response options ranging from “much earlier” to “much later.” Students were considered to have early timing if they responded “much earlier,” and to have late timing if they responded “much later” or “somewhat later.” This coding provided approximately the same distribution of early and late pubertal timing as the biological referent measure. Table 2.3 presents the frequency of early, on-time, and late pubertal timing by grade, sex and race for the two measures of pubertal timing. As with the biological referent version of pubertal timing, the trichotomized peer referent measure was converted into two dummy coded variables: 1)

early pubertal timing coded as “1” versus on-time and late pubertal timing coded as “0”; and 2) late pubertal timing coded as “1” versus on-time and early pubertal timing coded as “0”.

Demographic Control Variables

The following control variables were included from wave one: sex, age, race/ethnicity, family structure, and socioeconomic status. Sex was coded as male (1) or female (0). Race was coded as Black/African-American (0) or White (1). Family structure was a dichotomous variable reflecting if the adolescent reported living in a two-parent household which could include a stepmother or stepfather (0), versus living with one parent (1). Socioeconomic status was based on the student’s report of the highest level of education achieved by either parent on a six point scale that ranged from “did not graduate from high school” (0), to “graduate or professional school” (5).

Analysis Strategy

Test of Cohort Differences

Cohort sequential study designs are when two or more short-term longitudinal studies are used to simulate a longer longitudinal study (Duncan, Duncan, & Hops, 1996). Multiple cohorts with overlapping assessments can be combined into one common growth curve. One assumption of forming a common growth curve is that the separate trajectories of each cohort do not significantly differ from one another. I used a latent growth curve approach and a multilevel modeling approach to test for cohort differences.

For the latent growth curve approach I estimated a multiple group, multiple cohort growth model where a trajectory of dating abuse, with a mean intercept and slope, was estimated separately for each cohort. The intercept was set at the fall of 10th grade, the

point where all cohorts overlapped. In a nested model an invariance constraint was set whereby the mean of the intercept factor was held equal across the three cohorts. I tested the difference between the nested models using the Satorra-Bentler scaled chi-square difference test. After the Satorra-Bentler scaled chi-square returned a negative test statistic, I used the criteria that if the more restricted model did not degrade the CFI by more than .01, it could be considered to have equivalent fit to the less restricted model (Cheung & Rensvold, 2002). I did not find a significant change in model fit when constraining the mean of the intercept factor to be invariant across cohorts, concluding that it would be appropriate to combine cohorts into one common growth curve.

To confirm these findings, I used a multilevel modeling approach, as described by Miyazaki and Raudenbush (2000), to examine cohort differences. This approach has three steps. First I estimated a cohort-based model, which included a cohort variable, time variable (grade level), and a cohort by time (grade) interaction. This allows separate mean trajectories of dating abuse for each cohort. Next, I estimated a reduced/common model where there was no cohort by time effect and individual trajectories were allowed to vary around a single mean-grade trajectory. Finally, I conducted a likelihood-ratio test for the difference in the two models. Using this strategy I found the same result as the latent growth curve approach, that there was not a significant difference in cohorts in the dating abuse trajectories. Therefore, I concluded it would be reasonable to combine the growth curves of the three cohorts into one common growth curve ranging from grade eight through 12.

Test of Clustering

Before proceeding to model dating abuse, I assessed the potential dependency in the data due to students nested within schools. Because of the small number of schools it was not possible to examine nesting by school. As an alternative I investigated

a smaller unit, census block group, which could serve as a proxy for the neighborhood boundaries represented by school boundaries. I examined nesting of physical and psychological dating abuse perpetration by census block at each of the four waves. There were negligible design effects (average design effect was 1.11) and non-significant intraclass correlations (average ICC was .006). Previous studies of dating abuse with this dataset have found the same negligible design effects and have not accounted for the nested structure in analysis (Reyes, 2009). Nesting due to block group was not controlled for in this study and this is unlikely to bias the results.

Controlling for Dating Onset

For an adolescent to be involved in dating abuse, it is necessary that the student has dated. In previous studies, pubertal timing has been associated with dating onset; therefore, if there is a significant relationship between pubertal timing and dating abuse it may be confounded by dating onset. To examine this possibility, I tested the associations between both versions of the pubertal timing variable (peer referent and biological referent) with the dating onset variable (grade of dating onset). First I tested for a relationship between the pubertal timing variable used to test the early maturation hypothesis (early versus all others) and dating onset. Next I tested for a relationship between the two pubertal timing variables used in the off-time hypotheses (early versus on-time and late versus on-time) and dating onset.

In multivariate analyses (controlling for sex, race, one parent household and parental education), early pubertal timing versus all others was related to an earlier grade of dating onset. When both dummy coded variables were included in a model predicting grade of dating onset, early versus on-time pubertal timing was associated with an earlier grade of dating onset for the peer referent version and late versus on-time pubertal timing was associated with a later grade of dating onset for both the biological

and peer referent versions of pubertal timing. A summary of findings is shown in Table 2.4. These results provide evidence that early timing is associated with earlier dating onset and that late timing is associated with later dating onset. Given these findings, there is the potential for dating onset to confound the relationship between pubertal timing and dating abuse and therefore, it is necessary to consider dating onset as a control variable.

Table 2.4 Relationship between pubertal timing and grade of dating onset

	Grade of dating onset <i>b</i> (SE)
<u>Early maturation model</u>	
Peer Referent:	
Early versus all others	.29 (.11)**
Biological Referent:	
Early versus all others	.23 (.10)*
<u>Off-time model</u>	
Peer Referent:	
Early versus on-time	.25 (.11)*
Late versus on-time	-.20 (.10)*
Biological Referent:	
Early versus on-time	.13 (.10)
Late versus on-time	-.53 (.10)***

Note: analyses controlled for sex, race, one parent household and parental education

* $p < .05$, ** $p < .01$, *** $p < .001$

Latent Growth Curve Models

Latent growth curve models were used to examine how pubertal timing impacts trajectories of dating abuse. Latent growth curve models estimate an intercept and slope term for each individual, creating an equation for an individual trajectory. The unconditional (univariate) linear equation for an individual is given below.

$$y_{it} = \alpha_i + \beta_i \lambda_t + \varepsilon_{it} \quad (1)$$

In Equation 1, alpha is the random intercept, beta is the random slope, gamma is the

value of time, and epsilon is an individual and time specific residual. The intercepts and slopes are pooled to create a mean intercept and slope for all individuals. The following two equations illustrate how the intercept and slope factors are a function of the mean intercept or mean slope of all individuals, plus a disturbance term representing the variability around the means.

$$\alpha_i = \mu_\alpha + \zeta_{\alpha i} \quad (2)$$

$$\beta_i = \mu_\beta + \zeta_{\beta i} \quad (3)$$

Coding of Time

The measures of dating abuse were reorganized by grade resulting in eight time points from the fall of eighth grade through the fall of 12th grade. Table 2.5 summarizes the data available at each time point from each of the three cohorts. In the latent growth curve models, the factor loadings for the linear slope factor were spaced such that a one unit increase would represent one year in time. The first seven time points were spaced six months apart and so the linear factor loadings were set .5 units apart (e.g., 0.5, 1.0, 1.5, etc.). The final wave of assessment occurred one year after the previous wave; therefore, the final two factors loadings were one unit apart. The linear factor loading for the fall of eighth grade was set to zero, making that time point the intercept for the model.

Univariate Models for Dating Abuse

Due to difference in pubertal timing and dating abuse for boys and girls it was necessary to account for the students' sex in the models. One possibility was to model boys and girls separately. A second option was to use a multiple group approach which allows two groups (i.e., boys/girls) to share some model parameters while allowing other parameters to vary across groups. Each parameter can be tested for a significant

differences by sex. If some parameters are shared across groups, the multiple group approach provides the benefit of a more parsimonious model.

Table 2.5 Cohort data by wave and grade

Time point (grade)	Semester of data collection	Cohort 1	Cohort 2	Cohort 3
8	Fall	Wave 4		
8.5	Spring	Wave 5		
9	Fall	Wave 6	Wave 4	
9.5	Spring		Wave 5	
10	Fall	Wave 7	Wave 6	Wave 4
10.5	Spring			Wave 5
11	Fall		Wave 7	Wave 6
12	Fall			Wave 7

To determine the optimal unconditional/univariate model for each of the dating abuse outcomes, I fit a series of multiple group models starting with a linear model with all parameters held invariant across boys and girls. After inspecting the graphs of observed and estimated means, I determined if it would be reasonable to test if the addition of a quadratic slope factor for boys or girls would provide a better fit to the data than a linear model. A quadratic slope factor was retained if it improved overall model fit and the mean for the quadratic slope factor was significant. I also inspected the overall model fit and modification indices to see if model fit could be significantly improved by freeing parameters across gender. First I freed the latent factor means and variances across groups and then reevaluated model fit. If overall model fit was still less than adequate, I considered freeing residual variances across groups. At each step I tested for significant improvement in model fit.

Hypothesis Testing

After the optimal univariate model for dating abuse was established, the pubertal

timing variable(s) were added to the model as predictors of the intercept and slope factors for the dating abuse trajectory. To match Hypothesis 2.1 for girls, the dummy coded variable for early timing versus all other timing was added to the model as a predictor of the intercept and slope factors for girls. To match the Hypotheses 2.2 and 2.3 for boys, the two dummy-coded pubertal timing variables (early versus on-time and late versus on-time) were simultaneously added to the model as predictors of the intercept and slope factors for boys. Each of the dating abuse perpetration outcomes was assessed in turn. The biological referent version of the pubertal timing variable was tested separately from the peer referent version, resulting in a total of four models (two versions of pubertal timing variables modeled with two dating abuse perpetration outcome variables).

The two equations below show how pubertal timing, coded as two dummy variables, was included in an equation predicting intercept and slope factors.

$$\alpha_i = \mu_\alpha + \gamma_{\alpha 1} \text{early timing}_i + \gamma_{\alpha 2} \text{late timing}_i + \zeta_{\alpha i} \quad (4)$$

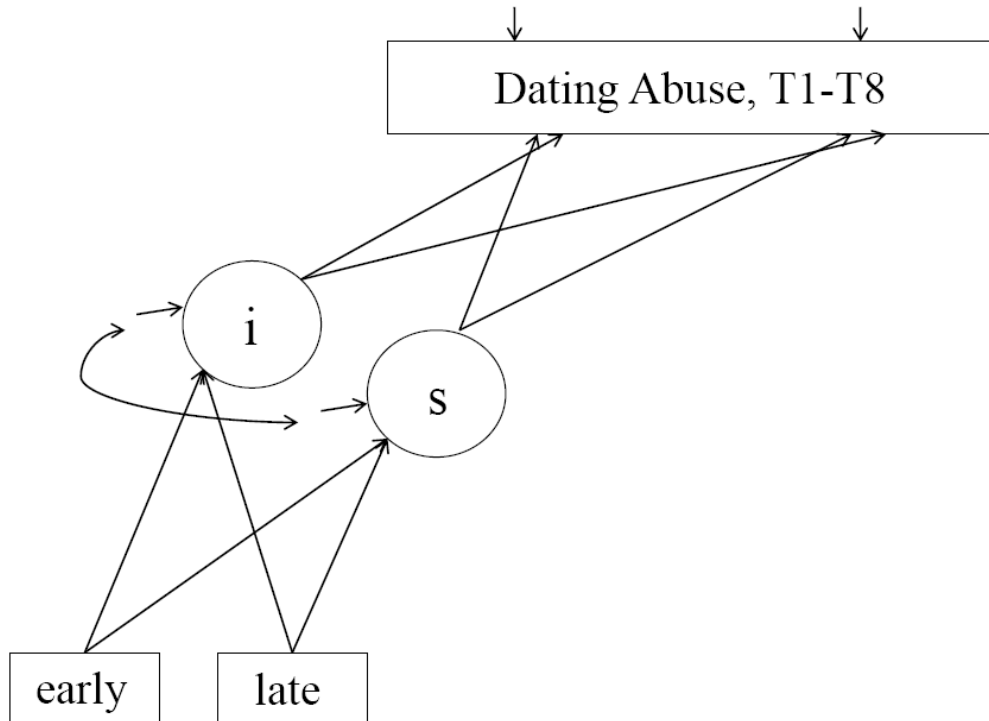
$$\beta_i = \mu_\beta + \gamma_{\beta 1} \text{early timing}_i + \gamma_{\beta 2} \text{late timing}_i + \zeta_{\beta i} \quad (5)$$

Significant gamma parameters indicate that pubertal timing impacts the equation defining the dating abuse trajectory for an individual (the intercept and slope). Figure 2.2 shows an example of a model with pubertal timing (coded as early versus on-time and late versus on-time) predicting the mean of the intercept and slope factors. For simplicity of the figure, the eight dating abuse time points are reduced to one box.

Next, control variables were added to the model. The control variables were grade of dating onset and demographic variables (age, race, one parent household, and parent education). The latent intercept and slope factors were regressed on grade of dating onset, race, parental education, and one parent household to control for the impact of these variables on the trajectory of dating abuse. Each of the eight dating abuse time points was regressed on age at wave one, to control for variation in age

within a grade, and the paths were constrained to be equal within groups. If the relationship between pubertal timing and dating abuse was not significant after adding control variables, then I explored which specific variable was responsible for attenuating the relationship.

Figure 2.2 Latent growth curve model for pubertal timing predicting dating abuse



Evaluating Model Fit

All latent growth curve models were estimated with Mplus version 6.11 (Muthén & Muthén, 1999) using the robust maximum likelihood (MLR) estimator. This estimator is robust to non-normality in the data. Model fit was evaluated by the chi-square test, the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis index (TLI; Tucker & Lewis, 1973), and the root mean square error approximation (RMSEA). As a general rule of thumb, models with a CFI and TLI of at least .95 and a RMSEA value of .05 or less were considered to be reasonable fitting models (Browne & Cudack, 1993; Hu & Bentler, 1999). Differences between nested models were evaluated with the chi-square

difference tests of the Satorra-Bentler scaled chi-square (Satorra, 2000) or a change in CFI of .01 or less (Cheung & Rensvold, 2002). For nested and non-nested models, I also considered the Bayesian information criterion (BIC), which favors more parsimonious models (Raftery, 1993).

RESULTS

Descriptive Statistics

Dating Abuse Prevalence

Table 2.6 presents the proportion of students engaging in physical and psychological dating abuse perpetration from eighth through 12th grade. The proportion of students engaging in physical perpetration ranged from 15.7% to 18.9%. Between 14.5% and 26.3% of students reported engaging in psychological perpetration. The proportion of students reporting physical perpetration and the mean level of physical perpetration was relatively steady over the study time period. In contrast, the mean level of psychological perpetration and the proportion of students reporting psychological perpetration generally increased over the study time period. This provides an indication that the unconditional model for physical perpetration will not substantially change over time whereas the unconditional model for psychological perpetration will be positive linear or positive quadratic.

Bivariate Correlations between Pubertal Timing and Dating Abuse Perpetration

Tables 2.7 and 2.8 present cross-sectional correlations for the relationship between pubertal timing and dating abuse perpetration, stratified by gender and grade. The tables include the correlations between the biological and peer referent versions of pubertal timing and physical and psychological dating abuse perpetration outcome variables. To match the hypothesis for girls, the correlations presented below for girls

are for early versus all other pubertal timing. To match the two hypotheses for boys, the correlations presented below are for early versus on-time and late versus on-time pubertal timing.

Table 2.6 Proportion of students reporting dating abuse and mean level of dating abuse

<u>Grade</u>	<u>Physical Perpetration</u>		<u>Psychological Perpetration</u>	
	<u>Proportion % (N)</u>	<u>Mean (SD)</u>	<u>Proportion % (N)</u>	<u>Mean (SD)</u>
8	16.2% (592)	.50 (2.1)	14.5% (592)	.45 (1.7)
8.5	15.7% (542)	.88 (3.8)	16.2% (543)	.86 (3.4)
9	16.3% (1078)	.65 (2.5)	16.2% (1078)	.69 (2.5)
9.5	16.9% (556)	.75 (3.2)	22.1% (556)	.86 (2.9)
10	17.4% (1491)	.66 (2.5)	22.7% (1491)	.77 (2.4)
10.5	18.9% (482)	.82 (3.4)	26.3% (482)	.99 (3.2)
11	16.3% (934)	.70 (2.7)	25.2% (934)	.85 (2.5)
12	17.6% (387)	.63 (2.3)	28.4% (387)	.74 (1.9)

Note: means and standard deviations (SD) are before the log-transformation of the variables

Table 2.7 Correlations between pubertal timing and dating abuse perpetration for girls

	<u>Biological Referent</u>	<u>Peer Referent</u>
	Early versus all others	Early versus all others
<u>Physical Perpetration (girls)</u>		
Fall 8 th	.02	.08
Spring 8 th	.03	-.04
Fall 9 th	-.07	.04
Spring 9 th	-.11*	.03
Fall 10 th	.02	.07
Spring 10 th	.02	.06
Fall 11 th	-.07	.10*
Fall 12 th	-.01	.05
<u>Psychological Perpetration (girls)</u>		
Fall 8 th	-.06	.12*
Spring 8 th	-.07	-.06
Fall 9 th	-.02	.06
Spring 9 th	-.01	.03
Fall 10 th	.02	-.01
Spring 10 th	.09	.06
Fall 11 th	-.01	.06
Fall 12 th	.08	-.01

*p<.05; **p<.01; ***p<.001

Table 2.8 Correlations between pubertal timing and dating abuse perpetration for boys

	<u>Biological Referent</u>		<u>Peer Referent</u>	
	Early versus on-time	Late versus on-time	Early versus on-time	Late versus on-time
Physical Perpetration (boys)				
Fall 8 th	.03	-.12	.10	.02
Spring 8 th	-.06	.02	-.01	-.01
Fall 9 th	.07	<.01	.05	.04
Spring 9 th	.04	.02	-.03	.02
Fall 10 th	.04	-.03	.16***	.10*
Spring 10 th	.08	<-.01	-.04	-.06
Fall 11 th	.14**	<.01	-.02	-.09
Fall 12 th	.09	.11	-.06	-.14
Psychological Perpetration (boys)				
Fall 8 th	.04	-.10	.13	-.02
Spring 8 th	-.06	<-.01	.01	-.01
Fall 9 th	.06	-.01	.04	<.01
Spring 9 th	.08	-.01	-.07	-.05
Fall 10 th	.03	.01	.13**	.07
Spring 10 th	.11	-.04	.07	-.05
Fall 11 th	.15**	-.04	-.05	-.09
Fall 12 th	<.01	.04	<.01	-.07

*p<.05; **p<.01; ***p<.001

For girls, there were few significant correlations for either version of the pubertal timing variable with either dating abuse outcome (Table 2.7). The significant correlation in the spring of ninth grade between biological referent pubertal timing and physical perpetration was in the opposite direction hypothesized; early versus all others was negatively correlated with physical perpetration. The other two significant correlations are in the direction hypothesized; early versus all others was positively correlated with dating abuse.

For boys, there were four significant positive correlations between early versus on-time pubertal timing and dating abuse. There was one significant positive correlation between late versus on-time pubertal timing. All significant correlations were in the direction hypothesized, that both early as compared to on-time and late as compared to on-time pubertal timing would be related to increased dating abuse.

Univariate Models

Univariate (unconditional) trajectory models were fit to the measures of physical perpetration and psychological perpetration. For both dating abuse outcomes, a significant improvement in model fit was achieved by allowing the latent factor means and variances to vary across boys and girls. Residual variances were permitted to vary across time but were held equal across boys and girls. For girls, a positive linear model provided the best fit for both outcomes. For males, the trajectory for physical abuse perpetration was flat whereas the trajectory for psychological abuse perpetration was positive and linear (Figures 2.3 and 2.4). Details of the final univariate model for each dating abuse outcome are discussed separately.

Physical Abuse Perpetration

The overall model fit for physical perpetration was excellent (Table 2.9). The intercept and linear slope factor means, variances, and covariance were permitted to vary across groups. For girls, the slope significantly increased linearly from eighth grade to 12th grade, whereas boys had a non-significant slope indicating a flat trajectory (Figure 2.3). Girls reported higher physical abuse perpetration than boys at the fall of eighth grade and at all other grades. For both girls and boys there was significant variance in the intercept factor. The variance for the boys' slope factor was set to zero after earlier models produced a negative variance for the boys' slope factor. Parameter estimates and fit indices for unconditional models are presented in Table 2.9; results for girls are in the top half of the table and results for boys are on the bottom.

Table 2.9 Factor means and variances for univariate models of dating abuse perpetration

	Physical Perpetration	Psychological Perpetration
Girls		
Intercept	.28***	.24***
Slope	.02*	.06***
Intercept Variance	.17***	.17***
Slope Variance	.02	.02
Intercept Slope Covariance	-.02	-.01
Boys		
Intercept	.12***	.13***
Slope	<.01	.03**
Intercept Variance	.05**	.07
Slope Variance	---	.01
Intercept Slope Covariance	---	-.01
Fit indices		
Scaled χ^2 (DF)	47.71 (48)	53.88 (46)
CFI, TLI	1.0, 1.0	.98, .98
RMSEA (90% CI)	<.01 (<.01, .02)	.01 (<.01, .03)

*p<.05, **p<.01; ***p<.001

Figure 2.3 Estimated mean trajectories of physical abuse perpetration for girls and boys

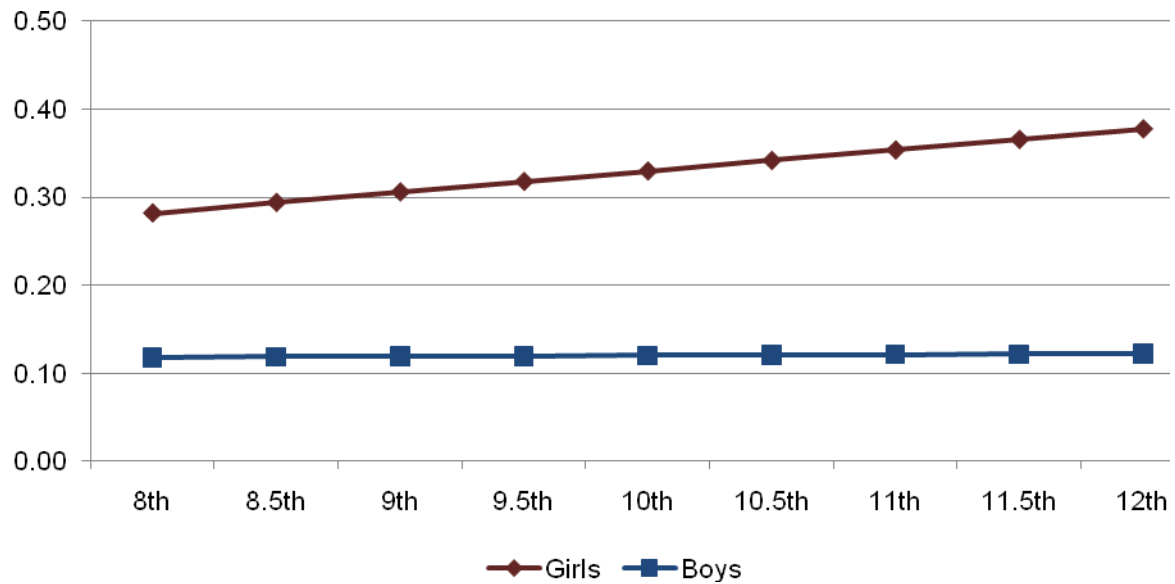
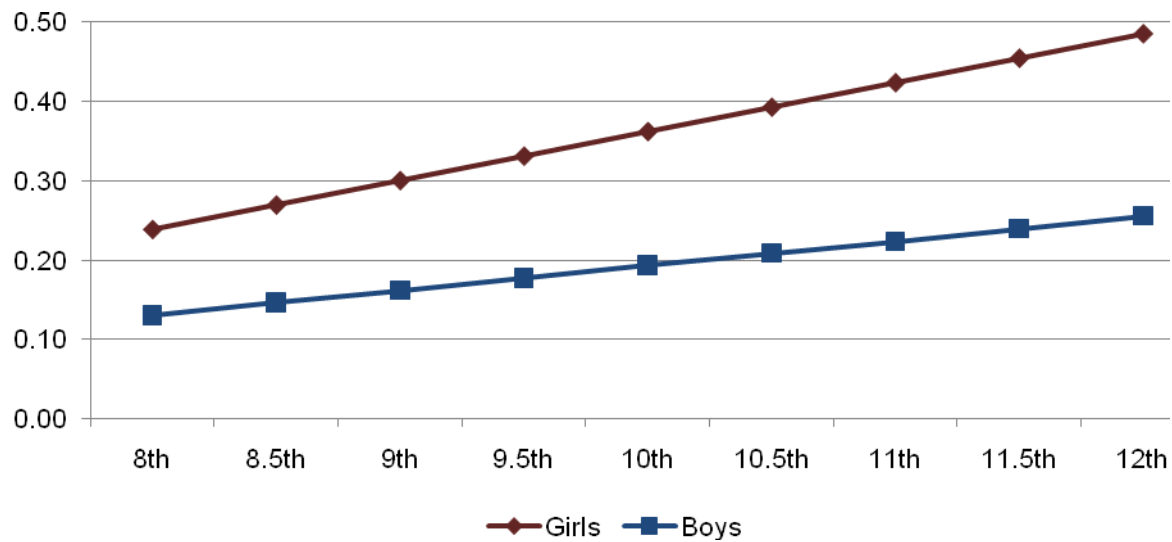


Figure 2.4 Estimated mean trajectory of psychological abuse perpetration for girls and boys



Psychological Abuse Perpetration

The final univariate model for psychological abuse perpetration also had excellent overall fit (Table 2.9). The intercept and linear slope factor means, variances, and covariances were permitted to vary across gender. Girls had higher levels of psychological abuse perpetration than boys at the fall of 8th grade and all at other grades (Figure 2.4). For boys and girls, a positive linear slope provided the best fit, meaning that psychological perpetration significantly increased from 8th grade to 12th grade for both boys and girls. For girls, but not boys, there was significant variance in the intercept factor but neither boys nor girls had significant variance in the slope factor (Table 2.9).

Testing Hypothesized Relationships between Pubertal Timing and Trajectories of Dating Abuse Perpetration

The univariate models for dating abuse were presented in Figures 2.3, 2.4, and Table 2.9. The next step was to add the measures of pubertal timing to the models. The latent factors (intercept and linear slope) were regressed on the dummy coded variables. To match the hypothesis for girls, the latent factors were regressed on early timing as

compared to all others (i.e., on-time and late pubertal timing, combined). To match the two hypotheses for boys, the latent factors were regressed on early timing as compared to on-time pubertal timing and late timing as compared to on-time pubertal timing. The biological referent version and the peer referent versions were tested separately. All of the final models fit the data well. Table 2.10 presents the parameter estimates for the effect of the pubertal timing variables on the mean intercept and slope factors as well as the fit indices for the models. The significant findings are described separately for girls and boys in correspondence with the study hypotheses.

Table 2.10 Pubertal timing predicting dating abuse perpetration

	<u>Physical Perpetration</u>		<u>Psychological Perpetration</u>	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls				
Early pubertal timing versus all others:				
Intercept	-.01 (.05)	.09 (.08)	-.07 (.05)	.13 (.08)
Slope	-.02 (.03)	.01 (.04)	.03 (.03)	-.02 (.04)
Boys				
Early pubertal timing versus on-time:				
Intercept	.03 (.07)	.12 (.07)	.06 (.07)	.13 (.08)
Slope	.02 (.03)	-.03 (.03)	.01 (.03)	-.04 (.04)
Late pubertal timing versus on-time:				
Intercept	-.06 (.04)	.08 (.05)	-.04 (.04)	.02 (.05)
Slope	.03 (.02)	-.05 (.02)*	.02 (.02)	-.02 (.02)
Fit indices				
Scaled χ^2 (DF)	78.64 (75)	75.20 (75)	84.41 (72)	91.26 (.72)
CFI, TLI	.99, .99	.99, .99	.98, .98	.96, .96
RMSEA (90% CI)	.01 (<.01, .02)	<.01 (<.01, .02)	.01 (<.01, .02)	.02 (<.01, .03)

* $p < .05$; CI: confidence interval; DF: degrees of freedom

Pubertal Timing and Dating Abuse Perpetration for Girls

Hypothesis 2.1 proposed that for girls, early pubertal timing as compared to all others would be associated with a higher mean level of dating abuse perpetration in the eighth grade and increased slope through 12th grade. For girls, early pubertal timing as

compared to all others was not significantly associated with physical or psychological dating abuse perpetration using either the biological referent or peer referent variables. Thus, Hypothesis 2.1 was not supported.

Pubertal Timing and Dating Abuse Perpetration for Boys

For boys, early as compared to on-time pubertal timing (Hypothesis 2.2) and late as compared to on-time pubertal timing (Hypothesis 2.3) were hypothesized to be associated with a higher mean level of dating abuse in the eighth grade and increased growth in dating abuse through grade 12. For boys, the biological referent version of pubertal timing was not associated with physical or psychological dating abuse perpetration. The peer referent version of pubertal timing was significantly associated with physical abuse perpetration such that late pubertal timing as compared to on-time pubertal timing was associated with a *decrease as opposed to an increase* in the slope of physical perpetration. This finding was the opposite of what was hypothesized. The univariate trajectory for physical abuse perpetration was flat; thus, late pubertal timing was associated with a significant negative linear slope instead of the flat slope for those with on-time pubertal timing.

Controlling for Dating Onset and Demographic Variables

As a final step, the control variable for grade of dating onset and demographic control variables were added to models. Table 2.11 presents the parameter estimates for the effect of the pubertal timing variables on the mean intercept and slope factors after including the control variables. Results for girls and boys are discussed separately.

Table 2.11 Pubertal timing predicting dating abuse perpetration with control variables

	<u>Physical Perpetration</u>		<u>Psychological Perpetration</u>	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls				
Early pubertal timing versus all others:				
Intercept	-.04 (.05)	.03 (.08)	-.09 (.05)	.09 (.08)
Slope	-.02 (.03)	.01 (.04)	.03 (.03)	-.02 (.04)
Dating Onset				
Intercept	.10 (.01)***	.10 (.01)***	.09 (.01)***	.09 (.01)***
Slope	<.01 (<.01)	<.01 (.01)	.02 (.01)**	.02 (.01)**
White (versus Black)				
Intercept	-.20 (.04)***	-.20 (.04)***	-.08 (.04)	-.08 (.05)
Slope	-.03 (.02)	-.03 (.02)	-.03 (.02)	-.03 (.02)
Parent Education				
Intercept	-.03 (.01)	-.02 (.01)	-.02 (.01)	-.02 (.01)
Slope	.01 (.01)	.01 (.01)	.01 (.01)	.01 (.01)
One Parent Household				
Intercept	.04 (.09)	.05 (.09)	.04 (.09)	.07 (.09)
Slope	.02 (.04)	.02 (.04)	-.01 (.04)	-.03 (.04)
Boys				
Early pubertal timing versus on-time:				
Intercept	.04 (.08)	.07 (.08)	.06 (.07)	.08 (.07)
Slope	.02 (.04)	-.02 (.03)	<.01 (.04)	-.02 (.04)
Late pubertal timing versus on-time:				
Intercept	-.01 (.04)	.05 (.05)	.01 (.04)	<.01 (.05)
Slope	.02 (.02)	-.03 (.02)	<.01 (.03)	-.01 (.02)
Dating Onset				
Intercept	.04 (.01)***	.04 (.01)***	.05 (.01)***	.05 (.01)***
Slope	<-.01 (.01)	<-.01 (.01)	.01 (.01)	.01 (.01)
White (versus Black)				
Intercept	-.11 (.04)**	-.10 (.04)*	-.09 (.04)*	-.08 (.04)
Slope	.04 (.02)*	.04 (.02)*	.06 (.02)**	.05 (.02)*
Parent Education				
Intercept	.01 (.01)	.01 (.01)	.01 (.01)	.01 (.01)
Slope	-.01 (.01)	<-.01 (.01)	<-.01 (.01)	<-.01 (.01)
One Parent Household				
Intercept	.08 (.09)	.05 (.10)	.05 (.10)	.02 (.10)
Slope	-.02 (.04)	-.01 (.04)	.02 (.05)	.04 (.05)
Fit indices				
Scaled χ^2 (DF)	133.89 (137)	125.34 (137)	144.63 (134)	151.13 (134)
CFI, TLI	1.0, 1.0	1.0, 1.0	.99, .99	.98, .98
RMSEA (90% CI)	<.01 (<.01, .02)	<.01 (<.01, .01)	.01 (<.01, .02)	.01 (<.01, .02)

*p<.05, **p<.01; ***p<.001; CI: confidence interval; DF: degrees of freedom

Results for Girls

There continued to be no significant relationship between early pubertal timing and dating abuse perpetration after the inclusion of control variables (Table 2.11). However, several of the control variables were associated with the dating abuse trajectories. An earlier grade of dating onset was positively associated with a higher mean level of dating abuse in the eighth grade for physical and psychological dating abuse perpetration. An earlier grade of dating onset was also significantly associated with an increase in slope for psychological dating abuse perpetration. In other words, earlier dating onset was associated with an increased risk of psychological dating abuse perpetration throughout high school. When all other control variables are at zero, each year (grade) of earlier dating onset was associated with .10 units increase in physical dating abuse perpetration or .09 units increase in psychological dating abuse perpetration. In the univariate model, the intercepts were .28 and .24 units, respectively for physical and psychological dating abuse perpetration. Thus, the effect of dating onset was large in comparison to the intercept. Similarly, the effect of a grade level earlier dating onset was .02, which is a third the size of the univariate slope (.06) for psychological dating abuse perpetration.

For girls, White race, as compared to Black, was associated with a lower mean level of physical dating abuse in the fall of eighth grade. One parent household and parent education were not significantly associated with the trajectories for dating abuse perpetration. Age was a significant covariate in all models of dating abuse perpetration for girls (results not shown).

Results for Boys

After including the control variables, there were no significant relationships

between pubertal timing and dating abuse for boys (Table 2.11). In the models without the control variables, late pubertal timing (peer referent version) had been associated with a decreased slope for physical dating abuse perpetration. By removing control variables one at a time, it appears that this relationship was due to the relationship between grade of dating onset and dating abuse; boys who were late maturers dated later and perpetrated less dating abuse.

An earlier grade of dating onset was associated with a higher mean level of dating abuse perpetration in the fall of eighth grade for physical and psychological dating abuse perpetration. When all other control variables are at zero, each year (grade) of earlier dating onset was associated with .04 units increase in physical dating abuse perpetration or .05 units increase in psychological dating abuse perpetration. In the univariate model, the intercepts were .12 and .13 units, respectively, so the effect of dating onset was large in comparison.

For boys, White race, as compared to Black, was associated with a lower mean level of physical dating abuse perpetration and a lower mean level of psychological perpetration in the eighth grade for the model that included the biological referent version of pubertal timing. However, White race was associated with an increase in the slope for both physical and psychological perpetration from grades eight through 12. In other words, White boys had lower levels of dating abuse in eighth grade but increased faster throughout high school. For boys, one parent household and parental education were not associated with any latent factors in any of the models presented in Table 2.11. Age was not a significant covariate of physical perpetration (biological referent only) or psychological perpetration (results not shown).

Further Exploration of the Relationship between Pubertal Timing and Dating Abuse Perpetration

Alternative Hypotheses

As none of the proposed a priori hypotheses were supported, several exploratory analyses were pursued to further explore the association between pubertal timing and dating abuse perpetration. It was hypothesized that early maturing girls as compared to all others would be associated with increased dating abuse perpetration. For boys, early as compared to on-time and late as compared to on-time pubertal timing were hypothesized to be associated with increased dating abuse perpetration. Thus, analyses were conducted in a way that did not assess the alternative: that early versus on-time and late versus on-time could be risky for girls and that early versus all others could be risky for boys. To determine if there was support for these alternative relationships, I modeled the early versus on-time and late versus on-time pubertal timing predicting dating abuse perpetration for girls and early versus all other pubertal timing predicting dating abuse perpetration for boys. Next, I added control variables to each model to see if significant relationships were maintained in the presence of control variables.

There were no significant relationships between early versus all other pubertal timing and dating abuse for boys. For girls, late versus on-time pubertal timing (both biological referent and peer referent versions) was associated with a *decreased* risk of physical and psychological abuse perpetration, which is the opposite of what would have been expected for the off-time model. After adding control variables, the significant relationship remained only for the biological referent version of the pubertal timing variable. Late versus on-time pubertal timing for girls was associated with a decrease in slope for physical and psychological perpetration (see Table 2.12). The univariate slope of physical perpetration was .02 and the univariate slope for psychological perpetration was .06. The coefficient for the effect of late versus on-time pubertal timing on the slope of both physical and psychological perpetration was -.06. Thus, when all control variables are zero, the slope for dating abuse perpetration decreased for physical

perpetration and was flat for psychological perpetration. In other words, late pubertal timing was protective against an increase in dating abuse over time, which does not support the study hypothesis.

Table 2.12 Exploratory analyses of pubertal timing predicting dating abuse perpetration, with control variables

	<u>Physical Perpetration</u>		<u>Psychological Perpetration</u>	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls				
Early pubertal timing versus on-time:				
Intercept	-.02 (.05)	.02 (.08)	-.08 (.06)	.08 (.08)
Slope	-.03 (.03)	.01 (.04)	.02 (.03)	-.03 (.04)
Late pubertal timing versus on-time:				
Intercept	.05 (.05)	-.05 (.05)	.03 (.05)	-.06 (.05)
Slope	-.06 (.02)**	<-.01 (.02)	-.06 (.03)*	-.02 (.03)
Boys				
Early pubertal timing versus not early:				
Intercept	.04 (.07)	.06 (.07)	.06 (.07)	.08 (.07)
Slope	.01 (.03)	-.01 (.03)	<.01 (.03)	-.02 (.04)
Fit indices				
Scaled χ^2 (DF)	130.90 (137)	125.03 (137)	140.82 (134)	147.01 (134)
CFI, TLI	1.0, 1.0	1.0, 1.0	.99, .99	.98, .98
RMSEA (90% CI)	<.01 (<.01, .01)	<.01 (<.01, .01)	.01 (<.01, .02)	.01 (<.01, .02)

* $p < .05$, ** $p < .01$; *** $p < .001$; CI: confidence interval; DF: degrees of freedom

Continuous Measure of Pubertal Timing

Thus far, the significant findings for boys and girls have been in the same direction; early timing increases the risk of dating abuse and late timing decreases the risk of dating abuse. Given there has been no evidence of a curvilinear relationship between pubertal timing and dating abuse perpetration for either boys or girls (i.e., that both early and late timing are risky), it would be reasonable to test the relationship between a continuous measure of pubertal timing and dating abuse. Continuous variables provide more power to test relationships as compared to the same variables

with cut-points. I tested the relationship between pubertal timing and dating abuse perpetration for both the biological version (standardized based on age, sex, and race) and peer referent version of the pubertal timing variables, as continuous variables. Although there were some significant relationships between the continuous measures of pubertal timing and dating abuse perpetration, those associations decreased to non-significance when control variables were included.

Younger Cohorts

In this study pubertal timing was assessed at grades six through eight. Eighth grade, particularly for girls, may be too late in the process of pubertal maturation to accurately identify which teens had truly early pubertal timing. To test the possibility that the lack of significant associations between pubertal timing and dating abuse perpetration could have been due to including the older cohorts in the study, I examined models with just the youngest cohort that started the study in the spring of sixth grade and then again with the cohorts that started in the spring of sixth and seventh grade. Removing the older cohort(s) from the analyses also removes some of the later time points in the dating abuse trajectory. The dating abuse trajectory for the youngest cohort spans eighth to 10th grade and the trajectory for the two youngest cohorts span eighth through 11th grade. Thus, it is not possible to model dating abuse trajectories from eighth through the 12th grade; however, it provides a reasonable test if the older cohort(s) attenuated relationships that existed with the younger cohorts. There were no significant relationships between early pubertal timing and dating abuse in either the models with the youngest cohort only (sixth graders) or the models with the youngest two cohorts (sixth and seventh graders only). This suggests that the study was not limited by the relatively older age of assessing pubertal timing.

DISCUSSION

Consistent with the early maturation model, early pubertal timing as compared to all other pubertal timing was hypothesized to increase the risk of dating abuse perpetration for girls. Consistent with the off-time model, early as compared to on-time and late as compared to on-time pubertal timing were hypothesized to increase the risk for dating abuse perpetration for boys. However, none of these hypotheses were supported. There were no significant relationships between early versus all other pubertal timing and dating abuse for girls. For boys, there was only one significant relationship between pubertal timing and dating abuse; late pubertal timing (peer referent version) was associated with a decline in physical perpetration from eighth to 12th grade. However, this relationship was no longer significant after including control variables. This finding for boys does not support the study hypothesis that both early and late pubertal timing would be related to an increased risk of dating abuse. It is possible the results are consistent with early maturation model, but given that this was the only significant relationship for boys, the results are too limited to be conclusive.

In exploratory analyses, late versus on-time pubertal timing for girls was associated with a decrease in slope for physical and psychological perpetration. Although this finding does not directly support the study hypothesis, it is consistent with the idea that earlier pubertal timing is risky. A few prior studies have found that late pubertal timing for girls is protective against risky behaviors. Dick et al. (2000) found that early pubertal timing was associated with substance use initiation, whereas late pubertal timing was protective against substance use initiation as compared to on-time development. Graber, Lewinsohn, Seeley, and Brooks-Gunn (1997) found that late maturing girls performed better in school than early or on-time maturers. The current study included relatively older students when reporting their pubertal maturation (seventh and eighth grade), which may have resulted in a well defined group of students

with late pubertal timing. This might have contributed to finding the protective effect of late pubertal timing on physical and psychological dating abuse perpetration over time.

It is possible that age of the participants limited the number of significant relationships between pubertal timing and dating abuse perpetration. If pubertal timing had been assessed at a younger age, when early timing is more pronounced, it might have been significantly associated with dating abuse. In this study, pubertal timing was measured when students were in the fall of sixth, seventh, and eighth grades, ranging in age from 11 to 16 years old. Ideally, pubertal timing would have been assessed during fifth and/or sixth grade, at ages 10 and 11. I attempted to address this limitation in the exploratory analyses by limiting the sample to the youngest cohort, but this greatly diminished the sample size and limited the outcome variable. The last data collection for the youngest cohorts was the fall of ninth grade and the fall of 10th grade, when dating abuse perpetration behaviors are still on the rise, particularly psychological dating abuse perpetration. It is possible that a larger sample of younger students followed through high school would uncover significant relationships between pubertal timing and dating abuse perpetration.

Dating onset was related to a higher initial level of physical and psychological dating abuse perpetration for boys and girls and was related to a faster increase in psychological dating abuse perpetration for girls. One explanation for this relationship is that earlier dating onset increases the opportunity for dating abuse to occur due to increased exposure to dating. Dating onset must occur before dating abuse, which is why dating onset was conceptualized as a confounder of the relationship between pubertal timing and dating abuse.

Besides dating onset, the only other control variable to be significantly associated with dating abuse perpetration was race. For both boys and girls, white race was predictive of a lower starting point for physical dating abuse perpetration. Yet, for boys,

white race was also associated with an increase in slope in both physical and psychological dating abuse perpetration. Thus, there may be some differences in the age of onset of dating abuse behaviors for white and black adolescents but it appears that differences diminish over time. Race has been found to be associated with dating abuse perpetration in other studies, with Black and Latino adolescents at increased risk for dating abuse perpetration compared to White adolescents (Foshee & Reyes, 2010).

The shape of the growth trajectories was partially in line with expectations. As expected, trajectories of psychological dating abuse perpetration increased linearly from eighth to 12th grade. It was predicted that physical dating abuse perpetration would be curvilinear, increasing from eighth to 10th grade and then decreasing. However, the trajectory of physical dating abuse perpetration for boys was flat and for girls, a linear model provided the best fit. A previous study using the same data found that trajectories of physical dating abuse perpetration were quadratic (Reyes, 2009). Incorporating a quadratic factor in this study provided similar parameters as the previous study but the linear and slope factor parameters were not significant, indicating that the quadratic model was not a better fit to the data. The earlier work by Reyes (2009) included Latino students and students of other race/ethnicity and did not restrict inclusion to students who had completed wave one, resulting in a sample of 2,272 as compared to the sample size in this study, 2,053. Also, the trajectory analysis in the work by Reyes (2009) combined girls and boys and controlled for sex as compared to the multiple group approach used in this study. It is possible that these subtle differences in sample and methods may have resulted in a significant quadratic factor. In a different sample, Foshee et al. (2009) also found that trajectories of moderate physical, severe physical and sexual dating abuse were all quadratic. Of the three outcomes, the quadratic shape was the least pronounced for moderate physical abuse, which is the most similar to the measure of physical abuse perpetration used in this study. Additionally, Foshee et al.

(2009) used age as the unit of time instead of grade and used random coefficient modeling instead of latent curve modeling. It is possible that the differences in sample, measures, and analysis resulted in the different result in the significance of a quadratic slope factor.

Strengths and Limitations

A strength of this study is that it examined trajectories for boys and girls whereas much of the literature has focused exclusively on girls. Another strength is that it distinguished between two different forms of dating abuse perpetration. Examining psychological dating abuse perpetration, which is more prevalent and socially acceptable than physical dating abuse, allows each behavior to have a separate trajectory. Furthermore, it is possible that pubertal timing could have had different associations with different types of dating abuse perpetration behaviors.

This study used longitudinal data spanning over four years and seven waves of data collection. This allows for an examination of change over time in dating abuse behaviors for an individual. By pooling across students the mean intercept and slope parameters provide a picture of the average change in dating abuse perpetration over time. These methods are helpful for a behavior like dating abuse which changes during adolescence. The measure of pubertal timing preceded the measures of dating abuse, which is necessary for establishing the temporality of a relationship. Additionally, this study improved on previous research by controlling for the potential confounding effect of dating onset in the relationship between pubertal timing and dating abuse, which was not included as a control variable in previous studies of pubertal timing and dating abuse (Foster et al., 2004).

A limitation of the study is that the study sample is from two rural counties in North Carolina and may not generalize to other adolescent populations across the

country. Secondly, this study excluded all but Black and White adolescents due to the constraint of standardizing pubertal timing by race. However, analyses suggested that this exclusion criteria was not a significant source of bias when generalizing to the larger study sample. A future study with a larger number of Latino and other race students could examine differences by ethnicity and race.

Several limitations of the measures should be noted. Both the peer referent and biological version of the pubertal timing variables were trichotomized into early, on-time, and late pubertal timing. The biological version was trichotomized using one standard deviation above and below as a cut-point, which is typical for studies of the effects of pubertal timing. The peer referent version was trichotomized from a five point item so that the distribution was similar to the biological version. It is possible that different cut-points could have produced different results. I attempted to address this possibility by also considering a continuous version of the pubertal timing variables which should provide the greatest power to detect significant relationships.

Some have criticized “acts scales” of dating abuse such as the one used in this study because they attempt to quantify dating abuse behaviors by asking about specific abusive acts of dating abuse without capturing the motivation or context of those acts (for examples of critiques see: DeKeseredy, & Schwartz, 1998; Dobash, Dobash, Wilson, & Daly, 1992; Kimmel, 2002; Schwartz, 2000). Additionally, as with any deviant behavior, there is the possibility of underreporting due to social desirability bias. The social desirability bias may differ for boys versus girls which may be a contributing factor to the higher number of girls reporting perpetration behaviors as compared to boys. However, the prevalence and pattern of results of dating abuse behaviors from this study are in line with the results from previous studies.

This study did not specifically include questions about same-sex dating relationships. Although the wording of the survey questions did not exclude same-sex

relationships, it did not specifically include them and so it cannot be assumed that the sample included same-sex relationships or that results can be generalized to that population.

The assessment of dating status and dating onset could be improved in future studies. Whereas the dating abuse questions asked about dating abuse in the past three months, the question at each wave about dating onset asked if the students had ever dated. In future studies, an alternative approach would be to ask if students have dated during the same time period referenced in the questions about dating abuse.

Conclusions

This study examined the relationship between pubertal timing and trajectories of two dating abuse perpetration outcomes: physical perpetration and psychological perpetration. When testing the hypothesis for girls, there were no significant relationships between early as compared to all other pubertal timing and dating abuse perpetration. Similarly for boys, there were no significant relationships between early or late pubertal timing as compared on-time pubertal timing and dating abuse perpetration after controlling for demographic variables and dating onset. In exploratory analyses, late versus on-time pubertal timing for girls was associated with a decrease in slope for physical and psychological perpetration, indicating that late pubertal timing was associated with lower risk of dating abuse perpetration. An earlier age of dating onset was significantly related to increased risk of dating abuse perpetration in all models.

CHAPTER 3: THE RELATIONSHIP BETWEEN PUBERTAL TIMING AND TRAJECTORIES OF ADOLESCENT DATING ABUSE VICTIMIZATION

INTRODUCTION

The purpose of this study is to investigate associations between the pubertal timing of boys and girls and developmental trajectories of adolescent dating abuse victimization from grades eight to 12. Deviations from the normal timing of puberty have been associated with several adolescent behaviors and risk factors that are also correlated with dating abuse victimization including depressive symptoms (Graber et al., 1997; Graber et al., 2004; Howard, Wang, & Yan, 2008; Lehrer, Buka, Gortmaker, & Shrier, 2006; Natsuaki et al., 2009; Roberts et al., 2003), substance use (Howard & Wang, 2003a; Howard & Wang, 2003b; Roberts et al., 2003; Stice, Presnell, & Bearman, 2001; Tschann, et al., 1994; Westling, et al., 2008), having sex (Flannery et al., 1993; Howard et al., 2008; Zabin, et al., 1986), and being a victim of sexual harassment (Chiodo, et al., 2009; Craig et al., 2001). Despite the probable connection between pubertal timing and dating abuse victimization, very little attention has been given to pubertal timing as a risk factor for dating abuse victimization.

Only one study has examined the association between pubertal timing and adolescent physical and psychological dating abuse victimization (Foster et al., 2004). However, that study was limited to girls and did not include trajectories of behaviors as outcomes. This study will extend that research by: 1) including boys and girls; 2) examining associations of pubertal timing on trajectories as opposed to point estimates of dating abuse victimization; 3) including more extensive measures of pubertal timing, and 4) controlling for dating onset.

Adolescent Dating Abuse Victimization

Approximately one third of teens report experiencing dating abuse victimization (Halpern et al., 2001). Nationally representative samples and local studies have been consistent in finding that psychological victimization is more prevalent than physical victimization and that approximately the same proportion of boys and girls report dating abuse victimization, or that boys report more victimization than girls (Arriaga & Foshee, 2004; Foshee, 1996; Foshee, et al., 2009; Jezl, Molitor, & Wright, 1996; Howard & Wang, 2003a; Howard & Wang, 2003b; O'Keefe, 1997). For example, results from the Add Health study found that 28% of boys and 29% of girls reported psychological dating abuse victimization in the past 18 months (Halpern et al., 2001). In the most recent Youth Risk Behavior Survey, 9.8% of boys and girls reported physical abuse victimization such as being hit, slapped, or physically hurt on purpose by a boyfriend or girlfriend in the past year (CDC, 2010).

Some evidence suggests that girls are more likely to be victims of severe forms of physical abuse (e.g., physically beating up including hitting, kicking, or throwing someone down) as compared to boys (Arriaga & Foshee, 2004; Coker et al., 2000). However, other studies have found conflicting results, either finding that there are no gender differences in severe physical dating abuse victimization (Foshee, 1996; Jezl et al., 1996; O'Keefe & Treister, 1998) or that boys are more likely than girls to be victims of severe physical abuse (Munoz-Rivas, Grana, O'Leary & Gonzalez, 2007).

The consequences of victimization are serious for both boys and girls. Longitudinal and cross-sectional studies have found that dating abuse victimization is associated with depression or depressive symptoms (Ackard et al., 2003; Ackard et al., 2007; Roberts et al., 2003), substance use (Ackard et al., 2003; Ackard et al., 2007; Coker et al., 2000, Howard & Wang, 2005; Magdol et al., 1998; O'Donnell et al., 2006; Raiford et al., 2007; Roberts et al., 2003; Silverman, Raj, Mucci, & Hathaway, 2001),

unhealthy eating and weight control behaviors (Ackard et al., 2003; Ackard et al., 2007; McCabe & Ricciardelli, 2004; Silverman et al., 2001), delinquency or antisocial behaviors (Roberts et al., 2003), and suicidal behaviors (Ackard et al., 2007; Howard & Wang, 2003a; Howard & Wang, 2003b; Roberts et al., 2003; Silverman, et al., 2001).

Additionally, cross sectional studies with girls have found victimization to be correlated with physical injury (O'Leary et al., 2008), early sexual intercourse, and pregnancy (Coker et al., 2000; Howard & Wang, 2003a; Silverman, et al., 2001). Because dating abuse victimization affects both boys and girls, this study will include both when examining the effects of pubertal timing on dating abuse victimization trajectories.

No previous study has described trajectories for psychological dating abuse victimization. Given that perpetration of dating abuse implies a recipient victim, it is reasonable to expect the trajectories for psychological victimization would be similar to those for psychological perpetration. Foshee et al. (2009) found that for both boys and girls trajectories of psychological dating abuse perpetration were linear, steadily increasing from eighth to 12th grade. Thus, I expect that trajectories of psychological abuse victimization will follow a linear pattern. Similarly, longitudinal studies of physical dating abuse perpetration found that dating abuse perpetration increased from eighth to 10th grade and then decreased through 12th grade (Foshee et al., 2009; Reyes, 2009). Given this evidence, I expect that trajectories of physical abuse victimization will be quadratic, increasing in the early high school years and then decreasing in later high school years.

Pubertal Timing and Dating Abuse Victimization

Despite the probable connection between pubertal timing and dating abuse victimization, only one study has investigated the relationship between pubertal timing and physical and psychological dating abuse victimization (Foster et al., 2004). Foster

and colleagues found that early pubertal development among girls was a risk factor for verbal and physical dating abuse victimization with an odds ratio of 1.94. Moreover, pubertal development accounted for most of the correlation between age and dating abuse victimization. However, this study did not include boys, did not include trajectories of behaviors as outcomes, and did not control for dating onset.

In related research, a study that interviewed 112 girls found that an earlier age of menarche was associated with being a victim of sexual assault from a dating partner, stranger, or family member (Vicary, Klingaman, & Harkness, 1995). A cross-sectional study by Schreck, Burek, Stewart, and Miller (2007) and a longitudinal study by Haynie and Piquero (2006) found that pubertal timing among boys and girls was associated with being a victim of violence. A study with middle school students found that pubertal timing was associated with an increased risk of being a victim of sexual harassment from peers (Craig et al., 2001), which is a predictor of later victimization by a dating partner (Chiodo et al., 2009). In summary, pubertal timing has been associated with dating abuse victimization as well as related behaviors such as being a victim of peer violence, sexual assault, and sexual harassment. However, further research is needed to understand the relationship for both boys and girls and the complexity of the relationship over time.

STUDY HYPOTHESES

Early Maturation Model

As in Chapter 2, the early maturation model and the off-time model will be utilized to hypothesize relationships between pubertal timing and dating abuse victimization. The early maturation model proposes that early pubertal timing, as compared to on-time and late pubertal timing, is a risk factor for adolescent problem behaviors because early maturing teens experience an accelerated transition from childhood to adolescence. This allows the teen less time to develop skills needed to manage the dynamics of dating

relationship. Furthermore, early developing teens would seek out older friends and/or friends who are engaging in deviant behaviors because those friends provide the appearance of maturity. A friendship group composed of friends with norm-violating behaviors such as dating, acting dominate and aggressive, and experimenting with tobacco, alcohol, and other drugs, would provide more opportunity for the adolescents' problem behavior. It would also be more likely that dating partners would have these same characteristics, increasing the opportunity for dating abuse victimization. A possible contributing aspect would be that parents and other adults allow more unsupervised time when the teen looks physically mature, wrongly assuming that the teen is mature enough to make responsible decisions.

Off-time Model

The off-time model, also known as the deviance hypothesis (Petersen & Taylor, 1980; Petersen & Crockett, 1985), proposes that teens who develop earlier or later than their peers are at greater risk for negative health outcomes like victimization because of psychosocial maladjustment resulting from a deviant social status. This concept comes out of life-span and life-course theories which suggest there is a normal and expected timing for life events (Brooks-Gunn et al., 1985; Neugarten, 1979). Events which are off-time can lead to emotional distress, lower self-concept, and poorer social adaptation. A study by Schreck et al. (2007) found that early puberty was associated with violent victimization for boys and girls. The authors found that the relationship between early pubertal timing and victimization was partially mediated for boys and fully mediated for girls by measures of distress including emotional distress, poor school performance, and drinking.

In addition to measures of distress, off-time pubertal timing could lessen the teen's social status among his or her peers. This could have consequences for dating

relationships. These teens may have difficulty in romantic relationships due to the lack of experience with positive peer interactions, which serve as a model for behavior in romantic relationships. Limited research suggests this is a plausible relationship. Peer rejection has been associated with peer victimization (Crick & Bigbee, 1998) and peer alienation and poor peer relations have been associated with physical and psychological violence in dating relationships (Linder et al., 2002; Sharpe & Taylor, 1999). Thus, difficulty with peer relationships could be predictive of victimization in dating relationships.

Hypothesis for Girls

There is strong evidence that early maturing girls, as opposed to on-time or late maturing girls, are at risk for victimization. For example, an earlier age of menarche has been associated with being a victim of sexual assault (Vicary et al., 1995). Earlier pubertal timing has been associated with being a victim of violence (Schreck et al., 2007; Haynie & Piquero, 2006) and an increased risk of being a victim of sexual harassment from peers (Craig et al., 2001). Finally, early pubertal timing has been associated with physical and psychological dating abuse victimization (Foster, et al. 2004).

In addition to the dynamics described in the early maturation model, early maturing girls may be considered more physically attractive by potential romantic partners and these girls may feel increased pressure to begin dating and maintain a dating relationship as a sign of their maturity and autonomy. Early maturing girls tend to affiliate with older male friends and boyfriends (Caspi, et al., 1993; Mezzich, et al., 1996), leading many researchers to postulate that this creates a power differential between the older and stronger boyfriend and the younger and less socially mature girl, making the girl more vulnerable to victimization. Additionally, earlier dating and greater physical development could also lead to earlier sexual activity, which would increase the

opportunity for dating abuse victimization because girls may be less psychologically and socially prepared to handle a physically intimate relationship. In several studies, early pubertal timing among girls has been associated with sexual debut. Researchers have found that appearing older than same-age, same-sex peers was associated with sexual debut (Resnick et al., 1997; Rosenthal et al., 1999) and that an earlier age at menarche was associated with sexual debut (Cavanagh, 2004; Zabin et al., 1986). Flannery et al. (1993) found that early pubertal timing was associated with more sexual experience. A study of romantic relationships and violent victimization found that violent victimization was more likely in relationships with sexual intercourse. In those relationships, sexual intercourse more often preceded the violence than the reverse (Kaestle & Halpern, 2005).

Given the theoretical rationale and consistent empirical support for behaviors related to dating abuse victimization it is hypothesized that: Hypothesis 3.1: For girls, early pubertal timing, as compared to on-time and late pubertal timing, will be associated with a higher mean level of physical and psychological victimization in the eighth grade (intercept) and increased mean growth (slope) through 12th grade. It is expected that the trajectories of physical dating abuse victimization will be positive and quadratic and trajectories of psychological dating abuse victimization will be positive and linear.

Hypothesis for Boys

Although it seems counter to common perceptions to think of boys as victims of dating abuse, particularly early maturing boys, it is important to note that boys are as likely as girls to be victims of dating abuse. Additionally, there is empirical evidence linking early maturation among boys with violent victimization. Craig et al. (2001) found that early maturing boys in grades five through eight, as compared with on-time and late maturers, were more likely to be victims of same-sex and opposite-sex sexual

harassment. A longitudinal study using Add Health data found that boys with early pubertal timing were more likely to report violent victimization (e.g., someone pulled a knife or gun on them, someone cut or stabbed them, they were involved in a physical fight) (Haynie & Piquero, 2006). A cross-sectional study using Add Health data with boys ages 11 to 15 found that early pubertal timing was associated with violent victimization (Schreck, et al., 2007).

Late maturing boys may also be victims of dating abuse because late pubertal timing is hypothesized to result in greater emotional distress and poorer social adaptation. This possibility is supported by empirical evidence linking late maturing boys to greater self-consciousness and more emotional reliance on others (Graber et al., 1997), and depression (Graber et al., 1997; Natsuaki et al., 2009). Late maturation has been associated with other risky health behaviors including alcohol use (Andersson & Magnusson, 1990), lower school achievement (Dubas, Graber & Petersen, 1991), and a higher risk for disruptive behavior disorders (attention-deficit/hyperactivity disorder and conduct and oppositional disorders) and substance abuse and dependence disorders at age 24 (Graber et al., 2004). For late maturing boys, a dating relationship may take on greater importance as a way to improve social status. Late maturing boys may tolerate dating abuse victimization in order to maintain their dating relationship.

Based on the empirical and theoretical evidence I hypothesize that:

Hypothesis 3.2: For boys, early pubertal timing (as compared with on-time pubertal timing) and late pubertal timing (as compared to on-time pubertal timing) will be associated with a higher mean level of physical and psychological victimization in eighth grade (intercept) and increased mean growth (slope) in dating abuse through grade 12. It is expected that the trajectories of physical dating abuse victimization will be positive and quadratic and trajectories of psychological dating abuse victimization will be positive and linear.

METHODS

Study Design

The data for this study come from two linked longitudinal studies. In the first study, *The Context of Adolescent Substance Use* (NIDA R01 DA 13459; PI Susan Ennett), data were collected from three sequential cohorts of adolescents in the public school systems of three predominately rural North Carolina counties when students were in the sixth, seventh, and eighth grades. Students were surveyed every six months for a total of five waves of data collection. Additional funding was awarded in 2003 for a second study, *Violence Against Peers, Dates, and Self: A Developmental Focus* (CDC R49 CCV423114; PI Vangie Foshee), which included extensive dating abuse questions in waves four and five and followed students in two of the three counties for an additional two waves, until students were in 10th, 11th, and 12th grades, for a total of seven waves of data collection. This study only includes data from the two counties where students were followed for the full seven waves.

All students enrolled in the grade cohorts of interest at each wave were eligible to participate in the study, except for students in special education classes or those unable to complete the questionnaire in English. As described in the previous chapter, the data were collected using self-administered questionnaires in school. The study and data collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, School of Public Health.

Study Sample

A total of 3,978 students participated in the original studies in the two counties at any of the seven waves of data collection. The sample for the current study was limited to students who completed the first wave of data collection and at least one of waves four through seven. This is because the measure of pubertal timing comes from the first

wave, and the dating abuse questions were added to the survey during waves four through seven. This left a possible eligible sample of 2,410 students. As was described in more detail in Chapter 2, students were excluded if they were missing age, sex, race/ethnicity, pubertal status, dating abuse, if they were a race/ethnicity other than Black or White, or if their age was outside of a three-year range of normal ages for a grade. These exclusion criteria resulted in a final analysis sample of 2,053.

Measures

The measures used in this study were self-reported by the students and include measures of dating abuse victimization, pubertal timing, and control variables. The Cronbach's alphas presented below are from wave one unless otherwise noted.

Dating onset: Before assessing dating abuse victimization, students were asked, "Have you ever been on a date?" A date was defined as an "informal activity like meeting someone at the mall, a park, or at a basketball game as well as more formal activities like going out to eat or to a movie together." From this item I created a variable to represent the student's grade when they first dated. This was an ordinal variable, based on the grade that a student was in when they reported dating for the first time during the study. The variable ranged from zero to five, with a higher number indicating earlier dating.

Dating Abuse Victimization: Students were asked, "During the past 3 months, how many times has anyone you were dating or on a date with done the following things to you? Don't count it if they did it to you in self-defense or in play." The scale was parallel to the dating abuse perpetration scale described in the previous chapter with all the items re-worded for victimization. The following five items were used to assess psychological dating abuse victimization: "said something to hurt your feelings," "insulted you in front of others," "made you describe where you were every minute of the day,"

“threatened to hurt you,” and “would not let you do things with other people” ($\alpha = .84$).

The following six items were used to assess physical dating abuse victimization:

“slapped or scratched you,” “physically twisted your arm or bent back your fingers,”

“pushed, grabbed, shoved, or kicked you,” “hit you with their fist or with something else

hard,” “beat you up,” and “assaulted you with a knife or gun” ($\alpha = .92$). The response

options for all items were on a five point scale ranging from zero to four: none (0), 1-2

times (1), 3-5 times (2), 6-9 times (3), and 10 times or more (4). Individual items were

summed at each wave and then transformed using the natural log to create continuous

measures of physical abuse victimization and psychological abuse victimization for the

four waves of assessment.

Pubertal Timing

Two measures of pubertal timing were used: pubertal timing with a biological

referent and pubertal timing with a peer referent. *Pubertal Timing with Biological*

Referent. The Pubertal Development Scale (Petersen et al., 1988) was used to measure

pubertal status. The scale references three aspects of biological development for boys

and girls (growth in height, body hair, and skin change) and two gender-specific items,

facial hair and voice changes in males and breast changes and menstruation in females.

The students ranked each aspect of development on a four-point scale from “not yet

started” (1) to “seems complete” (4), except for menstrual status which was

dichotomous, no (1) or yes (4). Responses to each question were averaged to provide a

pubertal status score. Pubertal status was measured at wave one, when students were

in sixth, seventh or eighth grade. The reliability for this measure at wave one was .71 for

girls and .74 for boys.

To convert pubertal status into a measure of pubertal timing, scores were

standardized for each year of age, sex (male or female), and race/ethnicity (Black or

White). After standardizing the pubertal timing variable it was coded so that one standard deviation and above the mean was considered early timing, one standard deviation and below the mean was considered late timing, and scores in between were considered on-time pubertal timing. The trichotomized measure was converted into two dummy coded variables: 1) early pubertal timing coded as “1” versus on-time and late pubertal timing coded as “0”; and 2) late pubertal timing coded as “1” versus on-time and early pubertal timing coded as “0”. This coding allows the flexibility of testing the hypothesis for girls that early pubertal timing versus all others is associated with increased risk, while meanwhile testing the curvilinear hypothesis for boys that early versus on-time and late versus on-time pubertal timing is associated with increased dating abuse.

Pubertal Timing with Peer Referent. The second measure of pubertal timing was a one item measure of pubertal timing as compare to one’s peers. Students were asked, “Compared to most others of your age and sex, do you think your development is...?”, with five response options ranging from “much earlier” to “much later.” Students were considered to be early timing if they responded “much earlier” and to be late timing if they responded “much later” or “somewhat later.” As with the biological referent version of pubertal timing, the trichotomized peer referent measure was converted into two dummy coded variables: 1) early pubertal timing coded as “1” versus on-time and late pubertal timing coded as “0”; and 2) late pubertal timing coded as “1” versus on-time and early pubertal timing coded as “0”.

Demographic Control Variables

The following control variables were included from wave one: sex, age, race/ethnicity, family structure, and socioeconomic status. Sex was coded as male (1) or female (0). Race was coded as Black/African-American (0) or White (1). Family structure

was a dichotomous variable reflecting if the adolescent reported living in a two-parent household which could include a stepmother or stepfather (0) versus living with one parent (1). Socioeconomic status was based on the student's report of the highest level of education achieved by either parent on a six point scale that ranged from "did not graduate from high school" (0), to "graduate or professional school" (5).

Analysis Strategy

Missing Data Analysis

Chi-square tests, t-tests, and logistic regressions were used to examine how students in the final analysis sample ($n=2,053$) differed from those excluded from the analysis sample (eligible sample = 3,978; excluded = 1,925) on key variables of interest including the outcome variables. In bivariate tests, students who were excluded were significantly more likely to be male, older, have lower parental education, have a one parent household, and report more psychological victimization at wave six ($p<.05$). Pubertal timing and dating abuse victimization at other waves were not associated with exclusion from the study. In multivariate logistic regression, controlling for age, sex, race, parental education and one parent household, psychological victimization at wave six was no longer associated with exclusion from the study.

Test of Cohort Differences

As described in more detail in the previous chapter, the outcomes were examined for differences in cohorts in the dating abuse trajectories using a latent growth curve approach and a multilevel modeling approach. Based on these analyses I concluded it would be reasonable to combine the growth curves of the three cohorts into one common growth curve ranging from grade eight through twelve.

Test of Clustering

I examined nesting of two dating abuse victimization outcome variables by census block at each of the four waves. There were negligible design effects (average design effect was 1.11) and non-significant intraclass correlations (average ICC was .006). Nesting due to block group was not controlled for in the models and this is unlikely to bias the results.

Latent Growth Curve Models

Latent growth curve models were used to examine how the timing of pubertal development impacts trajectories of dating abuse. As described in more detail in Chapter 2, latent curve models estimate an intercept and slope term for each individual, creating an equation for an individual trajectory. The intercepts and slopes are pooled to create a mean intercept and slope. The measures of dating abuse were reorganized by grade resulting in eight time points from the fall of eighth grade through the fall of 12th grade. The factor loadings for the linear slope factor were spaced such that a one unit increase would represent one year in time. The first seven time points were spaced six months apart and so the linear factor loadings were set .5 units apart (e.g., 0.5, 1.0, 1.5, etc.). The final wave of assessment occurred one year after the previous wave; therefore, the final two factors loadings were one unit apart. The linear factor loading for the fall of eighth grade was set to zero, making that time point the intercept for the model.

To determine the optimal unconditional/univariate model for each of the dating abuse outcomes I fit a series of multiple group models starting with a linear model with all parameters held invariant across boys and girls. After inspecting the graphs of observed and estimated means, I determined if it would be reasonable to test if the addition of a quadratic slope factor for boys or girls would provide a better fit to the data than a linear model. A quadratic slope factor was retained if it improved overall model fit

and the mean for the quadratic slope factor was significant. I also inspected the overall model fit and modification indices to see if model fit could be significantly improved by freeing parameters across gender. First I freed the latent factor means and variances across groups, and then reevaluated model fit. If overall model fit was still less than adequate, I considered freeing residual variables across groups. At each step I tested for significant improvement in model fit.

Hypothesis Testing

After the optimal univariate model for dating abuse was established, the pubertal timing variable(s) were added to the model as predictors of the intercept and slope factors for the dating abuse trajectory. To match the hypothesis for girls, the dummy coded variable for early timing versus all other timing was added to the model as a predictor of the intercept and slope factors for girls. To match the hypothesis for boys, the two dummy-coded pubertal timing variables (early versus on-time and late versus on-time) were simultaneously added to the model as predictors of the intercept and slope factors for boys. Each of the dating abuse victimization outcomes was assessed in turn. The biological referent version of the pubertal timing variable was tested separately from the peer referent version, resulting in a total of four models (two versions of pubertal timing modeled with two dating abuse outcome variables).

Secondly, control variables were added to the model. If the relationship between pubertal timing and dating abuse was not significant after adding control variables, then I explored which specific variable responsible for attenuating the relationship. The control variables were grade of dating onset and demographic variables (age, race, one parent household, and parent education). The latent intercept and slope factors were regressed on grade of dating onset, race, parental education, and one parent household to control for the impact of these variables on the trajectory of dating abuse. Each of the eight

dating abuse time points was regressed on age at wave one to control for variation in age within a grade and the paths were constrained to be equal within groups.

Evaluating Model Fit

All latent growth curve models were estimated with Mplus version 6.11 (Muthén & Muthén) using the robust maximum likelihood (MLR) estimator. This estimator is robust to non-normality in the data. Model fit was evaluated by chi-square test, the comparative fit index (CFI; Bentler, 1990), the Tucker-Lewis index (TLI; Tucker & Lewis, 1973), and the root mean square error approximation (RMSEA). As a general rule of thumb, models with a CFI and TLI of at least .95 and a RMSEA value of .05 or less were considered to be reasonable fitting models (Browne & Cudack, 1993; Hu & Bentler, 1999). Differences between nested models were evaluated with the chi-square difference tests of the Satorra-Bentler scaled chi-square (Satorra, 2000) or a change in CFI of .01 or less (Cheung & Rensvold, 2002).

RESULTS

Descriptive Statistics

Dating Abuse Prevalence

Table 3.1 presents the proportion of students who reported physical and psychological dating abuse victimization from eighth through 12th grade. The proportion of students reporting physical victimization ranged from 6.9% to 10.9%. Between 16.8% and 30.3% of students reported psychological victimization. The proportion of students reporting physical victimization and the mean level of physical victimization were low but generally increased over the study time period. The mean level of psychological victimization and the proportion of students reporting psychological victimization also increased over the study time period. This provides an indication that the unconditional

models for both physical victimization and psychological victimization will be positive and linear or positive and quadratic.

Table 3.1 Proportion of students reporting dating abuse and mean level of dating abuse

Grade	Physical Victimization		Psychological Victimization	
	Proportion % (N)	Mean (SD)	Proportion % (N)	Mean (SD)
8	6.9% (578)	.28 (1.8)	16.8% (578)	.60 (2.2)
8.5	8.1% (530)	.45 (2.5)	17.5% (530)	.65 (2.3)
9	9.6% (1044)	.45 (2.3)	21.3% (1044)	.76 (2.4)
9.5	10.0% (539)	.58 (3.0)	19.7% (539)	.89 (2.8)
10	9.1% (1465)	.49 (2.5)	24.5% (1465)	.96 (2.7)
10.5	10.8% (480)	.66 (3.2)	27.7% (480)	1.07 (2.9)
11	10.9% (915)	.47 (2.3)	30.3% (915)	1.02 (2.5)
12	10.7% (384)	.56 (2.7)	28.4% (384)	1.05 (2.8)

Note: means and standard deviations (SD) are before the log-transformation of variables

Bivariate Correlations between Pubertal Timing and Dating Abuse Victimization

The following two tables (Tables 3.2 and 3.3) present cross-sectional correlations for the relationship between pubertal timing and dating abuse victimization, stratified by gender and grade. The tables include the correlations between the biological and peer referent versions of pubertal timing with the physical and psychological victimization outcome variables. To match the hypothesis for girls, the correlations presented for girls are for early versus all other pubertal timing (Table 3.2). There was only one significant correlation between early versus all other pubertal timing and physical victimization. It was a positive correlation and therefore is in line with the study hypothesis that early versus all other pubertal timing is correlated with increased dating abuse.

Table 3.2 Correlations between pubertal timing and dating abuse victimization for girls

	<u>Biological Referent</u> Early versus all others	<u>Peer Referent</u> Early versus all others
<u>Physical Victimization (girls)</u>		
Fall 8 th	.02	.06
Spring 8 th	.01	-.05
Fall 9 th	<-.01	.04
Spring 9 th	-.01	.07
Fall 10 th	.03	.08*
Spring 10 th	.11	.03
Fall 11 th	<-.01	.07
Fall 12 th	.01	-.04
<u>Psychological Victimization (girls)</u>		
Fall 8 th	<-.01	.10
Spring 8 th	-.01	.03
Fall 9 th	<-.01	.06
Spring 9 th	.05	.02
Fall 10 th	.05	.02
Spring 10 th	.06	.04
Fall 11 th	.03	-.03
Fall 12 th	.10	-.06

*p<.05; **p<.01; ***p<.001

Table 3.3 Correlations between pubertal timing and dating abuse victimization for boys

	<u>Biological Referent</u>		<u>Peer Referent</u>	
	Early versus on-time	Late versus on-time	Early versus on-time	Late versus on-time
<u>Physical Victimization (boys)</u>				
Fall 8 th	.07	<-.01	.16*	-.02
Spring 8 th	-.07	-.06	-.03	-.01
Fall 9 th	.04	<-.01	.03	<.01
Spring 9 th	.12	-.04	-.07	<.01
Fall 10 th	.04	-.05	.01	.03
Spring 10 th	.03	-.11	.03	-.01
Fall 11 th	.15**	-.07	-.03	-.04
Fall 12 th	.08	-.03	-.11	-.09
<u>Psychological Victimization (boys)</u>				
Fall 8 th	.03	-.03	.10	-.04
Spring 8 th	-.08	-.04	.04	-.03
Fall 9 th	.08	-.05	.01	-.03
Spring 9 th	.09	-.07	-.12	-.07
Fall 10 th	.05	-.02	-.03	.06
Spring 10 th	.06	-.13	.07	-.04
Fall 11 th	.16**	-.10	-.07	-.09
Fall 12 th	.08	-.07	-.12	-.07

*p<.05; **p<.01; ***p<.001

To match the hypothesis for boys, the correlations presented are for early versus on-time and late versus on-time pubertal timing (Table 3.3). For boys, there were three significant correlations and all were between early versus on-time pubertal timing and dating abuse. As with girls, early versus on-time pubertal timing was positively correlated with increased dating abuse victimization for boys. This is in line with the study hypothesis; however, I also expected late versus on-time pubertal timing to be positively correlated with dating abuse.

Univariate Models

Univariate (unconditional) trajectory models were fit to measures of physical victimization and psychological victimization (Figures 3.1 and 3.2). For both dating abuse outcomes a significant improvement in model fit was achieved by allowing the latent factors means and variances to vary across boys and girls. Residual variances were permitted to vary across time but were held equal across boys and girls unless otherwise noted. Details of the final univariate model for each dating abuse outcome are discussed separately. Parameter estimates and fit indices for both unconditional models are presented in Table 3.4; results for girls are in the top half of the table and results for boys are on the bottom.

Physical Abuse Victimization

The final univariate model for physical abuse victimization had excellent overall fit (Table 3.4). There was very little change over time in physical abuse victimization. Girls and boys started at almost the same level in the fall of 8th grade and had slight linear increases by 12th grade (Figure 3.1). Despite the almost overlapping trajectories, the positive linear change for girls was significant but for boys it was not, meaning that for boys the linear change was not significantly different from zero. To achieve adequate fit

to the data the residuals for several time points were allowed to vary across boys and girls. There was significant variance in the intercept factor for girls but not for boys.

Figure 3.1 Estimated mean trajectory of physical abuse victimization for girls and boys

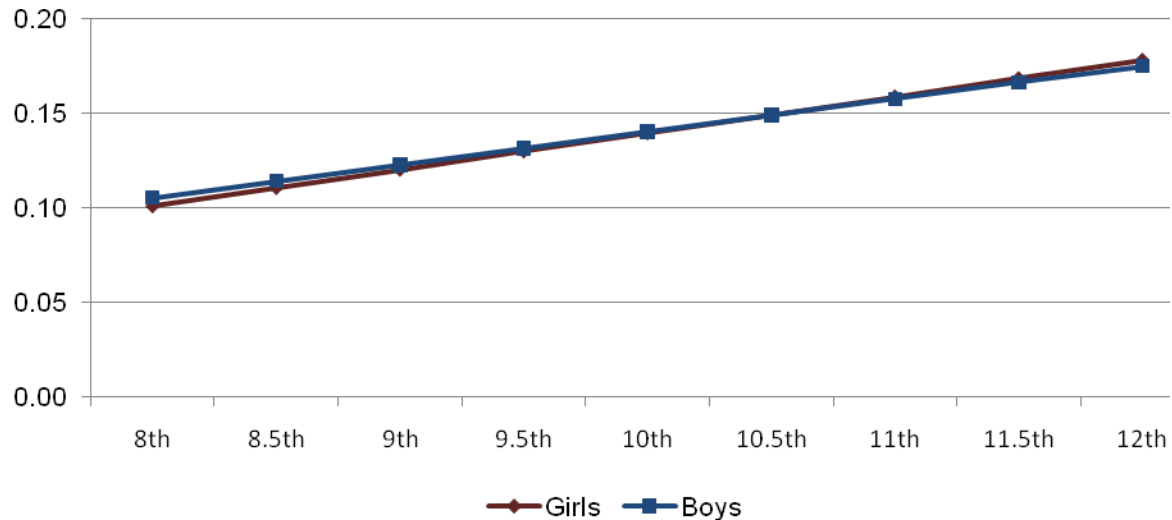
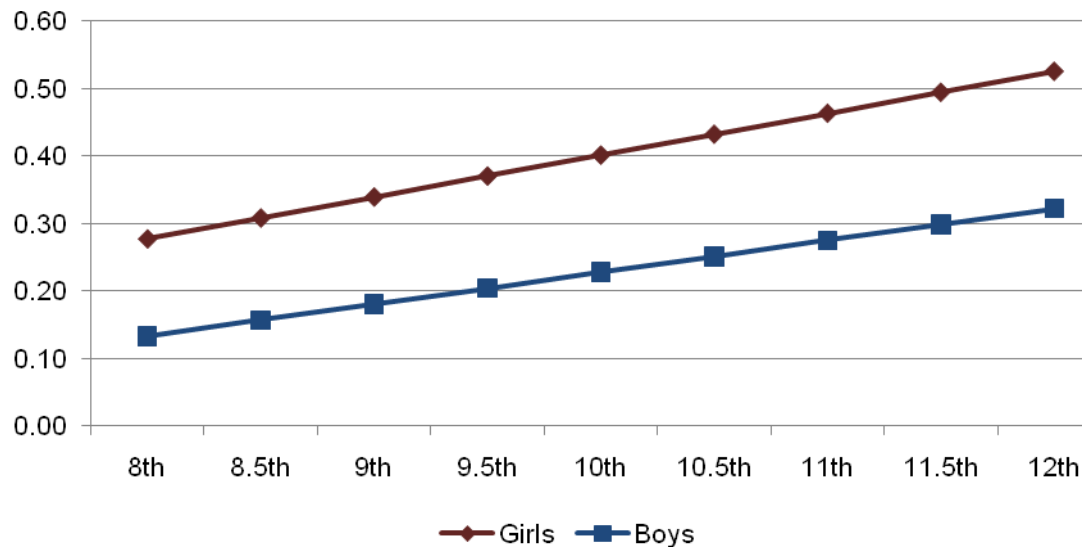


Figure 3.2 Estimated mean trajectory of psychological abuse victimization for girls and boys



Psychological Abuse Victimization

The univariate model for psychological abuse victimization also had excellent overall fit (Table 3.4). A positive linear model provided the best fit for girls and boys. The

level of psychological victimization significantly increased for boys and girls from the 8th grade through the 12th grade. Girls started higher than boys in the 8th grade and stayed higher through the 12th grade (Figure 3.2). There was significant variance in the intercept factors for both boys and girls but not significant variance in the slope factors for either boys or girls.

Table 3.4 Factor means and variances for univariate models of dating abuse victimization

	Physical Victimization	Psychological Victimization
Girls		
Intercept	.10***	.28***
Slope	.02*	.06***
Intercept Variance	.03*	.19***
Slope Variance	.01	.02
Intercept Slope Covariance	-.002	-.01
Boys		
Intercept	.11***	.13***
Slope	.02	.05***
Intercept Variance	.05	.07
Slope Variance	.01	.01
Intercept Slope Covariance	-.01	-.01
Fit Indices		
Scaled χ^2 (DF)	43.45 (42)	45.07 (46)
CFI, TLI	.98, .99	1.0, 1.0
RMSEA (90% CI)	.01 (<.01, .02)	<.01 (<.01, .02)

*p<.05, **p<.01; ***p<.001

Testing Hypothesized Relationships between Pubertal Timing and Trajectories of Dating Abuse Victimization

After establishing the univariate models (Figures 3.1, 3.2, Table 3.4), the measures of pubertal timing were added to the models. The latent factors (intercept and linear slope) were regressed on the two dummy coded variables for early timing and late timing. To match the hypothesis for girls, the latent factors were regressed on early timing as compared to all other timing (i.e., on-time and late pubertal timing combined). To match the hypothesis for boys, the latent factors were regressed on early timing as compared to on-time pubertal timing and late timing as compared to on-time pubertal

timing. The biological referent and the peer referent version of pubertal timing were tested separately. Table 3.5 presents the parameter estimates for the effect of the pubertal timing variables on the mean intercept and slope factors as well as the fit indices for the models. The significant findings are described separately for girls and boys in relation to the study hypotheses.

Table 3.5 Pubertal timing predicting dating abuse victimization

	<u>Physical Victimization</u>		<u>Psychological Victimization</u>	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls				
Early pubertal timing versus all others:				
Intercept	<.01 (.04)	.07 (.05)	-.03 (.06)	.19 (.09)*
Slope	.01 (.02)	<.01 (.03)	.04 (.03)	-.07 (.04)
Boys				
Early pubertal timing versus on-time:				
Intercept	<-.01 (.06)	.09 (.08)	.01 (.06)	.09 (.08)
Slope	.05 (.04)	-.05 (.04)	.05 (.04)	-.08 (.04)*
Late pubertal timing versus on-time:				
Intercept	<-.01 (.05)	<.01 (.05)	-.01 (.05)	-.02 (.05)
Slope	-.03 (.02)	-.01 (.02)	-.04 (.03)	<-.01 (.03)
Fit Indices				
Scaled χ^2 (DF)	72.20 (68)	67.17 (68)	71.04 (72)	73.90 (72)
CFI, TLI	.97, .97	1.0, 1.0	1.0, 1.0	.99, .99
RMSEA (90% CI)	.01 (<.01, .02)	<.01 (<.01, .02)	<.01 (<.01, .02)	.01 (<.00, .02)

* $p < .05$; CI: confidence interval; DF: degrees of freedom

Pubertal Timing and Dating Abuse Victimization for Girls

Hypothesis 3.1 proposed that for girls, early pubertal timing as compared to all others would be associated with a higher mean level of dating abuse victimization in eighth grade and increased slope through the 12th grade. In partial support of this hypothesis, early pubertal timing for girls (peer referent version) as compared to on-time and late pubertal timing was significantly associated with a higher level of psychological victimization in the 8th grade. There were no other significant relationships between pubertal timing and dating abuse victimization for girls.

Pubertal Timing and Dating Abuse Victimization for Boys

Hypothesis 3.2 proposed that for boys, early as compared to on-time pubertal timing, and late as compared to on-time pubertal timing, would be associated with a higher mean level of dating abuse victimization in the eighth grade and increased growth in dating abuse victimization through grade 12. Early pubertal timing (peer referent version) as compared to on-time pubertal timing was significantly associated with a decrease in slope for psychological victimization from eighth through 12th grade. The univariate models for psychological victimization for boys had a slope parameter of .05 ($p < .05$). The parameter for the slope factor regressed on early versus on-time pubertal timing was -.08 indicating that the previously positive linear slope was negative for early maturing boys. This finding is in contrast to the study hypothesis which proposed that both early and late pubertal timing would be associated with an increase in intercept and slope for dating abuse. Instead, early timing was associated with a decrease in the slope of psychological victimization from eighth through 12th grade.

Controlling for Dating Onset and Demographic Variables

As a final step, the grade of dating onset and demographic control variables were added to the models. The models fit the data well and are presented in Table 3.6. The findings are described separately for girls and boys.

Results for Girls

After controlling for grade of dating onset and the demographic variables, early pubertal timing (peer referent version) as compared to on-time and late pubertal timing continued to be associated with an increase in the level of psychological victimization in the eighth grade (Table 3.6). This finding is in line with Hypothesis 3.1. There continued to be no significant relationship between pubertal timing and dating abuse victimization

in the models using the biological referent version of the pubertal timing variable.

Several of the control variables were associated with dating abuse trajectories for girls. An earlier grade of dating onset was associated with an increase of about a third in the mean level of dating abuse in the eighth grade for physical and psychological dating abuse victimization. When all other control variables are at zero, each grade level of earlier dating onset was associated with .03 unit increase in physical dating abuse victimization from the intercept of .10, and a .09 unit increase in psychological dating abuse victimization from the intercept of .28 units. An earlier grade of dating onset was also significantly associated with an increase in slope for psychological dating abuse victimization in one of the two models. White race, as compared to Black, was associated with a higher level of psychological victimization in the eighth grade. One parent household and parent education were not significantly associated with the trajectories of dating abuse victimization in any of the models. Age was a significant covariate of physical and psychological victimization in all models (results not shown).

Results for Boys

When the control variables were included in the model, the significant association between early pubertal timing (peer referent version) and the slope factor for psychological victimization was no longer significant. Despite the race variable having a non-significant effect on dating abuse victimization, when it was removed from the model, but all other control variables were retained, the significant relationship between early pubertal timing (peer referent version) and the slope factor for psychological victimization was once again significant.

Table 3.6 Pubertal timing predicting dating abuse victimization, with control variables

	Physical Victimization		Psychological Victimization	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls				
Early pubertal timing versus all others:				
Intercept	-.01 (.04)	.07 (.06)	-.04 (.07)	.20 (.09)*
Slope	.01 (.02)	<.01 (.03)	.04 (.03)	-.07 (.04)
Dating Onset				
Intercept	.03 (.01)***	.03 (.01)***	.09 (.01)***	.09 (.01)***
Slope	.01 (.01)	.01 (.01)	.01 (.01)	.02 (.01)**
White (versus Black)				
Intercept	.02 (.03)	.03 (.03)	.11 (.05)*	.13 (.05)**
Slope	-.01 (.01)	-.01 (.02)	-.01 (.02)	-.01 (.02)
Parent Education				
Intercept	-.01 (.01)	-.01 (.01)	-.02 (.02)	-.01 (.02)
Slope	<.01 (.01)	<.01 (.01)	.01 (.01)	.01 (.01)
One Parent Household				
Intercept	.04 (.06)	.06 (.07)	.05 (.09)	.08 (.10)
Slope	-.01 (.03)	-.01 (.03)	-.03 (.04)	-.03 (.04)
Boys				
Early pubertal timing versus on-time:				
Intercept	-.01 (.07)	.07 (.08)	<.01 (.07)	.06 (.08)
Slope	.05 (.04)	-.04 (.04)	.05 (.04)	-.06 (.04)
Late pubertal timing versus on-time:				
Intercept	.04 (.05)	.02 (.05)	.04 (.06)	<-.01 (.05)
Slope	-.04 (.03)	-.01 (.02)	-.05 (.03)	<.01 (.03)
Dating Onset				
Intercept	.04 (.01)***	.04 (.01)***	.06 (.01)***	.05 (.01)***
Slope	<-.01 (.01)	<.01 (.01)	<.01 (.01)	.01 (.01)
White (versus Black)				
Intercept	.02 (.04)	.03 (.04)	.03 (.04)	.03 (.05)
Slope	.01 (.02)	.01 (.02)	.04 (.02)	.03 (.02)
Parent Education				
Intercept	<.01 (.01)	<.01 (.01)	-.01 (.01)	-.01 (.01)
Slope	-.01 (.01)	-.01 (.01)	<.01 (.01)	<.01 (.01)
One Parent Household				
Intercept	.22 (.12)	.24 (.13)	.17 (.12)	.18 (.13)
Slope	-.04 (.05)	-.06 (.06)	<-.01 (.06)	-.02 (.06)
Fit indices				
Scaled χ^2 (DF)	138.66 (120)	129.52 (130)	128.90 (134)	132.67 (134)
CFI, TLI	.97, .96	1.0, 1.0	1.0, 1.0	1.0, 1.0
RMSEA (90% CI)	.01 (<.01, .02)	<.01 (<.01, .02)	<.01 (<.01, .01)	<.01 (<.01, .02)

* $p < .05$, ** $p < .01$; *** $p < .001$; CI: confidence interval; DF: degrees of freedom

An earlier grade of dating onset was associated with almost a 40% increase in the mean level of dating abuse in the eighth grade for physical and psychological dating

abuse victimization. When all other control variables are at zero, each grade level of earlier dating onset is associated with .04 unit increase in physical dating abuse victimization from the intercept of .11, and a .05 or .06 unit increase in psychological dating abuse victimization from the intercept of .13 units. Race, parent education and one parent household were not significant covariates of dating abuse in any models. Age was a significant covariate of physical and psychological victimization in all models (results not shown).

Further Exploration of the Relationship between Pubertal Timing and Dating Abuse Victimization

It was hypothesized that for girls early maturing girls as compared to all others would be at increased risk for dating abuse victimization. For boys, early as compared to on-time and late as compared to on-time pubertal timing was hypothesized to be associated with increased risk for dating abuse victimization. Thus, analyses were conducted in a way that did not assess the alternative relationships: that early versus on-time and late versus on-time could be risky for girls and that early versus all others could be risky for boys. As an exploratory analysis, I examined models with these alternative relationships between pubertal timing and dating abuse. As a second step, I added control variables to each model to see if significant relationships remained in the presence of control variables. There were no significant relationships between pubertal timing and physical victimization, thus Table 3.7 only presents findings for psychological victimization.

For girls, early versus on-time pubertal timing for girls (peer referent) was associated with an increase in psychological victimization in the eighth grade (Table 3.7). This is the same relationship that was seen previously when testing Hypothesis 3.1 and does not contribute new information to the results (see Tables 3.5 and 3.6). After

adding control variables, there were no significant relationships between early versus all other pubertal timing and dating abuse for boys.

Table 3.7 Alternative hypotheses of pubertal timing predicting psychological dating abuse victimization, with control variables

	<u>Psychological Victimization</u>	
	Biological Referent <i>b</i> (SE)	Peer Referent <i>b</i> (SE)
Girls		
Early pubertal timing versus on-time:		
Intercept	-.05 (.07)	.20 (.09)*
Slope	.03 (.03)	-.07 (.04)
Late pubertal timing versus on-time:		
Intercept	-.02 (.05)	-.03 (.05)
Slope	-.04 (.03)	-.04 (.03)
Boys		
Early pubertal timing versus not early:		
Intercept	<-.01 (.07)	.06 (.08)
Slope	.05 (.04)	-.06 (.04)
Fit indices		
Scaled χ^2 (DF)	127.14 (134)	127.25 (134)
CFI, TLI	1.0, 1.0	1.0, 1.0
RMSEA (90% CI)	.01 (<.01, .01)	<.01 (<.01, .01)

* $p < .05$; CI: confidence interval; DF: degrees of freedom

Younger Cohorts

One limitation of this study that could have decreased the likelihood of finding associations between pubertal timing and dating abuse perpetration is that pubertal timing was assessed at grades six through eight. Eighth grade, particularly for girls, may be too late in the process of pubertal maturation to accurately identify which teens had early pubertal timing. To test the possibility that the lack of significant associations between pubertal timing and dating abuse perpetration could have been due to including the older cohorts in the study, I examined models with just the cohort that started the study in the spring of sixth grade and then again with the cohorts that started in the spring of sixth and seventh grade. Removing the older cohort(s) from the model also removes some of the later time points in the trajectory and so it is not possible to model

dating abuse trajectories from eighth through the 12th grade; however, it provides a reasonable test if the older cohort(s) attenuated relationships that existed with the younger cohorts. In the models with the youngest cohort only (sixth graders) and also in the models with the youngest two cohorts (sixth and seventh graders only), there were no significant relationships between early pubertal timing and dating abuse for boys or girls. This suggests that the study was not limited by the relatively older age of the adolescents when pubertal timing was assessed.

DISCUSSION

This is the first study to examine trajectories of dating abuse victimization and the first to test the effect of pubertal timing on trajectories of dating abuse victimization. As expected, trajectories of psychological dating abuse victimization increased linearly from eighth to 12th grade for boys and girls. Based on trajectories of physical dating abuse perpetration (Foshee et al., 2009; Reyes, 2009), it was predicted that physical dating abuse victimization would be curvilinear, increasing from eighth to 10th grade and then decreasing. However, there was very little change in physical abuse victimization over time. In fact, the slope for boys was not significantly different from zero. The slope for girls was positive and linear but there was minimal change over time. There was not a significant quadratic slope factor for physical dating abuse victimization for either boys or girls. As this is the first study to examine trajectories of dating abuse victimization there are no studies that can be directly compared. One nationally representative longitudinal study, not using trajectories, found an increase in the onset of intimate partner violent victimization from late adolescence (age 18 and younger) to young adulthood (over age 18) (Halpern, Spriggs, Martin, & Kupper, et al., 2009). In contrast, a longitudinal intervention study found that physical abuse victimization decreased for teens ages 14 to 16 over a two year follow-up for both the treatment and control groups (Wolfe, Wekerle,

Scott, Straatman, Grasley, & Reitzel-Jaffe, 2003). Additional studies would need to be conducted to establish the normative change in physical dating abuse victimization during high school.

Consistent with the early maturation model, early pubertal timing as compared to on-time and late pubertal timing was hypothesized to increase the risk of dating abuse victimization for girls. Consistent with the off-time model, early as compared to on-time pubertal timing and late as compared to on-time pubertal timing was hypothesized to increase the risk for dating abuse victimization for boys. For girls, early pubertal timing as compared to all others was associated with an increase in psychological victimization in the eighth grade. This finding supports the study hypothesis. For boys, there were no significant relationships between pubertal timing and dating abuse victimization after controlling for demographic variables and grade of dating onset.

One previous study found that early pubertal timing for girls was related to verbal and physical dating abuse victimization (Foster et al., 2004). Like that study, this study found that early pubertal timing for girls was associated with an increased risk of psychological victimization. However, there are some important differences between that study and this one. First, the previous study used a measure of pubertal status and controlled for age, rather than the one-item peer timing measure used in this study. Additionally, the previous study did not control for dating status or dating onset. The findings from this study suggest that the relationship between pubertal timing and dating status could inflate the relationship between pubertal timing and dating abuse. Earlier pubertal timing was associated with dating onset and dating onset is a condition for dating abuse.

Dating onset was related to a significantly higher initial level of physical and psychological dating abuse victimization for boys and girls and was related to a faster increase over time in psychological dating abuse victimization for girls in one of the two

models. It is noteworthy that the association between dating onset and dating abuse victimization was much stronger than the relationship between pubertal timing and dating abuse victimization. One explanation for this relationship is that earlier dating onset increases the opportunity for dating abuse to occur due to increased exposure to dating relationships. Additionally, students who seek out dating relationships at a younger age may also have more tumultuous relationships.

In preliminary analysis pubertal timing was associated with dating onset which is in line with prior studies that have found early pubertal timing to be associated with sexual debut (Cavanagh, 2004; Resnick et al., 1997; Rosenthal et al., 1999; Zabin et al., 1986). This literature, combined with the current findings of a strong relationship between dating onset and dating abuse, may suggest dating onset be reconceptualized as a potential mediator of the relationship between pubertal timing and dating abuse rather than a confounder. These relationships, and the measurement of dating onset, are a topic that could be explore further in future studies.

Besides grade of dating onset, the only other control variable to be significantly associated with dating abuse victimization was race. White girls had a higher level of psychological dating abuse victimization than Black girls. Findings from previous studies about race and ethnic differences in dating abuse victimization have been mixed, with studies finding that Black and Latino girls are at higher risk than White girls, and other studies finding that they are at lower risk or no significant difference in risk as compared to White girls (for a review, see Foshee & Reyes, 2010). There were no significant differences in dating abuse victimization by race for boys.

The proportion of students reporting physical victimization in this sample was reasonable considering results from nationally representative studies. In this study between 6.9% and 10.9% of students reported physical victimization in the past three months. Results from the Add Health study found that 12% of teens reported physical

abuse victimization (Halpern et al, 2001). The Add Health study asked about physical abuse victimization in the past 18 months, a much longer time period than the current study and also included seventh grade students in the sample, which is younger than the current study. The Youth Risk Behavior Survey found that 9.8% of 9th through 12th grade students reported physical dating abuse victimization in the past year (CDC, 2010).

The proportion of students who reported psychological victimization was similar to Add Health, despite the short time period referenced. In this study, a low of 16.8% of students in eighth grade and a high of 30.3% of students in 11th grade reported psychological victimization. By comparison the Add Health study found that 29% of seventh through 12th graders reported psychological dating abuse over the past 18 months (Halpern et al., 2001). Girls reported a higher level of psychological victimization than boys at all grades.

Of the four models tested for girls and boys, there was only one significant relationship between pubertal timing and dating abuse victimization. The limited significant findings in this chapter combined with the null results of the previous chapter are noticeable. As mentioned in the previous chapter, one possible explanation is that the effect of pubertal timing on dating abuse attenuates over time (Anderson & Magnusson, 1990; Natsuaki et al., 2009). Assessing dating abuse two to four years after pubertal timing may be too large of a gap in time to detect an effect. Studies that have measured a behavioral outcome one year after assessing pubertal timing appear to have more success in detecting an effect (Lanza & Collins, 2002; Lynne et al., 2006; Weisner & Ittel, 2002). This presents a problem for study design because pubertal timing should be assessed around age ten or 11 and dating abuse is relatively uncommon until mid to late adolescence. Consequently, the effect of pubertal timing on teen behaviors may be too short lived to effect dating abuse.

The one significant finding in this study was with girls. Whereas for girls, early pubertal timing has consistently been found to lead to risky behavior, for boys, the relationship is less certain. Early pubertal timing may have little to no effect on boys or even have a positive effect by increasing confidence and popularity. Late pubertal timing may not confer the risks hypothesized to boys because there is a protective benefit of an extended childhood.

Only the peer referent version of pubertal timing had a significant relationship with dating abuse after including control variables. The biological referent and peer referent versions of pubertal timing likely capture different aspects of pubertal development as evidenced by only a moderate correlation between the two (Cance, 2010). The pubertal development scale, used to calculate the biological referent version of pubertal timing, has been criticized because it sums across the components of the pubertal development scale which overlooks possible differences in importance between some of the items for teens at different points in pubertal development. For example, a girl may have reached menarche but not developed breasts. The social aspect of pubertal timing would then be mostly hidden from peers.

The peer referent measure of pubertal timing is the individual's assessment of how their development compares to their same age and gender peers. It requires the student to imagine a reference group before deciding on his/her level of development. Unfortunately, it is impossible to know to whom the student has compared his/her development. Although the questionnaire item directs the student to compare themselves to their same age and gender peers, it is possible they only compare themselves to their friends or use reference points outside of school in addition to those in school. It is possible that a student's social and dating experience could influence their perceptions of their development. For example, if a student generally feels less accepted by peers they may rate their development as slightly off (either early or late) even if it is

not. Further research that explores how students answer the question about perceived pubertal development as compared to peers would be worth considering.

Several limitations should be noted. First, the study sample is from two rural counties in North Carolina and may not generalize to other adolescent populations across the country. Secondly, this study excluded all but Black and White adolescents due to the constraint of standardizing pubertal timing by race. Both the peer referent and biological version of the pubertal timing variables were trichotomized into early, on-time, and late pubertal timing and it is possible that different cut-points could have produced different results. Additionally, as with any deviant behavior there is the possibility of underreporting of dating abuse victimization due to social desirability bias. The social desirability bias may differ for boys versus girls which may be a contributing factor to the higher rates of girls reporting victimization behaviors as compared to boys. Finally, the assessment of dating status and dating onset could be improved in future studies. Whereas the dating abuse questions asked about dating abuse in the past three months, the question about dating onset asked if the students had ever dated.

Conclusions

This study examined the relationship between pubertal timing, using two different variables, and trajectories of two dating abuse outcomes: physical victimization and psychological victimization. In support of the study hypothesis, early pubertal timing as compared to on-time and late pubertal timing was associated with an increase in psychological abuse victimization for girls. After controlling for demographic variables and dating onset, there were no significant relationships between pubertal timing and dating abuse victimization for boys.

CHAPTER 4: PEER CONTEXT AND INDIVIDUAL CHARACTERISTICS AS MEDIATORS OF THE RELATIONSHIP BETWEEN PUBERTAL TIMING AND PSYCHOLOGICAL ABUSE VICTIMIZATION

INTRODUCTION

The results presented in the previous chapter found that earlier pubertal timing was significantly related to an increase in psychological dating abuse victimization for girls. The purpose of this chapter is to test for mediators of the relationship between earlier pubertal timing and psychological dating abuse victimization for girls. It is hypothesized that mediators based on the early maturation model will explain the association between pubertal timing and psychological dating abuse victimization for girls because 1) the vast majority of studies with girls on pubertal timing have found that early pubertal timing, and not late, is associated with risky behaviors, suggesting that it is early timing, and not deviant timing that is risky, and 2) there has been little empirical support for the mediational processes proposed in the off-time model for girls. Even so, mediators from the off-time model will also be examined because if there is evidence that the variables based on the early maturation model significantly mediate the relationship between pubertal timing and dating abuse and the alternative variables based on the off-time model do not significantly mediate the relationship, then this will be further evidence that the early maturation model is supported.

Early Maturation Model

The early maturation model proposes that early pubertal timing, as compared to on-time and late pubertal timing, is a risk factor for adolescent problem behaviors. One of the primary mechanisms proposed by the early maturation model that explains why

early maturers may be at a higher risk of participating in problem behaviors is that in their attempt to match their own physical maturity, they tend to seek out friends and imitate behaviors that are perceived as more adult like. Because many problem behaviors are perceived by adolescents as exemplifying maturity and adult behaviors, early maturers may have friendships with adolescents who are participating in those kinds of behaviors. If an early maturing teen is enmeshed in a friendship group composed of friends involved in problem behaviors such as acting aggressive and experimenting with tobacco, alcohol, and marijuana, it is more likely that potential dating partners would also have the same behaviors, which in turn would increase the risk for the early maturer of dating abuse victimization. Similarly, if an early maturing teen has friends that are perpetrating dating abuse it could increase the early maturer's acceptance of those behaviors, thereby increasing the risk of dating abuse victimization.

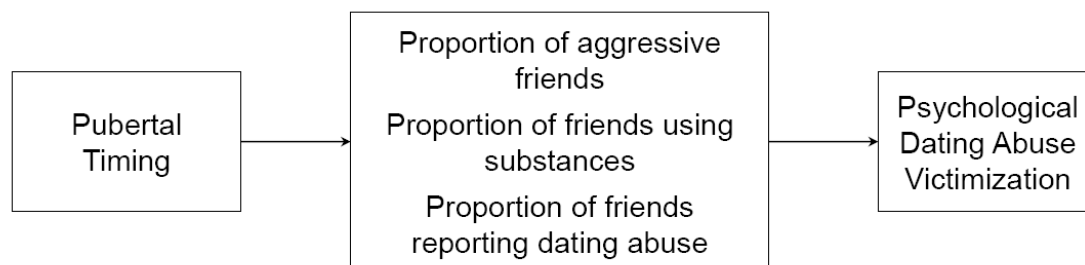
Empirical findings support the hypothesis that friend problem behaviors may mediate the association between pubertal timing and dating abuse victimization. First, early pubertal timing among girls has been associated with having friends with delinquent behaviors, including substance use, and aggressive behaviors (Magnussen, Stattin, & Allen, 1985; Stattin & Magnusson, 1990; Beaver & Wright, 2005; Caspi et al., 1993; Ge et al., 2002; Haynie, 2003). In turn, delinquent and aggressive behaviors among girls (Foster et al., 2004; Magdol, Moffitt, Caspi, & Silva, 1998; O'Donnell et al., 2006; Williams, Connolly, Pepler, Craig, & Laporte, 2008) and having friends who have been in violent relationships (Arriaga & Foshee, 2004) have been predictive of later dating abuse victimization. Although no study has tested the role of peer problem behaviors in mediating the relationship between pubertal timing and dating abuse, studies with relevant outcomes provide evidence that the characteristics and behaviors of close friends mediate the relationship between pubertal timing and other adolescent problem behaviors. Westling et al. (2008) found that for girls the relationship between

early pubertal timing and increased use of cigarettes was partially mediated by having deviant friends. Lynne et al. (2007) found that the level of friend delinquency in the sixth grade mediated the effect of pubertal timing on aggression and delinquency in the sixth, seventh, and eighth grades in a diverse, urban sample of middle school students.

Given the theoretical rationale and empirical support for behaviors related to dating abuse victimization, I expect the relationship between early pubertal timing and psychological dating abuse victimization for girls to correspond to the early maturation model and for the relationship to be mediated by the following peer context variables: proportion of aggressive friends, proportion of friends using substances, and proportion of friends reporting dating abuse.

Hypothesis 4.1: Earlier pubertal timing for girls will be associated with a higher proportion of aggressive friends, friends using substances, and friends engaging in dating abuse. In turn, this peer context of adverse influences will be associated with increased psychological dating abuse victimization.

Figure 4.1 Conceptual model for Hypothesis 4.1



Alternative: The Off-time Model

The primary mechanisms linking off-time pubertal timing to negative outcomes in the off-time model are the negative sequelae that result from being viewed as “abnormal” by peers, including rejection by peers and concomitant emotional distress associated

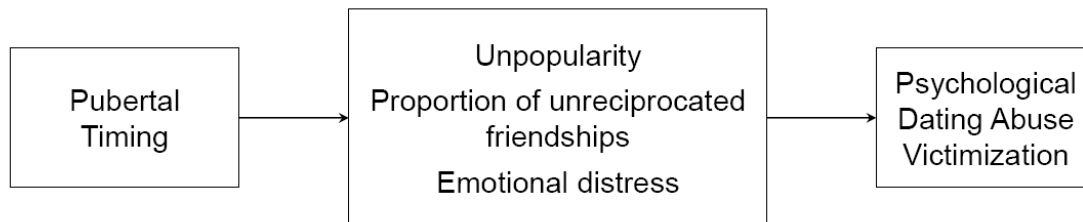
with that rejection. Teens who are rejected by their peers may have difficulty in romantic relationships due to the lack of experience with positive peer interactions, which serve as a model for behavior in dating relationships.

There has been empirical support for the meditational pathway specified in the off-time model for girls when considering other problem behaviors. A study by Schreck et al. (2007) found that for girls, the relationship between early pubertal timing and violent victimization was mediated by emotional distress, poor school performance, and drinking. Additionally, studies have found that early pubertal timing can lead to emotional distress for girls (Caspi & Moffitt, 1991; Ge, et al., 1996; Schreck et al., 2007) and increased depressive symptoms (Graber et al., 1997; Petersen et al., 1991; Rierdan & Koff, 1991). However, the evidence for the meditational pathway specified by the off-time model is less evident when considering peer factors. Studies have looked for and not found evidence that early or late pubertal timing result in lower popularity for girls (Duncan, Ritter, Dornbusch, Gross, & Carlsmith, 1985; McCabe & Ricciardelli, 2004). In fact, early pubertal timing in a sample of seventh and ninth grade girls was related to greater popularity among the opposite sex (McCabe & Ricciardelli, 2004). The association between early pubertal timing and earlier dating and sexual experience (Cavanagh, 2004; Flannery et al., 1993; Resnick et al., 1997; Rosenthal et al., 1999; Zabin et al., 1986) further suggests that early maturing girls are viewed as potential romantic partners, which does not correspond with peer rejection and social isolation aspects of the off-time model.

As demonstrated in Figure 4.2, the off-time model suggests that off-time pubertal timing may result in poor relationships with peers, defined here as being less popular and having fewer reciprocated friendships, and with emotional distress. In turn, this poor peer context and associated emotional distress could lead to equally poor quality dating relationships characterized dating abuse victimization. As noted earlier, I expect to see

less support for this set of mediators than for the mediators specified in the early maturation model.

Figure 4.2 Conceptual model for the off-time hypothesis



METHODS

Study Design

The data for this study come from two linked longitudinal studies. In the first study, *The Context of Adolescent Substance Use* (NIDA R01 DA 13459; PI Susan Ennett), data were collected from three sequential cohorts of adolescents in the public school systems of three predominately rural North Carolina counties when students were in the sixth, seventh, and eighth grades. Students were surveyed every six months for a total of five waves of data collection. Additional funding was awarded in 2003 for a second study, *Violence Against Peers, Dates, and Self: A Developmental Focus* (CDC R49 CCV423114; PI Vangie Foshee), which included extensive dating abuse questions in waves four and five and followed students in two of the three counties for an additional two waves, until students were in 10th, 11th, and 12th grades, for a total of seven waves of data collection.

All students enrolled in the grade cohorts of interest at each wave were eligible to participate in the study, except for students in special education classes or those unable to complete the questionnaire in English. As described in the previous chapter, the data were collected using self-administered questionnaires in school. The study and data

collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, School of Public Health.

This study uses data from waves one, three, and four from the two counties where students were followed through wave seven. Pubertal timing (the independent variable) will be measured at wave one, the mediators will be measured at wave three (with one exception described later), and psychological dating abuse (the dependent variable) will be measured at wave four. Thus, unlike the previous study in this dissertation research which used trajectories as outcomes, this study will use the measure of psychological dating abuse victimization from a single wave (wave four). Despite the change in analysis strategy from trajectories as outcome to a point in time, this study will continue to employ a longitudinal approach. This decision was based on the results of Chapter 3 which found that pubertal timing was associated with a change in the level of psychological dating abuse in the fall of eighth grade (intercept) but not the change over time (slope). There was a negative (although non-significant) effect of early pubertal timing on the slope of psychological dating abuse victimization, indicating that the level of psychological dating abuse victimization for girls with early pubertal timing became closer over time to that of girls with on-time and late pubertal timing. By utilizing the earliest measure of psychological dating abuse victimization, it ensures that the difference in the level of psychological dating abuse victimization between early pubertal timing and all other pubertal timing will be the largest that occurred during the study.

Study Sample

A total of 3,978 students participated in the original studies in the two counties at any of the seven waves of data collection and 1,878 were girls. The sample for the current study was limited to girls who completed the first wave of data collection and the psychological dating abuse question at wave four (N=1,025).

The previous study in this dissertation research limited the sample to White and Black students because there were too few students of other race/ethnicities to standardize the biological referent measure of pubertal timing. However, this study used a one item measure of pubertal timing that did not need to be standardized by race/ethnicity; therefore, there was no need to exclude students based on race/ethnicity. Similarly, the previous studies excluded students outside a normal age range or those missing age because age categories were used when standardizing the biological referent measure of pubertal timing, but this exclusion was not necessary for the current study.

As will be described in more detail in the analysis section, structural equation modeling in Mplus was used to estimate the mediation model. The Maximum Likelihood estimator uses all available data to estimate endogenous and dependent variables. However, a participant was excluded from analysis if they were missing for all independent variables in a model. Thus, the sample size for a particular model depended on the combination of variables included in that model.

Measures

Table 4.1 summarizes the variables included in the study and the wave from which they were drawn. Pubertal timing was measured at wave one. The following mediating variables were measured at wave three: proportion of aggressive friends, proportion of friends using substances, unpopularity, proportion of unreciprocated friendships and emotional distress. The proportion of friends reporting dating abuse victimization or perpetration were measured at wave four because it was the first time they were added to the survey. All demographic control variables and control variables for the baseline level of the mediators were measured at wave one, except for dating status which was assessed at wave four, and the size of the network, used for norming

the measure of unpopularity, which was assessed at wave three. Psychological victimization was measured at wave four.

Table 4.1 Summary of variables included in mediation models

	Mean (SD)	Min	Max
Dependent Variable			
Psychological Victimization (wave 4)	.95 (2.47)	0	20
Independent Variable			
Pubertal Timing (wave 1)	2.19 (1.00)	0	4
Early Maturation Model Mediators			
Proportion of Aggressive Friends (wave 3)	.41 (.30)	0	1
Proportion of Friends Using Tobacco (wave 3)	.20 (.26)	0	1
Proportion of Friends Using Alcohol (wave 3)	.24 (.28)	0	1
Proportion of Friends Using Marijuana (wave 3)	.13 (.22)	0	1
Proportion of Friends with Dating Abuse Victimization (wave 4)	.30 (.30)	0	1
Proportion of Friends with Dating Abuse Perpetration (wave 4)	.37 (.32)	0	1
Off-time Model Mediators			
Unpopular (wave 3)	10.45 (2.59)	0	14
Proportion of Unreciprocated Friendships (wave 3)	.46 (.33)	0	1
Anger (wave 3)	1.31 (.84)	0	3
Anxiety (wave 3)	1.97 (1.06)	0	4
Depression (wave 3)	1.09 (1.24)	0	4
Demographic Control Variables			
Age (wave 1)	13.01 (.96)	11.33	16.13
Grade (wave 1)	7.43 (.81)	6.5	8.5
Parent Education (wave 1)	2.19 (1.50)	0	5
One parent household (wave 1)	.08 (.27)	0	1
Black (wave 1)	.50 (.50)	0	1
Latino (wave 1)	.02 (.15)	0	1
Dating Status (wave 4)	.77 (.42)	0	1

Dating Status: Before assessing dating abuse victimization, students were asked, “Have you ever been on a date?” A date was defined as an “informal activity like meeting someone at the mall, a park, or at a basketball game as well as more formal activities like going out to eat or to a movie together.” Students who reported that they dated at

wave four were coded as “1.” Students that reported they did not date were coded as “0”.

Psychological Dating Abuse Victimization: Students were asked, “During the past 3 months, how many times has anyone you were dating or on a date with done the following things to you? Don’t count it if they did it to you in self-defense or in play.” The following five items were used to assess psychological dating abuse victimization: “said something to hurt your feelings,” “insulted you in front of others,” “made you describe where you were every minute of the day,” “threatened to hurt you,” and “would not let you do things with other people” ($\alpha = .84$). The response options for all items were on a five point scale: none (0), 1-2 times (1), 3-5 times (2), 6-9 times (3), and 10 times or more (4). Individual items were summed. The measure was then transformed using the natural log to create a continuous measure of psychological dating abuse victimization.

Pubertal Timing with Peer Referent: Students were asked to respond to the question, “Compared to most others of your age and sex, do you think your development is...?” with five response options ranging from “much earlier” (5) to “much later” (0). A higher score indicates earlier pubertal timing.

Social Network Analysis

All of the peer measures were created using social network analyses. During data collection, each student was provided with a roster listing the students in the grade levels targeted by the study and a unique four digit number identifying each student. The student (ego) was asked to nominate their five closest friends starting with their best friend (alters) by writing a four digit unique identifier from the school roster on the survey as well as the friend’s first name as a memory aid for answering questions about the friend. If the student did not have five friends they were instructed to leave the nomination space for that friend blank. If the friend did not attend the student’s school

the student was instructed to fill in the nomination space with “0000”. For this study, the student’s social network was defined as everyone the student (ego) nominated as a friend (alters) and all alters that nominated the ego. This is often referred to as the send and receive network.

Social network analyses allows for creating peer relational variables such as unpopularity and unreciprocated friendships as well as variables assessing friend behaviors from the friend’s reports of their own behaviors, which provides more accurate estimates of peer behavior as compared to adolescents’ reports of peer behavior, which have been found to significantly over estimate the congruence of peer behavior with self-reported behavior (Aseltine, 1995; Bauman & Ennett, 1994; Kandel, 1996).

Mediators Characterizing the Early Maturation Model

The three variables that characterize the early maturation model are described first, followed by a description of the three variables that characterize the off-time model. The early maturation model mediators were calculated as the proportion of friends with a given characteristic or behavior. The proportion of friends provides a measure of homogeneity and enmeshment in a social context. In a study of adolescent social networks using Add Health data, Haynie (2002) found that the proportion of delinquent friends in an adolescent’s friendship group was more strongly associated with the adolescent’s own level of delinquency than were measures of the absolute level of friend delinquency, the average level of friend delinquency, or the absolute number of delinquent friends.

Proportion of aggressive friends: This variable was created using four items from the Problem Behavior Frequency Scale measuring physical aggression (Farrell, Kung, White, & Valois, 2000). All items begin with the phrase, “In the last 30 days, how many times have you...” and the following response options: none, 1-2 times, 3-5 times, 6-9

times, and 10 times or more. Four items measured physical aggression, “hit or slapped another kid,” “threatened to hurt a teacher,” “threatened someone with a weapon (gun, knife, club, etc.) and “been in a fight in which someone was hit.” The measure was calculated as the proportion of friends who reported that they did any of aggressive behaviors 1-2 times or more in the past month ($\alpha = .82$).

Proportion of friends using cigarettes, alcohol, or marijuana: Three separate measures were created to indicate the proportion of friends who currently use (1) cigarettes, (2) alcohol, or (3) marijuana. Students were asked how many times they had used cigarettes, alcohol, or marijuana in the past three months, “During the past three months, about how many days did you smoke cigarettes?”, “During the past three months, about how many days did you have one or more drinks of alcohol?”, and “During the past three months, about how many times did you use marijuana?” Students who reported they had used a substance “1-2 times” or more in the past three months were coded as “1” for that substance. If a student reported that they had never smoked cigarettes or drank alcohol, or reported that they had not used cigarettes, alcohol, or marijuana in the past three months, they were coded as “0” for that substance.

Proportion of friends reporting dating abuse victimization or perpetration: Two variables were created to measure friend dating abuse behaviors based on the Safe Dates victimization and perpetration scales (Foshee et al., 1996) described in more detail in Chapters 2 and 3. Students who reported they had experienced physical or psychological dating abuse victimization in the past three months were coded as “1” and students who did not experience physical or psychological dating abuse victimization were coded as “0”. Similarly, students who reported either physical or psychological dating abuse perpetration in the past three months were coded as “1” and students who did not were coded as “0”. These variables were used to create the proportion of friends who reported (a) dating abuse victimization, and (b) dating abuse perpetration.

Unlike other mediating variables which are available at every wave, measures of dating abuse victimization and perpetration are only available beginning at wave four, which limits the possibility of controlling for the baseline value of the mediator. However, a modified version of the proportion of friends who reported dating abuse perpetration was available at wave one. Students were asked how many times in the past three months they had “hit someone you were dating” and “threatened to hurt someone you were dating.” If a student reported they had done either of these things one or more times in the past three months they were coded as “1”. If they reported they did not do these things they were coded as “0”. From this I created the proportion of friends who reported dating abuse perpetration at wave one as a control variable for the proportion of friend who reported dating abuse perpetration at wave four. No equivalent control variable was available for the proportion of friends who reported dating abuse victimization.

Mediators Characterizing the Off-time Model

Unpopularity: Popularity was calculated as the number of friendship nominations received which was then reverse coded so that a higher number indicated a less popular student. Network size was included as a control variable to standardize across varying sized networks.

Proportion of un-reciprocated friendships: This variable is the proportion of in-school friendship nominations that were not reciprocated. The higher the number, the greater the number of unreciprocated friendship nominations.

Level of emotional distress: anger, anxiety and depression: Three variables were created to indicate emotional distress. Anger ($\alpha = .85$) was calculated taking the mean of three items from the Revised Multiple Affective Adjective Checklist (Zuzkerman & Lubin, 1985) that asked how often students felt mad, angry, or furious in the past three

months, with four response options ranging from “never or almost never” (0) to “always or almost always” (3). Anxiety ($\alpha = .84$) was calculated as the mean of seven symptoms of anxiety, taken from a shortened version of the Revised Children’s Manifest Anxiety scale (Reynolds & Richmond, 1979). Example items for anxiety include, “I worried about what was going to happen” and “I felt sick to my stomach”. The depression sub-scale ($\alpha = .88$) was calculated as the mean of three items from the Short Mood and Feeling Questionnaire (Angold, Costello, & Messer, 1995). Example items for depression include “I hated myself” and “I did everything wrong.” For both anxiety and depression, students were asked, “how strongly do you agree with the following statements in describing how you have felt in the past 3 months?” with five response options ranging from strongly agree (4) to strongly disagree (0). For anger, anxiety, and depression, higher scores indicate higher emotional distress.

Demographic Control Variables

The following control variables were included from wave one: grade in school, age, race/ethnicity, family structure, and socioeconomic status. Race was coded as Black/African-American or Latino as compared to White. Family structure was a dichotomous variable reflecting if the adolescent reported living in a two-parent household which could include a stepmother or stepfather (0) versus living with one parent (1). Socioeconomic status was based on the student’s report of the highest level of education achieved by either parent on a six point scale that ranged from “did not graduate from high school” (0) to “graduate or professional school” (5).

Analysis Strategy

Missing Data

Analyses were conducted to examine how girls in the analysis sample ($n=1,025$)

differed from girls who participated at any wave ($n=1,878$). In bivariate analysis, girls who were excluded were significantly less likely to be White, more likely to be Latino, more likely to be older, have lower parental education, and more likely to have a one parent household. There was no difference in pubertal timing or dating status. Overall this suggests a higher risk sample was excluded.

The excluded sample was also more likely to have higher level of psychological victimization at wave four, but this difference was no longer significant after controlling for grade in school and race. Of the mediators, the excluded sample had lower popularity but there was no difference between included and excluded students in the remaining mediators: the proportion of aggressive friends, proportion of friends using tobacco, alcohol, marijuana, proportion of reciprocated friendships, level of anger, anxiety, or depression.

Hypothesis Testing

Structural equation modeling can be used to test for direct and indirect effects in a single model with multiple independent variables, mediators, and dependent variables. All paths are simultaneously estimated, removing the need to separately estimate a direct path between pubertal timing to dating abuse. Structural equation modeling provides an estimate of specific indirect effects (the effect of pubertal timing on psychological dating abuse via a particular mediating variable) and an estimate of the total indirect effect (the effect of pubertal timing on psychological abuse as mediated by the set of mediating variables). After testing the mediators from the early maturation model, I tested the mediators from the off-time model as a competing model.

Two modeling strategies were used to test for mediation. First, where theoretically appropriate, several variables were combined to form latent constructs. Specifically, the proportion of friends using tobacco, alcohol, or marijuana, were modeled

as a latent factor representing friend substance use; the proportion of friends reporting dating abuse victimization or dating abuse perpetration were modeled as a latent factor representing friend dating abuse; and anger, anxiety, and depression were modeled as a latent factor representing emotional distress. Incorporating latent factors rather than observed variables can reduce measurement error. Next, I modeled the observed variables separately to provide insight into which component of the latent factor contributed to a significant path. In both strategies, the value of the mediator at wave one was included as a control variable. The dependent variable was not available at any wave before wave four. Therefore, despite the temporal ordering of the dependent variable at a later wave than other variables, the lack of a control variable makes it impossible to determine if the dependent variable actually occurred after the independent variable or mediator. Mediators (either as latent factors or observed variables) were allowed to co-vary as were the controls for the mediators at wave one. If there was a significant path I proceeded to add demographic control variables. Modification indices were examined for areas of misspecification but additional paths were not added or removed because it would not have matched the study hypotheses or been theoretically appropriate.

The Mplus software provides estimates of total and specific indirect effects of the mediators. The confidence intervals for the indirect effects can be estimated using bootstrapping. Bootstrapping is used to create the sampling distribution for the confidence intervals by repeatedly sampling with replacement from the original sample. This overcomes the assumption of normality of the sampling distribution of the indirect effect, which tends to be asymmetric. Research has shown that using bootstrapping to test the significance of the mediated (indirect) effect is the preferred method for testing the effects of mediating variables (MacKinnon, Fairchild & Fritz, 2007; Williams & MacKinnon, 2008).

All structural equation models were estimated with Mplus version 6.11 using the maximum likelihood (ML) estimator. Model fit was evaluated by chi-square test, the comparative fit index (CFI; Bentler, 1990), and the root mean square error approximation (RMSEA). As a general rule of thumb, models with a CFI of at least .95 and a RMSEA value of .05 or less were considered to be good fitting models (Browne & Cudack, 1993; Hu & Bentler, 1999).

RESULTS

Early Maturation Model

Descriptive Statistics

Table 4.2 presents bivariate correlations between pubertal timing, the mediating variables characterizing the early maturation model, and psychological dating abuse victimization. Pubertal timing was significantly positively correlated with the proportion of friends using tobacco ($r=.07$, $p<.05$), the proportion of friends using marijuana ($r=.09$, $p<.01$), and psychological dating abuse victimization ($r=.10$, $p<.05$). Pubertal timing was not associated with either the proportion of aggressive friends or the proportion of friends reporting dating abuse victimization or perpetration, and proportion of aggressive friends and the proportion of friends reporting dating abuse victimization and perpetration were not significantly correlated with dating abuse victimization.

As would be expected, the three variables indicating friend substance use were strongly positively correlated with each other. The substance use variables were also significantly positively correlated with the proportion of aggressive friends and the proportion of friends reporting dating abuse victimization and dating abuse perpetration. The proportion of friends reporting dating abuse victimization was strongly positively correlated with the proportion of friends reporting dating abuse perpetration ($r=.60$, $p<.001$).

Table 4.2 Bivariate correlations for the early maturation model

Variable	1	2	3	4	5	6	7	8
1. Psychological victimization								
2. Pubertal timing	.10*							
3. Prop. of aggressive friends	-.03	.01						
4. Prop. of friends using tobacco	.08*	.07*	.22***					
5. Prop. of friends using alcohol	.05	.06	.17***	.57***				
6. Prop. of friends using marijuana	.05	.09**	.20***	.51***	.50***			
7. Prop. of friends reporting dating abuse victimization	.05	.05	-.01	.20***	.21***	.15***		
8. Prop. of friends reporting dating abuse perpetration	.03	.04	.11**	.17***	.15***	.18***	.60***	
Means	.95	2.19	.41	.20	.24	.13	.30	.37
(SD)	2.47	1.00	.30	.26	.28	.22	.30	.32

*p<.05; **p<.01; ***p<.001

Mediation

Hypothesis 4.1 proposed that earlier pubertal timing for girls would be associated with a higher proportion of aggressive friends, friends using substances, and friends reporting dating abuse. In turn, this peer context of adverse influences would be associated with increased psychological dating abuse victimization. A structural equation model incorporating mediators from the early maturation model was used to test this hypothesis (Figure 4.3). Friend substance use and friend dating abuse were represented as latent factors and the value of the same variables and latent factors at wave one were included as control variables.

Figure 4.3 Structural equation model for the early maturation model

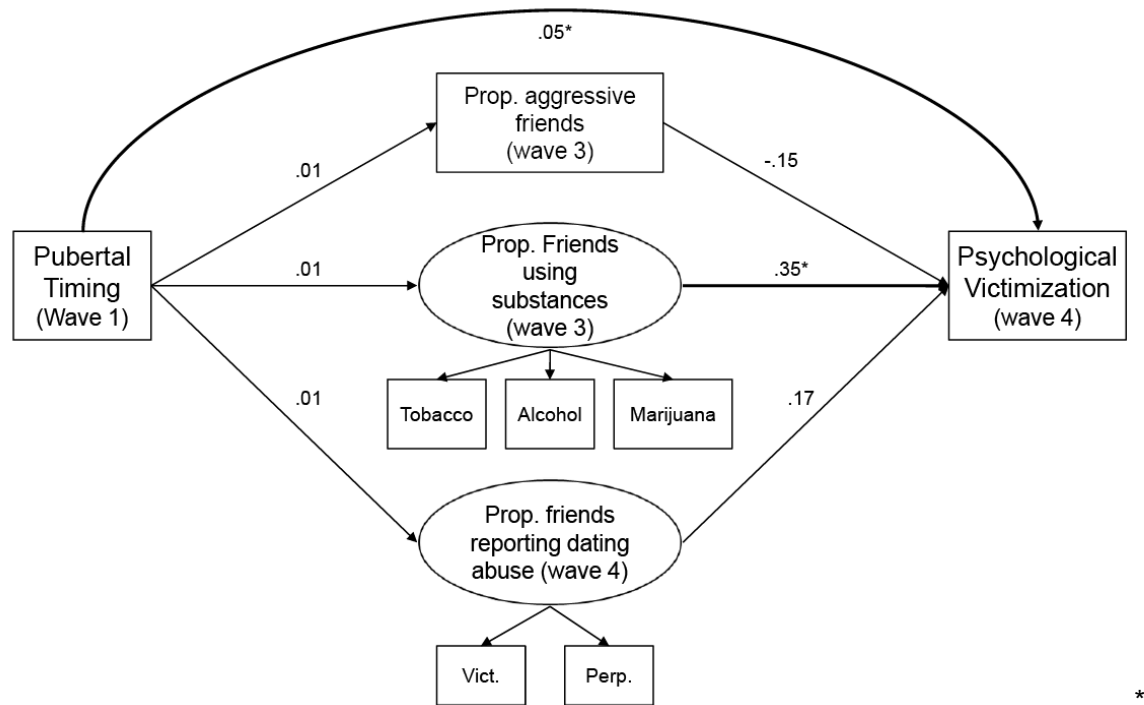


Table 4.3 Mediation model: total and specific indirect effects

Total and Specific Indirect Effects	Estimate	SE
Total indirect effect from pubertal timing to psychological dating abuse victimization	.01 ^a	.01
Pubertal timing		
Prop. friends with aggressive behavior		
Psychological dating abuse victimization	<.01	<.01
Pubertal timing		
Prop. friends with substance use		
Psychological dating abuse victimization	<.01	<.01
Pubertal timing		
Prop. friends with dating abuse		
Psychological dating abuse victimization	<.01	<.01

Fit Indices

χ^2 (DF) = 144.29 (51); CFI = .94; RMSEA (90% CI) = .04 (.04, .05)

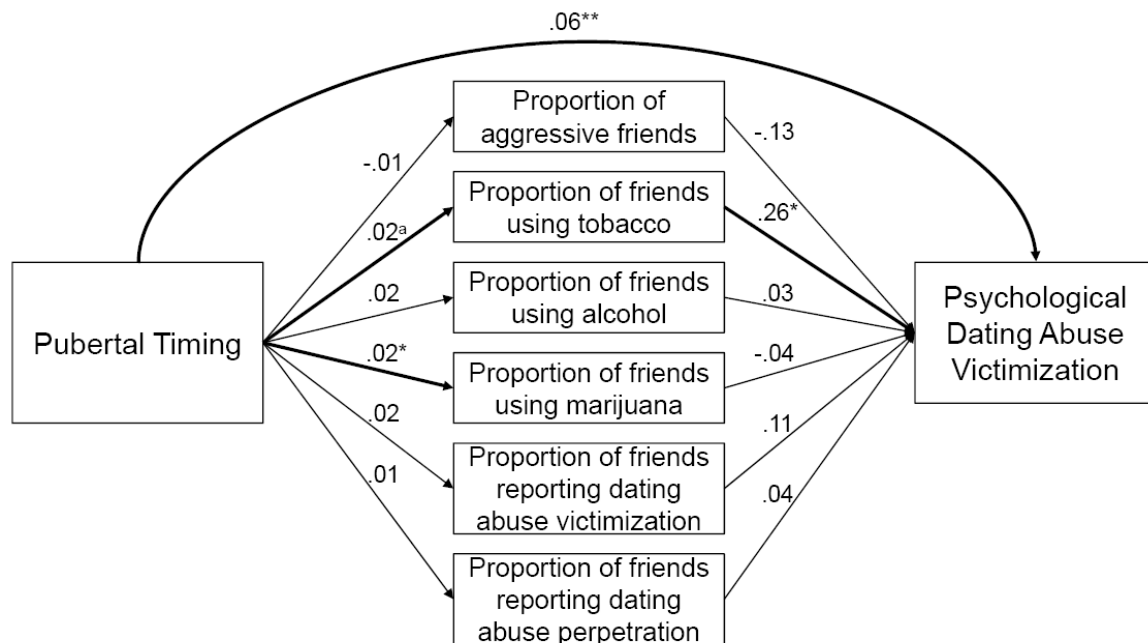
^ap<.10

In the model depicted in Figure 4.3, only two paths in the model were significant: the effect of pubertal timing on psychological dating abuse victimization (.05, $p < .05$), and the effect of friend substance use on psychological dating abuse victimization (.35, $p < .05$). Although the total indirect effect from pubertal timing to psychological dating abuse victimization was borderline significant (Table 4.3), there were no significant indirect effects from pubertal timing to psychological dating abuse victimization through any of the mediators.

To further explore the relationships, another model was examined with the mediators included as observed variables instead of latent factors. This model (Figure 4.4) adequately fit the data (χ^2 (DF) = 89.48 (30); CFI = .95; RMSEA (90% CI) = .05 (.04, .06)). Whereas in the previous model the path from friend substance use to psychological dating abuse victimization was significant, in this model only the path from friend tobacco use to psychological dating abuse victimization was significant (.26, $p < .05$). There were additional significant paths from pubertal timing to friend tobacco use (.02, $p = .06$) and friend marijuana use (.02, $p < .05$). Like the previous model with latent factors, in the model with observed variables, the direct path from pubertal timing to psychological dating abuse victimization was significant (.06, $p < .01$). There were no significant indirect effects from pubertal timing to psychological dating abuse victimization through any of the mediators.

For both versions of the mediation model (Figure 4.3 and 4.4) the addition of demographic control variables further diminished the number of significant paths. After including control variables, only the direct path from pubertal timing to psychological dating abuse victimization was significant.

Figure 4.4 Path model for the early maturation model



* $p < .05$; ** $p < .01$

Off-time Model

Descriptive Statistics

Given that the relationship between pubertal timing and psychological dating abuse victimization was not significantly mediated by the variables from the early maturation model, I considered a competing model using the mediators from the off-time model. Table 4.4 presents bivariate correlations between pubertal timing, the mediating variables characterizing the off-time model, and psychological dating abuse victimization. Pubertal timing was not significantly correlated with any mediators from the off-time model. Anger ($r = .14$, $p < .001$), anxiety ($r = .13$, $p < .001$), and depression ($r = .15$, $p < .001$) were positively correlated with psychological dating abuse victimization. Unpopularity was strongly positively correlated with having a higher proportion of unreciprocated friendships ($r = .51$, $p < .001$), but pubertal timing was not associated with either of these social network variables and neither of these social network variables were correlated with psychological dating abuse victimization.

Table 4.4 Bivariate correlations for the off-time model

Variable	1	2	3	4	5	6	7
1. Psychological victimization							
2. Pubertal timing	.10**						
3. Unpopular	-.02	.04					
4. Prop. of unreciprocated friendships	-.06	.04	.51***				
5. Anger	.14***	<.01	.02	.03			
6. Anxiety	.13***	.03	.05	.02	.45***		
7. Depression	.15***	.02	.05	.03	.39***	.58***	
Means	.95	2.19	10.45	.46	1.31	1.97	1.09
(SD)	2.47	1.00	2.59	.33	.84	1.06	1.24

*p<.05; **p<.01; ***p<.001

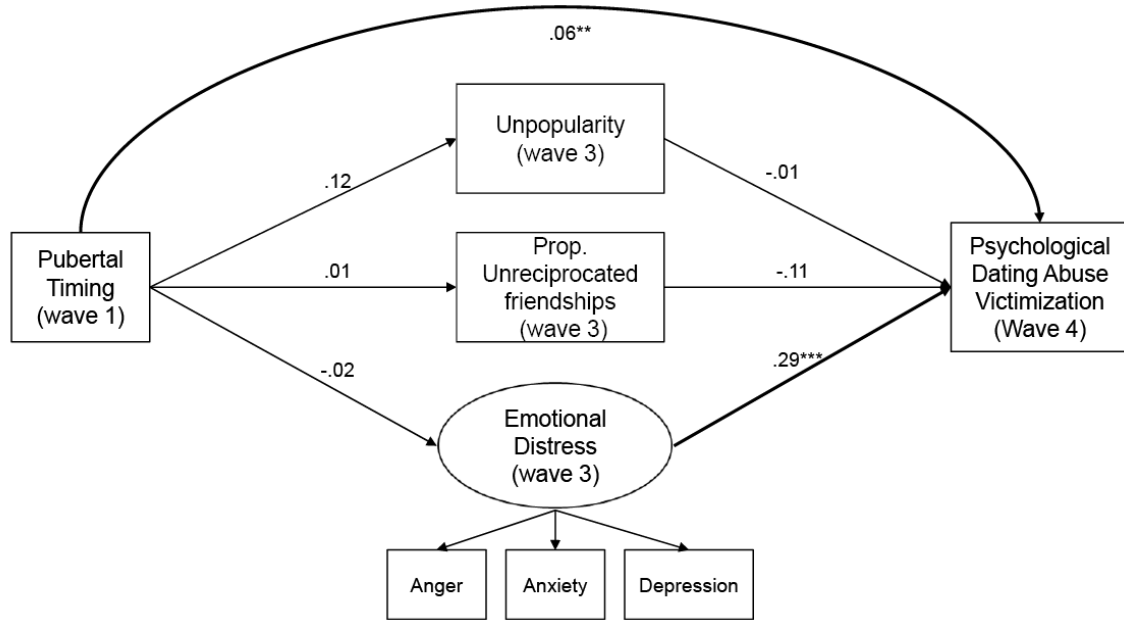
Mediation

All mediators from the off-time model were included in a structural equation model (Figure 4.5). Anger, anxiety, and depression were combined to represent emotional distress. Unpopularity, unreciprocated friendships, and emotional distress at wave one was included as control variables for the mediators at wave three. The structural equation model (depicted in Figure 4.5) was consistent with the bivariate results that found that pubertal timing was not significantly associated with any of the mediators from the off time model. Only two paths in the model were significant: the effect of pubertal timing on psychological dating abuse victimization (.06, $p<.01$), and the effect of emotional distress on psychological dating abuse victimization (.29, $p<.001$).

To examine these results further, a path model was examined (Figure 4.6) that utilized observed variables instead of the latent factor for emotional distress. In this model the effect of pubertal timing on psychological dating abuse victimization remained significant and the effect of depression on psychological dating abuse victimization was significant (.07, $p<.01$). Thus, it seems that the relationship between emotional distress and psychological dating abuse victimization was primarily due to the effect of

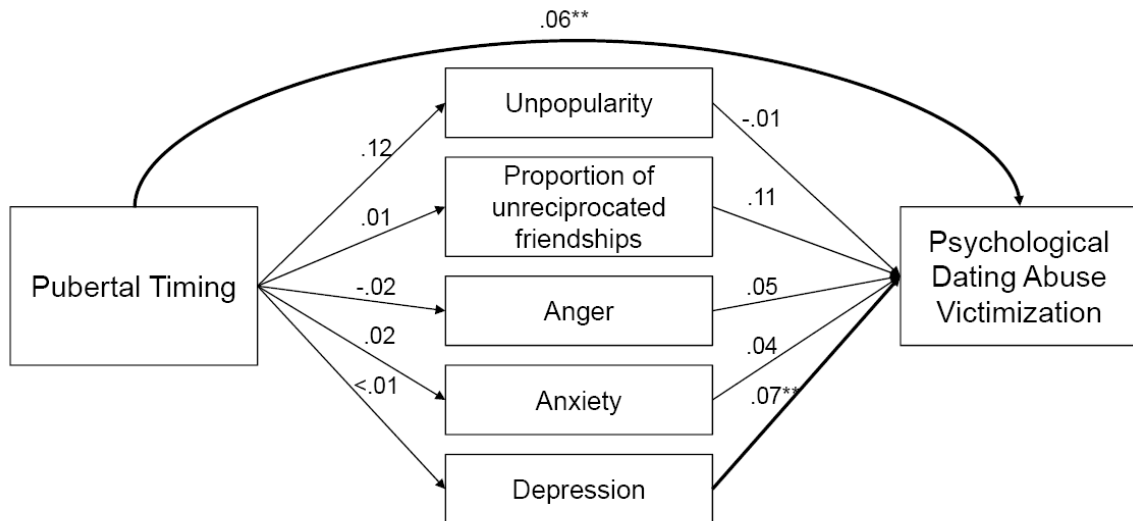
depression. As with the early maturation model, with the off-time model there were no significant indirect effects from pubertal timing to psychological dating abuse victimization.

Figure 4.5 Structural equation model for the off-time model



p<.01; *p<.001

Figure 4.6 Path model for the off-time model



**p<.01

DISCUSSION

None of the proposed mediators from the early maturation model or the off-time model mediated associations between early pubertal timing and psychological dating abuse victimization. The only mediator that was significantly correlated with both pubertal timing and psychological dating abuse victimization was the proportion of friends who use tobacco. In a mediation analysis, pubertal timing was (borderline) significantly related to the proportion of friends using tobacco which was, in turn, significantly related to psychological dating abuse victimization. However, this relationship was not large enough to constitute a significant indirect effect. In fact, in all models the direct effect from pubertal timing to psychological dating abuse victimization remained significant and was not substantially reduced by the mediating variables.

Perhaps the strongest relationship uncovered was between emotional distress (comprised of anger, anxiety, and depression) and psychological dating abuse victimization. Anger, anxiety and depression were all strongly correlated with psychological dating abuse victimization and in a structural equation model the latent factor of emotional distress was strongly associated with psychological dating abuse victimization after controlling for emotional distress at wave one. Further path analyses suggested that this association was primarily driven by depression. This is consistent with cross-sectional studies that have found associations between depression and dating abuse victimization among girls (Ackard et al., 2003; Ackard et al., 2007; Roberts et al., 2003). Two longitudinal studies of depression and victimization among girls were able to control for baseline levels of victimization and therefore conclude that depression occurred before victimization (Foshee et al., 2004; Lehrer et al., 2006). This study lacked a baseline measure of psychological dating abuse victimization which means the observed relationship between depression and dating abuse could be confounded by prior (unmeasured) levels of dating abuse. However, the findings are consistent with

studies using a stronger design.

Despite the strong relationship between emotional distress and psychological dating abuse victimization and theoretical rationale for why the relationship between off-time pubertal timing and psychological dating abuse victimization would be mediated by emotional distress, emotional distress was not a significant mediator because it was not related to pubertal timing. While several studies have found that early pubertal timing for girls is related to emotional distress (Ge et al., 1996) or depressive symptoms (Graber et al., 1997; Stice et al., 2001), there have been exceptions (Angold, Costello & Worthman, 1998; Tschann et al., 1994). One other study also concluded that the relationship between pubertal timing and health risk behaviors was not mediated by depressive symptoms (Weisner & Ittel, 2002).

Given that previous studies have found a relationship between peer dating abuse and respondent dating abuse, it was surprising that this study did not. Further exploration of the data at later waves revealed that although there was not a significant correlation between the proportion of friends who reported dating abuse and psychological dating abuse victimization at wave four, these two variables were significantly correlated with each other at waves five, six, and seven. Moreover, the proportion of friends who report any dating abuse at wave four was significantly predictive of psychological dating abuse victimization one wave later, after controlling for psychological dating abuse victimization at wave four. Perhaps the processes that give rise to the relationship between peer involvement in dating abuse and the student's involvement in dating abuse had not yet unfolded by wave four (eighth through 10th grade) in this sample. (However, it should be noted that Arriaga and Foshee (2004) found a relationship between having friends who had been in violent relationships and an increased risk of dating abuse victimization with an even younger sample of eighth and ninth grade students.)

Another explanation for the lack of a significant relationship between peer dating abuse and psychological dating abuse victimization could be due to differences in how peer dating abuse was measured. Previous studies have measured peer dating abuse by asking the participant to count the number of friends who report dating violence perpetration or victimization (Arriaga & Foshee, 2004; Foshee, Linder, MacDougall & Bangdiwala, 2001; Gwartney-Gibbs, Stockard & Bohmer, 1987). In contrast, this study calculated the proportion of friends in the adolescent's social network who had reported dating abuse victimization or perpetration based on friends' report. Thus, there are differences between this and previous studies in the form of the measure (number of friends vs. proportion) and the source of the measure (participant's report vs. peer report).

That none of the proposed mediators significantly mediated the relationship between early pubertal timing and psychological dating abuse victimization suggests that there may be other important mediators that were not examined in this study. For example, early maturing girls tend to affiliate with older male friends and boyfriends (Caspi et al., 1993; Mezzich et al., 1996), leading many researchers to postulate that this creates a power differential between the older and stronger boyfriend and the younger and less socially mature girl, making the girl more vulnerable to victimization. Age of romantic partner was not collected in this study and therefore not available as a mediator. The rosters used in collecting social network data prevent an unbiased examination of the age and gender of friends in a student's peer network; thus, it is not possible to examine if early maturing girls are more likely to have older male friends.

Another mediator of interest would be the level of sexual activity within a romantic relationship. Earlier dating and more advanced physical development among girls has been linked to earlier sexual debut (Cavanagh, 2004; Resnick et al., 1997; Rosenthal et al., 1999; Zabin et al., 1986) and sexual experience (Flannery et al., 1993).

A study of romantic relationships and violent victimization found that violent victimization was more likely in relationships with sexual intercourse. In those relationships, sexual intercourse more often preceded the violence than the reverse (Kaestle & Halpern, 2005). However, sexual activity is a sensitive topic and unlikely to be included on a school-based survey. A final possibility to be considered in future studies is individual substance use, rather than peer substance use. Early pubertal timing has clearly been linked to substance use for girls, using a variety of measures (Dick et al., 2000; Lanza & Collins, 2002; Stice et al., 2001; Tschann et al., 1994; Weisner & Ittel, 2002); and substance use, particularly measures that include illicit drug use, have been found to be predictive of dating abuse victimization of girls (Magdol et al., 1998; Raiford et al., 2007).

This study included temporal ordering of the variables; pubertal timing was assessed at wave one, psychological dating abuse victimization at wave four, and the mediating variables measured in between at wave three. Demonstrating the temporality of associations provides an indication of causation without using an experimental design. Furthermore, the analysis controlled for the value of the mediator at wave one to ensure that the meditational process is one that occurred after the independent variable was measured, rather than a process that was already underway before or concurrently with the independent variable. The temporal ordering of variables and inclusion of the mediator at wave one as a control variable is a stronger design than a cross-sectional study which has the risk of overinflating the relationships among variables (Maxwell & Cole, 2007). Despite this, perhaps the largest limitation of this study is the inability to control for the level of psychological dating abuse victimization at wave one due to the lack of items on the questionnaire at wave one that paralleled the psychological dating abuse victimization questions at wave four. Temporal ordering alone, without controlling for the prior level of the dependent variable, cannot ensure that the mediator actually preceded the dependent variable. Therefore, one cannot rule out the possibility that the

relationship between the mediator and the dependent variable could be reversed.

An additional limitation is that the girls excluded from the study significantly differed from those included in the study in a pattern that suggests a higher risk sample of girls was excluded. The magnitude of the differences was relatively small, yet it is difficult to know the extent to which this could have affected the relationships among the variables or biased the results.

Conclusions

This study tested for mediators of the relationship between pubertal timing and psychological dating abuse victimization for girls using two competing sets of mediators. When testing the hypothesis that variables explicated in the early maturation model would mediate the relationship, there were no significant indirect effects. Similarly for the off-time model, there were no significant indirect effects. Future studies could include additional mediators and control for baseline levels of dating abuse.

CHAPTER 5: SUMMARY

This dissertation investigated the associations between the pubertal timing of boys and girls and adolescent dating abuse perpetration and victimization from grades eight to 12, and examined theoretically-based processes through which pubertal timing influences the development of dating abuse.

The first study proposed hypotheses about associations between pubertal timing and trajectories of dating abuse. Consistent with the early maturation model, early pubertal timing as compared to on-time and late pubertal timing was hypothesized to increase the risk of dating abuse for girls. Consistent with the off-time model, early as compared to on-time pubertal timing and late as compared to on-time pubertal timing was hypothesized to increase the risk for dating abuse for boys. For girls, early pubertal timing as compared to all others was associated with an increase in psychological dating abuse victimization in the eighth grade. There were no significant associations between pubertal timing and dating abuse for boys after including control variables.

The second study expanded on the significant finding from the first study to investigate mediators of the relationship between early pubertal timing and psychological victimization for girls. This study utilized social network data to characterize an adolescent's peer context. Informed by the early maturation and off-time models, peer context and individual characteristics were hypothesized to mediate the relationship between pubertal timing and psychological dating abuse victimization for girls. The analysis found that pubertal timing was related to friend substance use and friend substance use and emotional distress were related to psychological dating abuse

victimization, but none of the mediators accounted for a significant indirect effect.

There are several possible explanations for the limited relationships between pubertal timing and dating abuse. First, it is possible that the effects of pubertal timing are too short lived to be detected. Thus, any relationship between pubertal timing and dating abuse would be small when assessed two to four years after pubertal timing was measured, as was the case in this study. A second possibility is that the effect of pubertal timing only exists for those with very early pubertal development. The study design limited a full investigation of this possibility. If pubertal timing had been assessed for the full sample at age 10 or 11, when early timing is more pronounced, and dating abuse had been assessed for the same students when dating abuse behaviors were relatively high, around 10th or 11th grade, it might have been possible to detect a significant association between pubertal timing and dating abuse. This possibility could be explored in a future study. Third, it is possible that pubertal timing is not related to dating abuse as it is with other risky behaviors like substance use, depression, violence, or being a victim of harassment. Future research could compare the relationship between pubertal timing and several problem behavior outcomes to determine which behaviors are most affected by timing differences and propose theoretical explanations for the differences.

There were several noteworthy findings in addition to the results of the main hypotheses. Only the peer referent version of pubertal timing had a significant relationship with dating abuse after including control variables. The peer referent measure of pubertal timing is the individual's assessment of how their development compares to their same age and gender peers. It requires the student to imagine a reference group before deciding on his/her level of development. One reason why the peer referent measure may have had greater significance is that the student was asked to decide on his/her level of development. In contrast, the biological referent measure

asks about five aspects of physical development, which are given equal weight, and then students are categorized based on constructed reference groups. The perceived reference group of the peer referent measure may be more salient than the constructed reference group used in the biological referent measure. It is possible that adolescents consider their development in comparison to peers of their same grade, rather than same aged peers. Further research could explore how students perceive pubertal development in comparison to biological development and other social markers of development.

The relationship between pubertal timing, dating onset, and dating abuse are worth exploring in future work for the following reasons. First, this study found that pubertal timing was related to an earlier age of dating onset, which is in line with previous research. Thus, dating onset was considered to be a potential confounder of the relationship between pubertal timing and dating abuse. Second, the association between dating onset and dating abuse was stronger and more consistent than the relationship between pubertal timing and dating abuse. This is partially a function of the wording on the questionnaire; a teen has to have dated before there can be dating abuse. The questionnaire design precluded examining dating onset as a mediator. However, there are several ways in which dating onset could increase the risk for dating abuse which could be examined in future studies. One possibility is that early dating marks increased exposure to dating relationship and that exposure to dating relationships increases the risk of dating abuse. This explanation assumes, perhaps falsely, that all teen dating relationships are at some risk for dating abuse. Another explanation is that a dating relationship at a younger age is inherently more risky than one that occurs later in adolescence because of the level of social immaturity. Thirdly, it is possible that teens who begin dating at an early age transition sooner to more intimate relationships, which might be associated with an increased risk of teen dating abuse.

As noted, these studies have several limitations. The study sample is from two rural counties in North Carolina and may not generalize to other adolescent populations across the country. Secondly, this study excluded all but Black and White adolescents due to the constraint of standardizing pubertal timing by race. The inability to control for the level of psychological dating abuse victimization at wave one was a limitation in the mediation analysis. Temporal ordering alone, without controlling for the prior level of the dependent variable, cannot ensure that the mediator preceded the dependent variable.

A strength of this dissertation is that it examined trajectories for boys and girls whereas much of the literature has focused on victimization of girls and perpetration by boys. Another strength is that these studies distinguished between two different forms of dating abuse perpetration and victimization. It is possible that pubertal timing could have had different associations with each of the different types of dating abuse behaviors, which was the case. The studies used longitudinal data spanning over four years and seven waves of data collection. This allowed an examination of change over time in dating abuse behaviors for an individual. The findings from the unconditional trajectories indicated that psychological and physical dating abuse perpetration increased linearly over the study time period. The change over time was significant for all outcomes except for physical dating abuse perpetration and physical dating abuse victimization for boys. This study improved upon previous research by controlling for the potential confounding effect of dating onset in the relationship between pubertal timing and dating abuse. Finally, this is the first study to examine trajectories of dating abuse victimization and the first to test the effect of pubertal timing on trajectories of dating abuse.

The limited significant relationships between pubertal timing and dating abuse provide limited rationale for preventive activities based on these results. Nonetheless, evidence from numerous other studies indicates the timing of puberty increases risk for several problem behaviors and it remains to be investigated why this would be different

for dating abuse behaviors. Furthermore, this study raises additional research questions regarding the relationship between pubertal timing, dating onset, and dating abuse. Further research could explore these questions to clarify the relationship between pubertal timing and dating abuse.

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