Separation anxiety in children suffering from sleep terrors or sleepwalking

Mémoire

Elham Garmroudinezhad Rostami

Maîtrise en psychologie - avec mémoire
Maître ès arts (M.A.)

Québec, Canada

Anxiété de séparation chez les enfants souffrant de terreurs du sommeil ou de somnambulisme

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Elham Garmroudinezhad Rostami

Sous la direction de :

Michel Boivin, directeur de recherche

Résumé

La relation entre la psychopathologie développementale et le sommeil, ou vice versa, est complexe (Gregory & Sadeh, 2016). Davantage de recherche est nécessaire, y compris des études longitudinales populationnelles chez les enfants. Cependant, le trouble d'anxiété généralisée et le trouble d'anxiété de séparation comptent tous deux les problèmes de sommeil parmi leurs principaux symptômes chez les enfants en clinique (Kupfer, 2015; Shanahan et al., 2014). Les résultats sont toutefois mitigés et certaines perturbations du sommeil ne sont pas associées à l'anxiété dans la population non-clinique d'enfants. On sait peu de choses sur la relation entre l'anxiété de séparation et les terreurs nocturnes et le somnambulisme chez les enfants d'une population non clinique. Donc, dans ce mèmoire, je tente de démontrer la présence de liens entre l'anxiété de séparation et les terreurs nocturnes d'une part, et le somnambulisme d'autre part, dans la petite enfance ; je teste la robustesse de ces associations après avoir pris en compte l'anxiété générale chez les participants. Enfin, j'explorerai les différences entre les sexes pour ces associations. Cette recherche fait partie de l'Étude longitudinale du développement des enfants du Québec (ÉLDEQ, Canada), pilotée par l'Institut de la statistique du Québec. Dans l'échantillon initial, 2223 familles ont été incluses lorsque les enfants avaient environ cinq mois. Dans cette étude, l'anxiété de séparation et l'anxiété générale ont été mesurés chaque année entre l'âge de 1,5 et 6 ans grâce au questionnaire informatisé rempli par l'interviewer, un entretien structuré en face à face avec la mère (N = 2045; 2044). Les terreurs nocturnes ont été évaluées entre 1,5 et 6 ans et le somnambulisme entre 2,5 et 6 ans à l'aide d'un questionnaire auto-administré à la mère (N = 1840; 1849). Un score moyen à travers les temps de mesure a été calculé pour l'anxiété de séparation et l'anxiété générale alors qu'une somme a été calculée

pour les terreurs nocturnes et le somnambulisme. Les associations ont été testées par des régressions hiérarchiques en trois étapes : (1) anxiété de séparation et facteurs de confusion, (2) inclusion de l'anxiété générale et (3) inclusion d'un terme d'interaction sexe * anxiété de séparation. L'une des principales conclusions de cette étude est que l'anxiété de séparation pouvait prédire à la fois les terreurs nocturnes et le somnambulisme dans la petite enfance, même après contrôle de l'anxiété générale entrée comme facteur de confusion dans les modèles. Cette dernière n'a montré aucune association avec les deux parasomnies. Les associations n'étaient pas différentes pour les garçons et les filles.

Nos résultats ont montré que l'anxiété de séparation pourrait jouer un rôle dans l'apparition des terreurs nocturnes et du somnambulisme chez les jeunes enfants dans la population générale (non-clinique). Cette étude représente une étape importante dans la compréhension des liens entre les symptômes d'anxiété de séparation et le sommeil chez les enfants.

Abstract

The relationship between developmental psychopathology and sleep is complex (Gregory & Sadeh, 2016). More research is needed, including longitudinal population-based studies in children. However, Generalized anxiety disorder and separation anxiety disorder all list sleep problems among their core symptoms in clinical children population (Kupfer, 2015; Shanahan et al., 2014), but results are mixed and sleep disturbances may not be associated with anxiety in non-clinical population of children. Little is known the relationship between separation anxiety and night terrors and sleepwalking among children in a non-clinical population. So, in this dissertation, I explore the links between separation anxiety and night terrors on one hand, and sleepwalking on the other hand, in a non-clinical early childhood sample. This research is part of the Quebec Longitudinal Study of Child Development (QLSCD, Canada), initiated by the Quebec Institute of Statistics. In the initial sample, 2223 families were included when children were approximately 5 months. Separation anxiety and General anxiety were measured from the ages of yearly 1.5 to 6 years through the Interviewer Completed Computerized Questionnaire, a face-to-face structured interview with the mother (N= 2045; 2044). Night terrors were assessed from 1.5 to 6 years of age, and sleepwalking from 2.5 years to 6 years, through a self-administered questionnaire completed by the mother (N= 1840; 1849). A mean score across measurement times was calculated for separation anxiety and general anxiety, and a sum for night terrors and sleepwalking. I tested the associations with three-step hierarchical regression models: (1) inclusion of separation anxiety and confounding factors as predictors, (2) inclusion of general anxiety, and (3) inclusion of an interaction term gender*separation anxiety. One of the major findings of this study is that separation anxiety predicts both night terrors and

sleepwalking in early childhood, even after controlling for general anxiety. The latter showed no associations with any of the two parasomnias. Finally, these associations were not different for boys and girls.

Our findings have shown that separation anxiety may play a role in night terrors and sleepwalking etiology. This study represents an important step for a better understanding of the association between separation anxiety symptoms and sleep in children in the general (non-clinical) population.

Contents

List of Tables

Thank you

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Michel Boivin Ph.D. is professors at the School of Psychology at Laval University and regular researcher at the Research Unit on Children's Psychosocial Maladjustment (GRIP). Nadine Forget-Dubois Ph.D. is a Research Coordinator at the School of Psychology at Laval University.

Chapter 1. General Introduction

1.1 Separation anxiety in early childhood

During the first postnatal years, children may show developmentally appropriate distress (clinging or crying) when facing situations in which they are separated from their attachment figure, usually their mothers (Costello, Egger, 2005; Gregory et al., 2005; Mattis, 2004). Separation anxiety is defined as a developmentally appropriate reaction to separation from caregivers (Aytekin, Doru, & Kucukoglu, 2016; Beesdo, Knappe, & Pine, 2011; Bowlby, 1969; Denis & Baghdadli, 2017; Lecompte & Moss, 2014). In the population, it is estimated that up to 40 % of children have experienced a separation from caregivers with manifest anxiety during their development (Muris et al., 2017; VanderLaan et al., 2018).

In the preschool period, this anxiety may show more readily due to transition from the family environment to the preschool environment (Franz et al., 2013). In such a context, children prone to anxiety may more eagerly want to stay near those who are close to them, partly reflecting a proper attachment (Bowlby, 1969). In that sense John Bowlby's theory of attachment provides a useful framework for understanding the unique importance of the child's relationship with the main attachment figure (usually the mother) in the context of the onset and development of separation anxiety (Bowlby, 1969, 1982).

1.1.1 Bowlby's Attachment theory

Attachment theory typically highlights separation anxiety, proximity seeking, and the search for a safe haven (Bowlby, 1988). Attachment is described as a long lasting psychological emotional bond between an infant or toddler and a meaningful person such as primary caregiver (e.g. mother). Bowlby proposed that some conditions, such as

separation, may threaten the achievement of proximity with the attachment figure, and activate attachment behaviors (Bowlby, 1958). Specifically, a secure attachment allows an infant to separate from the caregiver with minimum distress, and begin to explore the world around her. Children who have developed secure attachment typically feel less anxious when separated from their attachment figure (Ainsworth & Bowlby, 1991; Ainsworth, Blehar, Waters, & Wall, 2015). However, children who show an insecure attachment tend to also experience separation anxiety since their parents are not playing the role of a safe haven during times of distress (Bowlby, 1944). It should be noted that children will sometimes feel worried or upset when separated from their parents or other important caregivers. This type of behavior is normal and important for emotional and mental growth, but when this anxiety is severe and persistent, it may represent signs of a disorder.

1.1.2 Separation anxiety and separation anxiety disorder

The distress generated by separation anxiety can also manifest itself in the form of fear or worry about finding oneself alone in new social situations (Adelman, Taylor, 2010). As this separation repeats, children adapt and feel progressively less anxious because they recognize that there is no danger and learn to manage their anxiety successfully (Ginsburg et al., 2014). However, not all children do; when this anxiety persists for at least 4 weeks (for patients younger than 18 years), and appears developmentally unusual, it is dubbed Separation anxiety disorder (DSM-5; APA, 2013).

The reported prevalence of separation anxiety disorders in children ranges between 2.4% to 3.6% (Bolton et al., 2006; Costello, Egger, 2005; Schneier et al., 2017). The criteria for separation anxiety disorder are defined as follows according to American Psychiatric Association (2013):

"as evidenced by at least three of the following manifestations: a) recurrent excessive distress when anticipating or experiencing separation from home or from major attachment figures, b) persistent and excessive worry about losing major attachment figures or about possible harm to them, such as illness, injury, disasters or death, c) persistent and excessive worry about experiencing an untoward event (e.g., getting lost, being kidnapped) that causes separation from a major attachment figure, d) persistent reluctance or refusal to go out, be away from home, go to school, go to work, or elsewhere because of fear of separation, e) persistent and excessive fear or reluctance about being alone or without major attachment figures at home or in other settings, f) persistent reluctance or refusal to sleep away from home or to go to sleep without being near a major attachment figure, g) repeated nightmares involving the theme of separation, and h) repeated complaints of physical symptoms (e.g., headaches, stomach aches, nausea, vomiting) when separation from major attachment figures occurs or is anticipated".

It is important to note that distress upon separation from a parent is usually normal for a child before age 5 years, and a clinical diagnosis of separation anxiety disorder is rarely justified before then (Costello, Egger, 2005; Mattis, 2004). There is no exact pattern, for some children separation anxiety disappears quickly and easily, while others have longer spells that seem to build to a peak and then fade away, only to reappear again (Costello, Copeland, & Angold, 2011). This anxiety can disrupt their lives and influences the overall quality of children's life (Comer et al., 2012; Langley, Bergman, & McCracken, 2004).

1.1.3 Correlates of Separation anxiety in individual's life

Separation anxiety can interfere with child's normal activities. Some children with separation anxiety get depressed, withdrawn, and incurious (Eisen, 2007; National Collaborating Centre for Mental Health, 2015). Children with separation anxiety face more problems in contexts such as kindergarten or school than those without anxiety (Doobay, 2008; Kearney, 2008; Maynard et al., 2015). They can become isolated from their friends and classmates, and have difficulty developing and maintaining friendships.

Separation anxiety can also lead to missed opportunities to learn new things and participate in activities. Also, children showing separation anxiety are particularly at risk of experiencing sleep difficulties, such as bedtime refusal, nightmares, nigh terrors, and sleep waking (Alfano et al., 2010; Owens, 2007; Petit, 2013). Separation anxiety can cause even the best sleeper to start waking frequently at night, which is logical because they do not want to be alone all night (Bathory & Tomopoulos, 2017; Gregory & Sadeh, 2016). Indeed, night time represents anxiety can cause even the best sleeper to start waking frequently at night, which is logical because they do not want to be alone all night (Bathory & Tomopoulos, 2017; Gregory & Sadeh, 2016). This is not surprising given that the tendency to worry before bed and in bed has been shown to cause sleep interference (Cortese, Ivanenko, & Ramtekkar, 2014). In fact, sleep disturbances can be one of the major risks incurred by children with separation anxiety (Battaglia et al., 2016; Schlarb et al., 2016).

1.2 Sleep disturbances in early childhood

1.2.1 Importance of sleep in children

Sleep is very important for children and disturbances in sleep may negatively influence their quality of life (Meltzer, Montgomery-Downs, 2012; Sung et al., 2008). Indeed, sleep loss in children results in increased levels of anxiety and fear the following day (Laberge, Tremblay, Vitaro, & Montplaisir, 2000; Vriend & Corkum, 2011; Wilson et al., 2010). Sleep problems have been reported in 80 – 90 % of children with anxiety disorders (Alfano, Ginsburg, & Kingery, 2007; Alfano, Beidel, Turner, & Lewin, 2006; Alfano et al., 2010; Alfano et al., 2006;Chase & Pincus, 2011; Gillin, 1998; Shute, Hansen, Underwood, & Razzouk, 2011; Owens, 2007; Papadimitriou & Linkowski, 2005). However, children with sleep disturbances and anxiety may in fact have had prolonged sleep disturbances (Zuckerman, Stevenson, 1987; Gillin, 1998; Spruyt et al., 2005). There is increasing evidence that around 80% to 90% of children with sleep problems tend to experience persistent sleep problems into adulthood (Gregory et al., 2005). In addition, inadequate sleep may be particularly relevant to self-control in the regulation of behavior and emotion (Ehrenreich, Santucci, & Weiner, 2008; Turnbull et al., 2013). Several epidemiological findings suggest that persistent sleep problems in life are a predictor for the development of anxiety later in adolescence and adulthood (Gregory, Ende, Willis, & Verhulst, 2008; Smedje, Broman, Hetta, 2001; Whalen et al., 2017). These findings show the importance of sleep problems for the emotional and behavioral development of children, and thus point to children's sleep as a possible issue of public health risk factor. It is also true that sleep is a mix of physiological and behavioral development.

Healthy sleep for optimal health and functioning throughout life (Fabiano et al., 2009 ; Gregory et al., 2005; Mindell & Owes, 2003; Pilcher & Huffcutt, 1996) requires adequate

duration and the absence of sleep disturbances (Galland, Taylor, Elder, & Herbison, 2012; Iglowstein, Jenni, Molinari, & Largo, 2003). Adequate duration of sleep also promotes optimal health in individuals, especially in children (Paruthi et al., 2016). However, sleep needs may vary with age (Iglowstein et al., 2003; Ohayon et al., 2004). For instance, healthy term infants spend in excess of 15 h asleep each day in the form of brief 2–4 h sleep periods (Banks & Dinges, 2007; Hirshkowitz et al., 2015). The toddler and preschool years are characterized by regular declines in daily sleep duration, from an average of 13.9 h at 1 year of age to 11.4 h at age 5 (El Shakankiry, 2011; Roffward et al., 1966). In addition, the physiology of sleep is fundamental to understanding pediatric sleep disturbances.

1.2.1.1 Evolution of normal sleep during infancy and early childhood

Sleep duration, quality, and architecture changes over the lifespan, particularly in the first 5 years of life (Bathory, Tomopoulos, 2017; El Shakankiry, 2011; Sadeh, 2000). This maturational process is influenced by multiple biological and psychological factors (Owens, 2007). For the biological aspect the ultradian rhythm leads the sleep through night during this period by the light-dark cycle and the secretion of the pineal hormone melatonin which rises in the dark hours and drops in response to light exposure (Dahl & Lewin, 2002; Davis et al., 2004). Beyond the biological perspective, cultural and psychosocial influences on sleep evolution are related to psychosocial stress (for reviews, see Dahl & Lewin, 2002; Mindell & Owens, 2015; Bathory & Tomopoulos, 2017).

Sleep alternates between rapid eye movement sleep and non-rapid eye movement sleep, in sleep cycles or ultradian rhythms (Bathory & Tomopoulos, 2017; Banks & Dinges, 2007; El Shakankiry, 2011). Over the first five years, the biological rhythms also mature, with decreased sleep fragmentation and increased sleep at nighttime (Bathory & Tomopoulos, 2017; Davis et al., 2004; Sadeh, 2000). Indeed, sleep increases from 8 to 9 hours in 1 year

old to 10 hours per night at 5 year of age and remains quite stable until puberty (Bathory &Tomopoulos, 2017; Sadeh & Mindell, 2016). In addition, during nighttime sleep, if arousals occur in between sleep cycles can be disruptive to sleep. For example, separation anxiety sometimes leads to increased sleep disruptions (Petit et al., 2007; Schlarb et al., 2016). This anxiety is associated with interrupted sleep after sleep onset in children (i.e., rapid and non-rapid eye movement; El Shakankiry, 2011).

1.2.2 Non-rapid eye movement arousal parasomnias in early childhood

The American Academy of Sleep Medicine (2014) defines parasomnias as "undesirable physical events or experiences that occur during entry into sleep or during arousals from sleep". Sleepwalking and night terrors are classified as disorders of partial arousal parasomnias when children exit from slow wave sleep (i.e., stages 3 and 4 of non-rapid eye movement of sleep; Petit et al., 2015). Each stage of non-rapid eye movement among the four stages represents the gradation in depth of sleep and difficulty of arousal. It means that with stage 1 (non-rapid eye movement) being the lightest and stage 4 being the deepest sleep (Colten, Altevogt, & Colten., 2006). Although parasomnias are often assumed to be benign, it is important to recognize them properly for several reasons. First, sometimes they are reflecting a psychological problem for the child such as anxiety (Wilson et al., 2010). Second, even though parasomnias are common occurrences during childhood, they sometimes persist into adulthood (Laberge et al., 2000; Mason & Pack, 2007; Petit et al., 2007; Waters, Moretto, & Dang-vu, 2017). The exact causes of parasomnias are unknown, but pre-sleep stress and anxiety each increase the likelihood that such events will occur (Chow, 2007; Terzaghi et al., 2009).

1.2.2.1 Non-rapid eye movement arousal parasomnias: sleep terrors and sleepwalking

"Children often experience one or a combination of parasomnias" (Petit, et al., 2007). Indeed, 17% of sleepwalkers also suffer from night terrors, while 36% of night terrors sufferers have sleepwalking episodes (Chow, 2007; Laberge et al., 2000; Mahowald & Schenck, 2005;Waters et al., 2017). The American Academy of sleep medicine (2014) defines sleepwalking as "a series of complex behaviors that are usually initiated during arousals from slow wave sleep and culminate in walking around with an altered state of consciousness," whereas night terrors are "arousals from slow-wave sleep accompanied by a cry or piercing scream and autonomic nervous system and behavioral manifestations of intense fear". These parasomnias may be considered part of a continuum, as they share overlapping features (Irfan, Schenck, & Howell, 2017; Mason & Pack, 2007; Petit et al., 2015). The prevalence of parasomnias in the general population of children has been estimated at approximately 5%–15% for sleepwalking (Laberge et al., 2000; Petit et al., 2015; Stallman, et al., 2017), and 1%–14.7% for night terrors (Ophoff et al., 2018; Petit et al., 2015). This variation could be explained by the accuracy of the report of family members and, since confusion with other disorders is likely to occur as it is the case for nightmares (Broughton, Science, Series, & Mar, 2016; Zadra, Donderi, & Assad, 1991).

Sleepwalking behaviors can range from sitting up in bed to attempt to walk (Chow, 2007; Laberge et al., 2000). After the episode, children may return to bed and have little or no memory of the episode in the morning (Oudiette et al., 2009; Zadra, Desautels, Petit, & Montplaisir, 2013). In addition, many children have a family history of night terrors and sleepwalking (Hublin et al., 1997 ; Kales et al., 1980; Lecendreux et al., 2003; Licis et al, 2011; Tremblay et al., 2008). Finding positive history in families of children sleepwalking and displaying night terrors support the hypothesis that non-rapid eye movement share a

common genetic basis (Heidbreder et al., 2016; Hublin, Kaprio, Partinen, & Koskenvuo, 2001; Hublin et al., 1997).

1.2.2.2 Sex differences in sleep terrors and sleepwalking

Sleepwalking and night terrors were originally reported to be more frequent in boys than in girls (Adair & Bauchner, 1993; Davis et al., 2004). However, a high prevalence of night terrors is particularly striking for girls during adolescence (Ohayon et al., 2004). These studies were based on clinical impressions rather than on epidemiological data; in epidemiological studies, no significant gender differences were found for the prevalence of sleepwalking and night terrors (Fisher & Wilson, 1987; Fisher et al., 2012; Klackenberg, 1982). Differences between boys and girls in prevalence and etiology of parasomnias remain to be established in children in the general population.

1.3 Association of separation anxiety with sleep terrors and with sleepwalking in early childhood

Children with separation anxiety may experience high levels of stress and anxiety surrounding sleep. Rates of parent-reported sleep problems in children with separation anxiety were significantly higher across the diagnostic groups with the exception of parasomnias (Mason & Pack, 2007). Indeed, Pre-sleep stress and anxiety each increase the rates of parasomnias (Alfano et al., 2007). Thus, consistent with previous findings, Alfano and colleagues (2010) have examined sleep problems and pre-sleep arousal among anxious children and adolescents, in relation to primary anxiety disorder. They have suggested parasomnias were reported in children aged 7-14 years old with separation anxiety disorder and general anxiety disorder in clinical population. In a non-clinical population study of children aged 2.5 to 6 years, Petit and colleagues (2007) have evaluated the associations between persistent parasomnias in children with other areas of the child's life. They found persistent night terrors and sleepwalking were related to separation anxiety at 6 years of age; however associations with child's social development, more specifically on separation anxiety at other ages were not examined. Despite the similar pathophysiology and occurring factors for sleepwalking and night terrors (Irfan, Schenck, & Howell, 2017; Petit et al., 2015), factors that might precipitate sleepwalking in children are not well understood but Steinsbekk and Wichstrøm (2015) have examined the bidirectional relationship between sleep disorders and symptoms of psychiatric disorders in first grade in a large and representative community sample, they found sleepwalking predicted later separation anxiety disorder. Their results indicate that specific sleep disorders in preschoolers represent a risk factor for developing specific psychiatric symptoms in first grade. Moreover, Stallman and colleagues (2017) explored the relationship between sleepwalking

and other behaviors among Australian elementary children. They found a high association between sleepwalking and night terrors, and sleepwalking was more associated with problems of bedtime routine and bedtime anxiety. However, less is known about the association of separation anxiety with night terrors and with sleepwalking in early childhood in a non-clinical population of preschoolers. These parasomnias may represent different phenotypic expressions of the same underlying disorder. Here, we examine a new avenue: the possible association between separation anxiety between ages 1.5 to 6 years old, and two forms of sleep problems, night terrors and sleepwalking at the same period of ages.

1.4 Association of separation anxiety and general anxiety with sleep terrors and with sleepwalking

A growing body of research suggests a high prevalence of sleep problems among anxious youth (Alfano et al., 2006; Storch et al., 2008). Indeed, according to parents' reports, anxious children experienced different types of sleep problems. In fact, they encompass a diverse range of possible nighttime disturbances, ranging from reluctance to or avoidance of getting into bed and refusal to sleep independently to shifts in circadian rhythm, and to parasomnias (e.g., sleepwalking, night terrors, enuresis; Alfano et al., 2010). Indeed, the consequences of both cumulative and acute sleep loss increased levels of anxiety the next day among children (Jeynes, 2012; Lim & Dinges, 2010; Sagaspe et al., 2006). However, epidemiological studies have also shown that persistent sleep problems in children are a unique predictor for the development of anxiety during adolescence and adulthood (Gregory et al., 2005; Ong, Wickramaratne, Tang, & Weissman, 2006). In addition, researchers have proposed a reciprocal relation between sleep problems and anxiety, whereby disturbed sleep increases a child's vulnerability to developing anxiety, while anxiety, in turn, interferes with sleep (Alfano et al., 2010). Sleep and anxiety are thus intrinsically and reciprocally related.

General anxiety and separation anxiety are among the most common psychiatric illnesses in children (Costello, Egger, 2005; Kessler, Ruscio, Shear, & Wittchen, 2010). General anxiety and separation anxiety usually occur during childhood (Hirshfeld Becker & Biederman, 2002). They are commonly comorbid: Kendall, Brady, & Verduin (2001) have reported that approximately "one-third of the time" general anxiety co-occurs with separation anxiety in clinical sample, and have overlapping symptoms (e.g., somatic symptoms, problems sleeping,

and avoidance behavior; Angold, Costello, & Erkanli, 1999; Walkup et al., 2008). To date, published reports have tended to focus on sleep problems among youth with and anxiety disorders (Alfano et al., 2006; Alfano et al., 2007). The occurrence of parasomnias has been shown to increase with anxiety (Alvaro, Roberts, & Harris, 2013; Laberge et al., 2000). Indeed, general anxiety has also been associated with sleep terrors in children but only from clinical reports (Dahl. 1992; Waters et al., 2017). Although these studies provide an important basis for research in this area, data examining concurrent associations between sleep problems and both types of anxiety together (general anxiety and separation anxiety) in community-based samples of children are more limited. Thus, we are seeking to better understand the nature of comorbidities between both general anxiety and separation anxiety with night terrors and sleepwalking.

1.5 Objectives of the thesis

Empirical studies have drawn attention to a number of poor outcomes associated with separation anxiety, including failure to achieve critical developmental milestones such as leaving parents to play with friends, socialisation, family well-being and later mental health (Poulton et al., 2001). Separation anxiety has also been associated with other signs of dependence, notably in the context of sleeping. Anxious children often experience non-specific fears at night and difficulty sleeping alone/away from caregiver (Alfano et al., 2010; Laberge et al., 2000; Mindell & Barrett, 2002). In addition, recent research has suggested that separation anxiety might be associated with parasomnias in early childhood (Petit et al., 2007). However, no study has yet examined night terrors and sleepwalking as outcomes of separation anxiety from age of 1.5 to six years. In addition, it is crucial to examine the patterns of co-occurrence of two types of anxiety (separation anxiety and general anxiety) with these two parasomnias among preschoolers.

Accordingly, the specific aims of this dissertation are: (1) to investigate whether separation anxiety is associated with night terrors and sleepwalking in early childhood; (2) to determine whether separation anxiety remains associated with these two parasomnias after taking into account general anxiety; (3) examine potential sex differences in these associations.

Chapitre 2. Article

Association of separation anxiety with sleep terrors and sleepwalking in preschoolers: a population-based study

Elham Garmroudinezhad Rostami, M.D.
Université Laval

Michel Boivin, Ph.D.
Université Laval

Nadine Forget-Dubois, Ph.D.
Université Laval

Résumé

L'association de l'anxiété de séparation avec les terreurs nocturnes et le somnambulisme n'est pas encore bien comprise. L'anxiété de séparation a été proposée comme facteur de risque important dans l'apparition de parasomnies. Le but de cette étude était triple: (1) déterminer si l'anxiété de séparation prédit les terreurs nocturnes et le somnambulisme entre 1,5 et 6 ans; (2) examiner si l'anxiété de séparation est toujours associée aux parasomnies après avoir tenu compte de l'anxiété générale (3) rechercher d'éventuelles différences entre les sexes dans ces associations. Cette recherche fait partie de l'Étude longitudinale des enfants du Québec (ÉLDEQ, Canada), dirigée par l'Institut de la statistique du Québec. L'échantillon initial comprenait 2223 familles d'enfants de 5 mois, suivis chaque année par la suite. L'anxiété de séparation et les scores d'anxiété générale ont été mesurés entre l'âge de 1,5 et 6 ans au moyen d'un questionnaire informatisé rempli par un intervieweur, lors d'un entretien structuré en face à face avec la mère (N = 2045; 2044). la terreur nocturne a été évaluées de 1,5 à 6 ans et le somnambulisme de 2,5 à 6 ans, grâce à un questionnaire auto-administré rempli par la mère (N = 1840; 1849). Nos résultats montrent que l'anxiété de séparation était associée à la terreur nocturne et au somnambulisme à l'âge de 1,5 à 6 ans, même après contrôle de l'anxiété générale, et que les associations étaient similaires chez les garçons et les filles. Les problèmes d'anxiété de séparation dans la petite enfance pourraient donc être une cible pour prévenir et réduire les terreurs nocturnes et les manifestations de somnambulisme chez les enfants d'âge préscolaire.

Abstract

The association of separation anxiety with night terrors and sleepwalking is not yet well understood. Separation anxiety has been proposed as a significant risk factor in the emergence of parasomnias. The aim of the present study was threefold: (1) to determine whether separation anxiety predicts night terrors and sleepwalking between ages 1.5 and 6 years; (2) to examine whether separation anxiety is still associated with the parasomnias after controlling for general anxiety (3) to investigate possible sex differences in these associations. This research is part of the Quebec Longitudinal Study of Child Development (QLSCD, Canada), led by the Quebec Institute of Statistics. The initial sample included 2223 families of 5-month-old children, followed yearly thereafter. Separation anxiety and general anxiety scores were measured from the ages of 1.5 to 6 years through an interviewer-completed computerized questionnaire, a face-to-face structured interview with the mother (N= 2045; 2044). Night terrors were assessed from 1.5 years to 6 years of age, and sleepwalking from 2.5 years to 6 years of age, through a self-administered questionnaire completed by the mother (N= 1840; 1849). Our results show that separation anxiety was associated with night terror and sleepwalking at ages 1.5 to 6 years old, even after controlling for general anxiety, and that the associations were similar for boys and girls. Separation anxiety issues in early childhood could thus be a target for preventing and reducing night terrors and sleepwalking manifestations in preschoolers.

Introduction

Separation anxiety is defined as a developmentally appropriate reaction of the child to separation from caregivers (Aytekin et al., 2016; John Bowlby, 1988; Beesdo et al., 2011; Denis, Baghdadli, 2017; Lecompte & Moss, 2014; Steinsbekk & Wichstrøm, 2015). The most common symptoms of separation anxiety during that period are distress when separated from attachment figure as well as fear and avoidance of being alone and sleeping away from caregivers or from home (American Psychiatric Association, 2013). Separation anxiety usually occurs from late in the first postnatal year to the early preschool years (Gregory et al., 2005). Separation anxiety symptoms usually peak between nine and thirteen months of age, then decrease after two years of age. However, a second peak of symptoms often appear by age four to five, when the child starts kindergarten and elementary school (Costello, Egger, 2005; Mattis, 2004; Compton, Nelson, & March, 2000).

For most children, separation anxiety is a temporary problem which will pass without intervention but for others, this problem persists and may evolve into a disorder dubbed separation anxiety disorder (APA, 2013). Children with separation anxiety disorder show severe and inappropriate distress when separated from persons to whom they are attached (APA, 2013; Peleg, Halaby, & Whaby, 2006). Accordingly, the peak onset of separation anxiety disorder is between 7 and 9 years of age (Figueroa et al., 2012). Current evidence shows that separation anxiety symptoms that occur in children before age 6 should not be considered as a disorder, but this period of age is crucial for changing age-appropriate anxiety symptoms into a disorder. Girls report more fears than boys (Gullone, 2000), but they do not have higher rates of anxiety disorders (e.g., Kendall, Taylor, Perez, & Taylor,

2008). There is however some evidence of gender differences in separation anxiety in early childhood (e.g., Francis, Last, & Strauss, 1987; Halpern, Brand, & Malone, 2001).

Separation anxiety has been associated to overall quality of children's life (Langley, Bergman, McCracken, 2004). Children showing separation anxiety have a poorer emotional functioning compared with children without separation anxiety (Bastiaansen, Koot, Ferdinand, & Verhulst, 2004). Separation anxiety has also been associated with other signs of dependence, notably in the context of sleeping. One possible explanation for the association between separation anxiety and sleep-related problems (e.g. bedtime refusal, nightmares, night terrors, and sleepwaking; Alfano et al., 2010) is that nighttime involves a period of long separation from parents, and may thus trigger children's worst fears. This is not surprising given that the tendency to worry before bed and in bed has been shown to interfere with sleep. Conversily, disruption in sleep continuity and quality may result in excessive daytime sleepiness and anxiety in children (Aronen et al., 2000; Dewald et al., 2010; Fallone, Owens, & Deane, 2002; Fredriksen, Rhodes, Reddy, & Way, 2004; Willis & Gregory, 2015). Moreover, a growing body of research documents a high prevalence of sleep problems among children with general anxiety disorder (Alfano et al., 2006; Storch et al., 2008). Across studies, up to 90% of children experience at least one type of sleep problems, and 55% report several sleep-related difficulties including nightmares and refusal to sleep independently (Alfano et al., 2007; Storch et al., 2008). Indeed, sleep problems among children are generally associated with a wider range of behavioral problems, such as anxiety (Gregory et al., 2008; Gregory et al., 2005).

For families of children with separation anxiety, the most worrisome associated problems are sleep problems (Eisen & Schaefer, 2007). However, we still know little about this association, as the actual evidence is mainly based on clinical samples. For instance,

nightmare has been listed as a core symptom of separation anxiety disorder in the DSM-V-R (APA, 2013). Studies have reported the presence of parasomnias in children with separation anxiety disorder (Alfano et al., 2010; Verduin & Kendall, 2003). The American Academy of Sleep Medicine (2014) defines parasomnias as "undesirable physical events or experiences that occur during entry into sleep, within sleep or during arousals from sleep", including night terrors and sleepwalking. Although the link between separation anxiety disorder and parasomnias is well documented, less is known about the link between separation anxiety and parasomnias: in other words, it is yet to be established whether the association between separation anxiety symptoms and parasomnias also exists in the general, non-clinical population. So far, research examining the relation between separation anxiety and parasomnias such as night terrors and sleepwalking is extremely limited.

Children often experienced one or a combination of parasomnias. Indeed, children manifesting sleepwalking are also likely to show night terrors, or to show sleepwalking later, when they no longer exhibit night terrors (Stallman & Kohler, 2016; Petit et al., 2007; Petit et al., 2015). These two parasomnias have many similar characteristics. They both arise mainly from slow-wave sleep, and their occurrence is facilitated by the same factors (Petit et al., 2015). The American Academy of Sleep Medicine (AASM, 2014) defines night terrors as "arousals from slow-wave sleep accompanied by a cry or piercing scream and autonomic nervous system and behavioral manifestations of intense fear". Sleepwalking is defined as "a series of complex behaviors that are usually initiated during arousals from slow wave sleep and culminate in walking around with an altered state of consciousness"; it is regularly reported in children (Zadra & Pilon, 2011), and has also been linked with separation anxiety in several studies (Petit et al., 2007; Steinsbekk &

Wichstrøm, 2015). No gender differences has been reported in the prevalence of night terrors and sleepwalking (Petit et al., 2007; Stallman et al., 2017).

The prevention of parasomnias in children is particularly important because of the possible negative impact of unresolved sleep problems on daytime functions (Parent, Sanders, & Forehand, 2016; Slopen, Lewis, & Williams, 2016). Accordingly, a better understanding of the risk factors for parasomnias in the general population is needed, so that these conditions may be addressed and prevented appropriately. One of these risk factors could be separation anxiety (Alfano et al., 2007; Alfano et al., 2010; Verduin & Kendall, 2003). Children with general anxiety often experience worries about aspect of life more, and more often, than other children (Beesdo et al., 2011; Rector et al., 2016). According to the American Psychiatric Association (APA, 2013), separation anxiety is a type of worry about separation or loss of the home or of a specific person. Similarly, some common worries linked to general anxiety include worries about friends and family, such as relationships, and getting along with others. Both the "worry" part of separation anxiety and general anxiety cause non-specific fears at night and difficulty sleeping alone/away from caregiver (Alfano et al., 2010; Mindell & Barrett, 2002). Thus, consistent with previous results, children with general anxiety disorder and separation anxiety disorder may experience the highest levels of stress and anxiety surrounding sleep.

However, separation anxiety is not yet established as a significant risk factor in the emergence of night terrors and sleepwalking among children in a non-clinical population, and there is thus a need to document this putative association empirically. Moreover, the occurrence of parasomnias has been accounted to increase with general anxiety (Alvaro et al., 2013; Laberge et al., 2000). Despite the fact that the link between general anxiety and parasomnias is well known, their specific and unique links of general anxiety with

separation anxiety and night terrors and sleepwalking are yet to be established. To pinpoint the specific contribution of separation anxiety, we need to take into account other types of anxiety related to separation anxiety, such as general anxiety (Cummings, Caporino, & Kendall, 2014). The goal of the present study is to fill this gap by investigating in a longitudinal manner how separation anxiety relates to night terrors and sleepwalking etiology in children between 1.5 to 6 years of age. Specifically, the aims of the present study are threefold: 1) to document the association of separation anxiety with both night terrors and sleepwalking in a large community sample of children; 2) test whether these purported associations remain after taking into account general anxiety; 3) investigate sex differences in these associations as an exploratory step.

Method

Participants

The data used for the present study have been collected as part of a large longitudinal epidemiological study, the Quebec Longitudinal Study of Child Development (QLSCD), conducted by the Quebec Institute of Statistics (Canada). Infants were recruited from the Quebec Master Birth Registry of the Ministry of Health and Social Services. A randomized, 3-level, stratified survey design was used to study a representative sample of infants who were born in 1997-1998 in the province of Quebec. The 3 levels were (1) geographic region of Quebec, (2) each region subdivided in areas that were representative of the number of births in the region, and (3) number of children selected per area symmetric to the number of births and to the gender ratio of this area. Families living in the northern part of the province of Quebec, Inuit territories and First Nations reserves were excluded of the study for technical reasons due to the large dispersion of the Inuit Territories and the costs

associated with them. Also, children with medical problems were excluded from the cohort. In the initial cohort, most (85.7%) children had a Canadian non-immigrant mother and 14.3% were first-generation immigrants. The majority of the sample was Caucasian (89.7%), whereas Black (2.5%), Arab (2.3%), Asian (1.1%) and children from other origins (4%) completed the sample. Most mothers spoke French as a first language (77.1%), 8.9% others spoke English, and 14% had another first language.

The period between age 1.5 to age 6 years involved six assessment times with the Person Most Knowledgeable about the child (PMK; 99.7% of times the mother), followed by one teacher rating of participants' separation anxiety in kindergarten. Initially, 2,675 families were invited to participate in the study by mail and by telephone. Of these, 2,223 (83.1%) agreed to receive a first home visit when the target child was approximately 5 (4.5 ± 0.6) months old. All families had received detailed information by mail about the aims and procedures of the research program and signed a consent form. The protocol was approved by the Quebec Institute of Statistics. The first four assessments took place at 1-year intervals, and in the spring during school years. At the second round, 2045 children who were aged 17 months were still participating to the study. In the following years, 1997 families agreed to be interviewed again when the children were 29 months, 1950 children were seen again at the age of 41 months, 1944 children at the age of 45-56 months, 1759 children at 60 months, and finally 1492 children were still part of the study at 72 months. Here, we focus on the period spanning the age 17 months to the age 6 years (73.8 ± 3.1 months, end of kindergarten), this latter age representing the earliest age at onset for separation anxiety disorder indexed by large-scale epidemiological surveys (Shear et al., 2006). Quebec children enter kindergarten at age 5 years, thus beginning to systematically

experience separation from attachment figures several hours per day, although many have attended full-time daycare before school entry or earlier.

Outcome Measures

Data were collected through questionnaires and face-to-face interviews, in English or French according to each participant's preference.

Separation anxiety

First, the mother provided information on the child's separation anxiety in a face-to-face structured interview when the child was about 1.5 years, and approximately 2.5, 3.5, 4, 5, 6 years of age. Separation anxiety was assessed from 5 questions rated (0) "never or rarely"; (1) "sometimes"; (2) "often", in the past 3 months, how often would you say your child (1) "clung to adults or was too dependent", (2) "did not want to sleep alone", (3) "got very upset when separated from his or her parents", (4) "was preoccupied by losing his or her parents", and (5) "felt physical discomfort?". For the representation of separation anxiety from infancy to school entry, this present study used mean value by computing the average number for the total items' scores of each variable from 1.5 years to 6 years of age collected in the Interviewer Completed Computerized Questionnaire. The Cronbach's Alpha for the mean score of separation anxiety was .79, and stayed consistent and acceptable across ages (alpha = .78 at 17 months; .75 at 29 months; .74 at 41 months; .75 at 4 years; .76 at 5 years, .77 at 6 years; Battaglia et al., 2016).

Night terrors and sleepwalking

Night terrors and sleepwalking were measured according to the American academy of sleep medicine (AASM, 2014) criteria, which refers to parental report of the child being scared and screaming at night for night terrors, and walking when sleeping at night for

sleepwalking. Specifically, a self-administered questionnaire to the mother collected the occurrence of night terrors from age 1.5 to age 6 years, and of sleepwalking from age 2.5 to age 6 years. The question for night terrors was: "Does your child have night terrors (wakes up suddenly, crying, sometimes drenched in sweat and confused)?", whereas the question assessing sleepwalking was: "Does your child walk in his/her sleep?" The response choices were (0 = never, 1 = sometimes, 2 = often, and 3 = always). The six assessments (1.5-6 years of age) for night terrors, and five assessments (2.5-6 years of age) for sleepwalking, were then summed to yield a global score, which has a range of 6-16 for night terrors, and 5-15 for sleepwalking.

Confounding factors

The sex and age of the child were included as confounding factors. Socioeconomic status was calculated by a combination of variables: (1) "the parents' occupation", (2) "parental education status" and (3) "family economic position" in the past year when the child were 1.5 years of age. Child general anxiety was assessed by the same three questions to the PMK in the Interviewer Completed Computerized Questionnaire when the child was aged 1.5 to 6 years of age: "In the past 3 months, how often would you say your child: (1) "is nervous high string or tense?", (2) "appears fearful or anxious?", and (3) "appears worried?", with ratings from (0 = never; to 1 = sometimes, or 2 = often). Mean general anxiety scores were then calculated from 1.5 to 6 years of age, and these scores were the averaged over these six assessment times.

Ethical aspects

The ethics review committee of Quebec Institute of Statistics, which was responsible for data collection, approved the study. Before participating in the study, all families had

received detailed information by mail on the aims and procedures of the research program and had signed a consent form.

Statistical Analyses

The principal aim of the analysis was to document the relation between mean scores of separation anxiety and general anxiety with sum scores of night terrors and sleepwalking over the course of the preschool years and the beginning of school. Statistical analyses were conducted using with IBM SPSS Statistics version 19.0 (IBM Corp. Released, 2010). Correlations between mean score of separation anxiety and general anxiety, sum score of night terrors and sleepwalking were assessed using Pearson correlation coefficients. For all test conducted, the significance level was set at $p < .01$ to take into account the number of comparisons for each parasomnia. Hierarchical regressions were used to test how mean score of separation anxiety were associated with each of these two parasomnias. The model included three steps: (1) separation anxiety and confounding factors included as predictors, (2) inclusion of general anxiety and (3) inclusion of an interaction term between sex and separation anxiety.

Results

The prevalence of sleep terrors from ages 1.5 to 6 years and of sleepwalking from ages 2.5 to 6 years are reported in Table 1. This large cohort study reveals a high prevalence for sleep terrors of 34.4% at 1.5 years. This prevalence rapidly decreased to 13.4% at age 5, and slowly tapered to 11.6% at age 6 years. By contrast, sleepwalking was relatively infrequent during the preschool period and increased lightly to reach 8.3% by age 6 years.

Table 2 presents the descriptive statistic and correlations of the mean score of separation anxiety, the mean score of general anxiety at each time of measurement, as well as the sum score of night terrors and of sleepwalking over the same period age. The correlation between the mean score of separation anxiety and the sum score of night terror was larger than the correlation between the mean score of separation anxiety and the sum score of sleepwalking. Sex differences were negligible for separation anxiety, night terrors and general anxiety. It is noteworthy that general anxiety showed no correlation with night terrors and sleepwalking.

Association between Separation anxiety and Night terrors

Hierarchical linear regression analysis was used to test a prediction model of early childhood night terrors by separation anxiety. The regression coefficients are shown in Table 4 (step 1). Preliminary analyses were performed to ensure that there was no violation of the assumption of normality and linearity. The predictor variable (separation anxiety) had a significant ($p < .001$) correlation with night terrors. Step (1) accounted for 4.1% of the variance of separation anxiety, $F(4,1589) = 17.07$; $p < .001$.

Association between separation anxiety and sleep terrors, taking into account general anxiety

A second step of the hierarchical model was then tested to investigate whether there was a significant association between separation anxiety and night terrors, while taking into account general anxiety (mean score). The result of this analysis is presented in Table 4 (step 2). Introduction of the mean score of general anxiety resulted no significant changes in R^2 from step 1, F change (1; 1588) = .12; $p = .73$. Step (2) showed that general anxiety

was not associated with the night terrors in children, and that the association between separation anxiety and night terror was still significant.

Moderation by gender of the association between separation anxiety and sleep terrors

A third step of a hierarchical model was tested to investigate whether the association between separation anxiety and night terrors varied as a function of sex. The result of this analysis is presented in Table 4 (step 3). The interaction was not significant (F change (1; 1587) = .03; p = .85), so the associations between separation anxiety and night terror did not differ by sex.

Association between separation anxiety and sleepwalking

Hierarchical linear regression analysis was used to test a prediction model of early childhood sleepwalking by separation anxiety. The model included three steps: step (1): separation anxiety and confounding factors, step (2): inclusion of general anxiety and step (3): inclusion of an interaction term sex*separation anxiety. Basic regression coefficients are shown in Table 5 (step 1). Preliminary analyses were performed to ensure that there was no violation of the assumption of normality and linearity. The predictors variables (separation anxiety) had a significant (p < .001) association with sleepwalking, and also child sex at age 1.5 years old (p = .008) had a significant association. The child sex coded as (0) for boys, and (1) for girls. This result (β = -.006) in this study showed that boys are more sleepwalkers than girls. The step (1) accounted for 1.9% of the variance of sleepwalking, F(4; 1597) = 7.79; p < .001.

Association between separation anxiety and sleepwalking, taking into account general anxiety

A second step of a hierarchical model was then tested to investigate whether there was a significant association between separation anxiety and sleepwalking, while taking into account general anxiety (mean score). The result of this analysis is presented in Table 5 (step 2). Introduction of the mean score of general anxiety resulted no significant changes in R^2 from step 1, F change (1; 1596) = .04; p = .84. Step (2) showed that general anxiety was not associated with the sleepwalking in children. However, the association of separation anxiety with sleepwalking was still significant, while generalized anxiety did not add to the model.

Moderation by gender of the association between separation anxiety and sleepwalking

A third step was added to the hierarchical model to investigate whether the association between mean score of separation anxiety and global score of sleepwalking depends on the sex. The result of this analysis is presented in Table 5 (step 3). Sex did not significantly moderate the relationship (F change (1; 1595) = .33; p=.57).

Discussion

The goal of this article was to examine whether separation anxiety could uniquely predict night terrors and sleepwalking in early childhood, even accounting for general anxiety over the same period. Also, we explored whether gender moderated these associations. Our study provided a strong test of this question because the outcomes of interest were measured at multiple times and included assessments of separation anxiety, general anxiety, night terrors, and sleepwalking.

The first objective was to describe the association of separation anxiety with night terrors and sleepwalking during the preschool period in a non-clinical population. We found that separation anxiety was indeed associated with both night terrors and sleepwalking. Previous clinical and non-clinical studies suggested that night terrors and sleepwalking might be the nocturnal expression of otherwise repressed anger feelings toward life events (e.g., separation, divorce, parental conflict, family moves), which also translates into separation anxiety (Petit et al., 2007; Zadra et al., 1991; Zadra, Desautels, Petit, & Montplaisir, 2013). Moreover, night terrors and nightmares also are common among children with separation anxiety disorder in the clinical child population (Alfano et al., 2010; Chase & Pincus, 2011; Verduin & Kendall, 2003). This result highlights the importance of considering "separation anxiety" as a risk factor for night terrors and sleepwalking among children, as well as other psychological aspects, such as anxiety, stress, and depression. (Alkaabi, Meyerovich, Yakubov, & Shapiro, 2018; Hizli & Tarhan, 2012). It will be also important to investigate further whether similar findings are obtained when children using private day care programme (e.g., hosting children before kindergarten starts) or this context could has more influence on night terrors and sleepwalking.

These results also underline the importance of considering parental interactions with the child resulting from separation anxiety in order to potentially help reducing the intensity of night terrors and sleepwalking manifestations. Attachment representations are the result of parent–child interactions (Bowlby, 1988). For example, if an infant does not receive consistent and responsive caregiving, this would result in the development of an insecure attachment representation (Ainsworth, 1978). Subsequently, studies have demonstrated that insecurely attached children show higher dependency with their parents, and contribute to developing separation anxiety (Bowlby, 1969; Groh et al., 2017; Meins, Bureau, &

Fernyhough, 2018). Moreover, clinical observation suggests that pre-sleep routine and bedtime schedule is often a source of separation anxiety in children, little empirical attention has been devoted to understanding the nature of these associations. Children who go to bed early and who are not sleepy at this time stay alone in bed for a long time; this situation could increase their anxiety and insecurity. Separation anxiety related to pre-sleep routine before bedtime will be less present in societies where children go to bed later. Indeed, the improved secure attachment may strengthen the child's feeling of security and thus help the child to separate from the parent with less distress (Bowlby, 1969), and indirectly reduce the intensity of sleep terrors and sleepwalking manifestations.

The relation between separation anxiety and night terrors and sleepwalking remained even after taking into account general anxiety. In the DSM-V, general anxiety disorder and separation anxiety disorder all list sleep problems among their core symptoms, but this is not supported by our analyses of a sample drawn from the non-clinical population: we found no association of general anxiety with night terrors or with sleepwalking. One explanation for this inconsistency could be that the type of sleep problems varies with the type of childhood anxiety, and specific anxiety diagnoses are associated with specific types of sleep problems. For example, insomnia, nightmares, bedtime resistance, daytime tiredness and shorter sleep duration have been reported more commonly in children with general anxiety disorder (Alfano et al., 2006; Alfano et al., 2007; Alfano et al., 2010; Chase & Pincus, 2011). Another possible explanation for the inconsistency between these results and our findings may be the difference in sample: our study focused on children in non-clinical population, whereas these studies did not.

The last objective was to investigate gender differences in these associations. We found no difference in prevalence and no moderation by gender of the associations between

separation anxiety and night terrors in any of the associations tested. However, there was difference in prevalence but no moderation by gender of the association between separation anxiety and sleepwalking in the associations tested. Contrary to our results, night terrors has been reported to be more frequent in boys than in girls in previous studies (Adair & Bauchner, 1993; Mindell, 1993; Parkes, 1986; Shang, Gau, & Soong, 2006); however, these studies were based on clinical impressions rather than on a population-based sample. In contrast, no significant gender differences were seen for night terrors in the present study, as also found in numerous previous studies (Klackenberg, 1982; Morrison, McGee, & Stanton, 1992; Petit et al., 2015; Vela-Bueno, 1985). Discrepancies across these studies may be the result of the differences linked to gender was based on parent report for young children and on child report in older children; however, other studies used objective measures of sleep, specifically polysomnography. As found by Sadeh (2015), there are limitations between parental report and children's sleep. Support for this hypothesis Markovich and her colleague (2015) found that parents were poor reporter of events that occurred during the night when they were not with their child. Secondly, the most often used measurement approaches for parasomnias are questionnaire scales, the reliability of the questionnaire scales is more satisfactory if absolute answering categories have been applied (e.g. several times a week, once a week, about twice a month, about once a month, less than once a month; Schredl, 2004) than scales with relative categories like never, rarely, sometimes, often, very often. None of these studies tested a moderation by gender of the effects of the predictors of the parasomnias.

Limitations and strengths

This study is limited by its reliance on maternal self-report data. It is possible that mothers mistook nightmare with night terrors, or sleepwalking may be confused with other nocturnal wandering behaviors such as confusional arousals (Stallman et al., 2017). Especially for sleepwalking that may be difficult to assess in children because it can include simple behaviors such as briefly getting out of bed but not leaving the bedroom, that typically go unobserved, and in this study there has been no access to validate measures of sleepwalking and night terrors by polysomnography. Despite these limitations, parent-report has some strengths: 1) as sleepwalking and night terrors typically occurs in the first third of the night, children cannot remind these behaviors exactly 2) young children typically go to sleep before their parents, parents are more likely to observe nocturnal wandering at this time, which is more likely to be sleepwalking or sleep terrors (Boschloo et al., 2013).

Future longitudinal studies should include objective measures of night terrors, such as polysomnographic measures and audio-video recordings to get better insights on night terrors. The population studied here is mostly white and might not be representative of other populations, which suggests replicating these results in other populations. Despite these limitations, the strength of the study relies on the longitudinal nature of data about night terrors, sleepwalking, separation anxiety and general anxiety were collected in a prospective and longitudinal manner throughout early childhood in a population sample.

Conclusion

A better understanding of separation anxiety as a risk factor involved in the etiology of night terrors and sleepwalking may in the long term improve the interventions for children

suffering from these parasomnias. Interestingly, a psychiatrist or familial therapist recognizing separation anxiety among young children may suggest parents to be vigilant about night terrors and sleepwalking manifestations in their children. Future longitudinal studies should investigate the complex association between separation anxiety, sleepwalking and night terrors in early childhood in order to verify whether a parental intervention may reduce the intensity of night terrors and sleepwalking manifestations among children.

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Table 1

Prevalence of Sleep Terrors, Sleepwalking in a Longitudinal Sample

Age, Y[a]	Sleep Terrors		Sleepwalking	
	No.	Total % (95%CI)	No.	Total % (95%CI)
1.5	1937	34.4 (32.2-36.5)	-	-
2.5	1904	20.7 (18.9-22.5)	1881	3.6 (2.8-4.4)
3.5	1854	21.1 (19.2-23.0)	1852	2.6 (1.9-3.3)
4	1858	17.3 (15.7-19.2)	1858	4.1 (3.2- 5.1)
5	1438	13.4 (11.6-15.2)	1438	5.1 (4.0-6.2)
6	1306	11.6 (9.9-13.3)	1307	8.3 (6.8-9.8)

[a] Sleepwalking was evaluated from ages 2.5 to 6 years.

Table 2

Descriptive statistic of the mean score of separation anxiety and general anxiety, the sum score of sleep terrors and sleepwalking

Variables	N	Mean	SD	Min	Max
Mean score child Separation Anxiety at 1.5 -6 years	1941	2.62	1.49	.00	7.89
Mean score child Anxiety at 1.5 -6 years	1941	1.93	1.18	.00	7.08
Global score child sleep terrors at 1.5 -6 years	1840	7.27	1.69	6	16
Global score child sleepwalking at 1.5 -6 years	1851	5.24	.77	5	15
Child sex	2223	.49	.50	0	1

Note: N= Number; SD= Standard Deviation

Table 3

Correlation of the mean score of separation anxiety and general anxiety, the sum score of sleep terrors and sleepwalking

Variables	(1)	(2)	(3)	(4)	(5)
Child Separation Anxiety (1)	**1**				
Child Anxiety (2)	.020	**1**			
Child sleep terrors (3)	.21**	-.003	**1**		
Child sleepwalking (4)	.13**	.002	.19**	**1**	
Child sex (5)	.001	-.004	-.03	-.06*	**1**

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Note: Child separation anxiety= Mean score child Separation Anxiety at 1.5 -6 years; Child Anxiety = Mean score child Anxiety at 1.5 -6 years; Child sleep terrors = Global score child sleep terrors at 1.5 -6 years; Child sleepwalking = Global score child sleepwalking at 1.5 -6 years.

Table 4

Hierarchical regression for the association between separation anxiety and sleep terrors (step 1), after taking into account general anxiety (step 2) and moderated by sex (step3)

	Standardized Coefficients	Unstandardized Coefficients		
Steps and variables	β	B	SE	*P*
Step1				
Mean score child separation anxiety at 1.5-6 years	.197	.23	.03	.00*
Child age	.04	.15	.09	.10
Child sex at birth	-.02	-.08	.08	.33
Socioeconomic status at 1.5 years	.02	.04	.04	.36
Step 2				
Mean score child separation anxiety at 1.5-6 years	.197	.23	.03	.00*
Child age	.04	.15	.09	.10
Child sex at birth	-.02	-.08	.08	.33
Socioeconomic status at 1.5 years	.02	.04	.04	.39
Mean score child anxiety at 1.5-6 years	-.009	-.01	.03	.73
Step 3				
Mean score child separation anxiety at 1.5-6 years	.20	.23	.04	.00*
Child age	.04	.15	.09	.10
Child sex at birth	-.02	-.05	.17	.75
Socioeconomic status at 1.5 years	.02	.04	.04	.39
Mean score child anxiety at 1.5-6 years	-.008	-.01	.03	.73
Separation anxiety*sex	-.13	-.01	.06	.85

***p* < .01**

Table 5

Hierarchical regression for the association between separation anxiety and sleepwalking (step 1), after taking into account general anxiety (step 2) and moderated by sex (step3)

	Standardized Coefficients	Unstandardized Coefficients		
Steps and variables	β	B	SE	*P*
Step1				
Mean score child separation anxiety at 1.5-6 years	.12	.06	.01	.00*
Child Age	.03	.04	.04	.28
Child sex at birth	-.06	-.10	.04	.008
Socioeconomic Status at 1.5 years	-.01	-.01	.02	.59
Step 2				
Mean score child separation Anxiety at 1.5-6 years	.12	.06	.01	.00*
Child Age	.03	.05	.04	.28
Child sex at birth	-.07	-.10	.04	.008
Socioeconomic Status at 1.5 years	-.01	.01	.02	.58
Mean score child anxiety at 1.5-6 years	-.005	-.003	.02	.84
Step 3				
Mean score child Separation Anxiety at 1.5-6 years	.13	.07	.02	.00*
Child age	.03	.04	.04	.28
Child sex at birth	-.04	-.06	.08	.42
Socioeconomic status at 1.5 years	-.01	-.01	.02	.58
Mean score child anxiety at 1.5-6 years	-.005	.003	.02	.84
Separation anxiety*sex	-.03	-.01	.03	.56

***p* < .01**

Chapter 3. General conclusion

Through this study, we were able to describe how separation anxiety is associated with night terrors and sleepwalking manifestation throughout the preschool period. General anxiety, entered as a confounding factor in the predictive models, showed no associations with these two parasomnias; moreover, their association with separation anxiety remained. These associations were not moderated by gender. This study is an important step toward devising strategies to reduce nigh terrors and sleepwalking in children with developmentally appropriate separation anxiety, and guide psychologists in their intervention for these two parasomnias.

Furthermore, these findings are important because Zadra and his colleagues (2013) and Nielsen and his colleagues (2000) have shown in a clinical sample that anxiety might increase the occurrence of episodes of two types of parasomnias (sleepwalking and night terrors) in children. However, in the non-clinical population of children, results are mixed and certain sleep disturbances may not be associated with anxiety. For example, in one study, self-reported anxiety in children was associated with parent-reported bedtime resistance, but not other aspect of sleep including parasomnias (Gregory et al., 2006; Massetti et al., 2008). In other studies, anxiety symptoms have been associated with nightmares only (Gregory et al., 2005; Mindell & Barrett, 2002). In the present study, we highlight that separation anxiety is associated with night terrors and sleepwalking in the non-clinical preschool children population. This suggests a need for paying more attention to the occurrence of these parasomnias in children with developmentally appropriate separation anxiety, not only in children with clinical levels of anxiety.

Likewise, we hope that this study will promote greater interest in lifetime prevalence of sleepwalking and night terrors in children. As stated in a recent epidemiological study (Bjorvatn et al. 2010), of randomly selected young adults (18 years and older, "continuation the episodes of night terrors and sleepwalking after adolescence, this lifetime prevalence for sleepwalking was 22.4% and current prevalence 1.7%, and for night terrors lifetime prevalence was 10.4% and current prevalence 2.7%". Perhaps our study will spark more interest in the development of evidence-based process research that will lead to further intervention in sleepwalkers and children night terrors with appropriate separation anxiety and with other psychiatric problems in general population not just in the clinical population with psychiatric disorders.

3.1 Limitations and Strengths

The results of this dissertation must be interpreted in the context of the method used and its limits. First, as mentioned in the article, the separation anxiety and parasomnias measures used show some limitations. The assessment of sleepwalking and night terrors was not derived from physicians' diagnoses or from objective sleep laboratory assessments; the results were based on a single measurement method, the parent reports. Since only one person assessed the children, some assessments may not have been representative of actual separation anxiety or night terrors. However, considering that night terror has often been used interchangeably with nightmares, targeting specifically sleep terrors was one of the goals of this study. Parents may have over-reported sleep terrors in children, because both night terrors and nightmare share similar symptoms. Our questionnaire contained an operational definition for night terrors, but it is nevertheless possible that some parents mistook nightmares for night terrors and vice versa.

Despite its limitations, this thesis addresses some of the important shortcomings of previous work on the association between separation anxiety and two types of parasomnias (night terrors and sleepwalking). One of these shortcomings is the lack of consensus on the relation between separation anxiety and sleep problems in non-clinical children, which creates confusion in the evaluation of these specific outcomes' manifestations. By focusing on this specific manifestation of separation anxiety, within the child's socialization process, this thesis provides a new perspective on the consequences of separation anxiety during early childhood. The other strength of the method used lies in the size of the sample and in the data about separation anxiety and night terrors and sleepwalking collected in a

prospective and longitudinal manner throughout early childhood in a population sample. Finally, this thesis paves the way for future research on other types of sleep problems in non-clinical population of children.

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