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ANTECEDENTS OF ANXIETY SYMPTOMS IN PRESCHOOLERS: THE

INTERPLAY OF FEARFUL TEMPERAMENT, SLEEP REGULATION, AND

MATERNAL PROTECTIVENESS

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Abstract

Although children's regulatory skills (e.g. physiological, affective, attentional regulation) have been hypothesized to explain the longitudinal relations among temperamental characteristics, parenting, and anxiety symptom development, few studies have directly tested this proposition (Bosquet & Egeland, 2006; Degnan & Fox, 2007; Thompson, 2001). The present study examined observational and questionnaire data on 124 children and their mothers to test whether fearful temperament and maternal protective parenting behaviors may predict preschool-age sleep dysregulation. Sleep regulation—encompassing emotion, attention, arousal regulation—was examined as an intermediate developmental outcome that may be meaningfully related to early fearful temperament and later development of anxiety symptoms. The possible conditional indirect effects of fearful temperament on symptoms of separation anxiety and worry at kindergarten entry were also examined.

Contrary to the study hypotheses, the findings indicated that high levels of maternal protective behaviors predicted significantly fewer sleep dysregulation problems for temperamentally fearful children, whereas similar levels of protective behaviors predicted greater sleep dysregulation in children who were rated as less fearful as toddlers. Furthermore, although specific indices of preschool-age sleep dysregulation uniquely predicted anxiety symptoms at kindergarten entry above and beyond the prediction made by concurrent symptoms of anxiety at age 4, significant indirect relationship between fearful temperament and anxiety symptoms at kindergarten entry was not found. Implications of the present study findings and limitations are discussed.

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Introduction

Anxiety is a normative emotion that may at times serve an adaptive function (e.g. detection and avoidance of possible threat). However, anxiety symptoms that appear early in childhood have been identified as particularly robust predictors of subsequent development of the spectrum of anxiety symptoms (Hirshfeld-Becker, Micco, Simoes, & Henin 2008; Mian, Wainwright, Briggs-Gowan, & Carter, 2011). Exploring the links between early anxiety symptomatology and developmental antecedents of such symptoms has important implications for prevention efforts. A developmental psychopathology framework of anxiety development proposed by Vasey and Dadds (2001) posits that multiple factors implicated in anxiety development likely have a "probabilistic relation," whereby certain predisposing factors may increase the likelihood of the subsequent occurrence of other risk factors and intensify the emerging symptoms of anxiety. Consistent with the above perspective, the present study examined the associations among a set of factors associated with the emergence of anxiety symptoms in early childhood, in an attempt to explain a potential pathway of anxiety symptom development in preschoolers (see Figure 1). The present study conceptualized anxiety as a deviant outcome that results from the dynamic transaction between the child's "inner constitutional" (i.e. fearful temperament) and proximal environmental factors (i.e. maternal overprotective behaviors) (Cicchetti, 1986; Sameroff, 2000). The potential role of children's sleep regulation—an index of self-regulation—in anxiety symptom development was also examined.

Extant literature on anxiety development has identified a number of factors that are associated with an elevated risk for anxiety in children. Among the most frequently examined

factors include genetic risk factors (Warren, Schmitz, & Emde, 1999), temperamental vulnerability (Schwartz, Snidman, & Kagan, 1999), attachment (Warren, Huston, Egeland, & Sroufe, 1997), and a range of caregiver influences, such as parenting behaviors (McLeod, Wood, & Weisz, 2007; Rapee, 1997), parental psychopathology (Biederman et al., 2007), and family characteristics (e.g. isolation from a broader social network) (Bruch & Heimberg, 1994).

A growing number of studies also suggest that several indices of regulatory competence are associated with childhood anxiety and also that specific measures of regulation (e.g. emotion, attention) may signal risk for anxiety symptom development (Bosquet et al., 2006; Carthy, Horesh, Apter, & Gross, 2010; Dahl, 1998; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Gregory, Caspi, Eley, Moffitt, O'Connor, & Poulton, 2005; Weems, Zakem, Costa, Cannon, & Watts, 2005). Sleep represents a regulatory process that has conceptual and empirical significance in its relation to anxiety. Sleep encompasses regulation of several domains—attention, physiological arousal, emotion—that characterize the anxiety response system (Dahl, 1996). Research evidence documenting the frequent co-occurrence and the diagnostic overlap between anxiety and sleep-related problems also reinforces the theoretical association between sleep and anxiety (Alfano, Ginsburg, & Kingery, 2007). It has also been suggested that childhood sleep problems may specifically predict future onset of anxiety but not depression in adulthood (Gregory et al., 2005). Given the high prevalence rate of sleep-related problems in early childhood, establishing and understanding the predictive association between sleep and anxiety spectrum symptoms may add to the current body of knowledge on the developmental antecedents of childhood anxiety.

In summary, the present study examined a potential pathway to anxiety symptom development by exploring the associations among children's temperamental fearfulness,

sleep regulation, and maternal protective parenting behaviors as important individual and environmental factors that jointly contribute to the development of symptoms of anxiety in preschool-age children. More specifically, protective parenting behaviors were hypothesized to increase the risk for anxiety development in fearful toddlers by influencing children's regulatory skills involved in initiating and maintaining consolidated sleep. The following sections review the etiological significance of sleep and other developmental antecedents of anxiety symptomatology, as well as the hypothesized associations among the factors.
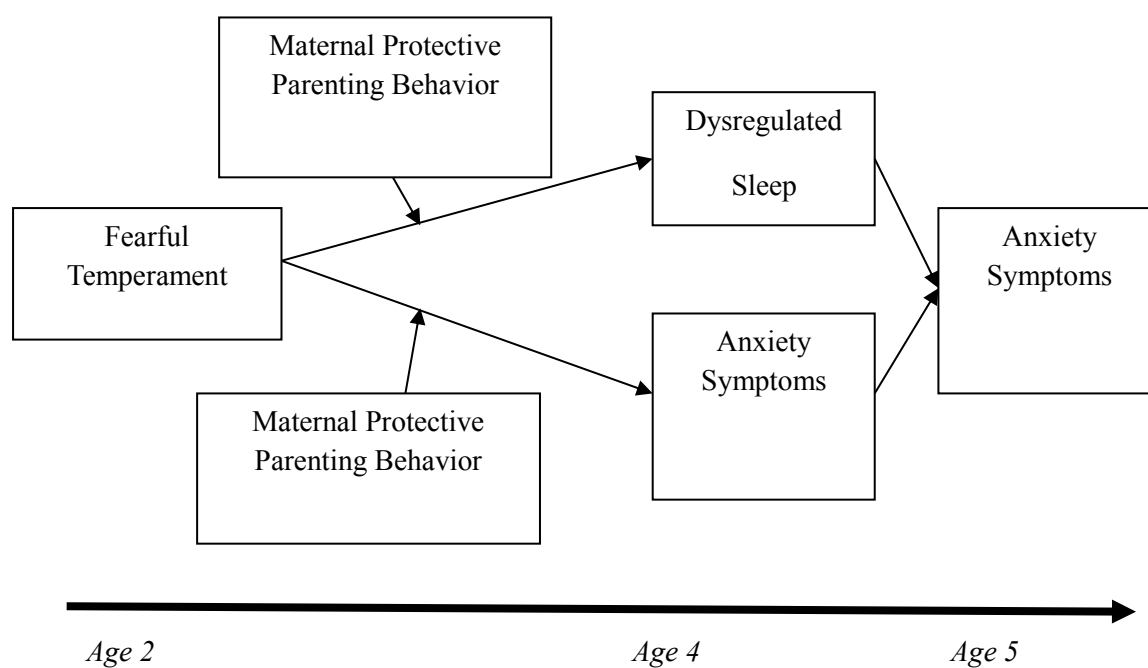
Figure 1. A Conceptual Model of Anxiety Symptom Development: Maternal Protective Parenting as a Moderator of the Two Potential Mediated Pathways from Fearful Temperament to Dysregulated Sleep and Anxiety Symptoms.

Fearful Temperament as an Early Predictor of Anxiety

　　　　Several challenges to reliable assessment of anxiety symptoms before the preschool

age have been noted (Warren, Umylny, Aron, & Simmens., 2006). Most notably, toddlers' limited capacity for introspection and articulation of internal states creates a challenge to reliable assessment of children's emotional and cognitive experiences associated with anxiety (Alfano, Beidel, & Turner, 2002). For example, studies have suggested that children younger than 6 years of age generally lack the abilities to detect their own cognitions and report details of the content of their thoughts (Flavell, Green, & Flavell, 2000). Young children may also have difficulty understanding the relationship between thoughts and emotions (Flavell, Flavell, & Green, 2001), and such difficulty may be more evident in anxious youth (Southam-Gerow & Kendall, 2000). Cognitive immaturity in this age-group has also been linked to more concrete (e.g. fear of physical threat) and less abstract types of fear-related cognitions and worries compared to older children (Vasey, Crnic, & Carter, 1994). Furthermore, it has been noted that the cognitive capacity for social evaluative concerns—a core symptom for the diagnosis of social phobia—do not emerge until about 4 years of age (Asendorpf, 1989; Warren et al., 2006). Thus, diagnoses such as social phobia or generalized anxiety disorder are often precluded until such capacity becomes evident near school entry (Warren et al., 2006). Taken together, available evidence suggests that toddlers lack skills to reflect on and to accurately report their anxious cognitions and emotions and limitations in emotional and cognitive awareness are also associated with the way children may experience anxiety (Muris, Merckelbach, Gadet, & Moulaert, 2000). Given such limitations, the study of temperament has served a particularly important role in elucidating the characteristics that are associated with an elevated risk for developing anxiety disorders (Biederman et al., 2001; Muris, van Brakel, Arntz, & Schouten, 2010; Warren & Dadson, 2001).

An impressive body of research suggests that fearful temperament [1](often studied as behavioral inhibition, shyness, and approach/withdrawal (Rapee & Coplan, 2010) represents an important index of early vulnerability for development anxiety symptomatology (Biederman et al., 2001; Buss, 2011; Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kagan, Snidman, Zentner, & Peterson, 1999; Schwartz et al., 1999). Fearful temperament broadly refers to a constellation of behavioral characteristics such as a tendency to experience and display heightened levels of fear and distress in response to novelty (Kagan, Reznick, & Snidman, 1988), and shyness and lack of approach in social situations (Rubin & Asendorpf, 1993). Longitudinal prospective studies have documented that fearful temperament is associated with an increased risk of social phobia in later childhood (Biederman et al., 1990; Hirshfeld-Becker et al., 2007; Schwartz et al., 1999) and these findings are corroborated by retrospective reports of childhood fearful temperament by anxious adolescents and adults (Gladstone, Parker, Mitchell, Wilhelm, & Malhi, 2005; Hayward et al., 2008).

The importance of considering temperamental fearfulness in relation to anxiety is also highlighted by the fact that there is a significant degree of overlap in the defining characteristics of the two constructs (Goldsmith & Lemery, 2000; Perez-Edgar & Fox, 2005). Phenotypic expressions and endophenotypic markers of both conditions share a set of features: behavioral avoidance, psychophysiological response patterns, attentional vigilance to threat, and patterns of emotion dysregulation. Avoidant behavioral patterns that typify clinically anxious individuals are also documented to be common in temperamentally fearful

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[1] Consistent with the common approach taken in extant literature on the continuity between temperament and anxiety, fearful temperament is used in the present study as an inclusive term that encompasses major variants of temperamental antecedents of anxiety development, including inhibition, shyness, approach/withdrawal, and fear proneness

children (Lang, 1985): Behavioral avoidance, shown as lack of behavioral approach and withdrawal in potentially threatening situations (Buss, 2011; Garcia-Coll, Kagan, & Reznick, 1984). High-levels of physiological reactivity as demonstrated by heart rate variability, electroencephalographic asymmetry, and greater startle response to threat have also been associated with both fearful temperament and anxiety (Calkins, Fox, & Marshall, 1996; Fox, et al., 2001; Kagan, Reznick, & Snidman, 1987). Growing research also indicates that greater attentional bias to threat is commonly seen in temperamentally fearful toddlers and clinically anxious individuals, such that both groups are vigilant to potential threat and show a tendency to react disproportionately to lower threshold level of threat (Bar-Haim et al, 2007; Perez-Edgar et al., 2010; Rothbart, Ahadi, & Hershey, 1994). Studies also suggest that dysregulation of emotion may also underlie both temperamental vulnerability and anxiety. For instance, fearful temperament is generally characterized by a heightened experience of fear emotion and difficulty in modulating the emotional expression of fear (Buss, Davidson, Kalin, & Goldsmith, 2004; Fox, 1994) and emerging evidence documents that anxious children exhibit dysregulated patterns of negative affect (e.g. sadness, anger) (Suveg & Zeman, 2004) and poorer understanding of emotions compared to non-anxious children (Southam-Gerow et al., 2000).

Although anxiety and fearful temperament are closely related conceptually and available empirical evidence broadly supports this link (Fox et al., 2005), the stability of temperament and its association with the future onset of anxiety is only moderate (Biederman, Rosenbaum, Chaloff, & Kagan,1995), suggesting that fearful temperamental disposition alone does not necessarily lead to the development of anxiety symptoms (Degnan et al., 2007). Etiological models of childhood anxiety imply that additional developmental (e.g., age-appropriate regulation of emotion, cognition, physiological arousal) and environmental

factors (e.g. parental influences) interact with individual dispositional characteristics (e.g., temperament) to intensify the pre-existing vulnerability for anxiety and to ultimately precipitate the development of anxiety symptoms or disorders (Vasey et al., 2001). This perspective is generally accepted in recent theories of anxiety development and studies have tested models that involve factors that may jointly contribute to the development of anxiety disorders (Mian et al., 2011). Nevertheless, few studies have specifically examined and characterized the intermediate developmental outcomes that may signal an intensified risk for anxiety. For instance, the etiological significance of the reciprocal interaction between children with fearful temperament and their mothers has been emphasized in the literature (Dadds & Roth, 2001). Thompson (2001) presented a particularly compelling idea that caregivers' overprotective or controlling attempts to manage children's fear and distress responses may "inadvertently" reinforce avoidant behaviors and promote "poor self-regulatory strategies" in children. Despite the widespread appeal of this view, specific deficits in regulatory skills in preschool age that result from such early maladaptive interactions, prior to the initial emergence of anxiety symptoms have received less empirical attention.

Sleep as a Regulatory Process Linked with Early Anxiety Symptoms

Sleep problems in preschool-age children is a prevalent developmental phenomenon that is also commonly seen in anxious youth (Alfano et al., 2007). The present study hypothesized that a greater level of sleep-related problems in preschool age may represent an intermediate developmental indicator for heightened vulnerability for future development of anxiety symptoms for children who are temperamentally fearful as toddlers.

Current theoretical formulations of sleep imply that regulation of sleep, arousal, affect, and attention overlap in physiological, neuroanatomical, clinical, and developmental domains

(Dahl, 1996). Sleep and vigilance are considered to be opponent processes, and effective regulation of attention and arousal as well as associated affect that result from particular cognitions are critical to initiation of sleep. The conceptualization of sleep as encompassing several regulatory processes (e.g. patterns of attention, arousal, affect regulation) which serve as measurable correlates of fearful temperament and anxiety disorder raises the possibility that regulation of sleep may also be linked to aspects of fearful temperament and anxiety.

Accumulating literature on children's sleep suggests that sleep represents a meaningful biophysical and psychological regulatory process that should be considered in addition to other measures of self-regulation (Seifer, Sameroff, Dickstein, & Hayden, 1996). In describing the regulatory processes involved in sleep, Sameroff (2009) referred to sleep as an "…example of a process in which biological regulation becomes psychological regulation through social regulation" (p.2). In accordance with this view, the following sections review how sleep in preschool-age children entails a complex interplay of biological and psychological processes involved in arousal regulation. The role of caregivers as social agents in facilitating regulation of biological and psychological factors that are associated with sleep is also discussed. Given that temperamentally fearful children demonstrate unique patterns of physiological and psychological regulation of fear responses, preschool-age children with fearful temperament may demonstrate specific patterns of sleep regulation, as specific fears (e.g. fear of darkness) are commonly reported in relation to refusal to separate from caregivers in preschool-age children (Spence, Rapee, McDonald, & Ingram, 2001).

Biological regulation of sleep. Two primary biological regulatory processes are theorized to independently yet jointly determine the periods of alertness and sleep: the *circadian rhythm* and the *homeostatic force* (Borbély et al., 1982; Borbély & Achermann, 1999). The *circadian*

rhythm ("internal clock") signals periods of wakefulness to the body and serves to maintain alertness and vigilance during the waking period. The *homeostatic force* regulates the overall length and duration of sleep by monitoring the internal accumulation of sleep pressure. With development, these biological regulatory processes associated with sleep undergo maturation: The circadian rhythm synchronizes better with external cues and homeostatic load changes are observed as most children between ages 3-5 graduate from taking daytime naps and get fewer hours of sleep (Webbs & Dingers, 1989). Such biological changes that occur in preschool-age children mark an important developmental transition in children's sleep. The sleep-wake cycle stabilizes between ages 3-5 and gradually approximates that of adults by age 5. By age 5, the duration of a sleep cycle extends to the adult level of 90 minutes (Davis, Parker, & Montgomery, 2004; Sheldon, 2002). The architecture of children's sleep—broadly consisting of rapid eye movement (REM) and non-rapid eye movement (non-REM)—also changes significantly during this developmental period, with duration of the final stages of non-REM sleep (i.e. delta sleep) reaching a peak between ages 3 to 5 in accordance with developmental changes in children's sleep-wake cycle (Dahl, 1998). During preschool age, parasomnias—which occurs primarily during slow-wave delta wave non-REM sleep—are also reported to be highly common, meaningfully coinciding with a relative increase in the duration of the two final stages of the non-REM sleep (Jenni, Fuhrer, Iglowstein, Molinari, & Largo, 2005; Petit, Touchette, Tremblay, Bolvin & Montplasir, 2007). One particularly common form of parasomnia in preschool-age children is night terror, which are defined as "arousals from slow-wave sleep accompanied by a cry or piercing scream and autonomic nervous system and behavioral manifestations of intense fear" (American Academy of Sleep Medicine, 2002). It has also been suggested that the tendency to feel tense, worried, anxious at bedtime—in addition to tiredness due to giving up daytime naps–are also linked to a

greater likelihood that parasomnias may occur during sleep (Dahl, 1998). Such perspective indicates that fearful children with greater levels of attentional vigilance to threat may be more prone to experiencing parasomnias during this developmental period. Finally, findings of a recent epidemiological study of sleep in children between 2.5 to 6 years of age also estimated that dyssomnias such as night wakings (1 or more awakenings per night) and sleep onset delay (greater than 20-30 minutes) were also prevalent in preschool-age children. This study indicated that the prevalence of sleep onset delay increased between ages 2.5-4 years and declined shortly thereafter at age 5 (Petit et al., 2007). In addition, night wakings which typically occur as a result of lack of consolidated sleep in infancy also remained prevalent in preschool-age children, with 20% of 3.5 year old children experiencing at least 1 awakening per night and the greatest number of children (22.9%) showing a termination of these problems at age 5. These findings highlight the significance of preschool age as a time when both parasomnias well as specific forms of dyssomnias remain salient.

Psychological and social regulation of sleep. Maturation of biological processes that underlie regulation of sleep for preschool-age children is also closely related to psychological and social processes that influence sleep during this period of development (Sameroff, 2009). Preschool age may be an ideal time to capture the social processes that play an instrumental role in making the "transition from biological to psychological regulation" of sleep for a number of reasons. Anxiety symptoms at bedtime are among the most frequently endorsed parent-rated anxiety symptoms for preschoolers (e.g., "child is afraid of the dark", "child is reluctant to go to sleep without caregiver") (Spence et al., 2001). As Dahl (1996) postulated, increased attentional vigilance toward threat may interfere with children's perception of safety and prevent them from relinquishing consciousness required to initiate sleep onset and

to return to sleep during several episodes of night waking that are commonly reported for preschool-age children (Dahl & Harvey, 2007; Petit et al., 2007). As the demand for autonomy grows and children's verbal abilities continue to develop in preschool age, bedtime may become a stage where children communicate their newly acquired nighttime fears and express the need for parental assistance. Furthermore, as a significant proportion of preschool-age children continue to experience several episode of night wakings, children may signal need for parental intervention during such episodes of semi-wakefulness, when they scan the environment to ascertain that they are in a safe, familiar setting (Davis et al., 2004). Parental involvement at bedtime and during night wakings has been linked to children's reliance on parent support for regulation of sleep, such that children may not develop age-appropriate self-regulatory strategies (e.g. attention switching) required to independently initiate and return to sleep when they awaken during sleep. Furthermore, inability to effectively regulate fearful cognitive and emotional responses may contribute to dyssomnias such as sleep onset delay or bedtime resistance.

Sleep and anxiety. The hypothesized connections among regulatory processes involved in sleep and anxiety are generally supported by research findings documenting the frequent co-occurrence of sleep problems and anxiety symptoms (Alfano et al., 2007; Owens-Stively et al., 1997). Sleep problems in anxious youth, as reported by parents, are estimated to be as high as 95% (Alfano et al., 2007). A significant proportion of these children sleep considerably less than non-anxious children (Hudson, Gradisar, Gamble, Schnierring, & Rebelo, 2009) and experience a number of parasomnias (e.g., sleep terrors), increased nighttime arousal, and decreased slow wave sleep (Alfano, Pina, Zerr, & Villata, 2010; Forbes et al., 2008). There is also some evidence suggesting that anxiety is associated with

difficulty falling asleep and frequent night wakings (Alfano et al., 2010; Forbes et al., 2008), but these findings have been inconsistent and thus need replication (Hudson et al., 2009). Bedtime resistance, trouble sleeping, and delayed sleep onset have also been linked to internalizing problems in school age children (Bruni, Lo Reto, Miano, & Ottaviano, 2000).

As suggested above, although the co-occurrence of anxiety and different types of sleep difficulties has been documented extensively in empirical research, the significance of these findings remain less well-understood, partly due to the inconsistency in definition and methodology used to assess sleep problems. Thus, the precise nature of the association is unclear and is currently characterized as "complex" and possibly "bi-directional" (Dahl et al., 2007). Although findings of epidemiological (Gregory, Eley, O'Connor, & Plomin, 2004; Gregory et al., 2005; Ong, Wickramaratne, Tang, &Weissman, 2006) and experimental studies (Dinges et al., 1997; Leotta, Carskadon, Acebo, Seifer, & Quinn, 1997) of different age groups generally indicate the plausibility of both directions of effect, longitudinal studies with young children suggest that sleep may serve as a meaningful antecedent of anxiety. An increasing number of recent studies suggest that early childhood sleep problems predict anxiety in adolescence and adulthood (Gregory & O'Connor 2002; Gregory et al., 2005; Johnson, Chilcoat, & Breslau, 2000; Ong et al., 2006; Petit et al., 2007). Persistent early sleep problems including both dyssomnias (e.g., frequent night waking) and parasomnias at age 2.5 to 6 years were associated with the presence of separation anxiety symptoms at age 6 (Petit et al., 2007). Similarly, Reid and colleagues (2009) examined a set of variables that are implicated in the development of internalizing problems and found a unique effect of sleep above and beyond other factors in predicting the development of internalizing symptoms. In addition, sleep problems such as 'trouble falling asleep' and 'nighttime wakings' were found to better predict internalizing than externalizing problems in toddlers (Reid, Hong, & Wade,

2009). The studies that reported a predictive association between early sleep problems and later anxiety disorders also noted that the longitudinal associations between sleep and anxiety strengthened over time (Gregory et al., 2002). These recent findings suggest that early appearing sleep problems are associated with an increased risk for anxiety development later in childhood. Based on the emerging evidence suggesting sleep as a meaningful antecedent of anxiety disorder, the proposed study will examine the role of dysregulated sleep in predicting early anxiety symptoms in preschoolers.

Currently, investigation of how early emerging individual differences in temperamental fearfulness may be related to regulation of sleep is virtually non-existent, despite the increased recognition of the parallel regulatory processes that likely underlie sleep, anxiety, and temperamental variation. Most studies of sleep problems of temperamental subgroups are limited to temperamentally unmanageable children with predominantly externalizing behavior problems (Bates et al., 2009) and there are few if any studies on sleep among temperamentally fearful children. Drawing meaningful conceptual connections across sleep regulation and other variables including anxiety also has been limited due to the lack of a consistent, unifying definition of what constitutes sleep dysregulation, particularly among young children (Chorney, Detweiler, Morris, & Kuhn, 2008). Furthermore, in extant literature, theories and research of young children's sleep exist in isolation and examining sleep regulation in the context of a conceptual model may provide a basis for understanding the conceptual link between sleep and other relevant constructs. Using sleep regulation as a potential indicator of children's ability to regulate affect, cognition, and physiological arousal/reactivity, the proposed study will examine whether preschoolers' dysregulated sleep (e.g., bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, parasomnias) predicts early symptoms of anxiety. The proposed study also hypothesizes that the link

between dysregulated sleep and early symptoms of anxiety will be stronger among temperamentally fearful children whose parents engage in high levels of protection, as such group may exhibit greater difficulty in regulating their high levels of baseline arousal and show greater dependence on parental assistance at bedtime. In an attempt to specify the nature of sleep dysregulation most closely associated with future anxiety symptoms and early signs of dysregulated fear, following eight indices of sleep dysregulation will be examined in relation to fearful temperament and early symptoms of anxiety: bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night waking, parasomnias, sleep disordered breathing, and daytime sleepiness (Owens, Spirito, & McGuinn, 2000).

Maternal Influence on Children's Temperament and Anxiety Symptoms

Parents—especially mothers—have assumed a prominent position in the etiological models of childhood anxiety disorders. Maternal influences, including factors such as maternal characteristics (e.g., psychological symptoms (anxiety), characteristics (catastrophizing)) and parenting styles (e.g., overprotective behaviors), are viewed as key environmental factors that have a moderating (Degnan et al., 2010; Rubin, Burgess, & Hastings, 2002) or less frequently a mediating influence (van der Bruggen, Stams, Bogels, & Paulussen-Hoogeboom, 2010) on the link between temperament and later emergence of anxiety. Additionally, maternal anxiety and other forms of psychopathology have been investigated as significant genetic diatheses (Eley & Lau, 2005) and environmental risk factors (Barrett, Rapee, Dadds, & Ryan, 1996) for both anxiety (Biederman et al., 2001) and fearful temperament in offspring (Battaglia et al., 1997; Manassis, Bradley, Goldberg, Hood, & Swinson, 1995; Rosenbaum et al., 2000).

Extant research has identified several aspects of maternal contribution that are linked to the development of anxiety-related outcomes in children. However, isolation of individual factors (e.g., maternal anxiety, socialization of fear) and identification of the specific risk conferred by a given factor is a complicated task, as genetic and environmental risk factors frequently co-occur (e.g., gene-environment correlation (rGE)) and several factors share common mechanisms (Eley, Napolitano, Lau, & Gregory, 2010). For instance, common mechanisms have been attributed to a number of maternal characteristics, including maternal anxiety and parenting styles variously referred to as "over-protection or protectiveness," "over-control," "lack of autonomy granting," "intrusiveness," or "over-involvement." It is generally believed that anxiety-driven, protective, controlling, and over-involved parenting styles deter the child from engaging in situations of mildly threatening nature, either by active removal of the threat, by socialization of avoidance (Barrett et al., 1996; Ginsburg & Schlossberg, 2002), or by engaging in excessive comforting and affectionate behaviors to alleviate child distress (Buss & Kiel, 2011), and consequently convey the message to the child that even situations or stimuli of low-threshold threat are to be feared (Rapee, 2001). Ultimately, this type of parenting deprives the child of opportunities to develop age-appropriate coping and regulatory skills to independently deal with perceived threat and increases the risk of anxiety development (Barlow, 2002).

In the mechanisms described above, it is difficult to disentangle the specific contribution of maternal anxiety to children's acquisition of anxiety within the context of "high risk" mother-child dyads in which the temperamentally fearful child also contributes to the type of an anxiety-enhancing interaction pattern by eliciting specific cognitions and behaviors from the anxious mother (Rubin, Nelson, Hastings, & Asendorpf, 1999). Although anxious mothers may be motivated to avoid threatening situations by their own fear or by

their concern about the threat posed to the child, experimental studies have also shown that children's anxiety may also elicit such behaviors from parents with or without anxiety (Eley et al., 2010; Moore, Whaley, & Sigman, 2004; Rapee, 1997; Rubin, et al., 1999; van der Bruggen, Stams, & Bogel, 2008). As an example, an observational study found that child anxiety was associated with less-warm, overprotective, and catastrophizing behaviors in mothers irrespective of maternal anxiety during conversational tasks (Moore et al., 2004). A similar line of study found that clinically anxious children elicited greater levels of involvement from both their own mothers as well as mothers of control group children without anxiety (Hudson, Doyle, & Gar, 2008). Increasing evidence consistent with the above findings provide a tentative indication that the evocative role of child anxiety may exceed the contribution of maternal anxiety to anxiety-enhancing behaviors (Eley et al., 2010). Therefore, as suggested by the transactional models of child development that highlight the reciprocal nature of parent-child interaction, maternal influence should be examined and interpreted in the context of the mother-child relationship.

Finally, although recent work has generated a considerable amount of evidence supporting the significance of parent-child interaction in the development of anxiety, more proximal outcomes resulting from such interaction—that have an etiological significance for future anxiety development—have not been clearly delineated. Based on theoretical grounds, it is generally believed that maternal protective or intrusive behaviors that shield children from threat or distress limit temperamentally vulnerable children's opportunities to develop age-appropriate regulatory coping skills (e.g. regulation of attention, affect, cognition associated with possible threat) (Thompson, 2001). Nevertheless, few studies have explicitly tested this proposition. As such, examination of the regulatory skills of at-risk children may

further clarify the hypothesized mechanism of the maternal contribution to anxiety development.

In the proposed study, it is hypothesized that the impact of parental influences will be more pronounced among the temperamentally fearful children, as the increased parental perception of the need to provide assistance (i.e. overprotection) to their children will lead to particularly higher levels of parental involvement for temperamentally fearful children. Such interactive style may also be seen in the parent-child interaction that takes place at bedtime and may be linked to children's increased reliance on their caregivers for assistance in initiating and maintaining a consolidated sleep.

Parenting and Regulation of Sleep

Maternal protective orientation also has direct implications for the development and maintenance of children's sleep problems. Although studies of sleep in preschool-age are limited, studies of infant sleep illustrate ways in which early appearing individual differences in regulatory patterns may interact with parenting practices at bedtime to determine infants' emerging regulatory competence. Infant studies suggests that as young children begin to develop an increasingly consolidated nocturnal sleep pattern, their ability to self-soothe and independently return to sleep after night waking episodes appears to distinguish children that better regulate their sleep from those that are unable to do so without parental intervention. According to a study by Gaylor and colleagues (2001), self-soothing ability at 12 months was associated with fewer sleep related problems at 2 years of age (Gaylor, Goodlin-Jones, & Anders, 2001). The results obtained with infants are presumed to be applicable to understanding the role of parents in facilitating consolidated sleep in preschoolers, as night wakings continue to be prevalent among preschoolers until their sleep cycle begin to extend

to adult-level sleep cycle (90 minutes) by age 5 (Dahl, 1996; Jenni et al., 2005). For children who show poor regulation of affective, attentional, and physiological arousal at bedtime, continued parental intervention beginning in infancy may adversely impact the development of coping competence.

The potential role of mother's own anxiety on the development of children's regulatory capacity was implied in follow-up studies that found that anxious mothers may provide assistance regardless of infants' signaling for parental intervention (Goodlin-Jones, Burnham, Gaylor, & Anders, 2001). In a study of infants of mothers with panic disorder (PD), PD mothers engaged with the infant to a greater degree at night time (e.g., more maternal feedings at night, not putting the children to bed awake) which was in turn associated with greater disturbance in infant sleep (Warren et al., 2003). Evidence for the association between trait-level anxiety in mothers of infants and infant sleep adjustment was also found, as infants of mothers scoring high on separation anxiety were more likely to be a 'night-waker' and less likely to engage in self-soothing behaviors to settle back to sleep in comparison to infants of mothers with low scores on separation anxiety (Scher & Blumberg, 1999). In the studies described above, the contribution of maternal overprotective orientation to increased maternal involvement is only assumed on the basis of mothers' diagnostic status and reported symptoms. However, it is important to directly assess the role of factors that may mediate the link between anxiety disorder and the observed interaction with children. A number of studies have suggested that the associations may be better accounted for by underlying processes that are closely associated with symptoms of specific psychopathology (e.g., anxiety) but are not limited to individuals affected by those disorders (Goodman & Gotlib, 1999; Hammen et al., 1987). For example, Teti and colleagues (2010) raised the possibility that the emotional quality of caregiving (i.e., "maternal emotional availability") may explain the putative

association between maternal depression and infant sleep adjustment outcomes. The present study hypothesized maternal protective behaviors as an important variable that underlies the association between maternal diagnostic status and child outcome variables. For parents of temperamentally inhibited or fearful children, their anticipation of child distress and lack of child's competence in self-regulation, and increased need for parental comforting during episodes of parasomnias may lead them to provide precautionary assistance to their children, which may in turn increase children's' dependence on their support. This increased reliance on parental intervention may limit children's' opportunity to develop coping mechanisms to regulate their internal processes (e.g., arousal, attention, emotion), further placing them at a risk for anxiety symptom development as well as persistence of sleep problems.

The Present Study

The present study examined a set of associations among factors hypothesized to jointly contribute to the development of childhood anxiety disorders. Anxiety is viewed as a deviant outcome that results from the reciprocal interactions among the child's temperamental predisposition, maternal protective behaviors, and the child's developing ability to regulate sleep. Given the accumulating evidence suggesting that there exists a meaningful association between sleep and anxiety, the present study examined dysregulated sleep in preschool-age as indicated by a range of common childhood sleep problems, as a potential antecedent of anxiety symptom development in temperamentally fearful children. The contribution of sleep regulation to the development of anxiety symptoms, particularly within the context of the interaction between the temperamentally fearful children and their mothers has not been examined in the extant literature, with a possible exception of a study that did not specify the processes underlying the associations (Reid et al., 2009).

In summary, the proposed study hypothesized that dysregulated sleep would precede the emergence of anxiety symptoms in temperamentally fearful preschoolers. Furthermore, maternal overprotective orientation was hypothesized to further increase the risk of sleep dysregulation and anxiety symptom development in fearful children.

Hypotheses

The proposed study aimed to explore the associations among the etiological factors of childhood anxiety by examining the following hypotheses:

I.   First, given the conceptual overlap and tentative empirical evidence suggesting the associations among temperament, regulation of sleep, and anxiety, early fearful temperament was hypothesized to be related to maternal report of dysregulated sleep.

II.   Second, the hypothesized association between fearful temperament and dysregulated sleep would be moderated by maternal protective orientation. Higher level of maternal protectiveness was hypothesized to increase the risk for greater dysregulation of sleep for children who were temperamentally fearful as toddlers.

III.   Consistent with emerging evidence indicating that sleep problems may precede the development of anxiety symptom development (Gregory et al. 2005), dysregulated sleep was hypothesized to predict the future development of anxiety symptoms (e.g., overanxiousness/worry and separation anxiety). Dysregulated sleep was also hypothesized to predict future anxiety symptomatology above and beyond the prediction made by concurrent anxiety symptoms.

Methods

Participants

The present study examined the sample of 124 toddlers (62 female) and their mothers who participated in a larger study of temperament. The sample examined in the present study represents a subsample drawn from one of the two study sites and thus does not reflect the demographic characteristics of the overall sample. Participants identified via local birth records were recruited by mail and an initial screening was conducted when toddlers were 18-20 months in age to obtain an oversample of toddlers who were high in fear and wariness according to mothers' reports. The remainder of sample was unselected for other characteristics. The majority of the families were identified as middle class (M=49.72, SD=10.70 on the Hollingshead index). The sample was primarily Caucasian (n=113; 90.4% of the sample), followed by Asian American (n=8; 6.4%), American Indian (n=2; 1.6%), African American (n=1; .8%) and Hispanic (n=1; .8%).

Families who provided consent were invited to participate in the Age 2 laboratory visit (M_{age}=24.43, SD= .47). In addition, questionnaire packets were mailed to the mothers annually. The present study examined observational data from the Age 2 laboratory visit as well as the set of questionnaires mothers completed at ages 3, 4, and upon children's entry to kindergarten (approximately age 5).

Procedures

During the laboratory visit, mothers and toddlers were asked to participate in a series of activities. The activities involved participating in modified episodes of standard laboratory procedures designed to elicit child wariness and distress in response to novel situations (Buss & Goldsmith, 2000; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996)

Additional episodes involved facilitated interaction with experimenters assuming different roles in each episode (e.g., clown, puppet show performer, stranger working,

stranger approaching). Children's approach response to novel objects designed to elicit wariness was also examined in two episodes by presenting two moving objects (e.g., robot and spider) that were controlled by the experimenter. These episodes were modified from procedures previously used to elicit and examine children's approach and withdrawal responses (Buss et al., 2000; Nachmias et al., 1996). The present study examined two episodes of lower threshold threat (Buss, 2011): *Clown and Puppet Show* episodes. In the *Clown* episode, a female experimenter dressed as a clown and invited the child to participate in three activities (e.g., blowing bubbles, beach ball game, and playing with musical instruments). In the *Puppet Show* episode, a female experimenter presented an interactive puppet show consisting of two puppets engaging in three activities (e.g., catch, fishing, and presentation of a sticker).

Measures

Fearful Temperament. Previous work has identified a "dysregulated fear group" that exhibited high levels of fear in mildly threatening contexts (Buss, 2011). This work has shown that heightened fear responses in the mildly threatening situations significantly predicted subsequent development of anxiety symptoms at preschool age and social withdrawal at kindergarten entry. Given the significance of the fear-eliciting context, the present study specifically examined toddlers' fear behaviors in the two "low-threat" episodes (i.e. Clown and Puppet) as behavioral indicators of fearful temperament. The two episodes presented a female experimenter dressed as a clown and an interactive puppet show. A second-by-second coding of the toddlers' latency to freeze, duration of facial fear, duration of bodily fear, duration of freezing, and duration of close proximity to mother during the two episode was included in the fearful temperament composite (Buss, 2011). Interrater reliability

for trained undergraduate coders who were trained to achieve a minimum kappa of .7 was .73 (k) for the coding of facial expressions of fear and .81 (k) for behavioral measures of fear.

Maternal Parenting Behavior. The present study examined mothers' protective behaviors in the two low-threat episodes based on previous work which also suggested that maternal protective behaviors in the low-threat but not high-threat context was concurrently associated with toddlers' fearful temperament and predicted subsequent development of shy/inhibited behaviors (Kiel & Buss, 2011). During the Age 2 laboratory visit, the experimenter provided a brief explanation of the episodes to the mothers and asked them to interact with their child however they typically would. Using the coding scheme used in previous studies of maternal protective behavior (Kiel & Buss, 2010), the maternal protective behavior was coded from each 10-second epochs of the two laboratory episodes. Protective behaviors, defined as "acts of shielding the child from the stimulus" was measured on the following scale: 0=*No protective behavior*, 1=S*light protection or a "quality" of protection*, 2=*Moderate protection; clear protective behavior but short in duration*, 3=*Obvious, higher intensity protective behavior or longer duration*. An average protection intensity composite variable was created by dividing the sum of all observed protective behaviors by the total number of epochs during which any protective behaviors occurred in each episode. The final protection intensity composite was created by averaging the protection intensity variables for the two episodes. Adequate interrater reliability was obtained for three coders who were trained to achieve a minimum kappa of .7 with the master coder (k=.73 to.91, inter-rater agreement: 87 to 99%).

Maternal Report of Child Sleep Problems. Prior to the Age 4 laboratory visit, mothers completed the Child Sleep Habits Questionnaire (CSHQ; Owens, Spirito, & McGuinn., 2000). CSHQ is a 56-item multiple-choice questionnaire that is widely used to screen sleep

problems in children between ages 4 and 10. The questionnaire addresses sleep problems noted by the parents in the last week, which is the equivalent time framework used for actigraph measures (Goodlin-Jones, Sitnick, Tang, Liu & Anders, 2008). The CSHQ items may be grouped to yield 8 subscale scores on various domains of sleep disturbance. The present study examined all of the following indices: Bedtime Resistance (α=.80), Sleep Onset Delay (single item), Sleep Duration (α=.70), Sleep Anxiety (α=.52), Night Wakings (α=.65), Parasomnias (α=.46), Daytime Sleepiness (α=.56) and Sleep Disordered Breathing (α=.46). The questionnaire also provides a total sleep problem score (CSHQ Total, α=.82), for which adequate sensitivity has been documented with clinical and community samples for screening purposes. The reliability coefficients obtained for the present study sample were consistent with the reliability coefficients reported for the published norms (Owens et al., 2000). Adequate psychometric properties have also been demonstrated for CSHQ among younger children, ages 2 to 5.5 years (Goodlin-Jones et al., 2008).

Maternal Report of Child Anxiety. Parents completed the MacArthur Health and Behavior Questionnaire (HBQ; Armstrong, Goldstein, & the MacAarthur Working Group on Outcome Assessment, 2003) when children were approximately 4 years old and again near children's entry to kindergarten (approximately age 5). The internalizing symptoms scale of the instrument yields two subscales of anxiety (overanxious and separation anxiety) in children age 4-16. Both subscales are rated on a 0=*Never or not true*; 1=*Sometimes or somewhat true*; 2=*Often or very true scale*. The overanxious subscale score is obtained by taking the mean of 12 items (e.g., "Needs to be told over and over that things are OK.") and the separation anxiety scale consists of 10 items (e.g., "Is afraid of being away from home."). The mean of the two subscale scores were used as the child's level of anxiety symptomatology (Age 4

Anxiety composite α=.74; Kindergarten entry anxiety composite α=.87).

Results

The present study tested the study aims in four steps: First, descriptive statistics and

bivariate correlations were computed. Second, the potential moderating role of maternal

protectiveness on the association between fear and sleep problems was examined. Third, the

predictive relations among fearful temperament, age 4 measures of sleep dysregulation, and

anxiety symptoms and anxiety symptoms at kindergarten entry were examined in additional

regression analyses. Finally, the proposed conceptual model including all study variables was

tested in two ways: 1) examination of moderated indirect pathway to anxiety symptoms at

kindergarten entry 2) use of path analytic approach to estimate the fit of the model including

all study variables (See Figures 5 & 6).

Analysis of Missing Data.

At the time of this analysis, 16 children had not yet entered kindergarten. Given that

these children were not eligible to participate in kindergarten assessment, kindergarten

assessment data (anxiety symptoms at kindergarten entry) for the 16 children was not

imputed and was thus excluded in the final analyses predicting kindergarten outcome variable

(n=108). Independent t-test indicated that the full (n=124) and partial sample (n=108)

differed significantly on one of the variables assessed prior to Kindergarten assessment:

Daytime Sleepiness Scale of CSHQ (age 4) (t=-2.18, *p*<.05). Mothers of the 16 children who

had not yet entered kindergarten reported relatively higher level of daytime sleepiness for

their 4-year olds. In addition, 16 children who were not yet eligible for kindergarten

assessment were rated as slightly—but not significantly—more fearful during the two low-

threat episodes at the age2 laboratory assessment (t=-1.73, *p*= .09).

Prior to conducting data analyses, missing data was further analyzed to detect any pattern of systematic missingness. From the initial group of 124 children and mothers who participated in the age 2 laboratory visit, 31 mothers (25%) did not complete the age 4 questionnaires: Child Sleep Habits Questionnaire and the MacAarthur Health and Behavior Questionnaire. Little's missing completely at random (MCAR) test was not significant (χ^2=22.05, p=.97), indicating that a systematic pattern was not present in the missing data. Data that was missing for the 31 participants at age 4 assessment was imputed using the expectation maximization (EM) algorithm (Howell, 2008).

Preliminary Analyses.

Descriptive statistics for all variables are presented in Table 1. Three sleep problem subscales—CSHQ Total sleep problems, Sleep Duration, and Sleep Disordered Breathing—were square-root transformed to correct for skewness and kurtosis. Following transformation, CSHQ Total sleep problems and Sleep Duration subscales adhered to a normal distribution (skew, kurtosis <1.5). However, transformation did not adequately correct for skewed distribution shown for Sleep Disordered Breathing, with 88.9% of mothers not reporting any symptoms (score=0) for their children. Given the significantly non-normal distribution of this subscale, the Sleep Disordered Breathing scale was not included in further analyses. The descriptive statistics (presented in Table 1) showed that the mean level of sleep problems in the study sample are relatively lower than those reported for normative sample of children 24 months to 5.5 years of age (Goodlin-Jones et al., 2008), indicating that the current sample in which fearful children are over-represented, did not report high levels of sleep problems on average.

Independent t-tests were conducted to examine whether there was any gender

difference in fearful temperament, maternal protective behaviors, sleep dysregulation, and anxiety symptoms assessed at age 4. Girls and boys differed significantly on daytime somnolence ("daytime sleepiness"), one of the indicators of age 4 sleep dysregulation (t=-2.38, $p<.05$), with mothers of girls reporting higher average level of daytime sleepiness behaviors. No other gender difference was found on other variables examined in the present study and gender was not included as a covariate in the substantive analyses.

Bivariate correlations among all of the study variables are displayed in Table 2. There was a significant positive association between the two observational measures, fearful temperament and maternal protective behaviors ($r=.33$, $p<.01$). Consistent with previous findings that indicated a positive association between sleep problems and anxiety symptoms, parent report of sleep dysregulation and symptoms of separation anxiety and worry were significantly correlated (range of $r=.11$ to .49). However, significant correlations were not found between age 2 behavioral observational measures (fearful temperament, maternal protective behaviors) and parent report on questionnaire measures. Thus, contrary to the hypotheses, age 2 fearful temperament was not significantly associated with preschool-age dysregulated sleep nor with anxiety symptoms at kindergarten entry. One exception was a significant positive relationship found for behavioral measure of maternal protection and parent report of child sleep anxiety at age 4 ($r=.27$, $p<.01$).

Moderation Analyses.

Prior to testing the full model, the hypothesis that maternal protective behavior would moderate the pathway between fearful temperament and indices of dysregulated sleep (total sleep problems, bedtime resistance, sleep onset delay, sleep anxiety, night wakings, parasomnias, and daytime sleepiness) was tested using the full sample (n=124). Hierarchical

regression analyses were conducted to examine whether (1) fearful temperament, (2) maternal protective behavior, and (3) the cross-product of fearful temperament and maternal protective behavior predicted sleep problems and symptoms of anxiety reported by the parents at age 4. In order to decrease multicollinearity and to increase the interpretability of the parameters, the predictor variables were mean-centered before creating the interaction terms (fearful temperament x maternal protective cognition; fearful temperament x maternal protective behavior) (Aiken & West, 1991).

It was hypothesized that maternal protective behavior would moderate the relation between children's fearful temperament and dysregulated sleep. More specifically, it was hypothesized that high levels of maternal protective behavior as observed during two low-threat episodes would strengthen the positive predictive relation between children's fearful temperament and symptoms of dysregulated sleep at age 4. Hierarchical regression analyses predicting seven different indicators of dysregulated sleep were conducted with predictor variables entered in the following order: Fearful temperament and maternal protective behavior (Step 1), the cross-product of fearful temperament and maternal protective behavior (Step 2). The results are summarized in table 3.

Prediction of age 4 sleep anxiety and bedtime resistance: Significant main effect of maternal protection. A significant main effect of maternal protection was found in two models in which sleep anxiety ($b=1.04$, $p<.01$) and bedtime resistance were predicted ($b=.99$, $p<.05$). However, the fearful temperament x protection interaction term did not predict sleep anxiety or bedtime resistance reported by parents at age 4. Thus, regardless of the level of fear shown by children in the two mildly threatening situations, maternal protective behaviors in such situation (age 2) significantly predicted maternal report of children's sleep anxiety and

bedtime resistant behaviors at age 4.

Prediction of age 4 total sleep problem, parasomnias, night wakings: significant fearful temperament x maternal protection interaction. A significant fearful temperament x maternal protection interaction effect was found for three models predicting: (1) total sleep problems (CSHQ Total), (2) parasomnias, and (3) night wakings. In the model predicting total sleep problems that mothers reported during the age 4 assessment, maternal protective behaviors during the age 2 assessment significantly predicted total sleep problems (b =.28, p<.05), whereas fearful temperament did not. The model changed significantly when the interaction term (maternal protective behavior x fearful temperament) was added (ΔR^2=.06, p<.05), as the interaction term predicted total sleep problems above and beyond the prediction made by maternal protective behavior (b =-.02, p<.05). This significant interaction was probed by testing the simple slopes at three levels of maternal protection (low [-1SD below mean], mean, high [+1SD above mean]). The regions of significance for maternal protection were also estimated to obtain the specific values of maternal protection at which the relationship between fearful temperament and total sleep problems became significant (Hayes & Matthes, 2009). Figure 2 illustrates the significant slopes and region of significance (highlighted). The simple slope analysis revealed that the relationship between fearful temperament and total sleep problems was significant only at high level of maternal protection (+1SD above mean). Contrary to the hypothesis that fearful children would exhibit more difficulties with sleep when their mothers engage in higher levels of protection behavior, the significant simple slope (+1SD above mean) revealed an inverse relationship between fearful temperament and total sleep problems. In other words, fearful children showed significantly fewer sleep problems when their mothers engaged in high levels of protective behaviors in mildly

threatening situations. Conversely, when mothers engaged in similarly high levels of protective behaviors toward children who are rated as less fearful, such children reportedly experienced significantly more sleep problems at age 4. In order to better understand this finding, the region of significance analysis was conducted to estimate the specific value of maternal protection at which the inverse relationship between fearful temperament and sleep problems became significant. This analysis identified an upper bound for maternal protection occurring approximately .19 SD above the mean (upper bound for maternal protection=.72)). This suggests that the negative slope between fearful temperament and total sleep problems became significant when the level of maternal protection slightly exceeded the mean level of protection.

A similar pattern of results was obtained for two additional models (predicting 1) parasomnias and 2) night wakings at age 4) that showed significant interaction effects (Figures 3 and 4). The simple slope analyses indicated that when mothers engaged in high level of protective behaviors (i.e. +1SD above mean), there was a significant inverse relationship between fearful temperament and both types of sleep problems (i.e. parasomnias, night wakings). The relationship between fearful temperament and parasomnias or night waking was not significant when mothers did not show elevated levels of protection. For the model predicting parasomnias, the region of significance was estimated to be approximately .26 SD above the mean (upper bound for maternal protection= .76). Therefore, when maternal protection exceeded .26 SD above the mean, temperamentally fearful children experienced fewer parasomnias at age 4, whereas children who exhibited low fearfulness were more likely to experience parasomnias.

Likewise, the simple slope between fearful temperament and night wakings at age 4

was only significant when mothers engaged in high level of protective behaviors. The inverse relationship between fearful temperament and night wakings became significant when the level of maternal protective behavior exceeded approximately .63 SD above the mean (upper bound for maternal protection=.95), a value that is relatively higher than those found for models predicting total sleep problems (+.19 SD) or parasomnias (+.26 SD).

No additional significant interactions were found for models examining other indices of sleep dysregulation (bedtime resistance, sleep anxiety, sleep onset delay, sleep duration, and daytime sleepiness). Thus, maternal protective behaviors did not influence the way in which fearful temperament predicted subsequent development of the above sleep problems.

Prediction of age 4 anxiety symptoms. Though not explicitly hypothesized, the present study also tested whether fearful temperament and maternal protective behavior predicted symptoms of anxiety that occur concurrently with age 4 sleep problems (anxiety symptoms at age 4 are later included in the final path analyses). Contrary to expectation, fearful temperament was not associated with anxiety symptoms at age 4. Neither a main effect of maternal protection nor an interaction effect between fearful temperament and maternal protection was present in the model predicting parent reported age 4 anxiety symptoms.

Prediction of anxiety symptoms at kindergarten entry. Before testing the full model including all of the study variables, the present study tested whether dysregulated sleep uniquely predicted anxiety symptoms at kindergarten entry after accounting for the prediction made by the concurrent anxiety symptoms. These analyses were conducted on the sample that excluded the 16 children who had not yet entered kindergarten (n=108) at the time of this analysis. Possible direct effect of fearful temperament was also estimated in this step of the analyses. Hierarchical regressions were conducted with fearful temperament, each sleep

dysregulation variable, and age 4 anxiety symptoms entered in the model in the respective order. The results indicated that: 1) there was no main effect of fearful temperament on anxiety symptoms in any of the models examined and 2) above and beyond the effect of age 4 anxiety symptoms, following indicators of sleep dysregulation significantly predicted anxiety symptoms at kindergarten entry: Total sleep problems ($b=.47, p<.05$), night wakings ($b=.05, p<.01$), sleep anxiety ($b=.03, p<.01$), bedtime resistance ($b=.01, p<.05$), and sleep duration ($b=.07, p<.01$). An exception to this pattern of finding was the model including parasomnias. Although parasomnias did not significantly predict anxiety symptoms at kindergarten entry in the first step, in the second step where age 4 anxiety symptoms were included in the same model, parasomnias at age 4 predicted significantly fewer anxiety symptoms as reported by parents at kindergarten entry.

Test of Potential Moderated Mediation Effect of Sleep Dysregulation

There were two important implications from the above findings. First, the absence of a main effect of fearful temperament on kindergarten age anxiety symptom did not support the test of mediation, as traditional methods of mediation testing requires that a direct effect be present between the focal predictor and the outcome variable (Baron & Kenny, 1986). However, this did not negate the possibility that a significant indirect effect may nonetheless be present between fearful temperament and anxiety symptoms that traditional mediational analysis may not detect (Hayes, 2009; Mathieu & Taylor, 2006). More specifically, preceding analyses had indicated that there were two possible indirect pathways via total sleep problems and night wakings, as 1) both variables were significantly predicted by the interaction term (fearful temperament x maternal protection) and also as 2) both variables significantly predicted anxiety symptoms at kindergarten entry above and beyond age 4 anxiety symptoms.

Therefore, given the significant interaction effect linking fearful temperament and two indices of sleep, and the significant predictive association between the two indices and anxiety symptoms, two models including total sleep problems and night wakings were tested for possible indirect effects.

An analytic tool (PROCESS Macro) designed to test indirect effects at conditional values of the moderator variable was used to examine whether fearful temperament exerted an indirect effect on anxiety symptoms at kindergarten entry through the two sleep dysregulation variables (i.e. total sleep problems and night wakings) (Hayes, 2012). This tool used the bootstrapping method that has two important advantages over the traditionally used Sobel test: 1) no assumption of normality of the sampling distribution of the interaction term, 2) enhanced power with smaller sample (Hayes, 2009; MacKinnon et al., 2004; Williams & MacKinnon, 2008). In both models, anxiety symptoms at age 4 was entered as a competing "third variable" through which fearful temperament may relate to anxiety symptoms at kindergarten entry. Contrary to the hypotheses, the two models did not identify any significant indirect effect occurring through sleep dysregulation or concurrent anxiety symptoms at different conditional values of maternal protection (-1SD, mean, +1SD). The summary of findings is as follows.

Model #1: Indirect Effect of Fearful Temperament on Anxiety Symptoms through Total Sleep Problems. The first model tested whether fearful temperament may exert an indirect effect on anxiety symptoms either through total sleep problems or concurrent anxiety symptoms at age 4, in the absence of a significant direct relationship between the two variables. A significant conditional indirect effect would be indicated by the confidence interval that does not include zero.

The confidence intervals produced from 10000 bootstrap samples did not indicate that there was any non-zero indirect effect occurring through either sleep problems or age 4 anxiety symptoms at various levels of maternal protection. At high levels of maternal protection (1+SD above mean), the confidence interval estimated for the indirect effect occurring through total sleep problems did not include 0 by a slight deviation (-.0014 to -.0001), possibly indicating the presence of a trivial indirect effect occurring through the total sleep problems. However, this result was not interpreted as an indication of a significant indirect effect between fearful temperament and anxiety symptoms assessed at kindergarten entry. The results heretofore are summarized as following: 1) there was a significant predictive relationship between the fearful temperament x maternal protection interaction term and age 4 total sleep problems, 2) total sleep problems at age 4 uniquely predicted anxiety symptoms at age 5 (b=.05, p<.05) above and beyond concurrent anxiety symptoms (b=.47, p<.01). Nevertheless, the total indirect effect was not detectably different from zero with the partial sample (n=108) used for this analysis.

Model #2: Indirect Effect of Fearful Temperament on Anxiety Symptoms through Night Wakings. The second model tested whether fearful temperament may exert an indirect effect on anxiety symptoms either through night waking problems or concurrent anxiety symptoms at age 4, in the absence of a significant direct relationship between the two variables. Again, all six of the bootstrapped confidence intervals (indirect effect occurring via night wakings or age 4 anxiety symptoms at three levels of maternal protection) contained a zero and did not suggest the presence of a significant indirect effect.

Path Analyses: Examination models specifying relations among all study variables

As a final step of the analyses, the model fit of the two indirect effects models were

estimated using path analyses to examine whether the proposed model that specified the relations among the study variables fit the data well (See Figures 5, 6). Given that neither fearful temperament nor maternal protection significantly predicted age 4 anxiety symptoms, the non-significant paths among these variables were removed from the initial saturated model. This allowed for the estimation of the model fit. Age 4 anxiety symptoms were still retained in the model to account for the concurrent relationship between total sleep problems and anxiety symptoms. As in the preceding regression analyses, fearful temperament and maternal protection composite that formed an interaction term were mean-centered to facilitate model fit. All variables were treated as observed variables with a single indicator. Models (estimated using Amos; Arbuckle & Wothke, 1999) were considered acceptable when the following indices indicated an adequate model fit (non-significant χ^2; CFI>.95, NFI>.95, RMSEA<.06, TLI>.9) (Hu & Bentler, 1999).

Model #1: Indirect effect of total sleep problems. The path diagram of the model including age 4 total sleep problems is presented in Figure 5. The specified model that included all study variables fit the data well according to all four of the indices considered: (χ^2(3)=1.97, p=.58; CFI=1.00, NFI=.97 RMSEA=.00, TLI=1.15). Consistent with previous analyses results, following path coefficients were estimated to be significant: 1) Fearful temperament x maternal protective behavior to total sleep problems (*b*=-.02, *p*<.05) 2) Total sleep problems to anxiety symptoms at kindergarten entry (*b*=.05, *p*<.10) 3) Age 4 anxiety symptoms to anxiety symptoms at kindergarten entry (*b*=.40, *p*<.01).

As a summary, the path coefficients of this final model provided partial support to the hypotheses that: 1) fearful temperament x maternal protection interaction would predict dysregulated sleep at age 4, 2) sleep problems at age 4 would predict subsequent

development of anxiety symptoms above and beyond the concurrent symptoms of anxiety.

Model #2: Indirect effect of night wakings. Equivalent results were obtained for the model including night wakings and are shown in Figure 6. Path analysis indicated that this model fit the data well (χ^2 (3)=1.96, p=.58; CFI=1.00, NFI=.96, RMSEA=.00, TLI=1.28). Consistent with previous regression analyses, following path coefficients were estimated to be significant: 1) Fearful temperament x maternal protective behavior to night wakings (*b*=-.03, *p*<.05) 2) night wakings to anxiety symptoms at kindergarten entry (*b*=.03, *p*<.10) 3) Age 4 anxiety symptoms to anxiety symptoms at kindergarten entry (*b*=.53, *p*<.01).

Discussion

The present study examined relations between fearful temperament and maternal protective behaviors, two factors that have been identified as important developmental antecedents of anxiety symptom development in early childhood. The study also addressed the possibility that the interaction between fearful temperament and maternal protective behavior would predict preschool-age sleep regulation. Sleep regulation—encompassing emotion, attention, arousal regulation—was examined as an intermediate developmental outcome that may be meaningfully related to early fearful temperament and later development of anxiety symptoms (Dahl, 1996; Gregory et al., 2005). The results suggested that maternal protection moderated the relationship between fearful temperament and sleep regulation. Sleep regulation, in turn, predicted subsequent symptoms of separation anxiety and worry at kindergarten entry. Nevertheless, the overall indirect effect between fearful temperament and anxiety symptoms was not significant with maternal protection and sleep included as two intervening factors in the hypothesized pathway.

As such, the findings provided partial support to the study hypotheses. Contrary to the

hypothesis, child fearful temperament—assessed in situations of mild threat—alone did not directly predict sleep dysregulation (age 4) or parent report of anxiety symptom. Furthermore, the prediction that the interaction between child fearful temperament and maternal protective behavior would predict developmentally important indices of sleep regulation in preschoolers (e.g. parasomnia, night wakings) was only partially supported, as the predictive relationship occurred in the reverse direction. Finally, as expected, several indices of sleep dysregulation predicted symptoms of anxiety at kindergarten above and beyond the prediction made by the concurrent symptoms of anxiety at age 4. As an exception, the experience of parasomnias (e.g. night terror) at age 4 predicted fewer symptoms at kindergarten entry. Despite the significant predictive relations found in the preceding steps, findings did not indicate that there was a total indirect effect that was detectably different from zero.

Fearful Temperament, Maternal Protective Parenting, and Sleep

Contrary to the expectation that the combination of fearful temperament and high levels of maternal protective behaviors would predict difficulties with sleep regulation at age 4, an inverse relationship was found between fearful temperament and sleep problems such as parasomnia and night wakings, when mothers engaged in above average level of protective behaviors. High levels of maternal protection predicted better sleep regulation in fearful toddlers whereas greater sleep dysregulation was predicted for children who were considerably less fearful.

Two possible alternative explanations are considered for these findings: 1) Maternal protection may be better characterized as sensitive parenting for fearful toddlers. Such protective behaviors may serve to promote better regulation of sleep in a subgroup of temperamentally fearful children. In contrast, what potentially represented sensitive parenting for fearful toddlers might have had a paradoxically adverse impact on less fearful toddlers'

regulation of sleep. These contrasting results suggested a differential impact of parental behaviors that served to shield the child from or removing the source of possible threat (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007). 2) Alternatively, parent report of better sleep regulation in fearful toddlers may represent the product of extensive external regulatory support provided at bedtime and not necessarily indicate fearful children's superior autonomous regulatory competence. Maternal protective behaviors, in addition with other parental influences not examined in this study (e.g. extensive parental involvement such as co-sleeping) might have served to externally regulate fearful children's sleep in preschool age and led to fewer disruptive sleep problems at nighttime. Continued reliance on "other"-regulation provided by parents in preschool age may minimize immediate problems for both the caregivers and the children but inadvertently delay the development of age-appropriate self-regulatory skills involved in sleep regulation (Sameroff, 2009).

With respect to the first explanation, the findings—taken at face value—suggested the possibility that maternal protective behaviors in distressing situation may function as a buffer against the likelihood of developing specific types of sleep dysregulation problems (i.e. night wakings, parasomnias, overall sleep problems) for temperamentally fearful toddlers. A recent study has suggested that maternal sensitivity during distressing but not non-distressing situations predicted less affect dysregulation for infants with high reactive temperamental disposition (Leerkes, Blankson, & O'Brien, 2009). Sensitivity was defined in the above study as prompt and appropriate responses to child's distress. Children who responded more fearfully in mildly threatening situation in the present study thus might also have benefited from parenting behaviors that promptly shielded them from potentially frightening aspects of the novel situation. However, similar effect was not present for children who might not have necessarily viewed the situation distressing or threatening at an equivalent level. Mothers

who engaged in above average levels of protective behaviors when neither the child (as

shown by low levels of fear display) nor the context explicitly warranted such behaviors,

were significantly more likely to report greater sleep dysregulation problems for their

children. Therefore, it may be that for less fearful toddlers, protective behaviors might

represent maternal insensitivity to the child's need to engage with the novel situation

potentially in the service of better regulation in the novel yet mildly threatening context.

Follow-up studies that examine additional behavioral and emotional characteristics (e.g. level

of activity, anger expression) as well as concurrent measures of physiological regulation (e.g.

respiratory sinus arrhythmia) may inform the immediate effect of maternal protective

behaviors on children who were rated as less fearful. Although parenting behaviors at

bedtime were not examined in the present study, similar lack of dyadic synchrony that carries

over into bedtime may lead to conflictual interaction between protective mothers and less

fearful toddlers with specific difficulties with arousal regulation. A possible pathway

describing how such interaction pattern may lead to difficulties with sleep may be

hypothesized on the basis of Morrell's (1999) conceptual model of sleep problem

development. Morrell hypothesized six factors to be implicated in the pathways to sleep

problem development: 1) Risk factors (e.g. temperament, parental psychopathology)→ 2)

Parental appraisal (e.g. conflict/tension: infant needs vs. parent needs)→ 3) Parental cognitive

responses (e.g. intolerable anger)→4) Dyadic interaction (e.g. overintrusiveness)→5) Infancy

regulation (e.g. decreased self-regulation)→ 6) Outcome: Sleep problems. Thus, a mismatch

between child dispositional needs and parental appraisal may lead to parent-child conflict at

bedtime and exacerbate the risk for developing sleep-related problems for children with

particular dispositional characteristics.

It is also important to acknowledge the bi-directionality of the relationship between

child temperament and maternal behaviors, in that mothers of less fearful toddlers might have engaged in what we labeled as protective behaviors for reasons that the present study was not designed to capture. For example, protective behaviors of mothers of children who readily engage in novel situations might have been responding to particular behavioral or temperamental characteristics shown by the less fearful toddlers, such as heightened activity level that might be characterized or perceived as "behavioral-emotional undercontrol" (Rubin, Burgess, Dwyer, & Hastings, 2003). In their interaction, maternal protective behaviors may be accompanied by explicit verbal messages that disapprove of or restrict children's attempts to engage with the novel situation. In contrast, protective behaviors shown toward fearful toddlers may be accompanied by affectionate, soothing behaviors intended to alleviate toddler distress (Buss et al., 2011). Therefore, protective behaviors exhibited by mothers of less fearful children might have been solicited by factors such as mothers' perceived need to moderate child's heightened activity level or even maternal misattribution (i.e. perceiving child as frightened in the absence of objective behavioral indicators of fear) of child's behaviors as warranting protection. Examination of explicit verbal messages as well as specific cognitions that underlie observed parenting behaviors may further explain these results. Finally, in the present study, both child fear and parental protective behaviors were examined only in mildly threatening context. Examination of fear and protective behaviors across multiple contexts of varying levels of threat may further explain the findings that suggest a difference between low and high fear groups.

Sleep Dysregulation as Predictors of Anxiety Symptom Development

Although similar interaction effects were found across children's overall difficulties with sleep, night wakings, and parasomnias, the findings provided one possible way to distinguish between night wakings and parasomnias. Night waking problems significantly

predicted subsequent development of anxiety symptoms at kindergarten entry, whereas high levels of parasomnias predicted significantly fewer anxiety symptoms. Both night wakings and parasomnias are reported to be prevalent among preschool-age children (Petit et al., 2007). However, different factors may contribute to the occurrence of the two problems.

Several studies have noted that most children experience several episodes of night waking before they develop an adult like sleep pattern around 5 years of age (Petit et al., 2007). Thus, what consistently distinguished between poor (fragmented) versus good sleepers was not the frequency of wakings but rather the regulatory ability (e.g. self-soothing) required to independently return to sleep after the episodes of night waking (Gaylor et al., 2001). It is possible that night wakings are detected by mothers only when 1) children signal their need for parent intervention or when 2) mothers are vigilant to possible signs of child awakening (Teti & Crosby, 2012). Thus, children who are reported by parents as experiencing night wakings may represent those who do not routinely engage in autonomous self-regulatory attempts to fall back to sleep, during the developmentally normative episodes of night wakings. The findings of the present study tentatively suggest that for a subgroup of children, exposure to protective style of parenting may have "inadvertently reinforced" children's tendency to rely on parents for regulation, which may consequentially enhance their vulnerability to developing symptoms of separation anxiety and worry at kindergarten entry (Thompson, 2001). It is important to note, however, that the significant indirect effect occurring via night wakings was not found in the present study. Future studies with improved power may examine whether the signficant indirect effect may in fact be present. In contrast, less fearful children who experienced greater level of parasomnias and subsequently fewer symptoms of anxiety at kindergarten entry may represent a unique temperamental subgroup of children distinct from the fearful children on aspects of arousal regulation or activity level.

Parasomnias such as night terror are characterized by sudden arousal often accompanied by piercing scream and expression of anxious and agitated behaviors. Abnormal intrusion of wakefulness into periods of deep, slow wave sleep, are thought to explain the occurrence of parasomnias (Avidan & Kaplish, 2010) and behavioral factors such as overtiredness or fear/anxiety were identified as frequent triggers of parasomnias (Dahl, 1998). As such, toddlers who exhibited low fear and experienced parasomnias may represent a unique subgroup that exhibit unique patterns of physiological arousal and show high levels of activity level during daytime. However, this study did not address additional factors that might explain the difference between potential subgroups of children. Future studies that examine concurrently obtained measures of various behavioral characteristics, physiological regulation, and parent behaviors (expressed emotion, behaviors, and report of cognitions) may better inform this issue.

Whereas the interaction between fearful temperament and maternal protective behaviors significantly predicted specific sleep dysregulation difficulties at age 4, similar predictions were not observed for concurrent anxiety symptoms at age 4. It is also important to note that children's overall difficulties with sleep (i.e. total sleep problems) and night wakings (reflective of lack of consolidated sleep and/or limited self-soothing ability) all significantly predicted anxiety symptom development at kindergarten entry above and beyond the prediction made by anxiety symptoms at age 4. These results indicate that preschool-age sleep dysregulation may uniquely predict subsequent development of anxiety symptoms.

Implications of Lack of Significant Indirect Pathway between Fearful Temperament and Anxiety Symptoms at Kindergarten Entry.

Final sets of analyses examined the viability of the proposed conceptual model

(Figure 1), where maternal protection moderated the indirect pathway between fearful temperament and anxiety symptom development occurring through preschool-age sleep dysregulation. The models that specified the relations among the study variables were based on 1) study hypotheses and 2) results from the preceding regression analyses which indicated that the overall models fit the data well. The relations specified among the variables in these models provided evidence that the fearful temperament and maternal protection interaction term jointly predicted children's overall sleep problems and night wakings more specifically. These sleep problems predicted anxiety symptoms reported by parents when these children entered kindergarten. These predictions remained significant when concurrent symptoms of anxiety at age 4 were included in the models. Nevertheless, tests of conditional indirect effect did not indicate that the hypothesized indirect effect was present.

In considering the overall effect of temperament, maternal protection, and regulatory mechanisms that underlie preschool-age sleep, the unexpected direction of the interaction effect may explain the overall non-significant indirect pathway between fearful temperament and anxiety symptom development. More specifically, the results indicate that there may be a potentially protective role of maternal protection or sensitivity on fearful children's regulatory ability as indexed by sleep regulation. Enhanced sleep regulation may further protect against the likelihood that the fearful toddlers would subsequently develop symptoms of anxiety.

However, it is also plausible that the findings do not support the assumption that preschool-age dysregulated sleep would be a meaningful index of self-regulation, particularly for temperamentally fearful toddlers examined in the present study. Although the commonly accepted view that poor regulatory skills lead to anxiety symptom development in children with temperamental vulnerability may hold true in other contexts that demand self-regulation,

sleep dysregulation at preschool age may not be a sensitive index of fearful children's regulatory skills—required for affect, attention, and physiological arousal regulation—that may also meaningfully relate to subsequent development of anxiety symptoms. Therefore, protective parenting may yield some beneficial outcomes—one of which may be less problematic sleep in preschool age—but the benefits may be limited to the specific context of regulation.

Context specificity is particularly relevant in interpreting the results of the present study. Previous work has suggested that children who exhibited high levels of fear in novel situation of mild threat as well as situations with higher levels of threat were at a greater risk for subsequent anxiety symptom development (Buss, 2011). Given the relative significance of context, it may be possible that sleeping in one's own bedroom or even in parents' bedroom may not present novelty that typically triggers fear or wariness, or present particular threat and challenges for temperamentally fearful preschoolers. This may be particularly true when a subgroup of protective mothers of fearful toddlers are accustomed to providing precautionary support at bedtime.

Additionally, given that the present study relied exclusively on parent report of sleep and anxiety symptoms, a systematic pattern of parental responses, which may vary as a function of other parental attributes (e.g. parent perception of child's need for protection or child's difficulties with sleep), might have resulted in findings inconsistent with the hypothesized outcomes. Again, examination of specific parental cognitions (e.g. perception of child fear, regulatory ability) as well as specific parenting practices at bedtime may better inform these questions (Morrell, 1999; Teti et al., 2012). The findings suggested that specific types of sleep problems putatively reflective of autonomous regulatory ability (e.g. self-soothing during night waking), but not others (e.g. parasomnias such as night terror),

predicted subsequent anxiety symptoms that were noted by the parents. Thus, it is possible that protective mothers of less fearful children are likely to detect and report more night wakings in their children and also perceive greater symptoms of anxiety when these children enter kindergarten.

Limitations and Future Directions

The present study was one of the first studies to examine the longitudinal, predictive relations among fearful temperament, preschool-age dysregulated sleep, and anxiety symptoms at kindergarten entry. Nevertheless, a number of important limitations in the attempt to address this research question are acknowledged. First, measures of sleep dysregulation and anxiety symptoms relied exclusively on parent report on questionnaires. Future work examining additional measures such as videotaped observation, actigraphs, and parental report of cognitions about bedtime parenting may better explain the findings obtained for night wakings (Morrell, 1999). More specifically, identifying patterns of child and parent responses to developmentally normative episodes of night waking may explain the relations between temperamental characteristics and sleep dysregulation. This is an important limitation given that the present study examined the possible effect of maternal protective behaviors on the development of sleep and anxiety problems. It is possible that the present study did not account for possible patterns of responses (or biases) shown by mothers who engaged in relatively higher levels of protective behaviors. Furthermore, although not directly hypothesized in the study, actual parenting practices at bedtime were not measured in the current study. Therefore, the results of the study does not directly inform 1) the continuity between parenting in novel laboratory situation and parent behaviors at bedtime and 2) impact of actual parenting practice that occur around children's sleep on children's regulation of sleep. These limitations may be addressed in future work that includes measures of 1)

maternal perception of child temperament or regulatory competence 2) maternal cognitions about parenting (e.g. parent worry, parenting orientation as reported on measures of parental attitudes) and 3) direct assessment of parenting behaviors at bedtime using observational or questionnaire measures. The second important limitation of this study is that because the study aimed to examine the relations among the developmental antecedents of childhood anxiety symptoms, it was not designed to adequately characterize the parent-child interaction patterns unique to the subset of "less fearful" children whose mothers reported greater number of sleep dysregulation problems at age 4. Future work may seek to distinguish the parenting behaviors shown by mothers of less-fearful and fearful children by examining the intention and significance of specific types of protective parenting behaviors. One possible way to address this question may be to assess the parental cognitions that underlie the observed parenting behaviors. Finally, given that data-collection was on-going at the time of this analyses, a relatively small number of children (n=108) was included in the test of total indirect effect. Subsequent analyses after the completion of ongoing data collection (n=124) will test whether significant effects may be present with improved power.

Conclusion

In summary, the present study sought to advance the literature on the developmental antecedents of anxiety symptoms by examining sleep regulation as one possible index of children's regulatory skills that may precede the development of anxiety symptoms. Maternal protective behavior, often examined as an environmental factor that may moderate or mediate the documented association between temperamental vulnerability and anxiety symptom development was found to play an important role. As suggested by previous work which highlighted the potentially equivocal impact of protective or affectionate types of parenting behaviors on children with varying dispositional characteristics (Buss et al., 2011;

Crockenberg & Leerkes, 2006; Kiel et al., 2011), the findings of the present study provide a preliminary evidence suggesting that protective parenting practices interact with child temperamental characteristics and may have a differential impact on children's developing regulatory abilities. Finally, various indices of dysregulated sleep predicted parent reported symptoms of separation anxiety and worry at kindergarten entry, suggesting the utility of considering preschool-age sleep regulation as a meaningful developmental antecedent of anxiety symptom development in children with known temperamental vulnerability.

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    51

Tables

Table 1. Descriptive Statistics For All Study Variables: Results for Total Sample (n=124) and Gender.

Variables	Total				Gender							
					Females				Males			
Age 2 Measures	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*
Fear	34.58	19.62	.83	86.60	34.47	19.56	.83	77.36	34.68	19.83	1.47	86.60
Protection	.62	.53	.00	1.83	.62	.54	.00	1.71	0.62	.52	.00	1.83
Age 4 Measures												
Total Sleep Problems	1.82	6.42	2.00	40.00	11.27	7.17	2.00	40.00	10.33	5.56	4.00	29.00
Bedtime Resistance	2.20	2.78	.00	10.00	2.15	2.80	.00	10.00	2.13	2.79	.00	10.00
Sleep Onset Delay	.37	.60	.00	2.00	.42	.65	.00	2.00	.36	.53	.00	2.00
Sleep Duration	.56	1.02	.00	5.00	.48	1.01	.00	5.00	.64	1.03	.00	4.00
Sleep Anxiety	1.59	1.78	.00	7.00	1.44	1.72	.00	6.00	1.67	1.80	.00	7.00
Parasomnias	1.58	1.55	.00	8.00	1.71	1.82	.00	8.00	1.33	1.115	.00	4.00
Night Wakings	1.33	1.35	.00	5.00	1.02	1.17	.00	4.00	1.53	1.47	.00	5.00
Daytime Sleepiness	3.92	2.40	.00	12.00	**4.67**[*]	2.55	1.00	12.00	**3.53**[*]	2.24	.00	10.00
Age 4 Anxiety Composite	.34	.20	.00	.82	.35	.19	.05	.82	.32	.21	.00	.82
Kindergarten Measure												
Anxiety Composite	.35	.20	.04	.88	.35	.20	.07	.80	.34	.21	.04	.88

Note: [*] denotes significant mean difference between boys and girls (*p* <.05)

Table 2. Bivariate Correlations

Variables	Fear, Protection		Dysregulated Sleep								Anxiety Symptoms	
	1	2	3	4	5	6	7	8	9	10	11	12
1. Fear	--											
2. Protection	.33**	--										
3. Total Sleep Problems	-.09	.11	--									
4. Bedtime Resistance	-.11	.14	.72**	--								
5. Sleep Onset Delay	.06	-.04	.36**	.18†	--							
6. Sleep Duration	-.05	-.04	.39*	.30**	.23*	--						
7. Sleep Anxiety	-.01	.27**	.54**	.77**	.00	.13	--					
8. Parasomnias	-.12	-.04	.61**	.48**	.23*	.18†	.19**	--				
9. Night wakings	.00	.10	.52**	.41**	.27**	.30**	.37**	.11	--			
10. Daytime Sleepiness	.02	.02	.61**	.17	.28**	.37**	-.02	.29**	.00	--		
11. Age 4 Anxiety Composite (HBQ)	-.12	.07	.48**	.39**	.11	.25*	.31**	.41**	.21**	.26	--	
12. Kindergarten Anxiety Composite (HBQ)	-.13	-.06	.49**	.46**	.20	.39**	.47**	.18	.24†	.18*	.54**	--

Note: Analyses were performed on full sample (n=124). †$p<.10$, *$p<.04$, **$p<.01$

Table 3. Hierarchical Regression Analyses Predicting Dysregulated Sleep

Dependent Variables	Variables Entered	ΔR^2	F	Sig.	b	SE	t	Sig.
Total Sleep Problem	1. Fear	.04	2.35	.1	-.01	.00	-1.60	.11
	Protection				.27†	.14	1.92	.06
	2. Fear	.04*	3.49*	.02	-.00	.00	-1.10	.28
	Protection				.28*	.14	2.01	.05
	Fear x Protection				-.02*	.01	-2.36	.02
Parasomnias	1. Fear	.02	1.1	.34	-.01	.01	-1.38	.17
	Protection					.01	.24	-.04	.97
	2. Fear	.04*	2.41†	.07	-.01	.01	-.91	.37
	Protection				.01	.24	.02	.98
	Fear x Protection				-.03*	.01	-2.23	.03
Night Wakings	1.Fear	.02	1.00	.37	-.00	.01	-.65	.52
	Protection				.30	.01	1.40	.16
	2. Fear	.04*	2.22†	.09	-.00	.01	-.20	.85
	Protection				.31	.21	1.48	.14
	Fear x Protection				-.02**	.01	-2.14	.03
Sleep Anxiety	1. Fear	.11**	7.8**	.00		.01	-1.58	.12
	Protection				1.04**	.27	3.91	.00
	2. Fear	.00	5.13**	.00	-.01	.01	-1.47	.15
	Protection				1.04**	.27	3.90	.00
	Fear x Protection				-.01	.01	-.36	.72
Bedtime Resistance	1. Fear	.06	3.73*	.03	-.03*	.01	-2.15	.03
	Protection				.99*	.43	2.31	.02
	2. Fear	.01	3.02*	.03	-.02†	.01	-1.84	.07
	Protection				1.01*	.02	2.35	.02
	Fear x Protection				-.03	.02	-1.25	.21
Sleep Onset Delay	1. Fear	.01	.66	.52	.00	.00	.98	.33
	Protection				-.08	.00	-.90	.37
	2. Fear	.01	.52	.67	.00	.00	1.01	.29
	Protection				-.08	.09	-.88	.38
	Fear x Protection				-.00	.01	-.5	.62
Sleep Duration	1. Fear	.00	.34	.72	-.00	.00	-.71	.48
	Protection				-.02	.10	-.15	.88
	2. Fear	.02	.65	.58	-.00	.00	-.46	.65
	Protection				-.01	.10	-.12	.91
	Fear x Protection				-.01	.01	-1.13	.26
Daytime Sleepiness	1. Fear	.00	.24	.79	.00	.01	.03	.98
	Protection				.25	.39	.64	.52
	2. Fear	.01	.50	.69	.00	.01	.24	.81
	Protection				.26	.39	.67	.51
	Fear x Protection				-.02	.02	-1.0	.32

Note: Analyses were performed on full sample (n=124). $^\dagger p<.10$, $^* p<.05$, $^{**} p<.0$

Table 4. Hierarchical Regression Analyses Predicting Anxiety Symptoms (Kindergarten)

Variables			ΔR^2	F	Sig.	b	SE	t	Sig.
Total Sleep	1.	Fear	.01	.49	.49	-.00	.00	-.70	.49
Problem	2.	Fear	.21**	14.3	.00	.00	.00	.27	.79
		Sleep				.10**	.02	5.30	.00
	3.	Fear	.18**	22.31	.00	.00	.00	.28	.78
		Sleep				.05*	.02	2.27	.03
		Anxiety				.47**	.09	5.5	.00
Parasomnias	1.	Fear	.01**	.49	.49	-.00	.00	-.70	.49
	2.	Fear	.01**	.68	.51	.00	.00	-.58	.56
		Sleep				.01	.01	.93	.35
	3.	Fear	.39	22.38**	.00	.00	.00	.08	.93
		Sleep				-.03	.01	-2.30	.02
		Anxiety				.65**	.08	8.06	.00
Night	1.	Fear	.01**	.49	.49	-.00	.00	-.70	.48
Wakings	2.	Fear	.10†	5.64**	.01	.00	.00	-.60	.55
		Sleep				.05**	.01	3.28	.00
	3.	Fear	.40**	22.73**	.00	.05	.00	.25	.80
		Sleep				.03*	.01	2.44	.02
		Anxiety				.54**	.08	7.18	.00
Sleep	1.	Fear	.01	.49	.49	-.00	.00	-.70	.49
Anxiety	2.	Fear	.21**	13.57**	.00	-.00	.00	.65	.52
		Sleep				.05**	.01	5.15	.00
	3.	Fear	.43**	26.36**	.00	.00	.00	.15	.89
		Sleep				.03**	.01	3.59	.00
		Anxiety				.49**	.08	6.44	.00
Bedtime	1.	Fear	.01**	.49	.49	-.00	.00	-.70	.49
Resistance	2.	Fear	.17	11.02**	.00	.00	.00	-.19	.85
		Sleep				.03**	.01	4.63	.00
	3.	Fear	.39	22.50**	.00	.00	.00	.39	.70
		Sleep				.01*	.01	2.35	.02
		Anxiety				.50**	.08	6.15	.00
Sleep Onset	1.	Fear	.01	.49	.49	-.00	.00	-.70	.49
Delay	2.	Fear	.06*	3.46*	.04	-.00	.00	-.91	.36
		Sleep				.08*	.03	2.53	.01
	3.	Fear	.38**	21.37**	.00	.00	.00	.03	.97
		Sleep				.05†	.03	1.83	.07
		Anxiety				.56**	.08	7.33	.00
Sleep	1.	Fear	.01	.49	.49	-.00	.00	-.70	.49
Duration	2.	Sleep	.14**	8.38**	.00	-.00	.00	-.63	.53
	3.	Fear				.11**	.03	4.03	.00
		Sleep	.41**	24.17**	.00	.00	.00	.21	.84
		Anxiety				.07**	.02	2.95	.00
Daytime	1.	Fear	.00	.00	.96	.00	.08	.05	.96
Sleepiness	2.	Fear	.37**	30.29**	.00	.01	.21	.81	.42
		Sleep				1.61**	.21	7.78	.00
	3.	Fear	.37**	20.00**	.00	.01	.01	.79	.43
		Sleep				1.62**	.24	6.67	.00
		Anxiety				-.09	1.06	-.09	.93

Note: Analyses were performed on full sample (n=124). †$p<.10$, *$p<.05$, **$p<.0$
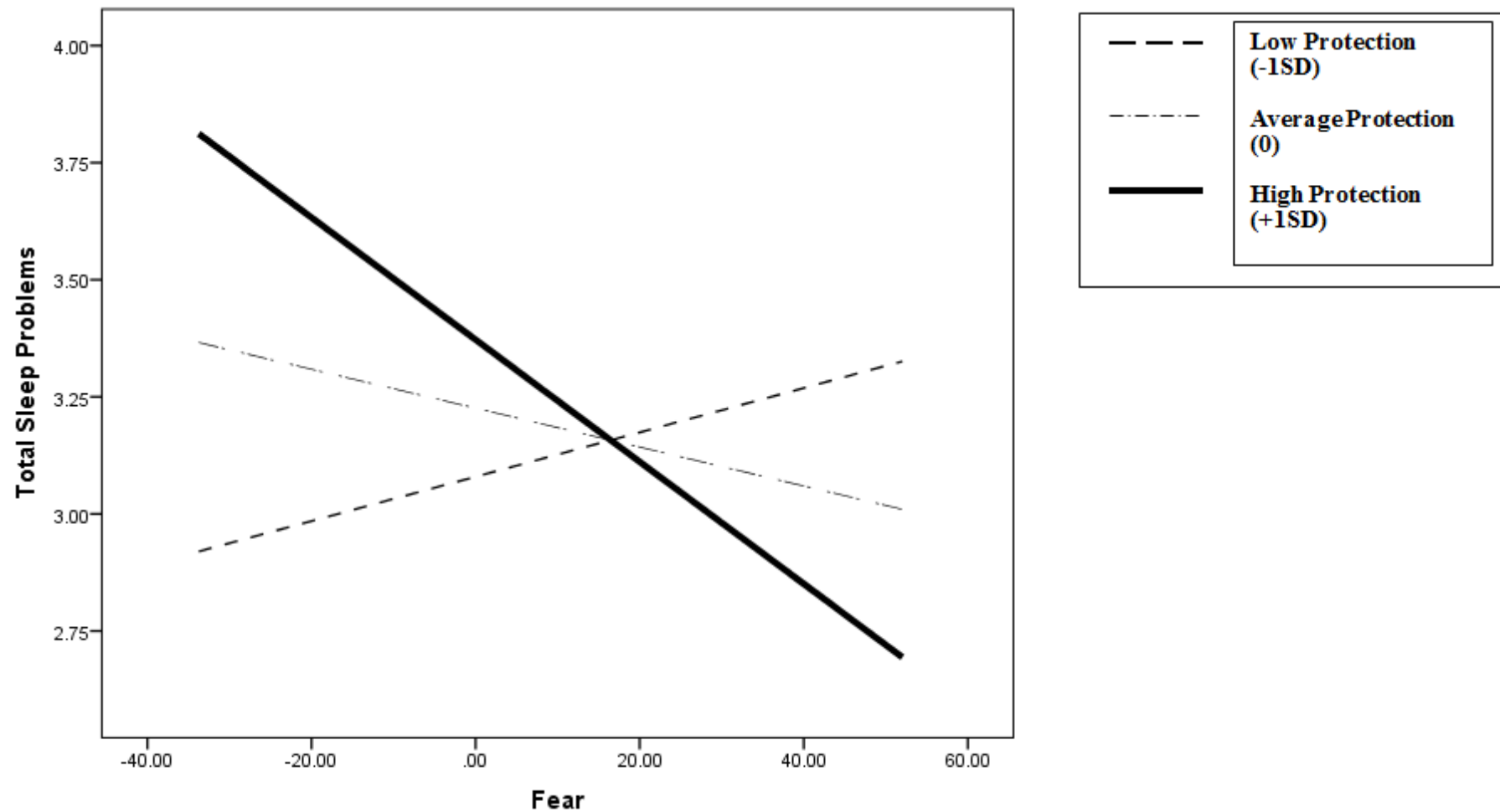
Figures

Figure 2a. Maternal protective behaviors in low threat episodes moderates the relationship between fearful temperament and maternal report of total sleep problems at age 4. The solid line represents a significant simple slope occurring at high level of maternal protection (+1sd above mean).
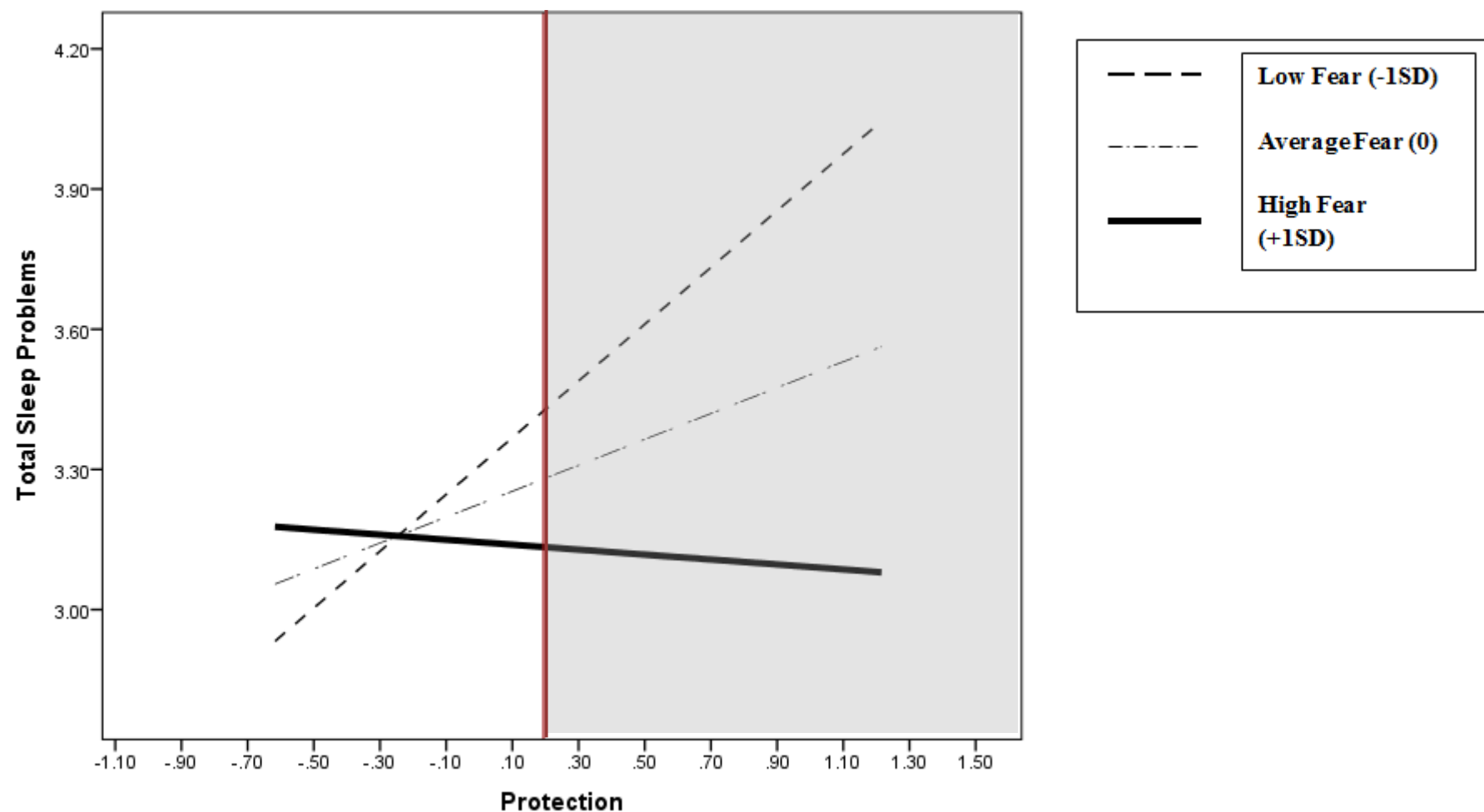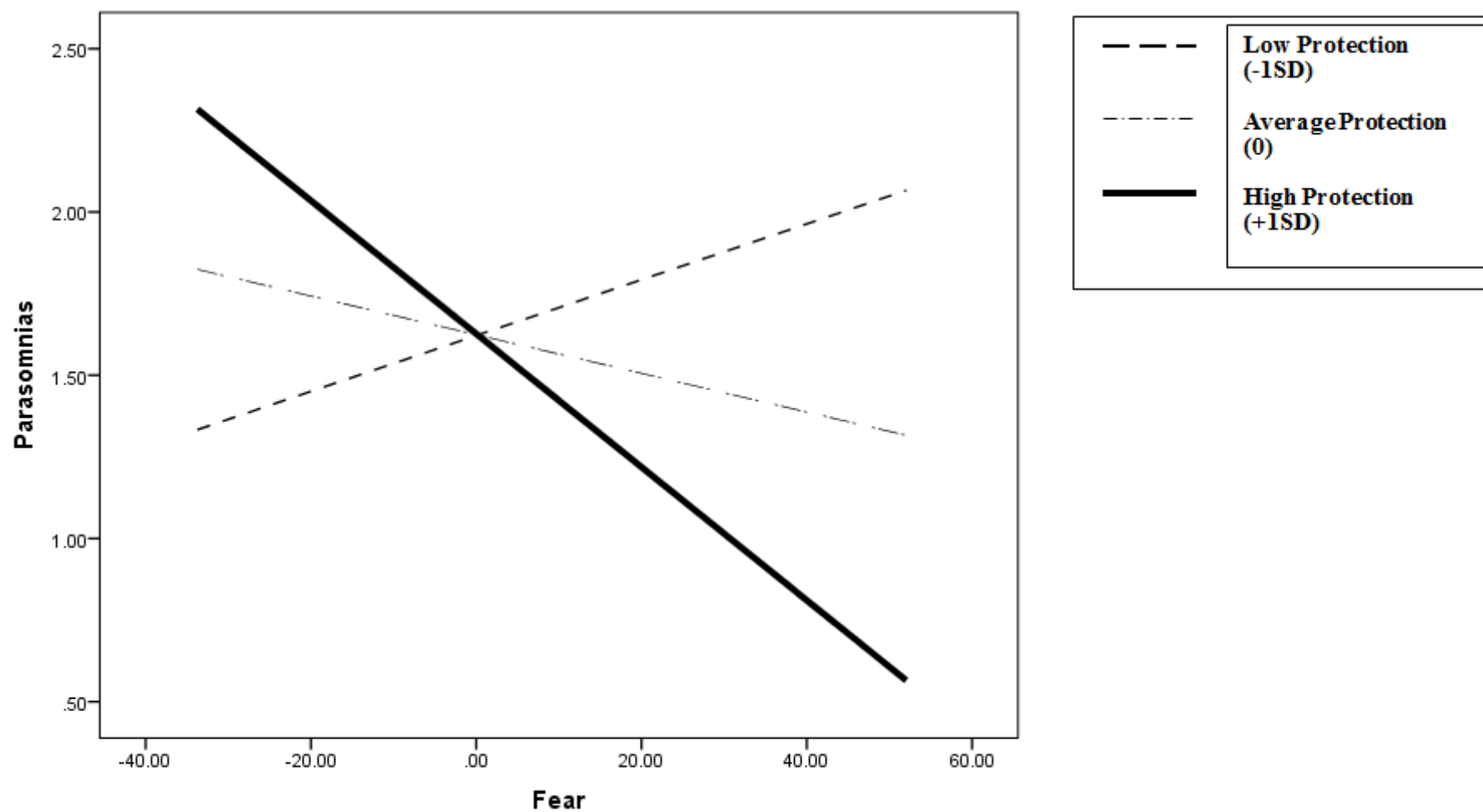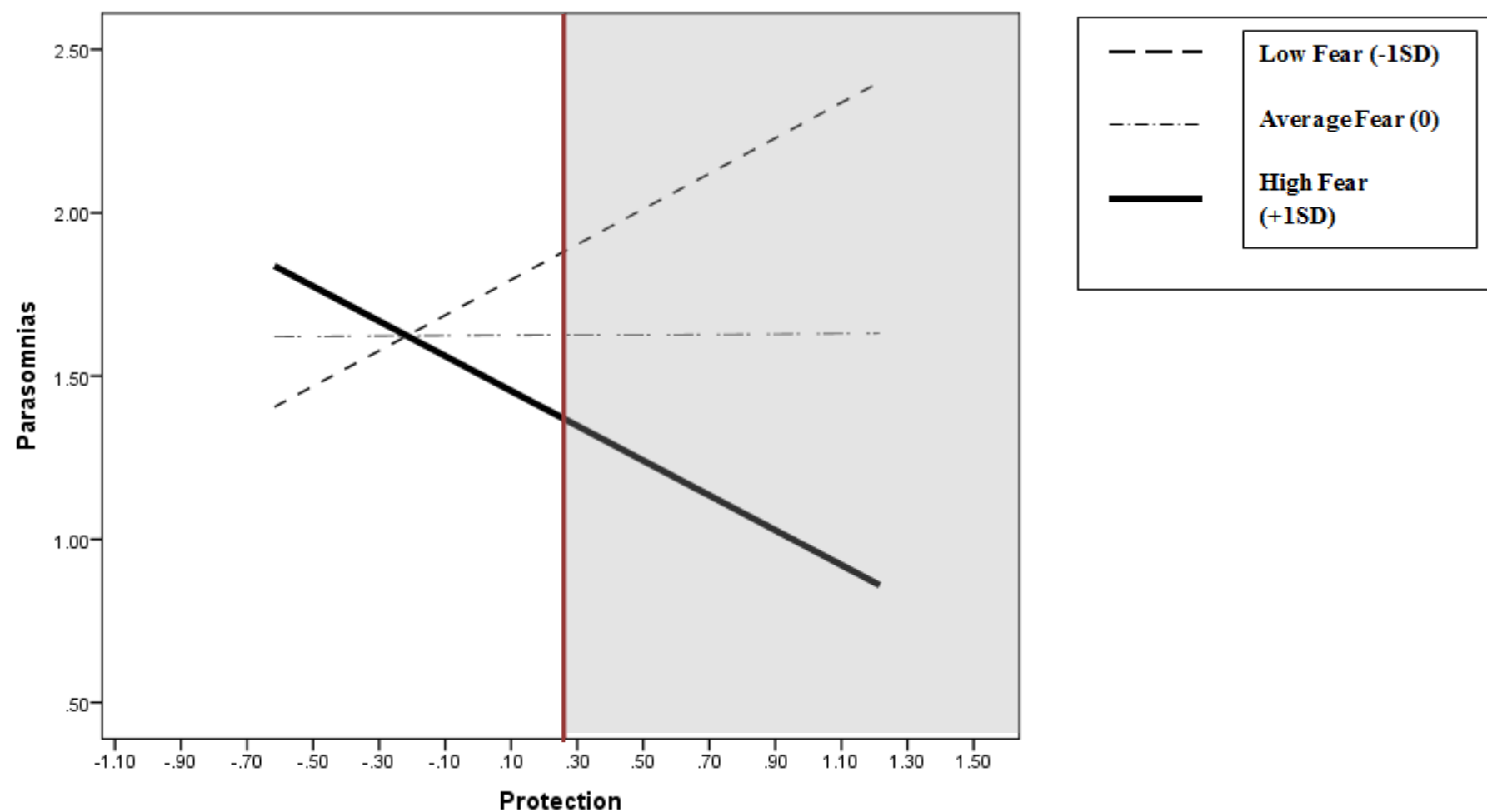
Figure 2b. Maternal protection intensity in low threat episodes moderates the relationship between fearful temperament and maternal report of total sleep problems at age 4. The shaded area represents the region of significance at which the predictive relationship between fearful temperament and total sleep problems becomes significant (Upper bound: +.19SD above mean).
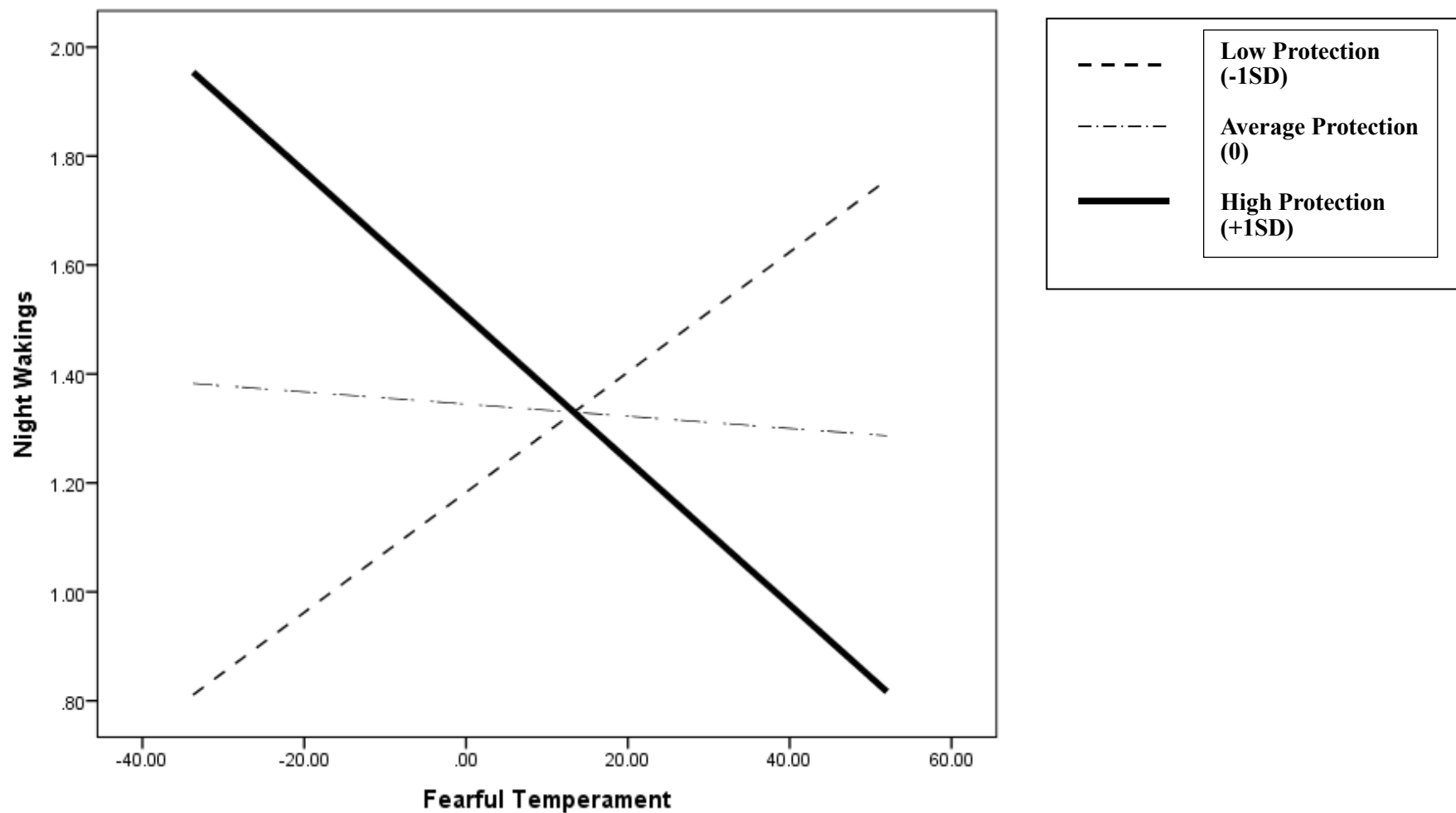
Figure 3a. Maternal protective behaviors in low threat episodes moderates the relationship between fearful temperament and maternal report of parasomnias at age 4. The solid line represents a significant simple slope occurring at high level of maternal protection (+1sd above mean).

Figure 3b. Maternal protection intensity in low threat episodes moderates the relationship between fearful temperament and maternal report of parasomnias at age 4. The shaded area represents the region of significance at which the predictive relationship between fearful temperament and parasomnias becomes significant (Upper bound: +.26 SD above mean).

Figure 4a. Maternal protective behaviors in low threat episodes moderates the relationship between fearful temperament and maternal report of night wakings at age 4. The solid line represents a significant simple slope occurring at high level of maternal protection (+1sd above mean).
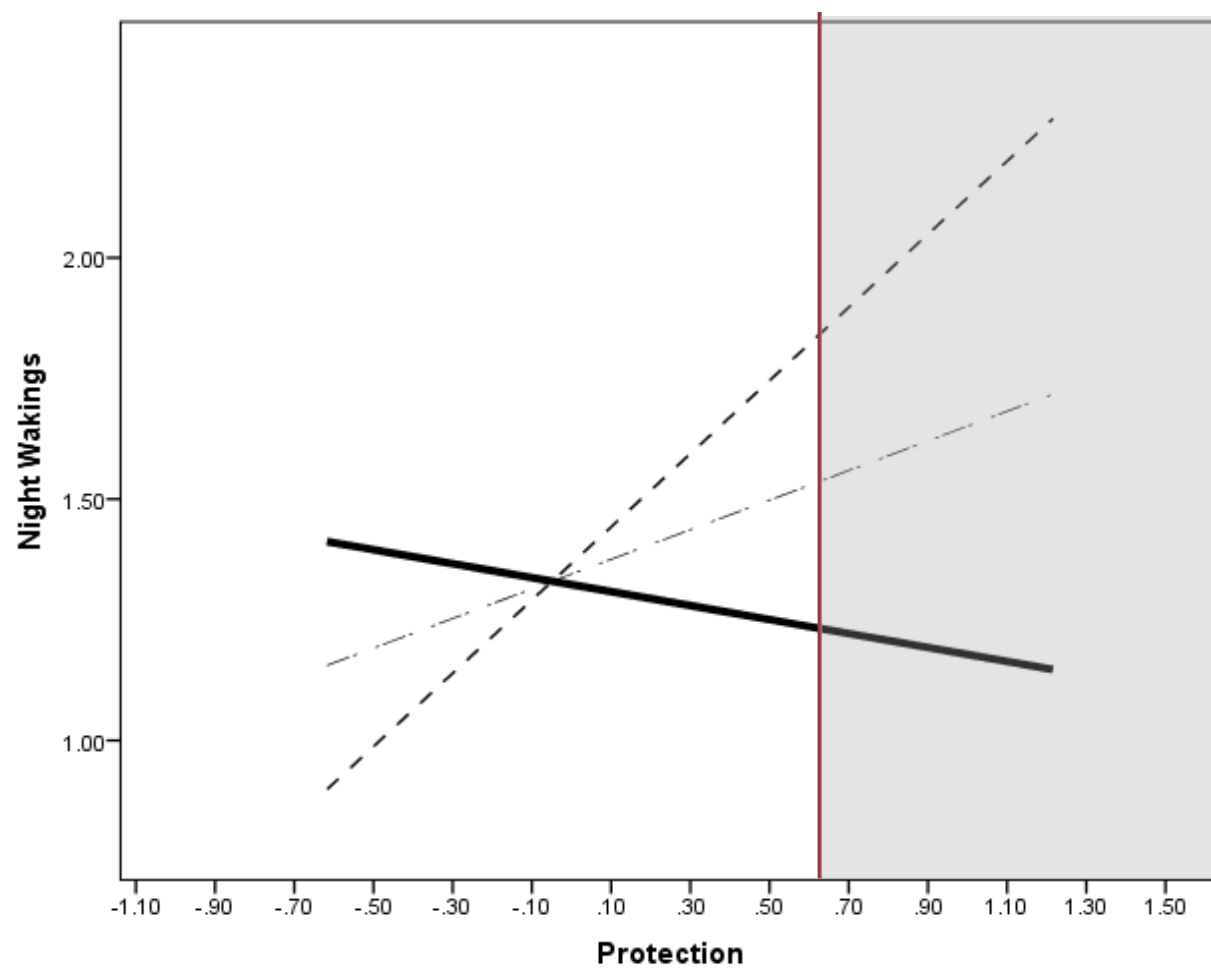
Figure 4b. Maternal protection intensity in low threat episodes moderates the relationship between fearful temperament and maternal report of night wakings at age 4. The shaded area represents the region of significance at which the predictive relationship between fearful temperament and night wakings becomes significant (Upper bound: +.63 SD above mean)
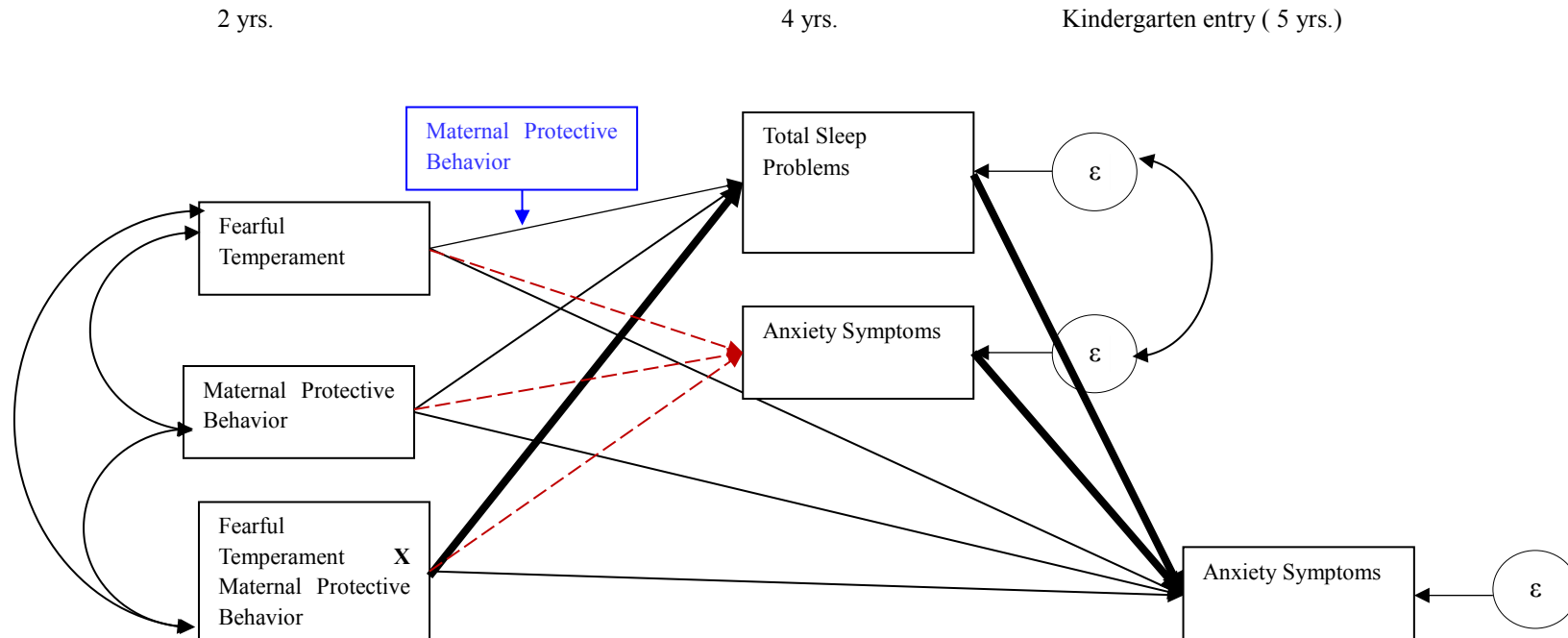
Figure 5. Final path analysis model examining the indirect effect of the total sleep problems: Bold lines represent significant paths (*p*<.10), solid lines represent non-significant paths, dotted lines represent non-significant paths removed from the initial saturated model.

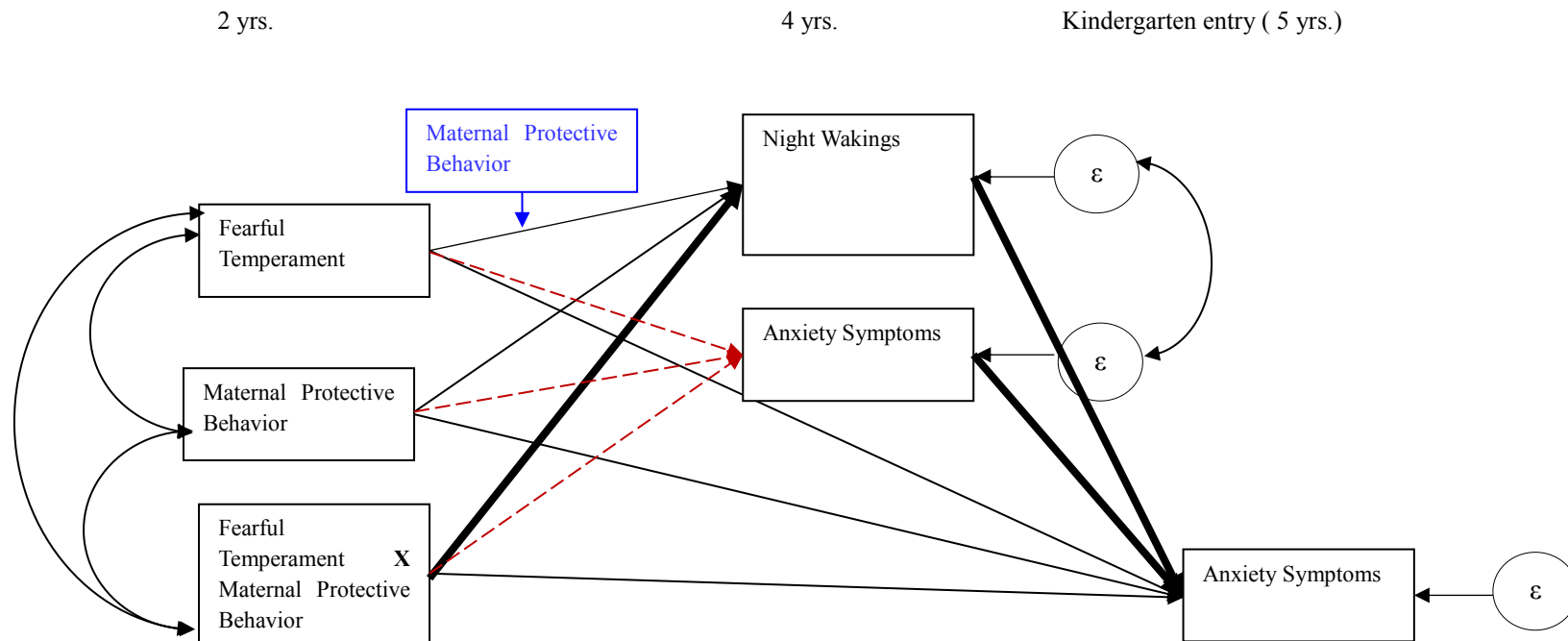$\chi^2(3)=1.97$, p=.58; CFI=1.00, NFI=.97 RMSEA=.00, TLI=1.15

Figure 6. Final path analysis model examining the indirect effect of the Night Waking: Bold lines represent significant paths (*p*<.10), solid lines represent non-significant paths, dotted lines represent non-significant paths removed from the initial saturated model.

χ^2 (3)=1.96, p=.58; CFI=1.00, NFI=.96, RMSEA=.00, TLI=1.28