A Longitudinal Bidirectional Analysis of Early School Age Anxiety and Maternal Warmth and the Prediction of Internalizing Symptoms in Late Childhood and Adolescence

by

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Abstract

The purpose of this study was to extend previous research on the bidirectional relationship between parental warmth and child anxiety, and to further examine the predictive utility of parental warmth on later child anxiety and depressive disorder outcomes. Parental warmth has previously been identified as a contributing factor to child anxiety (e.g., McLeod et al., 2007b, Yap et al., 2014; Yap & Jorm, 2015); however, the bidirectionality of these constructs has only once been measured in a population of children at early school-age (Gouze, Hopkins, Bryant, & Lavigne, 2017), and has not before been measured both longitudinally and observationally. The results of this study extend previous research suggesting that child psychopathology may result in increasing negative parenting behaviours over time. Conversely, a parent-effect was not found; low maternal warmth was not shown to significantly predict subsequent increases in child anxiety at early school-age. This study did not find main effects of early school-age maternal warmth on anxiety and depressive disorder criterion counts in middle childhood through adolescence. However, findings indicated that maternal warmth *negatively* predicted generalized anxiety disorder (GAD) criterion counts among those with low SES in grade 12, and *positively* predicted GAD and depressive disorder criterion counts among those with moderate-to-high SES in grade 12 and grade 6, respectively. These results are understood within a larger discussion of risk factors associated with low SES as well as by examining the directionality of effects. It is strongly recommended that future researchers measure anxiety and depression longitudinally across the early developmental lifespan alongside observed parental warmth to disentangle the complex relationship between these constructs. The utmost goal is to identify a profile of risk that includes both early internalizing problems and parenting factors in order to positively benefit healthy outcomes among children and families. This study contributes towards a better understanding of these relationships, and towards the appropriate design of interventions to prevent the onset of anxiety, depression, and associated deleterious outcomes among children and youth.

Keywords: maternal warmth; child anxiety; child depression; bidirectionality; internalizing problems; developmental psychopathology

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Chapter 1.

Introduction

Anxiety disorders are the most common psychological disorders among children (10-20%; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Kessler et al., 2005; Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015), and have a negative impact on child and family functioning (Mazzone et al., 2007; Towe-Goodman, Franz, Copeland, Angold, & Egger, 2014; Wood, 2006). Childhood anxiety problems influence many areas of child development, such as social and peer relations (Wood, 2006) and academic achievement (Essau, Lewinsohn, Olaya, & Seeley, 2014; Mazzone et al., 2007). Moreover, they are highly correlated with later anxiety problems throughout adolescence and adulthood (Copeland, Angold, Shanahan, & Costello, 2014; Kim-Cohen et al., 2003; Sterba, Prinstein, & Cox, 2007). Efforts to monetize the health care burden of anxiety disorders have estimated the annual cost to be $65 billion in Canada and upwards of $67 billion in the United States, which represents approximately one third of the budget allocated to mental health concerns (Kessler & Greenberg, 2002; Tolin, Gilliam, & Dufresne, 2009). Experiencing anxiety during childhood is associated with other mental health concerns in adolescence and adulthood, including substance use (Compton, Burns, Egger, & Robertson, 2002) and depression (Kendall, Safford, Flannery-Schroeder, & Webb, 2004). Although anxiety and depressive disorders share similar risk factors, anxiety typically has an earlier onset than depression (Merikangas et al., 1996). Further, the onset of anxiety during childhood significantly increases the risk of experiencing depression in adolescence and young adulthood (Wittchen, Kessler, Pfister, & Lieb, 2000). Given the high prevalence rates of anxiety disorders among children and the associated deleterious outcomes, researchers have identified paediatric anxiety as a significant public health concern.

1.1. Anxiety and Depression in Childhood and Adolescence

Research has identified strong shared genetic and environmental risk factors across anxiety disorders that result in different manifestations of anxiety across developmental stages (Merikangas & Pine, 2002). In fact, the risk of developing a second anxiety disorder increases threefold after receiving an initial diagnosis (Kessler et al., 1994). This multifinality has been demonstrated across anxiety disorders, and more generally for a range of internalizing disorders (Merikangas & Pine, 2002).

Previous research has demonstrated that symptoms of anxiety commonly emerge in childhood and that specific features (e.g., behaviourally inhibited temperament) are exhibited as early as infancy (Perez-Edgar & Fox, 2005). Prospective studies examining the presence of psychopathology among children have shown that anxiety more commonly manifests in early childhood, whereas other internalizing (e.g., mood disorders) and externalizing (e.g., substance use disorders) childhood disorders typically demonstrate a later onset (Beesdo, Knappe, & Pine, 2009; Kessler et al., 2005). However, prevalence rates and the onset of anxiety disorders differ across development, with some more commonly occurring in early childhood (e.g., selective mutism) and others more frequently starting in later childhood or adolescence (e.g., generalized anxiety).

Separation anxiety disorder, specific phobia, and selective mutism are most likely to arise before age 12 and peak in prevalence during this time (Donnelly & Rhoads, 2012). In contrast, social phobia (i.e., social anxiety disorder) and generalized anxiety disorder (GAD) have higher prevalence rates and are more likely to have an onset in early adolescence (Donnelly & Rhoads, 2012). In fact, GAD shows an age-of-onset slope more similar to depressive disorders, rather than anxiety disorders, with primary incidence periods occurring in adolescence and early adulthood (Beesdo, Pine, Lieb, & Wittchen, 2010). Of note, GAD has its core period for first onset in later adolescence (Beesdo et al. 2009; Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). Panic disorder also begins to emerge in adolescence (Craske et al., 2010), and is one of the strongest predictors of GAD, along with agoraphobia and specific phobia. In fact, an earlier presence of panic disorder, agoraphobia, or specific phobia predicts an earlier

emergence of GAD (Kessler, Andrade, Offord, Demler, & Stein, 2002). Further, research has shown that childhood depression is most strongly associated with GAD in adolescence (compared to other anxiety disorders; Newman, Shin, & Zuellig, 2016).

Depressive disorders are less common than anxiety disorders in childhood (Bowers, Weston, & Jackson, 2012). Prevalence rates of depression increase with age from 1% to 2% in prepubertal children, more than 3% of early adolescents, and up to 5.6% by the completion of adolescence (Costello, Erkanli, & Angold, 2006; Zalsman, Brent, & Weersing, 2006). Further, there is a high degree of comorbidity between anxiety and depressive disorders; up to 50% of depressed youths also have a comorbid anxiety disorder (Axelson & Birmaher, 2001).

It is clear that a developmental framework for examining anxiety and depressive disorders is imperative. Early childhood anxiety and depression have long-lasting effects and are independent risk factors for later persisting psychopathology as well as other deleterious outcomes, such as chronic stress and decreased life satisfaction (Compton et al., 2002; Copeland et al., 2014; Essau et al., 2014). In particular, early childhood may represent a particularly sensitive developmental period in which to intervene in order to prevent early indicators of internalizing difficulties from developing into clinical anxiety or depression. Therefore, it is critical to understand factors that play a role in childhood internalizing problems.

1.2. Parenting and Childhood Anxiety

Given the adverse outcomes and decreased quality of life associated with anxiety among children (Essau et al., 2014), researchers have examined a multitude of factors that influence its development, maintenance, and amelioration. Parenting is an important area of study given its known impact on a range of childhood factors, as well as the potential malleability of parenting behaviors. Over the last two decades, particular attention has been focused on understanding the role of parenting in childhood anxiety problems. This research has highlighted a number of areas that contribute to the development and maintenance of anxiety. For example, parental accommodation (i.e.,

parental actions that serve to alleviate a child's anxiety in the short term) is widespread (Thompson-Hollands, Kerns, Pincus, & Comer, 2014) and has been found to increase anxiety symptom severity and impair functioning (Kagan, Frank, & Kendall, 2017). Further, parental anxiety plays an important role in child anxiety, over and above genetics, by way of modelling to children how to interpret stimuli and cope with stressful situations (Wood, McLeod, Sigman, Hwang, & Chu, 2003). Some research has indicated that children of parents with anxiety are more likely than parents without anxiety to develop inappropriate coping and problem-solving strategies (Whaley, Pinto, & Sigman, 1999), as well as inappropriate cognitive styles (Lester, Seal, Nightingale, & Field, 2010), which are posited to be important mechanisms involved in the development of anxiety.

While parental accommodation and parental anxiety have demonstrated a significant relationship with child anxiety, an association between child anxiety and parenting *behaviour* has also gained significant empirical support. Parenting behaviours or practices are differentiated from parenting styles or specific individual factors, such as parent anxiety (Maccoby, 1992). Parenting behaviours are concerned with specific acts or sets of acts of parenting, and are more malleable and responsive to treatment. Parenting style, conversely, is described as a global set of parental attitudes, goals, and overarching patterns of parenting practices that result in the climate and context of the parent-child relationship. Wood et al. (2003) aptly outlined the difference between parenting styles and behaviours: "A self-report that assessed an accepting parenting style might be, 'My parent understands how I feel,' whereas an item assessing specific parenting behaviours might be, 'Today before school, my parent let me know s/he understood how I was feeling'" (p. 135).

Research has indicated that two domains of parenting behaviour have the strongest relationship with child anxiety: parental control and parental rejection (McLeod, Wood, & Weisz, 2007b). The construct of parental control (i.e., excessive parental regulation of children's activities and routines [e.g., posing strict and developmentally-inappropriate boundaries for permitted actions, such as not allowing a child to walk a few blocks to school alone at an appropriate age], encouragement of children's dependence on parents, and instructions to children on how to think and feel;

McLeod et al., 2007b) has consistently demonstrated a strong, well-established positive relationship with child anxiety, with medium-to-large effect size (*ES* = .58; Creswell, Murray, Stacey, & Cooper, 2011; McLeod et al., 2007b; Negreiros & Miller, 2014; Van der Bruggen, Stams, & Bogels, 2008; Waite, Whittington, & Creswell, 2014; Wood et al., 2003). It has been hypothesized that by routinely taking over tasks a child could do for him/herself (i.e., exerting controlling behaviour), parents contribute to undermining self-efficacy and lowering perceived control, which contributes to the development of anxiety (Chorpita, 2001). Further, some research has indicated that parents who act intrusively may prevent a child from confronting feared stimuli, which undermines mastery and reinforces avoidance behaviours in a similar way to accommodation behaviour (Fox, Henderson, Marshall, Nichols, & Ghera, 2005).

1.2.1. Parental rejection and anxiety.

While parental control has well-established connections to child anxiety, the role of parental rejection is less clear. Previous research has identified three subdomains of parental rejection: parental withdrawal (e.g., lack of involvement and emotional support), parental aversiveness (e.g., hostility towards the child), and lack of parental warmth (McLeod et al., 2007b). Parental warmth is defined as a sense of positive regard expressed towards the child, pleasant interactions shared between parent and child, or parent involvement in the child's activities (Yap, Pilkington, Ryan, & Jorm, 2014), with low or lack of warmth indicating low levels of positive regard, little positive interaction, and limited involvement. Meta-analytic review of primarily cross-sectional studies has indicated that the overarching construct of parental rejection has a significant positive relationship with child anxiety (*ES* = .20; McLeod et al., 2007b). Within the construct of rejection, the subdomain of parental warmth has been noted to be particularly important. Considerable research has demonstrated lack of warmth as a risk factor for a host of negative outcomes, including conduct problems and callous-unemotional traits (Pasalich, Dadds, Hawes, & Brennan, 2011), poor psychological adjustment (Suchman, Rounsaville, DeCoste, & Luthar, 2007), reduced prefrontal cortex activation in adulthood when responding to reward (Morgan, Shaw, & Forbes, 2014), and depression (McLeod, Weisz, & Wood, 2007; Yap et al., 2014).

Theories about the interaction of parental warmth and child psychopathology differ considerably. With respect to externalizing disorders, it is hypothesized that parent-child relationships that involve positive affect and responsiveness result in children being more likely to internalize similar values and to display these in their behaviour. Therefore, it is suggested that children are less likely to engage in antisocial and aggressive behaviour if their parents express consistent and warm parenting (Kochanska, 2002). Low parental warmth is posited to contribute to childhood depression by undermining self-esteem, promoting a sense of helplessness, and prompting the development of negative self-schemas (Garber & Flynn, 2001; McLeod et al., 2007a; Rapee, 1997). Less research has examined the relationship between parental warmth and childhood anxiety, but existing hypotheses propose that low levels of parental warmth may lead to increased child anxiety as a result of increasing sensitivity to anxiety by undermining the child's ability to regulate emotions (McLeod et al., 2007b).

Recent reviews have explored the relationship between child anxiety and parental warmth. In their meta-analysis, McLeod and colleagues (2007b) demonstrated that parental warmth has a small effect size (*ES* = .06) on child anxiety. However, Yap and colleagues' (2014) meta-analysis found a small-to-medium (*ES* = .20) effect size when examining the relationship between child anxiety (*ES* = .15 and .31 for cross-sectional and retrospective studies, respectively) and depression (*ES* = .29, .20, and .24 for cross-sectional, longitudinal, and retrospective studies, respectively) with parental warmth among 12-18 year-olds. Further, Yap and Jorm (2015) found a small-to-medium effect size between anxiety (*ES* = .24; cross-sectional studies only) and depression (*ES* = 0.17; cross-sectional studies only) with parental warmth among 5-11 year-olds. Notably, these reviews relied primarily on cross-sectional, retrospective, and correlational studies and included very limited longitudinal data on parental warmth and anxiety.

The few available longitudinal studies in this area have not provided strong converging evidence for the relationship between these constructs, or the directionality of effects. For example, Rubin, Burgess, and Hastings (2002) found that observed parental warmth moderated the relationship between inhibition at age 2 and internalizing features at age 4. Specifically, if parents exhibited low parental warmth, the association between

inhibition and later internalizing features was strong and positive. Conversely, inhibition and later internalizing features were not significantly related among children whose parents exhibited high warmth. Ginsburg, Grover, and Ialongo (2005) examined observed parental warmth and child anxiety among a predominately African American community based high-risk sample of 5–8 year-olds. Parental warmth was correlated with youth-reported anxiety at grade 7 among non-anxious parents, but not anxious parents. Further, Sentse, Lindenberg, Omvlee, Ormel, and Veenstra (2010) investigated the relation of parental warmth and internalizing problems from pre-adolescence to early adulthood. They found that parental warmth was not predictive of early adolescent internalizing problems. Schwartz and colleagues (2012) examined the association between observed parental warmth and youth-reported anxiety among 11–13 year-olds. They found that level of parental warmth during a problem-solving task designed to elicit parental negativity (i.e., lack of parental warmth) was not associated with adolescent anxiety at follow-up 2–3 years later. However, warmth was negatively associated with level of depression symptoms at follow-up. Barry, Frick, and Grafeman (2008) further found that both parent- and youth-report measures of positive parenting (i.e., parental involvement and positive reinforcement) were negatively predictive of child anxiety and depression among a community sample of 9–15 year-olds at risk for behaviour problems. These results provide some evidence for a significant relation between parental warmth and child anxiety; however, they vary with regard to developmental period, do not use comparable methodologies, and present varied measures of both parental warmth and child anxiety. Further, while Barry and colleagues provide evidence that parental warmth and child anxiety are longitudinally significantly related during early to late childhood, there is less consistency in longitudinal findings during adolescence. Notably, cross-sectional studies have shown parental warmth and child anxiety to be related in adolescence (e.g., Gallagher & Cartwright-Hatton, 2008), whereas longitudinal studies have not found this relationship (e.g., Schwartz et al., 2012; Sentse et al., 2010). Overall, this body of research on the relation between parental warmth and child anxiety displays mixed findings, and therefore requires further longitudinal examination.

1.2.2. Bidirectionality of the relationship between parental warmth & child anxiety.

Overall, meta-analytic and systematic reviews provide mixed evidence for a relationship between parental warmth and child anxiety (McLeod et al., 2007b; Yap & Jorm, 2015; Yap et al., 2014). However, the large majority of these studies were cross-sectional, and only three explored the directionality of effects (Gouze, Hopkins, Bryant, & Lavigne, 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011). The likelihood of bidirectional relations between child and parenting behaviour was first introduced by Bell (1968). He proposed that child and parenting behaviour transacted such that parenting not only influenced child behaviour but also that child behaviour influenced parenting. More recent explorations have suggested that child anxiety may influence parental warmth independently (Drake & Ginsburg, 2012). It has been posited that child anxiety, over time, may lead parents to withdraw and show less affection as a result of greater reticence, withdrawal behaviours, and avoidance from children (Hipwell et al., 2008). Moreover, it may be that these constructs have bidirectional effects (e.g., child anxiety may elicit, provoke, or reinforce parental warmth, and vice versa) that result in a transactional pattern that strengthens both the parent's maladaptive behaviours and magnifies children's negative mental health outcomes (Maccoby, 1992; Yap & Jorm, 2015). Gouze and colleagues (2017) found that parental warmth at age 5 predicted reductions in anxiety symptoms at age 6/7, and that anxiety at age 5 was associated with reductions in parental warmth at age 6/7. However, they did not find effects in either direction between age 4 and 5. Lansford and colleagues (2018) investigated the bidirectionality of the relationship between parental warmth and internalizing behaviour in 8- to 13-year-olds across nine countries. Their study indicated strong child effects (i.e., high child internalizing behaviour predicted lower parental warmth) across the majority of cultural groups from age 8 to 9 and age 10 to 12, and for most cultural groups across from age 9 to 10 and age 12 to 13. Parenting effects (i.e., low parental warmth predicting high child internalizing behaviour) was also identified, but a weaker pattern of results was exhibited. In each cultural group, parental warmth at age 8 and 9 were negatively associated with child internalizing behaviours at ages 9 and 10, respectively; however, no other significant effects at the older age groups were identified. Van Zalk and Kerr

(2011) examined the bidirectional relation of youth-reported parental warmth and rejection separately in relation to features of social anxiety among youth across grades 7–9. Over 3 years, they found that features of adolescent social anxiety predicted later perceptions of increased parental rejection and lack of warmth, but that parenting did not predict changes in features of adolescent social anxiety. Therefore, only two studies (i.e., Gouze et al., 2017; Lansford et al., 2018) provide preliminary evidence to suggest parental warmth may be bidirectionally associated with child anxiety.

All three bidirectional studies (Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011) used autoregressive cross-lagged (ARCL) panel modeling, which does not take into account the relationship between the two constructs at the level of their underlying trajectories *and* at the level of time-specific measures. Recent literature has suggested that autoregressive latent trajectory (ALT) modeling is a superior method of analysis as it accounts for both the underlying trajectories *and* the level of time-specific measures in the model (Berry & Willoughby, 2017). Gouze and colleagues (2017), Lansford and colleagues (2018), and Van Zalk and Kerr (2011) also used parent- and/or youth-report measures of parental warmth, as opposed to observational measures of parenting, which are considered a more objective assessment of parenting (McKee, Jones, Forehand, & Cuellar, 2013; Taber, 2010).

In summary, there is some indication in the research of a significant relationship between parental warmth and child anxiety, and of a bidirectional association between them. The foundation of this relationship has been demonstrated by studies showing that: 1) child anxiety is associated with changes in parental warmth (e.g., Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011), and 2) parental warmth is associated with changes in child anxiety (e.g., Gouze et al., 2017; Lansford et al., 2018; Rubin et al., 2002). Gouze and colleagues and Lansford and colleagues conducted the only two known studies to identify a bidirectional relationship; child anxiety was associated with changes in parental warmth, and vice versa. Therefore, there are still insufficient empirical findings to support this bidirectional relationship. Further, notable limitations to existing research such as small sample sizes; parent- and youth-report, rather than observed, measures of parental warmth; lack of clear operationalization of parental warmth; and

nonspecific measures of anxiety (e.g., shyness, inhibition) limit the interpretability of available longitudinal studies (i.e., Barry et al., 2008; Ginsburg et al., 2005; Rubin et al., 2002; Schwartz et al., 2012; Sentse et al., 2010). Researchers in the area of parenting and anxiety have underlined the need for further longitudinal research examining the directionality of the relationship between parental warmth and child anxiety to elucidate the nature of this relationship (Creswell et al., 2011; McLeod, Wood, & Avny, 2011; Wood et al., 2003).

1.2.3. Socioeconomic status and child sex in relation to parental warmth.

Research in this area has also suggested the possibility of differences in the relationship between parental warmth and both anxiety and depression as a factor of socioeconomic status (SES) and sex. Previous research has indicated that higher SES parents may be more receptive to their children's emotional needs (Martini, Root, & Jenkins, 2004), and more capable of adapting their parenting behaviour to children requiring special attention (Paulussen-Hoogeboom, Stams, Hermanns, & Peersma, 2007) than parents of lower SES. Therefore, it may be that parents of higher SES are better equipped and more likely to display higher levels of parental warmth, potentially impacting their children's internalizing behaviour outcomes. Further, high anxiety sensitivity has been shown to increase the potential impact of negative parenting on children (Kochanska & Askan, 2006), and females are more likely to display high rates of anxiety sensitivity than males (Silverman Goedhart, Barrett, & Turner 2003). As such, it may be that the relationship between parental warmth and anxiety differs as a factor of child sex.

In the area of parental control and anxiety, meta-analytic research has indicated larger effect sizes among high SES (*ES* = 0.81) versus middle (*ES* = 0.58) or low (*ES* = 0.26) SES samples (van der Bruggen et al., 2008). However, no research in regard to parental warmth and anxiety or depression has been conducted, despite preliminary research suggesting there may be group differences. Given the limited research exploring group SES and gender differences with regard to parental warmth, it is recommended that further steps be taken to explore potential differences in the current study.

1.3. Goals of the Current Study

The purpose of the current study was to extend previous research on the bidirectional relationship between parental warmth and anxiety, and to further examine the predictive utility of parental warmth on later anxiety and depressive disorder outcomes. This study longitudinally examined the relationship between maternal warmth and anxiety at early school age (i.e., kindergarten, grade 1, and grade 2), and examined whether early school-age observed maternal warmth predicted anxiety and depressive disorder criterion counts in late childhood and early adolescence (i.e., grades 3, 6, 9 and 12). To control for possible confounding effects, sex, race, age, family SES, maternal depression, as well as several study-specific variables (to be described below), were chosen a priori as covariates. These covariates were chosen based on recent literature stating that "covariates should be proposed a priori and should always have a strong rationale and justification and should be as few in number and as noncorrelated as possible" (p. 962; Kraemer, 2015).

The current study had three primary goals. The first goal was to *examine the relationship between maternal warmth and child anxiety* across 3 years from kindergarten to grade 2, and to *explore the directionality of this relationship*. It was hypothesized that maternal warmth and childhood anxiety would be bidirectionally negatively related across 3 years from kindergarten to grade 2. Specifically, it was expected that maternal warmth at kindergarten would negatively predict child anxiety problems at grade 1 and maternal warmth at grade 1 would negatively predict child anxiety problems at grade 2 (i.e., a parent effect; Gouze et al., 2017; Lansford et al., 2018). Moreover, it was expected that child anxiety at kindergarten would negatively predict maternal warmth at grade 1 and child anxiety at grade 1 would negatively predict maternal warmth at grade 2 (i.e., a child effect; Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011). Further, exploratory analyses were conducted to examine whether group differences existed by sex (i.e., male and female) and SES (i.e., low or moderate-to-high). In these exploratory analyses, sex and SES, respectively, were not included as covariates.

The second goal of this study was to *examine whether early school-age maternal warmth predicted a composite of anxiety disorder criterion counts at grades 3 and 6, and generalized anxiety disorder (GAD) criterion counts at grades 9 and 12*. Given previous research (e.g., McLeod et al., 2007b, Yap et al., 2014; Yap & Jorm, 2015), it was hypothesized that the composite of early school-age maternal warmth (i.e., from kindergarten to grade 2) would negatively predict anxiety disorder criterion counts at grades 3 and 6, and GAD criterion counts at grades 9 and 12. GAD was identified during adolescence as this is a critical period for its onset (Kessler et al., 2012), and GAD is both a strong indicator of past anxiety problems as well as persisting anxiety problems into adulthood (Beesdo et al., 2010; Kessler et al., 2002). The aforementioned covariates were included in these analyses, as well as early school-age anxiety problems (i.e., a composite that encompasses child anxiety problems across kindergarten to grade 2). Further, exploratory analyses were conducted to examine whether group differences existed by sex and SES. In these exploratory analyses, sex and SES, respectively, were not included as covariates.

The third goal of this study was to *examine whether early school-age maternal warmth predicted depressive disorder criterion counts at grades 3, 6, 9, and 12*. While the relationship between warmth and depression has been demonstrated to be strong, the limited longitudinal research exploring this relationship in both childhood and adolescence warrants further study (e.g., Yap et al., 2014; Yap & Jorm, 2015). This study aimed to replicate previous research findings in this area. Given previous research (e.g., McLeod et al., 2007a, Yap et al., 2014; Yap & Jorm, 2015), it was hypothesized that the composite of maternal warmth (i.e., from kindergarten to grade 2) would negatively predict depressive disorder criterion counts at grades 3, 6, 9, and 12. The aforementioned covariates were used in these analyses. Further, exploratory analyses were conducted to examine whether group differences existed by sex and SES. In these exploratory analyses, sex and SES, respectively, were not included as covariates.

Chapter 2.

Method

2.1. Participants

2.1.1. Fast Track project.

Participants came from a community-based sample of children drawn from the Fast Track project, a longitudinal multisite investigation of the development and prevention of childhood conduct problems (Conduct Problems Prevention Research Group [CPPRG], 1992, 2000). Children were identified in schools within four sites (Durham, NC; Nashville, TN; Seattle, WA; and rural Pennsylvania), and classified as high risk based on crime and poverty statistics of the neighbourhoods that they served. Within each site, schools were divided into sets matched for demographics (i.e., size, percentage free or reduced lunch, ethnic composition), and the sets were randomly assigned to control and intervention groups. A multiple-gating screening procedure was utilized that combined teacher and parent ratings of disruptive behaviour among 9,594 kindergarteners from 55 schools across three cohorts (1991–1993). Children were initially screened for classroom conduct problems by teachers, using the Authority Acceptance (AA) score of the Teacher Observation of Child Adjustment-Revised Authority Acceptance score (TOCA-R; Werthamer-Larsson, Kellam, & Wheeler, 1991). The AA scale of the TOCA-R includes 10 items asking teachers to rate the frequency of their students' behavior problems in the classroom. Those children scoring in the top 40% within cohort and site were solicited for parent-report home behaviour problems, using items from the Child Behavior Checklist/4–18 (CBCL; Achenbach, 1991) and similar scales, and 91% agreed to participate (n = 3,274). The teacher and parent screening scores were then standardized and summed to yield a total severity-of-risk screen score. Children were selected for inclusion into the high-risk sample based on this screening score, moving from the highest score downward until desired sample sizes were reached within sites, cohorts, and groups. Deviations were made when a child failed to

matriculate in the first grade at a core school (*n* = 59) or refused to participate (*n* = 75), or to accommodate a rule that no child would be the only girl in an intervention group. Overall, 891 children (control = 446 and intervention = 445) were selected for the high-risk sample and participated (see Figure 1).

In addition to the high-risk sample of 891 children, a stratified normative sample of 387 children was selected to represent the population normative range of risk scores and was followed over time. This normative sample was selected from the control schools (*n* = 27), such that 100 kindergarten children were selected at each site (except for Seattle, WA, where only 87 children were selected, due to a data collection error). Participants in the normative sample were randomly selected to represent the population according to race, sex, and level of teacher-reported behaviour problems (10 children at each decile of the distribution of scores from the TOCA-R). The normative sample included a portion of high-risk control group children to the proportional degree that they were represented in the school population.

2.1.2. Sample description.

Both the high-risk control group and normative sample were utilized for the current study. Participants from the high-risk intervention sample were not included (see Figure 1). Probability weights were constructed to adjust for the over-sampling of high-risk children (Jones, Dodge, Foster, Nix, & CPPRG, 2002), and were used in the current study. These weights are calculated based on the distributions of within-site stratification of the TOCA-R (Werthamer-Larsson et al., 1991; teacher report) and the distribution of *T*-scores of behaviour problems on the CBCL (Achenbach, 1991; parent report). These probability weights correct for the disproportionate number of high-risk control youth presented when the high-risk control and normative samples are combined, such that the weighted sample approximates a normative distribution, within the population sampled, across the screening variables. As 79 of those recruited for the high-risk control group were also included as part of the normative sample and 1 participant was missing a weighting variable value, the final sample size for the current analyses included 753 participants (42.0% female) across three cohorts (cohort 1 = 61.4%, cohort 2 = 21.4%,

cohort 3 = 17.3%). Children were on average 5.89 years old (*SD* = .43) at the start of the Fast Track project (i.e., kindergarten). This sample represents the ethnic diversity of the populations at the four sites of data collection; the majority of the sample was either European American (49.9%) or African American (46.1%), with 4.0% of the sample representing other ethnic groups (i.e., Hispanic, Asian, Native American).

Figure 1. Consort Flow Chart

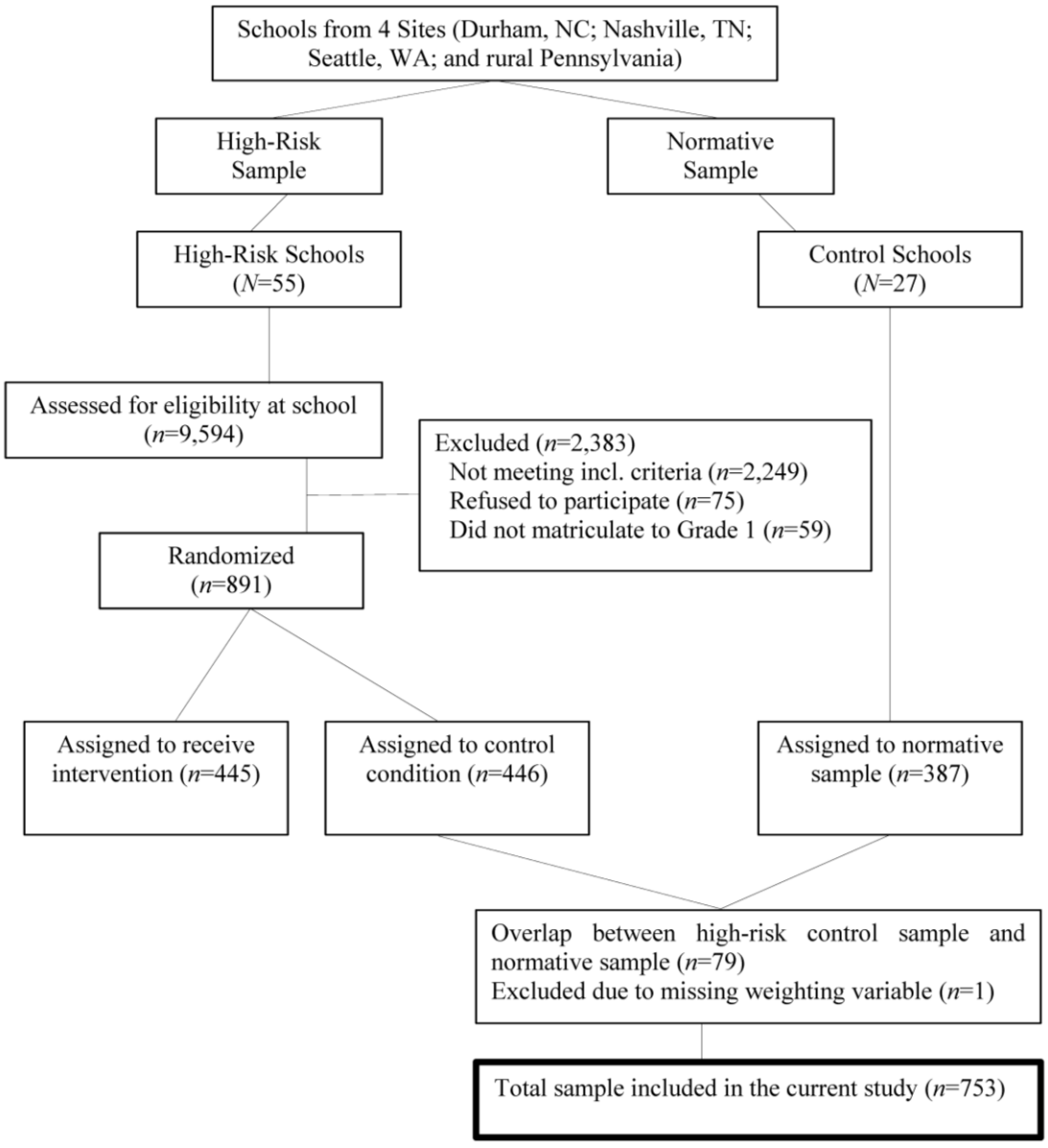


Figure adapted from Dodge et al. (2015)

2.2. Procedure

Annual home interviews were conducted with primary caregivers and children. Interviews began during the summer before children's entry to grade 1. Caregivers and children completed the interviews separately with two different interviewers over the course of approximately 2 hours. Measures given during these interviews assessed several domains, including demographic information (e.g., sex), maternal depression, broadband childhood behavioural and emotional problems, anxiety disorder symptomatology, and depressive disorder symptomatology. Further, primary caregivers and children participated in the Parent-Child Interaction Task (PCIT; see description in measures section below), a semi-structured family observation procedure; this and specific measures from kindergarten–grade 3, grade 6, grade 9, and grade 12 included in the current study are described below. See Table 1 for a timeline of measures included in this study.

Table 1. Timeline of Variables Collected

	K	Gr1	Gr2	Gr3	Gr6	Gr9	Gr12
Demographics	✓						
Maternal Depression	✓	✓	✓				
Achenbach DSM-IV Anxiety Problems	✓	✓	✓				
DISC-IV Anxiety Criterion Counts				✓	✓	✓[a]	✓[a]
DISC-IV Depression Criterion Counts				✓	✓	✓	✓
Maternal Warmth	✓	✓	✓				

Note. K = kindergarten; Gr = grade; DISC-IV = Diagnostic Interview Schedule for Children Version IV; [a] = Generalized anxiety disorder only

2.3. Measures

Data collected for this study were gathered by interview, child- and parent-report measures, and observational procedures.

2.3.1. Demographics.

The Family Information Form (CPPRG, 1990) was primarily used to derive demographic information, information concerning family structure, and SES. From this measure, the *Socioeconomic Status Continuous Code* was created, whose scoring was based on a formula derived by Hollingshead (1975). The score was "calculated by multiplying the scale value for an occupation by a weight of five and the scale value for education by a weight of three" and adding these two values (Hollingshead, 1975). If both parents worked, the score of both parents was summed and the total score was divided by two.

The Family Information Form was further used to gather information regarding the participating child's race (African American [AA], European American [EA], Hispanic, Asian, Native American, or other). Due to the multi-site sampling design of the Fast Track project, race and urban/rural status were confounded, given that the vast majority of AA participants lived in urban areas (>99%). Thus, for the current study, analyses examining race utilized a race/urban status variable representing three groups: urban AAs (45.6%) urban EUs (24.4%), and rural EUs (25.5%). Other ethnic minorities (i.e., Hispanic, Asian, Native American, or other) were not included in these analyses due to the small sample sizes in these groups (combined 4% of the sample). Race/urban status was dummy coded for analyses.

2.3.2. Maternal depression.

Mothers were administered the Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) for 3 consecutive years (kindergarten, grade 1, grade 2). In this study, each time point was used as an indicator of a latent variable of maternal depressive symptoms. The CES-D is a 20-item measure that has well-established psychometrics, including high concurrent validity, as well as adequate discriminant validity (Radloff, 1977). The CES-D showed strong internal reliability in this sample (α = 0.88, α = 0.89, and α = 0.89 in years 1–3, respectively). For the purpose of this study, the CES-D scores were averaged across years 1–3 to create a composite score.

2.3.3. Early school age anxiety.

Anxiety at kindergarten and grades 1 and 2 was measured using the parent-report CBCL/4–18 (Achenbach, 1991). For this study, the DSM-IV Anxiety Problems scale was employed. Achenbach and Dumenci (2001) and Achenbach, Dumenci, and Rescorla (2003) provide a framework for interpreting items on the CBCL/4–18 that correspond to symptoms of child anxiety in the DSM-IV (American Psychiatric Association, 1994; i.e., the Anxiety Problems scale). The six items included in the DSM-IV Anxiety Problems scale are as follows: #11 *clings to adults or too dependent*; #29 *fears certain animals, situations, or places, other than school*; #30 *fears going to school*; #45 *nervous, highstrung, or tense*; #50 *too fearful or anxious*; and #112 *worries*. Achenbach (2014) recommends that raw scores from the DSM-oriented scales be used for statistical analyses because they "reflect all the variation that actually occurs in scores obtained by the individuals whose data are being analyzed" (p. 25). Items on the CBCL/4–18 were scored from 0 (*not true*) to 2 (*very true or often true*). Therefore, scores on the CBCL/4–18 DSM-IV Anxiety Problems scale range from 0 to 12.

Numerous studies support the reliability and validity of the CBCL/4–18 across a broad range of sample types (Berubé & Achenbach, 2010; Konold, Walthall, & Pianta, 2004; McConaughy, 1993). The factor structure of the DSM-oriented scales has also been supported using community samples (Achenbach et al., 2003). Further, the DSM-oriented scales, in particular the Anxiety Problems scale, show strong concurrent validity in conjunction with the DSM-IV (Ebesutani et al., 2010). The Anxiety Problems scale has been shown to have strong reliability, convergent and discriminative validity, and clinical utility (Ferdinand, 2008; Nakamura, Ebesutani, Bernstein, & Chorpita, 2009; Pauschardt, Remschmidt, & Mattejat, 2010). In this sample, the DSM-Oriented Anxiety Problems scale showed acceptable internal reliability (α = .53, α = .57, and α =.61, across years 1 – 3, respectively).

2.3.4. Youth anxiety and depression.

Anxiety and depressive disorder criterion counts were measured using the parent-report Diagnostic Interview Schedule for Children–Version IV (DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). The DISC-IV, a highly structured, laptop computer-administered clinical interview, is appropriate for use for children aged 6-17 and assesses DSM-IV diagnoses. The DISC-IV was administered in the summer following grades 3 (parent report), 6 (child report), 9 (child report), and 12 (child report). Anxiety criterion counts of the following DSM-III-R anxiety disorders were measured in grade 3: separation anxiety disorder, simple phobia, avoidant disorder, overanxious disorder, social phobia, panic disorder, agoraphobia, obsessive-compulsive disorder, and generalized anxiety disorder. In grade 6, criterion counts for the following DSM-IV anxiety disorders were measured: separation anxiety disorder, specific phobia, social phobia, panic disorder, agoraphobia, obsessive-compulsive disorder, and generalized anxiety disorder. In grade 9 and 12, only DSM-IV generalized anxiety disorder was available. Although post-traumatic stress disorder was included as an anxiety disorder in the DSM-III-R and DSM-IV, it was not included in the analyses for this study. Further, DSM-IV selective mutism criterion counts were not collected and therefore were not included.

Criterion counts of DSM-III-R and DSM-IV major depressive disorder was also measured in grades 3, 6, 9 and 12. Criterion counts for dysthymic disorder were also available; however, these criterion counts were entirely subsumed by those in major depressive disorder, and therefore were not included in analyses to avoid multiple reports of the same criterion. Criterion counts for each DSM-III-R and DSM-IV anxiety disorder were combined for an aggregate anxiety disorder outcome score at grades 3 and 6. Criterion counts for generalized anxiety disorder were used as outcome variables representing anxiety criterion counts at grades 9 and 12. Criterion counts for major depressive episode were used as an outcome variable representing depressive criterion counts at each of grades 3, 6, 9, and 12.

The DISC-IV has well-established psychometrics, including good diagnostic reliability (κ = 0.81–0.96), test-retest reliability (κ = 0.65–0.88), and concurrent validity (κ = 0.62) for anxiety disorders (Schwab-Stone et al., 1996; Silverman, Saavedra, & Pina, 2001). The DISC-IV also has good test-retest reliability (κ = 0.56) and concurrent validity (κ =0.58) for depressive disorders (Schwab-Stone et al., 1996). In the current study, the child-report DISC-IV showed internal reliability that was acceptable in grade 6 across anxiety disorders (α = 0.61 – 0.92), with the exception of panic disorder, which was poor (α = 0.38). However, internal reliability for overall DISC-IV anxiety in grade 6 (i.e., a composite comprised of criteria from all grade 6 anxiety disorders) that was used for analyses was excellent (α = 0.91). Internal reliabilities for DISC-IV anxiety in grades 9 and 12 (i.e., generalized anxiety disorder) were acceptable (α = 0.69 and 0.78, respectively). Internal reliability for depressive disorders was strong across grades 6, 9, and 12 (α = 0.83 – 0.93). Unfortunately, due to a missing scoring program indicating the variables that comprise the criterion counts in grade 3, the internal consistency for anxiety and depressive disorders in that year could not be calculated.

2.3.5. Maternal warmth.

Children and their mothers participated in the Parent-Child Interaction Task (PCIT) during home visits in the summers following kindergarten, grade 1, and grade 2. The PCIT is a semi-structured family observation procedure involving free play (i.e., Child's Game; 5 minutes), parent-led play (i.e., Parent's Game; 5 minutes), a Lego task (i.e., child makes a replica of a difficult figure while being coached by the parent; 5 minutes); and Clean-up (3 minutes; McMahon & Estes, 1994). After each PCIT task, coders made global ratings of parent and child behavior using an adaptation of the Interaction Rating Scales (IRS; Crnic & Greenberg, 1990), which includes 16 items scored along a 5-point scale (1 = low or negative value; 5 = high or positive value). The 6-item IRS construct of maternal warmth used in this study was developed by Pasalich, Witkiewitz, McMahon, Pinderhughes, and the CPPRG (2016) using data from the Fast Track project. The score for maternal IRS warmth was the mean of six items that were coded across the four tasks. From the Child's Game, parent gratification (item1; 1 = no

positive enjoyment; 5 = long periods of enjoyment), parent sensitivity (item 3; 1 = out of sync; 5 = tuned in to child/good rhythm), and parent involvement (item 4; 1 = self-occupied; 5 = mainly engaged in interaction) were used. From the Parent's Game, parent gratification was used (item 6; 1 = no positive enjoyment; 5 = long periods of enjoyment). From the Lego Task, parent gratification (item 10; 1 = no positive enjoyment; 5 = long periods of enjoyment) and parent sensitivity (item 12; 1 = out of sync; 5 = tuned in to child/good rhythm) were used. These items broadly relate to parental gratification (e.g., enjoyment in the interaction), sensitivity (e.g., sensitive responding to the child's cues), and involvement (e.g., time spent interacting with the child). An aggregate measure of maternal warmth was developed by averaging the IRS scores across kindergarten, grades 1, and grade 2. This aggregate was used to predict DISC-IV anxiety and depressive criterion counts in grade 3, 6, 9, and 12.

Coders received training on the IRS by a lead observer at each of the four sites. Coders met weekly to control for coder drift, and lead observers were trained annually and participated in conference calls to minimize cross-site coder drift. Interrater agreement on the IRS was assessed on 15% of the PCIT sessions. In this sample, the IRS scale showed very strong internal reliability in kindergarten, grade 1, and grade 2 (α = 0.88, α = 0.92, and α = 0.88, respectively). The mean intraclass correlation coefficient for the IRS items was 0.74.

Chapter 3.

Results

3.1. Analysis Plan

Descriptive analyses were conducted in SPSS (Version 22; IBM Corp., 2013). All other analyses were conducted in Mplus 8.0 (Muthén & Muthén, 2012-2017). Means, standard deviations, and intercorrelations for all study variables were examined. A probability weight based on group (normative vs. high-risk control) was previously calculated for all normative and high-risk control group participants to account for the oversampling of high-risk children in the Fast Track project (Jones et al., 2002). All study analyses incorporated this weighting variable.

3.1.1. Covariates.

Covariates included in all analyses included sex (child), age, SES, maternal depression, race/urban status, and the Fast Track severity-of-risk screen score. For study goal two, the Achenbach DSM-IV Anxiety Problems scale was included as a covariate to control for early childhood anxiety problems. The Achenbach DSM-IV Depression Problems scale was proposed to use as a covariate for study goals one and three to control for early childhood depressive problems. However, initial analyses revealed that this composite measure was negligibly correlated with all of the study variables, so it was removed from analyses. Further, initial plans were to utilize social competence (i.e., Social Competence Scale – Parent Version [SCS], mean of years 1–3) and general cognitive ability (Wechsler Intelligence Scale for Children – Revised [WISC-R], mean of years 1–2) as covariates. However, correlation analyses showed that while both of these variables had low to moderate correlation coefficients with the study variables of interest (SCS median r = .13; mean r = .13; WISC-R median r = .10; mean r = .14), they were also correlated with the majority of the other study covariates (SCS median r = -.19; mean r = .21; WISC-R median r = -.22; mean r = .22). This, paired with literature stating,

"covariates should be proposed a priori and should always have a strong rationale and justification and should be as few in number and as noncorrelated as possible" (p. 962; Kraemer, 2015) led to the decision to exclude these variables from study analyses.

3.1.2. Missing data.

Given the longitudinal design of this study, it was expected that there would be a degree of missing data due to attrition. However, while attrition levels in Fast Track were quite low, a planned missingness (PM) design was utilized and therefore some items were deliberately not administered to certain cohorts in specific years. In particular, administration of items of the CBCL/4-18 (Achenbach, 1991) differed across kindergarten – grade 2. The six items corresponding to the Achenbach DSM-IV Anxiety Problems scale were not administered to cohort two or three in grade 1. Further, two of the six items that comprise the Achenbach DSM-IV Anxiety Problems scale were not administered in kindergarten to cohort three (high-risk control group) and in grade 2 to cohort one, cohort two (high-risk control group), and cohort three (high-risk control group). See Table 2 for details.

Table 2. Achenbach DSM-IV Anxiety Problem Scale Missing Data

	Cohort 1		Cohort 2		Cohort 3	
	Normative	HR Control	Normative	HR Control	Normative	HR Control
K	✓	✓	N/A	✓	N/A	[a]
Gr1	✓	✓	N/A	[b]	N/A	[b]
Gr2	[a]	[a]	N/A	[a]	N/A	[a]

Note: K = kindergarten; Gr = grade; ✓ = no items missing; [a] = items 29 and 30 missing; [b] = no items administered; N/A = not applicable – normative sample was in cohort 1 only

Unplanned missing data ranged across the study variables. For early childhood anxiety (i.e., Achenbach DSM-IV Anxiety Problems scale), the amount of missing data across the 3 years included in this study ranged from 0.8% to 8.9%. Missing data for the IRS (i.e., maternal warmth) was 0.5%, 6.5%, and 11.7%, across kindergarten – grade 2, respectively. In grade 3, missing parent-report anxiety and depressive disorder criterion counts ranged from 11.9% to 13.0%. In grade 6, missing child-report anxiety and depressive disorder criterion counts ranged from 17.8% to 17.9%. In grade 9, child-report

GAD and depressive disorder criterion counts were each missing 27.3% of responses. In grade 12, missing child-report GAD and depressive disorder criterion counts ranged from 28.8% to 30.0%.

Missing data were handled with full-information maximum likelihood (FIML), so that participants with at least one outcome measure available were included in the analyses (Baraldi & Enders, 2010; Little & Rubin, 2002). FIML was also used for PM data (i.e., missing Achenbach DSM-IV Anxiety Problems scale items), which conform to the assumptions of missing completely at random (MCAR; i.e., data that is missing as a result of a purposeful byproduct of the research design and, therefore, missingness that is unrelated to study variables; Little & Rhemtulla, 2013). FIML does not fill in missing values, such as multiple imputation does, but instead uses all of the available data (missing and non-missing) to identify the parameter values that have the highest probability of producing the sample data (Baraldi & Enders, 2010). A maximum likelihood estimator that calculated robust standard errors (MLR) was used for analyses. This is an accepted approach to handling missing data when variables are non-normal (Asparouhov & Muthén, 2006; Little & Rubin, 2002; Satorra & Bentler, 2001).

3.1.3. Descriptive statistics.

The descriptive statistics of the covariates included in this study are presented in Table 3. Table 4 displays the intercorrelations between all of the covariates and study variables. Pearson product-moment correlations were used to analyse the relationship between continuous variables and Spearman correlations were used to analyze the relationship between continuous and categorical (multivariate) variables and between categorical variables. Table 5 displays descriptive statistics for the study variables. Group differences for sex (i.e., male and female) and SES (i.e., low or moderate-to-high) were examined for all study variables. DISC-IV anxiety disorder criterion counts differed on the basis of sex in grade 3, $t[653] = 1.68$, $p < 0.01$, grade 6, $t[615] = 3.47$, $p < 0.05$, grade 9, $t[545] = 1.48$, $p < 0.01$, and grade 12, $t[534] = 2.23$, $p < 0.001$, and on DISC-IV depression disorder criterion counts in grade 3, $t[653] = -1.25$, $p < 0.05$, with females receiving higher anxiety disorder scores than males and males receiving high depressive

disorder scores than females. No other group differences by sex were found. Early school-age anxiety problems differed by level of SES at kindergarten, $t[745] = 4.12$, $p < 0.01$, grade 1, $t[428] = 3.74$, $p < 0.001$, and grade 2, $t[684] = 2.27$, $p < 0.001$, with those in the low SES group receiving higher scores than those in the moderate-to-high SES group. Further, group differences were found for DISC-IV anxiety disorder criterion counts in grade 3, $t[653] = 2.86$, $p < 0.01$, and grade 9, $t[545] = 2.01$, $p < 0.001$, and for DISC-IV depressive disorder criterion counts in grade 3, $t[653] = 1.49$, $p < 0.01$, grade 9, $t[545] = 2.06$, $p < 0.001$, and grade 12, $t[525] = 1.21$, $p < 0.05$, with those in the low SES group receiving higher scores than those in the moderate-to-high SES group.

Descriptives of anxiety and depressive disorder base rates and criterion counts are presented in Table 6. Table 7 displays skewness and kurtosis statistics of the continuous variables. A normally distributed variable typically displays a skewness statistic between -1.0 and 1.0 and a kurtosis statistic between -1.5 and 2.0. The data showed positive skew (i.e., an indication that most of the scores are below the mean) and positive kurtosis (leptokurtic distributions; i.e., distributions with heavier tails and higher peaks) on the Achenbach DSM-IV Anxiety Problems scale in kindergarten, grade 1, and grade 2 (and on the composite including scores from kindergarten to grade 2). Further, the Kolmogorov-Smirnov test indicated the rejection of the null hypothesis (i.e., $p < .05$) for these variables, which illustrates univariate non-normality. In order to correct for significant positive skewness and kurtosis, scores on these measures were log-10 transformed. After this transformation, skewness and kurtosis were highly improved and fell in the acceptable range (Table 7).

Table 3. Covariate Descriptives

Variable	*% (N)*	*M (SD)*
Sex		
Male	58.00 (437)	
Female	42.00 (316)	
Race/Urban Status		
Urban European American	24.40 (184)	
Urban African American	45.60 (343)	
Rural European American	25.50 (192)	
Age		5.89 (0.43)
SES		25.66 (12.90)
Achenbach Anxiety Problems (K–Gr2)[a]		0.41 (0.31)
CES-D (K–Gr2)		14.34 (8.30)

Note. [a] = Raw scores are presented here. Log-10 transformations were applied to correct for positive skewness; K = kindergarten; Gr = grade; Age = age (in years) in kindergarten; Achenbach Anxiety Problems (K–Gr2) = Achenbach DSM-IV Anxiety Problems Scale mean score; CES-D (K–Gr2) = Center for Epidemiological Studies - Depression Scale mean score

Table 4. Intercorrelations of Covariate, Predictor, and Outcome Variables

Variable	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
1. Sex	-.01	.02	-.02	.07*	.01	.02	.06	-.03	.08	.05	.01	-.05	-.15***	-.06	-.10*	.05	-.07	-.03	.01	-.01	.00	.03	.00
2. Urbanicity UEA	---	-.56***	-.35***	-.02	.03	.12**	-.08*	.01	.09	.05	.05	.07	-.06	-.05	.01	.07	-.02	.01	.01	.20***	.14***	.27***	.24***
3. Urbanicity UAA		---	-.58***	.02	-.12**	-.20***	.17***	-.11**	-.13**	-.10*	-.13**	-.09*	.20***	.08	.04	-.08	.01	.09*	.04	-.22***	-.15***	-.11**	-.19***
4. Urbanicity REA			---	.00	.11**	.11**	.12**	.12**	.05	.06	.09*	.04	.17***	-.05	-.05	.02	.01	-.10*	-.06	.05	.03	-.14**	-.02
5. Severity-of-Risk				---	.01	-.13**	.27***	.22***	.21***	.24***	.28***	.11**	.07	.05	.05	.14***	.05	.10*	.07	-.02	-.12**	-.13**	-.11**
6. Age					---	-.12**	.13***	.16***	.08	.06	.14**	.05	-.06	.07	-.01	-.04	-.03	.13	.02	-.02	-.11**	-.16***	-.13**
7. SES						---	-.37***	-.14***	-.08	-.10**	-.14***	-.10*	-.15***	-.09*	-.05	-.04	.00	-.12**	-.05	.28***	.35***	.24***	.36***
8. CES-D K–Gr2							---	.33***	.28***	.31***	.39***	.30***	.16***	.01	.10*	.19***	.06	.08	.14**	-.18***	-.24***	-.26***	-.28***
9. Achenbach Anxiety Problems K								---	.44***	.47***	.83***	.33***	.05	.03	.02	.11***	-.01	.09*	.07	.00	-.10**	-.16***	-.11**
10. Achenbach Anxiety Problems Gr1									---	.55***	.81***	.31***	.05	-.03	.02	.17**	-.17*	.04	.14*	.01	-.11*	-.07	-.07
11. Achenbach Anxiety Problems Gr2										---	.87***	.35***	.01	-.03	.09*	.20***	.00	.06	.11*	-.03	-.09*	-.08*	-.08*
12. Achenbach Anxiety Problems K–Gr2											---	.40***	.03	-.01	.07	.19***	-.03	.10*	.12**	-.01	-.10**	-.13**	-.09*
13. DISC-IV Anxiety Gr3												---	.09*	.07	.18***	.41***	.07	.10*	.16***	.03	.00	-.07	-.01
14. DISC-IV Anxiety Gr6													---	.18***	.11*	.02	.31***	.16***	.06	-.13**	-.11*	-.08	-.13**
15. DISC-IV Anxiety Gr9														---	.08	-.06	.13***	.34***	.11*	-.03	-.07	-.05	-.06
16. DISC-IV AnxietyGr12															---	.12**	.03	.21***	.46***	.02	-.08	.04	.00
17. DISC-IV Depression Gr3																---	.00	.00	.05	.04	.00	.01	.02
18. DISC-IV Depression Gr6																	---	.05	.02	-.02	-.01	-.06	-.03
19. DISC-IV Depression Gr9																		---	.30***	-.08	-.14**	-.11*	-.14**
20. DISC-IV Depression Gr12																			---	.02	-.03	-.03	-.01
21. Maternal Warmth K																				---	.42***	.33***	.76***
22. Maternal Warmth Gr1																					---	.43***	..79***
23. Maternal Warmth Gr2																						---	.79***
24. Maternal Warmth K–Gr2																							---

Note. * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; UEA = Urban European American; UAA = Urban African American; REA = Rural European American; K = Kindergarten; Gr = Grade; Achenbach Anxiety Problems = Achenbach DSM-IV Anxiety Problems Scale mean score; CES-D = Center for Epidemiological Studies - Depression Scale; [1] = Generalized anxiety disorder only; [2] = Major depressive disorder criterion counts

Table 5. Study Variable Descriptives

Variable	Criterion Counts	Diagnosis
	M (*SD*)	% (*N*)
Achenbach DSM-IV Anxiety Problems		
Kindergarten[a]	0.39 (0.34)	
Grade 1[a]	0.34 (0.30)	
Grade 2[a]	0.44 (0.41)	
DISC-IV Anxiety Criterion Counts		
Grade 3 (PR)[a]	6.96 (7.17)	
Meets Diagnosis for Any AD		30.80 (201)
Grade 6 (CR)[a]	7.49 (6.98)	
Meets Diagnosis for Any AD		20.90 (129)
Grade 9 (CR; GAD only)[a]	0.24 (0.76)	
Meets Diagnosis for GAD		0.20 (1)
Grade 12 (CR; GAD only)[a]	0.24 (0.87)	
Meets Diagnosis for GAD		0.40 (2)
DISC-IV Depression Criterion Counts		
Grade 3 (PR)[a]	0.44 (1.03)	
Meets Diagnosis for MDD		1.10 (7)
Grade 6 (CR)[a]	0.17 (0.80)	
Meets Diagnosis for MDD		0.70 (4)
Grade 9 (CR)[a]	0.32 (1.12)	
Meets Diagnosis for MDD		2.2 (12)
Grade 12 (CR)[a]	0.39 (1.25)	
Meets Diagnosis for MDD		2.7 (14)
Maternal Warmth		
Kindergarten	21.14 (4.75)	
Grade 1	22.00 (4.90)	
Grade 2	21.69 (5.48)	
Kindergarten – Grade 2	21.59 (3.97)	

Note. [a] = Raw scores are presented here. Log-10 transformations were applied for all analyses to correct for positive skewness; DISC-IV = Diagnostic Interview Schedule for Children – Version IV; GAD = Generalized anxiety disorder; PR = parent report; CR = child report; AD = anxiety disorder; MDD = Major depressive disorder

Table 6. Anxiety and Depressive Disorder Diagnostic and Criterion Count Descriptives

Variable	Criterion Counts		Diagnosis
	M (*SD*)	Range	% (*N*)
Grade 3 Anxiety Disorders (PR)			
Separation Anxiety Disorder	1.31 (1.65)	0 – 10	5.50 (36)
Simple Phobia	2.52 (2.59)	0 – 10	18.7 (123)
Avoidant Disorder	0.52 (1.42)	0 – 6	3.20 (21)
Overanxious Disorder	0.87 (1.28)	0 – 7	4.10 (27)
Social Phobia	1.34 (2.68)	0 – 15	11.0 (72)
Panic Disorder	0.06 (0.72)	0 – 10	0.20 (1)
Agoraphobia	0.04 (0.22)	0 – 2	0.90 (6)
Obsessive-Compulsive Disorder	0.07 (0.36)	0 – 3	0.60 (4)
Generalized Anxiety Disorder	0.87 (2.45)	0 – 17	1.70 (11)
Grade 3 Depressive Disorders (PR)			
Major Depression	0.44 (1.03)	0 – 8	1.10 (7)
Dysthymia[1]			0.80 (5)
Grade 6 Anxiety Disorders (CR)			
Separation Anxiety Disorder	0.74 (1.30)	0 – 7	3.90 (24)
Specific Phobia	4.20 (4.29)	0 – 12	11.80 (73)
Social Phobia	1.20 (1.27)	0 – 4	2.30 (14)
Panic Disorder	0.05 (0.27)	0 – 3	0.30 (2)
Agoraphobia	0.29 (0.77)	0 – 5	7.40 (46)
Obsessive-Compulsive Disorder	0.78 (2.18)	0 – 9	1.60 (10)
Generalized Anxiety Disorder	0.20 (0.81)	0 – 7	0.30 (2)
Grade 6 Depressive Disorders (CR)			
Major Depression	0.17 (0.80)	0 – 6	0.70 (4)
Dysthymia[1]			0.50 (3)
Grade 9 Anxiety Disorders (CR)			
Generalized Anxiety Disorder	0.24 (0.76)	0 – 6	0.20 (1)
Grade 9 Depressive Disorders (CR)			
Major Depression	0.32 (1.12)	0 – 8	2.20 (12)
Dysthymia[1]			0.20 (1)
Grade 12 Anxiety Disorders (CR)			
Generalized Anxiety Disorder	0.24 (0.87)	0 – 7	0.40 (2)
Grade 12 Depressive Disorders (CR)			
Major Depression	0.39 (1.25)	0 – 9	2.70 (14)
Dysthymia[1]			0.80 (4)

Note. PR = Parent report; CR = Child report; [1] = Dysthymia criterion counts were entirely subsumed by Major depressive disorder criterion counts and therefore were not reported

Table 7. Skewness and Kurtosis of Continuous Variables

Variable	Before Log-10 Transformation		After Log-10 Transformation	
	Skewness (*SE*)	Kurtosis (*SE*)	Skewness (SE)	Kurtosis (SE)
Age	0.96 (0.90)	1.78 (0.18)	---	---
SES	0.54 (0.90)	-0.31 (0.18)	---	---
CES-D	0.69 (0.90)	0.16 (0.18)	---	---
Achenbach Anxiety Problems K	1.07 (0.90)	1.39 (0.18)	-0.63 (0.12)	-0.74 (0.24)
Achenbach Anxiety Problems Gr1	1.00 (0.12)	0.82 (0.24)	-0.57 (0.12)	-0.87 (0.24)
Achenbach Anxiety Problems Gr2	0.76 (0.09)	-0.07 (0.19)	-0.37 (0.12)	-1.43 (0.24)
Achenbach Anxiety Problems K–Gr2	0.89 (0.09)	0.89 (0.18)	-0.75 (0.12	-0.14 (0.24)
Maternal Warmth K	-0.44 (0.09)	0.04 (0.18)	---	---
Maternal Warmth Gr1	-0.45 (0.09)	-0.27 (0.18)	---	---
Maternal Warmth Gr2	-0.84 (0.10)	1.50 (0.19)	---	---
Maternal Warmth K–Gr2	-0.39 (0.09)	-0.12 (0.18)	---	---

Note. K = kindergarten; Gr = grade; Age = age (in years) in K; CES-D = Center for Epidemiological Studies - Depression Scale mean score K–Gr2

3.2. Structural Equation Modeling Analyses

Study Goal 1: The first goal was to examine the relationship between maternal warmth and child anxiety across 3 years from kindergarten to grade 2, and to explore the directionality of this relationship. It was hypothesized that maternal warmth and childhood anxiety would be bidirectionally negatively related across 3 years from kindergarten to grade 2. Specifically, maternal warmth at kindergarten would negatively predict child anxiety problems at grade 1 and maternal warmth at grade 1 would negatively predict child anxiety problems at grade 2 (i.e., a parent effect; Gouze et al., 2017; Lansford et al., 2018). Moreover, child anxiety at kindergarten would negatively predict maternal warmth at grade 1 and child anxiety at grade 1 would negatively predict maternal warmth at grade 2 (i.e., a child effect; Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011).

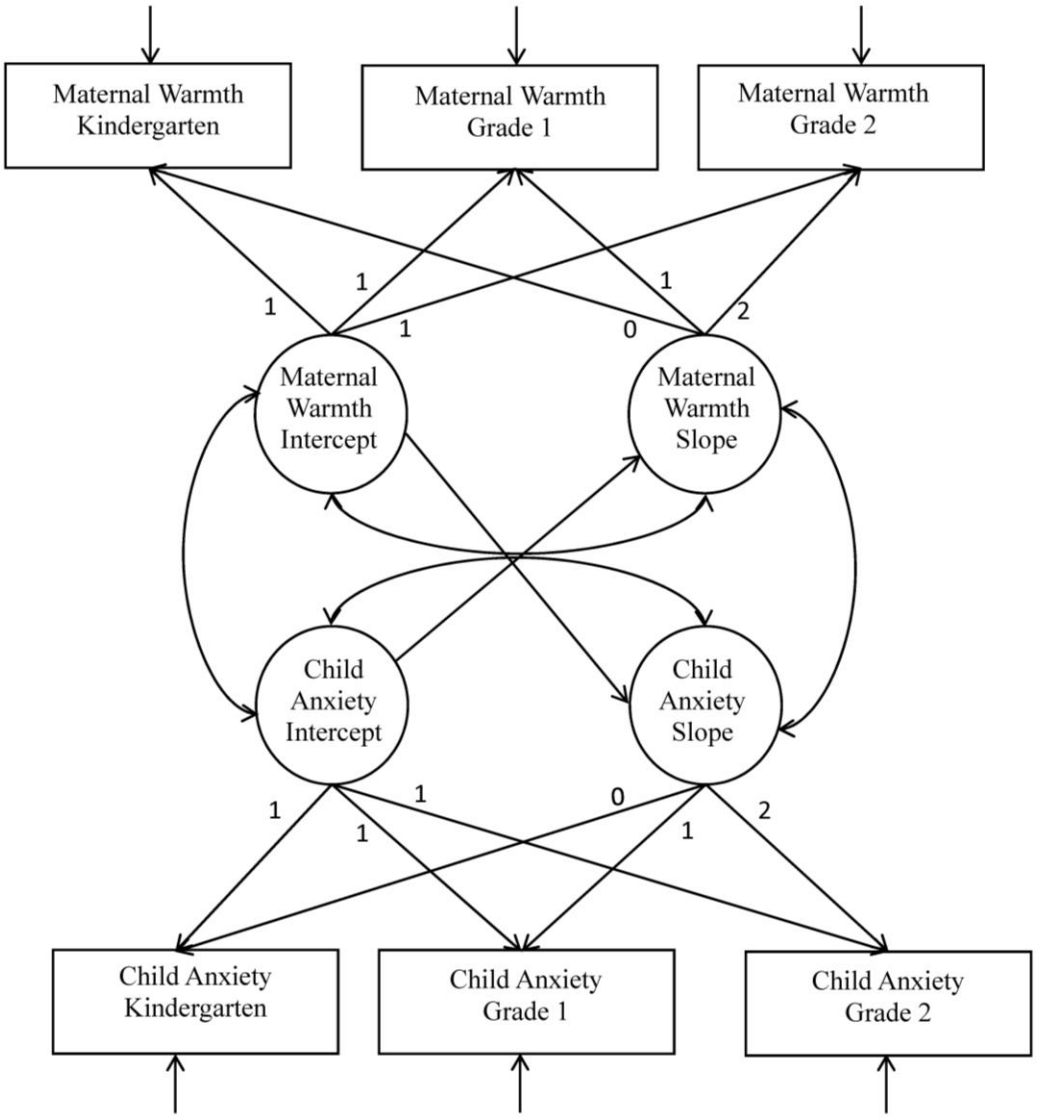
3.2.1. Analytic strategy.

To address the first goal of this study, structural equation modeling (SEM)-based latent growth curve (LGC) modeling was utilized (Bollen, 1989). This method allows for the development of a variable to be modeled as a constant or mean level (i.e., intercept) and as a growth or rate of change (i.e., slope). LGC modeling also allows for the estimation of developmental trajectories that provide an analysis of individual change over time (Curran & Hussong, 2003; Preacher, Wichman, MacCallum, & Briggs, 2008). Individual variability in the LGC model is modeled by the inclusion of variances around the intercept and slope factors. Intercept factor loadings were fixed to 1 and the linear slope factor loadings were fixed to 0, 1, and 2 for kindergarten, grade 1, and grade 2, respectively.

Bivariate LGC models were conducted to analyze the association between maternal warmth and early childhood anxiety (see Figure 2). A number of defaults are set when using LGC modeling in Mplus, including: (a) the coefficients of each intercept factor are fixed to 1, (b) the intercepts of the outcome variables are fixed to 0, (c) the means and variances of both the intercept and slope factors are estimated, (d) the factor

covariance between the intercept-slope pair is estimated, (e) cross-domain factor covariances are estimated, (f) residual variances of the outcome variables are estimated and allowed to vary across time points, and (g) residual covariances are assumed to be 0 (Byrne, 2012). Covariances added between the latent intercept factors and latent slope factors tested if initial levels of and growth in maternal warmth and child anxiety were correlated. Error terms for measures within the same measurement period (e.g., maternal warmth at kindergarten and child anxiety at kindergarten) were allowed to covary. These analyses examined the relationship between the underlying developmental trajectories of maternal warmth and early childhood anxiety.

Figure 2. Bivariate Latent Growth Curve (LGC) Model Examining Correlated Rates of Change between Maternal Warmth and Child Anxiety



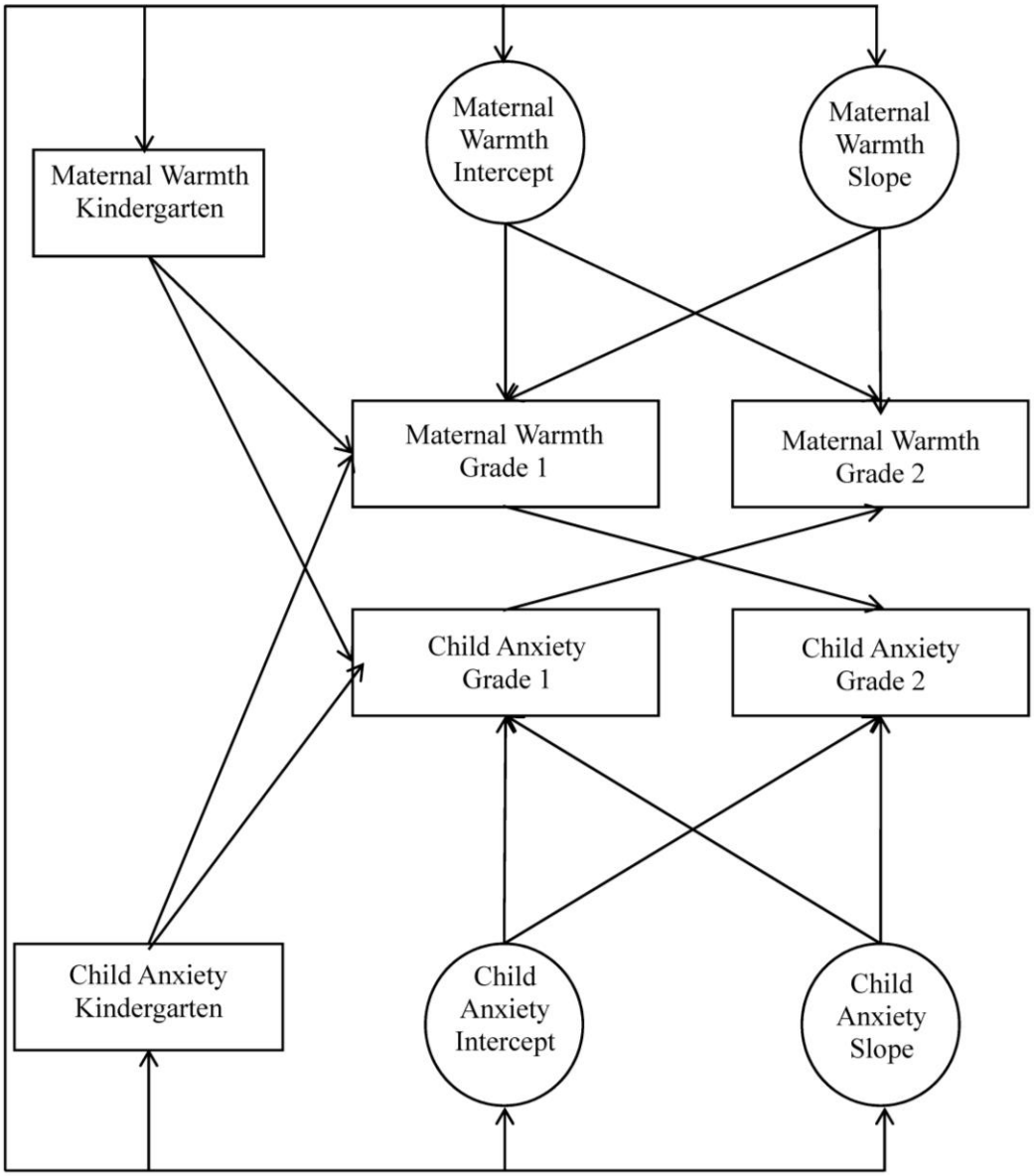
Note. Single-headed arrows indicate error variance.

To test the reciprocal effects between child anxiety and maternal warmth from kindergarten to grade 1 and from grade 1 to grade 2, a cross-lagged model with three time points was utilized using autoregressive latent trajectory (ALT) modeling (Bollen & Curran, 2004, 2005). This model type is superior to the traditionally-used autoregressive cross-lagged (ARCL) panel model, which can result in estimates that are invalid, given the difficulty in disaggregating within- and between-person findings (Berry & Willoughby, 2017). The ALT model was designed to combine latent growth curve

modeling and ARCL modeling, and involves the simultaneous estimation of the relationship between two constructs at the level of their underlying trajectories (i.e., autoregressive paths) and at the level of time-specific measures (i.e., cross-lagged correlations). Consequently, bidirectional associations (i.e., cross-lagged correlations) can be examined while controlling for the trajectories that underlie these constructs. ALT models are notably complex, and therefore it is recommended that they be developed from simpler models to determine if the added complexity enhances understanding of the specific construct under study. The analytic strategy used in this study was based on recommendations and procedures used by Berry and Willoughby (2017), Bollen and Curran (2006), and Morin, Maiano, Marsh, Janosz, and Nagengast (2011).

LGC models for maternal warmth and child anxiety were included in the ALT models as well as time-specific bidirectional relations and autoregressive paths between the repeated measures of each latent factor (see Figure 3). Specifically, the cross-lagged correlations examined if maternal warmth in one year predicted changes in child anxiety the next year (i.e., parent effect) while controlling for growth in childhood anxiety over time. Similarly, these correlations determined if child anxiety in one year predicted changes in maternal warmth in the following year (i.e., child effect) while controlling for growth in maternal warmth over time. The autoregressive paths examined cumulative prediction in maternal warmth and child anxiety from kindergarten to grade 1 and from grade 1 to grade 2, while controlling for the overall underlying trajectory. The first measurement point in ALT models is treated as exogenous and is correlated with the latent intercept and slope factors (to avoid potential bias in estimates caused by "infinite regression"; Bollen & Curran, 2004, 2006). Given these specifications, the intercepts in the ALT models in this study represented the portion of the grade 1 variable that was unexplained by the kindergarten variable.

Figure 3. **Autoregressive Latent Trajectory Model (ALT) Combining the Developmental Trajectories of Maternal Warmth and Child Anxiety with Cross-Lagged Correlations between the Repeated-Measures Indicators**



Bivariate LGC models are not nested within ALT models, however it is possible to estimate an ALT model in which the autoregressive and cross-lagged parameters are fixed to zero. This constrained ALT model is nested within the unconstrained ALT model, and is similar to a bivariate LGC model. The constrained ALT model was compared to the unconstrained ALT model to determine if the incorporation of cross-lagged and autoregressive parameters provided a better representation of the data.

Additional constraints were then progressively added to the ALT model to ensure that the final ALT model was the most parsimonious representation of the data. A number of model constraints were considered, as suggested by the literature. These included: (a) fixing the variance of the slope factors to 0, (b) fixing the mean of the slope factors to 0, (c) removing the time-specific correlations between the repeated measures, (d) constraining the time-specific correlations to equality, (e) constraining the autoregressive parameters to equality across time periods, and (f) constraining the cross-lagged parameters to be equal (Berry & Willoughby, 2017; Bollen & Curran, 2006; Morin et al., 2011). Following this model testing, the covariates were added to the final ALT model.

In evaluating model fit, a nonsignificant chi-square test indicates good fit; however, this statistic has been shown to be sensitive to sample size and the size of the correlations between variables, which leads to over-rejection of adequate models. Therefore, current practice emphasizes the importance of using additional fit statistics to assess model fit (Kline, 2005). The root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis Index (TLI), and standardized root mean square residual (SRMR) were examined to evaluate the fit of all models conducted for the current study, as these indices have been shown to be most sensitive to model misspecification (Hu & Bentler, 1999). For RMSEA values less than .06 indicate close fit, for CFI and TLI values greater than .90 indicate adequate fit (although values greater than .95 are preferable), and for SRMR values smaller than .08 indicate adequate fit (Hu & Bentler, 1999).

3.3. Structural Equation Modeling Results

3.3.1. Bivariate LGC model of maternal warmth and child anxiety.

The bivariate LGC model examining maternal warmth and child anxiety provided an adequate fit to the data, χ^2 (15, N = 753) = 229.63, $p < 0.001$; CFI = 0.95, TLI = 0.89, RMSEA = 0.05, SRMR = 0.04 (see Table 8). No further model specifications were performed on the bivariate LGC model in order to avoid an overfitted model (Byrne, 2012; MacCallum, Roznowski, & Necowitz, 1992). The slope and intercept of

child anxiety were not significantly correlated, nor were those of maternal warmth (*p*s = 0.33 and 0.87, respectively). Results indicated significant associations between the slope of maternal warmth and the intercept of child anxiety (r = -0.21, $p < 0.01$) as well as the slope of child anxiety (r = 0.14, $p < 0.01$), such that higher rates of change in maternal warmth were related to lower initial levels of child anxiety and higher rates of change in child anxiety. Further, this model indicated that the maternal warmth variable increased by, on average, 0.79 points over the next 2 years (i.e., between kindergarten – grade 2; $p < 0.001$).

3.3.2. Bivariate ARCL model without constraints.

Following Bollen and Curran's (2004, 2006) recommendations, exploration of a bivariate ARCL model (i.e., the traditionally-used model for examining bidirectional relationships between longitudinal variables) was also conducted to ensure appropriate estimation of the ALT model. Of note, ARCL modeling does not take into account the developmental trajectories of the variables. The ARCL model fit the data poorly (see Table 8), and therefore the results from this specific model are not reported here.

3.3.3. Bivariate ALT models of maternal warmth and child anxiety.

The unconstrained bivariate ALT model (model 3) displayed difficulties in convergence, and indicated that the constrained model was preferable. These difficulties in convergence indicated that the mean and variance of the slope of child anxiety should be fixed to zero. The constrained bivariate ALT model (model 4) provided a marginally adequate fit to the data, χ^2 (15, N = 753) = 229.63, $p < 0.001$; CFI = 0.93, TLI = 0.78, RMSEA = 0.07, SRMR = 0.05 (see Table 8). However, the conditional bivariate ALT model (model 5) with constraints provided an adequate fit to the data, χ^2 (15, N = 753) = 229.63, $p < 0.001$; CFI = 0.96, TLI = 0.87, RMSEA = 0.05, SRMR = 0.05 (see Table 8). The final conditional bivariate ALT model (model 6) also included constraints on the slope factor for child anxiety (mean and variance were fixed to zero). Covariates (i.e., sex, urban/race status, age, SES, maternal depression, and the severity-of-risk screen score) were then added to this final ALT model, and this model fit the data well, χ^2 (57,

N = 707) = 621.38, $p < 0.001$; CFI = 1.00, TLI = 1.02, RMSEA = 0.00, SRMR = 0.01 (see Table 8). Latent parameter estimates are presented in Table 9 and cross-lagged parameter estimates are presented in Table 10.

Findings from this ALT model indicated that the intercepts (i.e., the portion of grade 1 measures left unexplained by kindergarten measures) of maternal warmth and child anxiety were significantly different from zero, with significant individual heterogeneity in initial levels. Additionally, the intercept of maternal warmth was significantly positively associated with the intercept of child anxiety, such that higher initial levels of maternal warmth were associated with higher initial levels of child anxiety (see Table 9). All autoregressive effects for maternal warmth and child anxiety were significant. These results indicate incremental prediction of these measures at one year from the previous year, over and above what was expected based on the individual trajectories. Cross-lagged analyses indicated significant cross-lagged parent effects in this model, such that maternal warmth in kindergarten predicted child anxiety in grade 1, and maternal warmth in grade 1 predicted child anxiety in grade 2. However, no cross-lagged parent effects were identified (i.e., no effects of maternal warmth on child anxiety in kindergarten and grade 1; see Table 10).

Table 8. Model Fit Indexes and Comparison for Bivariate LGC and ALT Models of Maternal Warmth and Child Anxiety

	Indices of model fit					
Model	χ^2	*df*	CFI	TLI	RMSEA	SRMR
1. Bivariate LGC	229.63***	15	0.95	0.89	0.05	0.04
2. Bivariate autoregressive	224.39***	14	0.83	0.41	0.11	0.05
3. ALT, full model	---	---	---	---	---	---
4. ALT, nested LGC	229.63***	15	0.92	0.85	0.05	0.06
5. ALT model with constraints	229.63***	15	0.96	0.87	0.05	0.05
6. ALT model with constraints and covariates	621.38***	57	1.00	1.02	0.00	0.01

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; LGC = latent growth curve; ALT = autoregressive latent trajectory

Table 9. Latent Parameter Estimates from Final ALT Model for Maternal Warmth and Child Anxiety

Parameter	Est. (*SE*)	Std. Est.
Factor Means		
Intercept – Child Anxiety	1.07 (0.50)	2.15*
Linear Slope – Child Anxiety	-0.20 (0.42)	-0.49
Intercept – Maternal Warmth	46.99 (6.61)	7.11***
Factor Variances		
Intercept – Child Anxiety	29.98 (22.32)	1.34
Intercept – Maternal Warmth	5125.43 (1775.45)	2.89**
Factor Covariances		
Intercept CA ←→ Intercept MW	372.69 (171.09)	2.18*

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

Table 10. Autoregressive and Cross-Lagged Parameter Estimates from ALT Model for Maternal Warmth and Child Anxiety

Parameter	*b*	SE	β
Autoregressive maternal warmth effects			
Kindergarten → Grade 1	-0.54***	0.13	-0.03***
Grade 1 → Grade 2	-0.54***	0.13	-6.87***
Autoregressive child anxiety effects			
Kindergarten → Grade 1	0.54**	0.17	0.05**
Grade 1 → Grade 2	0.54**	0.17	0.49**
Cross-lagged effects			
Kindergarten MW → Grade 1 CA	-0.01	0.01	-0.01
Grade 1 MW → Grade 2 CA	-0.01	0.01	-0.14
Kindergarten CA → Grade 1 MW	-6.62**	1.98	-0.04**
Grade 1 CA → Grade 2 MW	-6.62**	1.98	-4.92**

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

The final ALT models examined sex and SES differences. To examine SES in a multi-group framework, a median split was conducted to classify scores in the bottom 50% reflecting "low SES" and the top 50% representing "moderate to high SES." The multi-group sex analysis indicated that the model fit the data well, χ^2 (102, N = 707) = 950.71, $p < 0.001$; CFI = 1.00, TLI = 1.04, RMSEA = 0.00, SRMR = 0.02. For the male ALT model, the intercept (i.e., the portion of grade 1 measures left unexplained by kindergarten measures) of maternal warmth was significantly different from zero, with significant individual heterogeneity in initial levels. Additionally, the intercept of maternal warmth was significantly positively associated with the intercept of child anxiety, such that higher initial levels of maternal warmth were associated with higher initial levels of child anxiety among males (see Table 11). All autoregressive effects for maternal warmth and child anxiety were significant. These results indicate incremental prediction of these measures at one year from the previous year, over and above what was expected based on the individual trajectories. Cross-lagged analyses indicated significant cross-lagged child effects in this model, such that maternal warmth in kindergarten predicted child anxiety in grade 1, and maternal warmth in grade 1 predicted child anxiety in grade 2. However, similarly to the overarching model, no cross-lagged parent effects were identified among males (i.e., no effects of maternal warmth on child anxiety in kindergarten and grade 1; see Table 12).

For the female ALT model, the intercepts (i.e., the portion of grade 1 measures left unexplained by kindergarten measures) of maternal warmth were significantly different from zero, with significant individual heterogeneity in initial levels (see Table 11). All autoregressive effects for maternal warmth and child anxiety were significant. These results indicate incremental prediction of these measures at one year from the previous year, over and above what was expected based on the individual trajectories. Cross-lagged analyses indicated significant cross-lagged child effects in this model, such that maternal warmth in kindergarten predicated child anxiety in grade 1, and maternal warmth in grade 1 predicted child anxiety in grade 2. However, similarly to the overarching model and the male model, no cross-lagged parent effects were identified among females (i.e., no effects of maternal warmth on child anxiety in kindergarten and grade 1; see Table 12).

Table 11. Latent Parameter Estimates from Final ALT Model for Maternal Warmth and Child Anxiety, by Sex

Parameter	Males		Females	
	Est. (*SE*)	Std. Est.	Est. (*SE*)	Std. Est.
Factor Means				
Intercept – CA	1.06 (0.62)	1.72	0.96 (0.54)	1.77
Linear Slope – CA	-0.15 (0.34)	-0.43	-0.08 (0.34)	-0.22
Intercept – MW	42.48 (7.09)	5.99*	49.74 (7.72)	6.45*
Factor Variances				
Intercept – CA	36.45 (18.98)	1.92	20.58 (19.65)	1.05
Intercept – MW	3601.02 (1475.13)	2.44*	6492.43 (2916.67)	2.23*
Factor Covariances				
Intercept CA ←→ Intercept MW				
	343.59 (147.08)	2.34*	362.21 (193.07)	1.88

Note. * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

Table 12. Autoregressive and Cross-Lagged Parameter Estimates from ALT Models for Maternal Warmth and Child Anxiety, by Sex

Parameter	Males			Females		
	b	SE	β	*b*	SE	β
Autoregressive MW effects						
Kindergarten → Grade 1	-0.42**	0.15	-0.03*	-0.57***	0.15	-0.03***
Grade 1 → Grade 2	-0.48***	0.14	-4.55**	-0.60***	0.10	-8.83***
Autoregressive CA effects						
Kindergarten → Grade 1	0.53**	0.15	0.05**	0.53**	0.15	0.05**
Grade 1 → Grade 2	0.53**	0.15	0.50***	0.53**	0.15	0.46**
Cross-lagged effects						
Kindergarten MW → Grade 1 CA	-0.01	0.01	-0.01	-0.01	0.01	-0.01
Grade 1 MW → Grade 2 CA	-0.01	0.01	-0.16	-0.01	0.01	-0.21
Kindergarten CA → Grade 1 MW	-6.83***	1.49	-0.04***	-6.83***	1.49	-0.04**
Grade 1 CA → Grade 2 MW	-6.83***	1.49	-4.83**	-6.83***	1.49	-5.37***

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

The multi-group SES analysis indicated that the model fit the data well, χ^2 (102, N = 707) = 714.29, $p < 0.001$; CFI = 0.98, TLI = 0.90, RMSEA = 0.04, SRMR = 0.04. For the low SES ALT model, the intercepts (i.e., the portion of grade 1 measures left unexplained by kindergarten measures) of child anxiety and maternal warmth were significantly different from zero, with significant individual heterogeneity in initial levels. The linear slope of child anxiety was significantly different from zero. Additionally, the intercept of maternal warmth was significantly positively associated with the intercept of child anxiety, such that higher initial levels of maternal warmth were associated with higher initial levels of child anxiety among the low SES group (see Table 13). All autoregressive effects for maternal warmth and child anxiety were significant. These results indicate incremental prediction of these measures at one year from the previous year, over and above what was expected based on the individual trajectories. Cross-lagged analyses indicated significant cross-lagged child effects in this model, such that child anxiety in kindergarten predicted maternal warmth in grade 1, and child anxiety in grade 1 predicted maternal warmth in grade 2. However, similarly to the overarching

model, no cross-lagged parent effects were identified among those with low SES (i.e., no effects of maternal warmth on child anxiety in kindergarten and grade 1; see Table 14).

For the moderate/high SES ALT model, the intercepts (i.e., the portion of grade 1 measures left unexplained by kindergarten measures) of child anxiety and maternal warmth were significantly different from zero, with significant individual heterogeneity in initial levels. The linear slope of child anxiety was significantly different from zero (see Table 13). Autoregressive effects on child anxiety were significant, but were non-significant for maternal warmth. These results indicate incremental prediction of child anxiety measures at one year from the previous year, over and above what was expected based on the child anxiety trajectory. Cross-lagged analyses indicated significant cross-lagged child effects in this model, such that maternal warmth in kindergarten predicted child anxiety in grade 1, and maternal warmth in grade 1 predicted child anxiety in grade 2. However, no cross-lagged child effects were identified among those with high/moderate SES (i.e., no effects of maternal warmth on child anxiety in kindergarten and grade 1; see Table 14).

Table 13. Latent Parameter Estimates from Final ALT Model for Maternal Warmth and Child Anxiety, by Level of SES

Parameter	Low SES		Moderate/High SES	
	Est. (*SE*)	Std. Est.	Est. (*SE*)	Std. Est.
Factor Means				
Intercept – CA	2.29 (0.96)	2.40*	-0.39 (0.30)	-1.29***
Linear Slope – CA	-1.11 (0.44)	-2.50*	-0.01 (0.07)	-0.17***
Intercept – MW	56.79 (7.93)	7.16***	26.54 (6.63)	4.00***
Factor Variances				
Intercept – CA	88.26 (33.29)	2.65**	-0.02 (0.08)	-0.28
Intercept – MW	6550.24 (2981.38)	2.20*	13.47 (9.43)	1.43
Factor Covariances				
Intercept CA ←→ Intercept MW				
	707.55 (254.24)	2.78**	0.71 (0.61)	1.17

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

Table 14. Autoregressive and Cross-Lagged Parameter Estimates from ALT Model for Maternal Warmth and Child Anxiety, by Level of SES

Parameter	Low SES			Moderate/High SES		
	b	SE	β	*b*	SE	β
Autoregressive maternal warmth effects						
Kindergarten → Grade 1	-0.74***	0.11	-0.04***	-0.20	0.30	-0.20
Grade 1 → Grade 2	-0.74***	0.10	-10.41**	-0.23	0.29	-0.15
Autoregressive child anxiety effects						
Kindergarten → Grade 1	0.69***	0.18	0.05**	0.69***	0.18	0.60**
Grade 1 → Grade 2	0.69***	0.18	0.67***	0.69***	0.18	0.56***
Cross-lagged effects						
Kindergarten MW → Grade 1 CA						
	0.01	0.01	0.01	0.01	0.01	0.06
Grade 1 MW → Grade 2 CA						
	0.01	0.01	0.10	0.01	0.01	0.05
Kindergarten CA → Grade 1 MW						
	-3.20**	1.19	-0.02*	-3.20**	1.19	-0.32*
Grade 1 CA → Grade 2 MW						
	-3.20**	1.19	-3.09*	-3.20**	1.19	-0.25**

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; ALT = autoregressive latent trajectory; CA = child anxiety; MW = maternal warmth

3.4. Anxiety Regression Analyses

Study Goal 2: The second goal of this study was to examine whether early school-age maternal warmth (i.e., from kindergarten to grade 2) predicted a composite of anxiety disorder criterion counts at grades 3 and 6, and GAD criterion counts at grades 9 and 12. Given previous research (e.g., McLeod et al., 2007b, Yap et al., 2014; Yap & Jorm, 2015), it was hypothesized that the composite of early school-age maternal warmth would negatively predict anxiety disorder criterion counts at grades 3 and 6, and GAD criterion counts at grades 9 and 12.

3.4.1. Analytic Strategy

To address the second goal of this study, negative binomial regression models were utilized to determine the relationship between maternal warmth and anxiety disorder criterion counts. The anxiety disorder count variables displayed high positive skewness and heteroscedasticity, which is intrinsic to count data (Hilbe, 2011). The literature recommends using a form of Poisson or negative binomial modeling for count outcome

variables (Atkins & Gallop, 2007; Hilbe, 2011, 2014; Muthén & Schultzberg, 2017), as these models follow a gamma distribution rather than a normal distribution. These forms of general linear models (GLM) are considered a better choice for count data than a transformed linear regression due to differences in the assumptions of linear regression models (e.g., the assumptions of linearity and homoescedasticity) and the loss of data that results when transforming zero (or zero plus a constant; Gardner, Mulvey, & Shaw, 1995; Hilbe, 2014; O'Hara & Kotze, 2010). Further, zero-inflated models were regarded as inappropriate because all zeros reported represent true zeroes (i.e., no reported anxiety or GAD symptoms), not a secondary cause (e.g., the reporting period was too brief and did not capture anxiety criterion).

Negative binomial models are preferable to Poisson models in cases when the variance is larger than the mean, which indicates overdispersion of the data (Hilbe, 2014; Muthén & Schultzberg, 2017). Increasing degrees of dispersion around the mean are accounted for in a negative binomial model through increasing values to the parameter. Whereas a Poisson regression fixes the dispersion parameter at one, a negative binomial model estimates the dispersion parameter (Atkins & Gallop, 2007). Further, negative binomial models are preferred over Poisson models given that most real data display overdispersion. Interpretation of an overdispersed Poisson model results in increased risk of a Type 1 error (Hilbe, 2011, 2014). As such, the negative binomial model is considered the more conservative statistical procedure to model count data. However, the best-fitting model was also considered when choosing between a Poisson and a negative binomial model for each regression model. In Mplus, the Bayesian Information Criterion (BIC) is considered the best statistic to test for count-outcome regression model fit, with lower values indicating a better fit (Hilbe, 2014; Muthén & Schultzberg, 2017). For study goal two, negative binomial models provided the best fit for the data. Since regression models using count data do not have standardized residual variance, it is not possible to report R^2 values for these models.

Individual models were created to examine the prediction of the composite maternal warmth measure on the aggregate measure of anxiety disorder symptom counts at grades 3 and 6, respectively, and GAD at grades 9 and 12, respectively. All models

controlled for sex, urban/race status, age, SES, maternal depression, and the Fast Track severity-of-risk screen score. Further, the Urban AA category was used as the urban/race status reference group, and therefore was not included in the regression analyses. Early school-age anxiety problems were also controlled for in study goal two using a composite that encompasses child anxiety problems across kindergarten to grade 2. Exploratory moderation analyses were also conducted to examine whether sex differences (i.e., male or female) or differences based on level of SES existed. To examine SES in a multi-group framework, a median split was conducted to classify scores in the bottom 50% reflecting "low SES" and the top 50% representing "moderate to high SES." An interaction term was added to each model to examine whether sex by warmth or SES by warmth significantly predicted the outcome variable. If this interaction variable was significant, the regression analyses were re-examined separately by child sex and/or level of SES. Tables 15–19 present the results of these analyses.

3.5. Results of Anxiety Regression Analyses

3.5.1. Maternal warmth and anxiety in grade 3.

Maternal warmth did not significantly predict parent-reported DISC-IV anxiety disorder criterion counts at grade 3 (Table 15).

Table 15. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Parent-Reported Anxiety Disorder Criterion Counts in Grade 3

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	-0.02	0.04	0.98
Sex	0.05	0.12	1.05
Urban EA	-0.01	0.13	0.99
Rural EA	-0.12	0.14	0.89
Age	0.04	0.12	1.10
SES	0.00	0.01	1.00
Maternal Depression	0.02*	0.01	1.02
Achenbach Anxiety Problems K–Gr2	0.91***	0.18	2.48
Maternal Warmth K–Gr2	0.01	0.02	1.01

Note. * = $p < 0.05$; *** = $p < 0.001$; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between parent-reported DISC-IV anxiety disorder criterion counts in grade 3 and maternal warmth. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

3.5.2. Maternal warmth and anxiety in grade 6.

Maternal warmth did not significantly predict child-reported DISC-IV anxiety disorder criterion counts at grade 6 (Table 16).

Table 16. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Anxiety Disorder Criterion Counts in Grade 6

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.03	0.05	1.03
Sex	-0.17	0.14	0.84
Urban EA	-0.25	0.14	0.78
Rural EA	-0.53**	0.16	0.59
Age	-0.30*	0.13	0.74
SES	-0.01	0.01	0.99
Maternal Depression	0.02	0.01	1.02
Achenbach Anxiety Problems K–Gr2	0.41*	0.18	1.51
Maternal Warmth K–Gr2	0.00	0.02	1.00

Note. * = p < 0.05; ** = p < 0.01; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV anxiety disorder criterion counts in grade 6 and maternal warmth. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

3.5.3. Maternal warmth and generalized anxiety disorder in grade 9.

Maternal warmth did not significantly predict child-reported DISC-IV generalized anxiety disorder criterion counts at grade 9 (Table 17).

Table 17. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Generalized Anxiety Disorder Criterion Counts in Grade 9

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.32**	0.11	1.38
Sex	-0.89*	0.39	2.44
Urban EA	-0.20	0.55	0.82
Rural EA	-0.92	0.50	0.40
Age	0.53	0.39	1.70
SES	-0.03	0.02	0.97
Maternal Depression	-0.07**	0.03	0.93
Achenbach Anxiety Problems K–Gr2	0.88	0.47	2.41
Maternal Warmth K–Gr2	-0.01	0.05	0.99

Note. * = $p < 0.05$; ** = $p < 0.01$; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV generalized anxiety disorder criterion counts in grade 9 and maternal warmth. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

3.5.4. Maternal warmth and generalized anxiety disorder in grade 12.

Maternal warmth did not significantly predict child-reported DISC-IV generalized anxiety disorder criterion counts at grade 12 (Table 18).

Table 18. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Generalized Anxiety Disorder Criterion Counts in Grade 12

Variable	*B*	*SE*	Exp(*B*)
Risk	0.25	0.13	1.28
Sex	-1.34**	0.41	0.26
Urban EA	0.13	0.56	1.14
Rural EA	-0.44	0.49	0.64
Age	-0.06	0.46	0.94
SES	0.01	0.02	1.01
Maternal Depression	0.06*	0.03	1.06
Achenbach Anxiety Problems Yr1–3	0.60	0.50	1.82
Maternal Warmth Yr 1–3	0.04	0.06	1.04

Note. * = $p < 0.05$; ** = $p < 0.01$; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV generalized anxiety disorder criterion counts and maternal warmth in grade 12. The interaction of sex by maternal warmth was not significant ($p > 0.05$), so further analyses by sex were not conducted. However, the interaction of SES by maternal warmth was significant ($p < 0.01$) so the sample was split by low and moderate-to-high SES to explore differences in the relationship between maternal warmth and child-reported GAD criterion counts. Table 19 presents the results of these analyses. Maternal warmth significantly predicted child-reported DISC-IV generalized anxiety disorder criterion counts at grade 12 among those with low SES ($p < 0.05$). For every one-point increase in maternal warmth scores, generalized anxiety disorder criterion counts decreased by 0.16 points. By exponentiating the coefficient, we find that every one-unit rise in maternal warmth decreased the GAD criterion count score by 15%. Maternal warmth also significantly predicted child-reported DISC-IV generalized anxiety disorder criterion counts at grade 12 among those with moderate-to-high SES ($p < 0.001$). For every-one point increase in maternal warmth scores, generalized anxiety disorder criterion counts increased by 0.17 points. By exponentiating the coefficient, we find that every one-unit rise in maternal warmth increased the GAD criterion count score by 19%.

Table 19. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Parent-Reported Generalized Anxiety Disorder Criterion Counts in Grade 12, by Level of SES

Variable	Low SES			Moderate-to-High SES		
	B	*SE*	Exp(*B*)	*B*	*SE*	Exp(*B*)
Risk	0.04	0.21	1.04	0.45***	0.10	1.57
Sex	-0.97	0.51	0.38	-1.30***	0.32	0.27
Urban EA	0.06	0.72	1.06	-0.01	0.46	0.99
Rural EA	-0.31	0.65	0.73	-0.10	0.42	0.90
Age	-0.21	0.52	0.81	-0.10	0.47	0.90
Maternal Depression	0.07*	0.03	1.07	0.02	0.03	1.02
Achenbach Anxiety Problems K–Gr2	0.63	0.75	1.88	0.04	0.38	1.04
Maternal Warmth K–Gr2	-0.16*	0.07	0.85	0.17***	0.04	1.19

Note. * = p < 0.05; *** = p < 0.001; EA = European American; K = kindergarten; Gr = grade

3.6. Depression Regression Analyses

Study Goal 3: The third goal was to examine whether early school-age maternal warmth predicted depressive disorder criterion counts at grades 3, 6, 9, and 12. Given previous research (e.g., McLeod et al., 2007a, Yap et al., 2014; Yap & Jorm, 2015), it was hypothesized that the composite of maternal warmth (i.e., from kindergarten to grade 2) would negatively predict depressive disorder criterion counts at grades 3, 6, 9, and 12.

3.6.1. Analytic Strategy.

Negative binomial regression analyses were used to determine the association between maternal warmth and depressive disorder criterion counts. For more detailed description of these models and fit, see the analytic strategy for study goal two. Negative binomial models provided superior fit (i.e., lower BIC values) to Poisson models and were used for all regression models in study goal three. Individual models were created to examine the prediction of the composite maternal warmth measure on depressive disorder symptom counts at grades 3, 6, 9 and 12, respectively. All models controlled for sex, urban/race status, age, SES, maternal depression, and the Fast Track severity-of-risk screen score. Further, the Urban AA category was used as the urban/race status reference group, and therefore was not included in the regression analyses. Exploratory moderation analyses were also conducted to examine whether sex differences or differences based on level of SES existed. An interaction term was added to each model to examine whether sex by warmth or SES by warmth significantly predicted the outcome variable. If this interaction variable was significant, the regression analyses were re-examined separately by child sex and level of SES. Tables 20–24 present the results of these analyses.

3.7. Results of Depression Regression Analyses

3.7.1. Maternal warmth and depression in grade 3.

Maternal warmth did not significantly predict parent-reported DISC-IV depressive disorder criterion counts in grade 3 (Table 20).

Table 20. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Parent-Reported Depressive Disorder Criterion Counts in Grade 3

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.11	0.12	1.12
Sex	0.68*	0.29	1.97
Urban EA	-0.10	0.29	0.90
Rural EA	0.05	0.38	1.05
Age	-0.41	0.28	0.66
SES	-0.02	0.01	0.98
Maternal Depression	0.04**	0.01	1.04
Maternal Warmth K–Gr2	-0.01	0.05	0.99

Note. * = p < 0.05; ** = p < 0.01; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between parent-reported DISC-IV depressive disorder criterion counts and maternal warmth in grade 3. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

3.7.2. Maternal warmth and depression in grade 6.

Maternal warmth did not significantly predict child-reported DISC-IV depressive disorder criterion counts at grade 6 (Table 21).

Table 21. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Depressive Disorder Criterion Counts in Grade 6

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.30	0.15	1.34
Sex	0.32	0.55	1.38
Urban EA	-0.48	0.60	0.62
Rural EA	0.12	0.65	1.13
Age	-1.68*	0.72	0.19
SES	0.01	0.02	1.01
Maternal Depression	0.07	0.04	1.07
Maternal Warmth K–Gr2	0.03	0.08	1.03

Note. * = p < 0.05; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV depressive disorder

criterion counts in grade 6 and maternal warmth. The interaction of sex by maternal warmth was not significant ($p > 0.05$), so further analyses were not conducted. However, the interaction of SES by maternal warmth was significant ($p < 0.05$), so the sample was split by low and moderate-to-high SES to explore differences in the relationship between maternal warmth and child-reported DISC-IV depressive disorder criterion counts. Table 22 presents the results of these analyses. Maternal warmth did not significantly predict child-reported DISC-IV depressive disorder criterion counts at grade 6 among those with low SES ($p > 0.05$); however, it did significant predict DISC-IV depressive disorder criterion counts at grade 6 among those with moderate-to-high SES. For every one-point increase in maternal warmth scores, depressive disorder criterion counts among those with low-to-moderate SES increased by 0.31 points. By exponentiating the coefficient, we find that every one-unit rise in maternal warmth increased the GAD criterion count score by 36%.

Table 22. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Depressive Disorder Criterion Counts in Grade 6, by Level of SES

Variable	Low SES			Moderate-to-High SES		
	B	*SE*	Exp(*B*)	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.28	0.24	1.32	0.44***	0.10	1.55
Sex	1.68*	0.71	5.36	-0.10	0.14	1.11
Urban EA	-0.62	0.82	0.54	-0.14	0.19	1.15
Rural EA	3.13***	0.83	22.87	-0.44***	0.12	0.64
Age	-0.16	0.77	0.85	-0.37**	0.13	0.69
Maternal Depression	0.03	0.04	1.03	0.53***	0.12	1.70
Maternal Warmth K–Gr2	-0.12	0.09	0.88	0.31*	0.15	1.36

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; EA = European American; K = kindergarten; Gr = grade

3.7.3. Maternal warmth and depression in grade 9.

Maternal warmth did not significantly predicted child-reported DISC-IV depressive disorder criterion counts at grade 9 (Table 23).

Table 23. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Depressive Disorder Criterion Counts in Grade 9

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.49***	0.13	1.63
Sex	-1.41**	0.43	0.24
Urban EA	1.30	0.71	3.67
Rural EA	-2.00***	0.49	0.14
Age	0.54	0.42	1.71
SES	-0.06**	0.02	0.94
Maternal Depression	-0.02	0.03	0.98
Maternal Warmth K–Gr2	-0.05	0.06	0.95

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV depressive disorder criterion counts and maternal warmth in grade 9. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

3.7.4. Maternal warmth and depression in grade 12.

Maternal warmth did not significantly predict child-reported DISC-IV depressive disorder criterion counts at grade 12 (Table 24).

Table 24. Negative Binomial Regression Model Estimating the Effects of Maternal Warmth on Child-Reported Depressive Disorder Criterion Counts in Grade 12

Variable	*B*	*SE*	Exp(*B*)
Severity-of-Risk	0.09	0.14	1.09
Sex	0.25	0.50	1.28
Urban EA	-0.11	0.55	0.90
Rural EA	0.54	0.63	1.72
Age	0.28	0.50	1.32
SES	-0.02	0.02	0.98
Maternal Depression	0.09**	0.03	1.09
Maternal Warmth K–Gr2	0.10	0.06	1.11

Note. ** = p < 0.01; EA = European American; K = kindergarten; Gr = grade

Exploratory moderation analyses were conducted to investigate sex and SES differences in the relationship between child-reported DISC-IV depressive disorder

criterion counts in grade 12 and maternal warmth. Neither the interaction of sex by maternal warmth or SES by maternal warmth was significant (*p*s > 0.05).

Chapter 4.

Discussion

This is the first known study to examine the bidirectional relationship between childhood anxiety and maternal warmth at early school age using autoregressive latent trajectory (ALT) modeling, and to longitudinally extend those analyses to test the prediction of early school-age maternal warmth on anxiety and depressive disorder symptomatology at grades 3, 6, 9, and 12. The goals of this study were threefold. First, this study aimed to examine the relationship between maternal warmth and child anxiety across three early school-age years (i.e., kindergarten to grade 2) and to explore the directionality of this relationship. Second, this study investigated whether early school-age maternal warmth predicted a composite of anxiety disorder criterion counts at grades 3 and 6, and generalized anxiety disorder (GAD) criterion counts at grades 9 and 12. Third, this study examined whether early school-age maternal warmth predicted depressive disorder criterion counts at grades 3, 6, 9, and 12. Exploratory analyses were conducted for each goal to examine whether group differences existed by sex (i.e., male and female) and SES (i.e., low or moderate-to-high).

4.1. Bidirectionality of Maternal Warmth and Child Anxiety

The results of this study are a significant contribution to existing research investigating the relationship between maternal warmth and anxiety. While there is a substantial body of literature exploring how these constructs may be related, the temporal ordering of parent and child effects remains to be fully elucidated (Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011). This study addressed this knowledge gap by using ALT modeling to examine these constructs and, specifically, to provide more refined evidence for the directionality of this relationship at early school age. Findings supported a child effect model, but not a parent effect model. Namely, anxiety in kindergarten significantly negatively predicted maternal warmth in grade 1 and anxiety in grade 1 significantly negatively predicted maternal warmth in grade 2. This supports an

early, but accumulating, body of evidence regarding the impact of child anxiety on parental warmth (Gouze et al., 2017; Lansford et al., 2018; Van Zalk & Kerr, 2011). These results support recent speculation that child anxiety, over time, may lead parents to withdraw and show less affection as a result of greater reticence, withdrawal behaviours, and avoidance from children (Hipwell et al., 2008). Similarly to Van Zalk and Kerr (2011), this study did not find evidence to support a parent effect and, therefore, does not support a reciprocal relationship. Maternal warmth did not, in turn, significantly predict decreases in child anxiety. Further, this study showed that maternal warmth tends to slightly increase during this developmental period. This aligns with previous research examining maternal warmth on this sample (i.e., Zheng, Pasalich, Oberth, McMahon, & Pinderhughes, 2017), and provides additional support for the longitudinal investigation of parenting in order to capture its dynamic properties. Exploratory sex and SES analyses did not identify group differences between males or females and those with low or moderate-to-high SES.

Overall, these findings align with those who have previously examined the bidirectionality of parental warmth and anxiety; Gouze and colleagues (2017), Lansford and colleagues (2018), and Van Zalk and Kerr (2011) found evidence for the directionality of child effects. In addition, both Gouze and colleagues and Lansford and colleagues found a parent effect. Gouze and colleagues found that parental warmth at age 5 negatively predicted child anxiety at age 6/7. However, they did not find the same effect at a younger age; parental warmth at age 4 did not predict child anxiety at age 5. Lansford and colleagues found strong and consistent child effects (i.e., high child internalizing behaviour predicted lower parental warmth) across the majority of cultural groups from age 8 to 9 and age 10 to 12, and for most cultural groups across from age 9 to 10 and age 12 to 13. They also found parenting effects (i.e., low parental warmth predicting high child internalizing behaviour) among each cultural group, such that parental warmth at age 8 and 9 were negatively associated with child internalizing behaviours at ages 9 and 10, respectively; however, no other significant effects at the older age groups were identified. Similarly to the current study, Van Zalk and Kerr found a child effect only, such that social anxiety predicted decreases in perceived parental warmth among early adolescents; however, given the different developmental stage of

these participants, these constructs may relate differentially during this period. While the results of the current study are broadly congruent with previous research, differences in findings could be attributable to differences in methodology and statistical modeling. Gouze and colleagues, Lansford and colleagues, and Van Zalk and Kerr used autoregressive cross-lagged panel modeling, which does not take into account the relationship between the two constructs at the level of their underlying trajectories *and* at the level of time-specific measures such as ALT modeling does (Berry & Willoughby, 2017). Further, these studies used parent- and youth-report measures of warmth, respectively, which may be less reliable and sensitive measures of parenting than observational methods (McKee et al., 2013; McLeod et al., 2007b; Taber, 2010). Overall, this study provides an important step in further understanding how child anxiety and parental warmth relate during the early school-age developmental period, and supports previous research demonstrating a child effect such that child psychopathology drives subsequent change in parenting behaviour.

4.2. Early School Age Maternal Warmth, Youth Anxiety, and Youth Depression

It has been posited that low parental warmth may be related to anxiety as a result of increasing sensitivity to anxiety by undermining the child's ability to regulate emotions (McLeod et al., 2007b), while its relation to depression may be a result of low parental warmth undermining self-esteem, promoting a sense of helplessness, and prompting the development of negative self-schemas (Garber & Flynn, 2001; McLeod et al., 2007a; Rapee, 1997). Although much research has documented the relationship between parental warmth and both child anxiety and depression retrospectively and cross-sectionally, very few studies have explored this relationship longitudinally. A number of recent reviews have underlined the need for longitudinal investigation of these constructs (McLeod et al., 2007a; Negreiros & Miller, 2014; Yap & Jorm, 2015; Yap et al., 2014). Contrary to hypotheses, none of the main effects of maternal warmth on anxiety or depression across middle childhood through adolescence were significant. These findings are inconsistent with the one previous longitudinal study examining parental warmth and both pediatric anxiety and depression, which found that parental

warmth was predictive of anxiety and depression among 9–15 year olds (i.e., Barry et al., 2008). However, similarly to the current study, previous longitudinal research exploring this relationship up to mid-adolescence has failed to show a significant relation between parental warmth and anxiety (e.g., Schwartz et al., 2012; Sentse et al., 2010). Conversely, a number of studies have shown parental warmth and depression to be related longitudinally (Yap & Jorm, 2015; Yap et al., 2014).

The differences in findings between the current study and that of Barry and colleagues (2008) may be due to methodological differences. Barry and colleagues measured anxiety and depression using subscale scores from the Behavior Assessment Scale for Children (BASC; Reynolds & Kamphaus, 1992), a broadband scale of behavioural and emotional problems, as opposed to criteria from a clinical interview (i.e., DISC-IV). Further, they used parent- and self-report measures of warmth, rather than observational methods of parent-child interactions, which are considered more objective assessments of parenting (McKee et al., 2013; Taber, 2010).

It is also important to address the lower than expected base rates of anxiety and depression found in this study, and their potential contribution to these null findings. The current study found lower than anticipated population base rates of anxiety and depression, particularly in grades 9 and 12 for GAD and across grades 3, 6, 9, and 12 for major depressive disorder. While it is unclear why these sample rates of diagnosable internalizing disorders were so low among this sample, it is important to address the potential of a Type II error in this study. Specifically, it may be that we failed to reject the null hypothesis erroneously given issues with statistical power, regardless of the large sample size. One possibility is that the clinical interview used (i.e., DISC-IV) was less sensitive to sub-clinical features of anxiety that appear in a typical population. Future use of a narrow-band subscale of anxiety and depression may elucidate this relationship and align with previous research.

While this study did not find main effects of maternal warmth on anxiety or depression, it did find a number of isolated moderation findings related to SES. Specifically, maternal warmth *negatively* predicted GAD criterion counts among those

with low SES in grade 12, and maternal warmth *positively* predicted depressive disorder and GAD criterion counts in grade 6 and grade 12, respectively, for those youth in the moderate-to-high SES group. This study found that among children in grade 6 with moderate-to-high SES, maternal warmth *positively* predicted depressive disorder criterion counts. Jones and colleagues (2008) also examined the relation between parental warmth and depression, and found that parental warmth was longitudinally *positively* related to depression in 6–13 year olds, such that increases in warmth were associated with increases in depressive features. However, their sample was primarily composed of inner-city African American children, and was therefore likely a low SES sample. Conversely, Sagrestano, Holmbeck, Paikoff, and Fendrich (2003) found that parental warmth *negatively* predicted subsequent depressive disorder symptoms among a low SES sample when using parent-report measures of warmth, but not when using observational methods. While there is not a strong empirical consensus regarding the relationship between these constructs at different levels of SES, previous research in this area may help explain the results of the current study. In their meta-analysis, McLeod and colleagues (2007a) found a pattern in which studies with high SES samples yielded stronger correlations between parenting and childhood depression than did lower SES samples. They noted that this pattern of findings suggested that parenting behaviours, such as warmth, might have more salient consequences for depression at higher levels of SES. Given that lower SES families experience a broader range of stressors at greater frequencies than high SES families (Bolland, Lian, & Formichella, 2005), it may be that depression is less dependent on parenting behaviour among these families than it is on other stressors, such as exposure to violence and traumatic stress. Although meta-analyses assessing parental warmth and anxiety did not detect the same SES-moderated effects (e.g., Mcleod et al., 2007b), they noted that there was limited power to conduct such analyses. As such, it may be that other family or neighbourhood factors are interacting with, or are more strongly responsible for, internalizing outcomes among these low SES youth than are parenting behaviours. Future research should include measurements of other common stressors among a low SES population to disentangle this relationship.

In regards to the *positive* relations between warmth and both depression and anxiety among a subset of the moderate-to-high SES sample, the most probable explanation is the directionality of the relationship. It may be that anxiety and depression among adolescents are associated with subsequent increases in parental warmth, *not* that increased parental warmth leads to increases in internalizing features. Jones and colleagues (2008) suggested that "the most likely explanation for [their] finding [of a positive relationship between parental warmth and child depression] is that children's depressive symptoms lead mothers to ramp up their warmth"; however "depressed children may be more likely to doubt the sincerity of increases in maternal warmth and support (i.e., "reassurance"), which in turn may exacerbate, rather than ameliorate, their depressive symptoms" (p. 189). Further, previous research has indicated that higher SES parents may be more receptive to children's emotional needs (Martini et al., 2004), and are more capable of adapting their parenting behaviour to children requiring special attention (Paulussen-Hoogeboom et al., 2007). As such, it may be that the results found in this study among moderate-to-high SES participants are better explained as parents aptly increasing their level of warmth as a response to observed difficulties with anxiety and depression. As aforementioned, Gouze and colleagues (2017), Lansford and colleagues (2018), and Van Zalk and Kerr (2001) found child effects, such that anxiety predicted decreases in parental warmth among early adolescents and early school age children, respectively. Further, the current study similarly demonstrated that the direction of effects at early school age is from child to parent (i.e., child anxiety had an effect on subsequent maternal warmth). Together, these studies suggest that anxiety problems may engender increases in positive regard expressed towards the child and sensitivity towards the child's experiences. While the current study did not examine the directionality of effects during middle childhood to adolescence, these accumulating research findings provide ample rationale to examine the directionality, and potential transactional nature, of this relationship in future studies.

4.3. Strengths and Limitations

This study has several strengths. First, a large sample size (N = 753) and geographically diverse population (i.e., participants from urban and rural locations across

4 U.S. sites), with comparable numbers of EA and AA families, allowed for both broad and specific research questions to be examined with ample statistical power. Further, this study had access to both parent- and child-report measures of internalizing problems. While parent-report methods of measuring child anxiety are considered valid (Cole, Hoffman, Tram, & Maxwell, 2000), investigations of parent versus child reports demonstrate that youth are better reporters of internalizing features whereas parents are better reporters of externalizing problems (Cantwell, Lewinsohn, Rohde, & Seeley, 1997; Klein, Dougherty, & Olino, 2005; Silverman & Ollendick, 2005). Research has indicated that parents tend to underreport internalizing symptoms in their children, particularly in non-clinical samples (Cartwright-Hatton, McNicol, & Doubleday, 2006), and therefore parent reports may not capture the true incidence or severity of internalizing symptoms among their children. However, younger children are still developing cognitive abilities related to understanding internal processes, and have limited insight into these processes, and are therefore typically not considered valid reporters until approximately age 9–10 (Albano & Silverman, 1996). As a result, relying on parent report of anxiety in younger children is necessary. As informed by the literature, the current study used parent-report measures of internalizing features from kindergarten to grade 3 and child-report measures in grades 6, 9, and 12.

Third, a marked strength of this study is the observational measure of maternal warmth. Interpretations regarding the relation of parenting behaviours and anxiety vary depending on the form of measurement used. Many different methods of assessing parenting behaviour exist (McMahon & Metzler, 1999). While there is some disagreement as to the best measure of parenting (Locke & Prinz, 2002), direct observations of parent-child interactions by independent raters are typically seen as the "gold standard" for the reliable, objective assessment of parenting (McKee et al., 2013; Taber, 2010). Meta-analytic research has also demonstrated a stronger association between parenting behaviour and child anxiety when observational methods of parenting are used (i.e., *ES* = .28 for observational methods; *ES* = .21 for child-report, *ES* = .14 for parent-report); McLeod et al., 2007b), indicating that this method may be more sensitive to the relationship between these constructs. Further, while this study examined parent and child features in a community sample, the use of a clinical diagnostic measure of

anxiety and depression in later childhood and adolescence (i.e., the DISC-IV) contributes to potential generalizability to clinical populations and outcomes.

This study also has a number of limitations. First, a measure of maternal depression was employed as a covariate to examine the relation between maternal warmth and child anxiety and depression over and above any effects directly related to mothers' depressive features. However, this study did not have access to a measure of parental anxiety. Research has shown that level of parent anxiety is a predictor of later child anxiety, over and above genetic contributions (Rapee, 2009), and may moderate outcomes between warmth and anxiety (e.g., Gar & Hudson, 2008; Teetsel, Ginsburg, & Drake, 2014; Williams, Kertz, Schrock, & Woodruff-Borden, 2012). As such, future research exploring these constructs may include parental anxiety as a covariate, or explore potential moderation effects that exist in parents with differing levels of anxiety.

Although early childhood anxiety and maternal warmth were analyzed bidirectionally, this study focused on this relationship unidirectionally in later childhood and adolescence. However, it cannot be assumed that they direction of effects exists from parental warmth to child and adolescent anxiety and depression. In fact, the results of this study, paired with previous research, suggest that the directionality of effects may be from child to parent (e.g., Jones et al., 2008; Sagrestano et al., 2003; Van Zalk & Zerr, 2001). Moreover, a more complex transactional relationship between these constructs may exist in later childhood and adolescence. The results of this study highlight the need for future research to explore the directionality of the relationship between parental warmth and internalizing problems at different developmental periods (e.g., late childhood, adolescence) in order to further elucidate our understanding in this important area of research.

The sample demographics represent a relative limitation, as parent informants were exclusively mothers. Studies in this area overwhelmingly use maternal reports, as mothers are often the most easily accessible and available reporters; however, there may be differences in the relationship between parental warmth, anxiety, and depression when parent dyads are compared. Some research has shown that mothers and fathers respond

differently to children's negative emotions (Nelson, O'Brien, Blankson, Calkins, & Keane, 2009), and that fathers may be differentially involved in the development of anxiety disorders in their children (Bögels & Phares, 2008). Mezulis, Shibley Hyde, and Clarke (2004) examined the role of paternal and maternal warmth and child internalizing features from birth to 4-years-old and found that *lower* levels of self-reported paternal warmth were associated with fewer internalizing symptoms in infancy. This suggests a differential relationship between paternal warmth and child anxiety than maternal warmth and child anxiety. However, other research has shown similar contributions by both mothers and fathers (del Barrio, Holgado-Tello, & Carrasco, 2016). Future research should aim to include both mothers and fathers to disentangle the relations between these constructs across parents.

This study exclusively focused on warmth, and did not address other parenting behaviour domains, such as parental control. Further, within the area of parental rejection, subdomains of withdrawal and aversiveness were not explored. Future research in this area should aim to extend our understanding of these constructs by similarly exploring the directionality of the relationships between these factors and child internalizing outcomes, as this is a notable gap in the literature.

4.4. Clinical Implications

A central goal of this research was to provide a foundation for more specific directions for prevention and intervention research on childhood internalizing problems. The results of this study suggest that early school-age child anxiety has a stronger impact on subsequent maternal warmth than the inverse, and provides evidence to support future research regarding the directionality of the relationship between warmth and internalizing problems into adolescence. Silverman, Kurtines, Jaccard, and Pina (2009) demonstrated that the dynamics of change in treatment are bidirectional. However, they found much stronger evidence to support the premise that improvements in child functioning positively influence parenting rather than that parents positively influence child outcomes. They demonstrated that reductions in child anxiety symptoms were associated with subsequent reductions in negative parenting (i.e., decreases in parent anxiety,

youth's evaluation of parent-child conflict, and negative parenting behaviours). However, there is evidence that parental warmth is modifiable, and that purposeful increases in parental warmth may result in decreases in anxiety and depressive problems in adolescents over time (Zhou, Sandler, Millsap, Wolchik, & Dawson-McClure, 2008). However, very limited clinical research has examined changes in parenting behaviour as a function of intervention for child internalizing problems and, therefore, to what extent improvements in child anxiety may be associated with changes in parent behaviour (see Forehand, Jones, & Parent, 2013, for a review; Silverman et al., 2009).

Limitations in consistent findings regarding the relation between parenting and child anxiety, and the lack of translation from research to clinical practice, further highlight the need for additional research to longitudinally explore the relationship between parenting behaviours and anxiety (Negreiros & Miller, 2014). A greater understanding of the role of parental warmth in the development, maintenance, and amelioration of anxiety, and vice versa, may ultimately result in more specific targeting of parent behaviours in interventions for clinical anxiety. Further, while the current study demonstrates that child anxiety influences maternal warmth at early school age, the directionality of the relationship between these constructs, as well as depression, in later childhood and adolescence is unclear and requires further investigation.

4.5. Summary and Future Directions

This study investigated maternal warmth, child anxiety, and child depression in a sample of 753 boys and girls followed prospectively from kindergarten to grade 12. Parental warmth has previously been identified as a contributing factor to child anxiety; however, the bidirectionality of these constructs had only once been measured in a population of children at early school-age (Gouze et al., 2017), and had not before been measured both longitudinally and observationally. The results of this study extend previous research suggesting that child psychopathology may result in increasing negative parenting behaviours over time (Hipwell et al., 2008). Specifically, this study demonstrated that anxiety at kindergarten was negatively predictive of maternal warmth at grade 1, and that anxiety at grade 1 was negatively predictive of maternal warmth at

grade 2. Additionally, this study extended previous research highlighting the relationship between maternal warmth and child anxiety and depression in late childhood to adolescence. Findings indicated that maternal warmth *negatively* predicted GAD criterion counts among those with low SES in grade 12, such that lack of maternal warmth at early school age predicted the presence of GAD criterion counts at grade 12 among those with low SES. Maternal warmth *positively* predicted GAD and depressive disorder criterion counts among those with moderate-to-high SES in grade 12 and grade 6, respectively, such that higher levels of maternal warmth at early school age were associated with GAD and depressive disorder criterion counts at grade 12 and grade 6, respectively, among those with moderate-to-high SES. These results are understood within a larger discussion of risk factors associated with low SES as well as by examining the directionality of effects. It is strongly recommended that future research measure anxiety and depression longitudinally across the early developmental lifespan alongside observed parental warmth to disentangle the complex relationship between these constructs. Further, it may be warranted to use both a clinical measure of internalizing problems, similarly to this study (e.g., DISC-IV), alongside more commonly broadband scales (e.g., CBCL) or more specific continuous measures of anxiety or depression (e.g., MASC-2, CDI-2), in order to more sensitively capture subclinical aspects of internalizing problems among a non-clinical population.

Understanding the nature of the association between parenting and internalizing problems is crucial for appropriate design and implementation of interventions to prevent the onset of anxiety, depression, and associated deleterious outcomes among children and youth. The utmost goal is to identify a profile of risk that includes both early internalizing problems and parenting factors in order to positively benefit healthy outcomes among children and families. Although there have been many contributions to research exploring parental warmth and internalizing problems, far too few have the methodological and statistical rigour to answer important questions that will lead to advances in the prevention and treatment of these problems. This study provides a small contribution towards a better understanding of these relationships, and informs the design of future studies in this area.

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