

SCIENTIFIC INVESTIGATIONS

Sleep terrors in early childhood and associated emotional–behavioral problems

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Study Objectives: While sleep terrors are associated with emotional–behavioral problems in school-aged children and adults, little is known about these associations in early childhood, when sleep terrors prevalence is at its highest. Moreover, studies using a longitudinal design and controlling for confounding variables are scarce. This study's objective was to determine whether the frequency of sleep terrors in toddlers predicts emotional–behavioral problems during the preschool years.

Methods: Participants (n = 324) were enrolled in the prospective Maternal Adversity Vulnerability and Neurodevelopment cohort study. The frequency of sleep terrors in children was assessed at 12, 18, 24, and 36 months using maternal reports. Children's emotional–behavioral problems were measured at 48 and 60 months using the Child Behavior Checklist. Relevant confounders linked to the child, mother, and environment were also taken into consideration.

Results: The frequency of sleep terrors was relatively stable across early childhood (16.7–20.5%). A generalized estimating equation revealed that the frequency of sleep terrors in early childhood was associated with increased emotional–behavioral problems at 4 and 5 years of age, more specifically with internalizing problems ($P < .001$), after controlling for child's sex, time point, family socioeconomic status, maternal depressive symptoms, and nighttime sleep duration. The frequency of sleep terrors was further associated with the emotionally reactive, anxious/depressed, and somatic complaints scales ($P < .01$).

Conclusions: This longitudinal study provides further support for a high prevalence of sleep terrors in early childhood. Our findings show meaningful associations between higher frequency of sleep terrors and emotional–behavioral problems as early as toddlerhood, especially internalizing problems.

Keywords: sleep terrors, externalizing disorders, internalizing disorder, emotional disorder, maternal depression

Citation: Laganière C, Gaudreau H, Pokhvisneva I, et al. Sleep terrors in early childhood and associated emotional–behavioral problems. *J Clin Sleep Med*. 2022;18(9):2253–2260.

BRIEF SUMMARY

Current Knowledge/Study Rationale: While the prevalence of sleep terrors peaks in toddlerhood, most studies investigating the association between sleep terrors and emotional–behavioral problems focus on school-aged children, adolescents, and adults. Moreover, longitudinal studies are lacking.

Study Impact: This longitudinal study shows that sleep terrors in toddlerhood are highly prevalent and are associated with emotional–behavioral problems at 4 and 5 years old. Therefore, in some children, sleep terrors can represent an early warning sign of internalizing problems.

INTRODUCTION

Sleep terrors (also called night terrors) are described as sudden and partial arousals from sleep, often accompanied by a cry or piercing scream.¹ These events are characterized by arousal of the autonomic nervous system (increased heart rate, sweating, and rapid breathing) and behavioral manifestations of intense fear, such as sitting upright in the bed suddenly, looking scared, and screaming. This parasomnia (or disorder of arousal) is typically present in early childhood and is often associated with prolonged inconsolability during the night. Along with sleepwalking and confusional arousals, sleep terrors are believed to result from incomplete arousal from slow-wave sleep.^{2,3}

While the prevalence of sleep terrors in adults seems low (1–2% in the general population), this sleep disorder is quite common in children, especially young ones.^{4–7} In a community sample of children between 2.5 and 6 years old, the prevalence of sleep terrors was as high as 39.8%.⁸ The prevalence is known

to gradually decrease with age, with rates of about 35% at 18 months old and about 20% at 30 months old.^{9,10} The occurrence of sleep terrors appears to decline further in school-aged children, as shown by a prevalence of 6.5% in a sample of 2,584 children with a mean age of 10.8 years old.¹¹ These studies highlight the greater prevalence of sleep terrors in toddlers as opposed to older children.

In adulthood, a significant association was described between sleep terrors and more affective difficulties, such as anxiety symptoms.¹² In school-aged children, sleep terrors have also been linked with higher separation anxiety, internalizing problems (anxious/depressed, withdrawn symptoms), and psychotic symptoms.^{8,13–15} Very few studies have documented the presence of externalizing symptoms in patients experiencing sleep terrors. A cross-sectional study revealed significant associations between sleep terrors and several types of externalizing problems (aggressive behavior, attention problems, delinquent behavior, and social problems) in school-aged children.¹⁵ A recent study

also showed greater internalizing and externalizing symptoms in a clinical sample of 41 children and adolescents (aged between 6 and 17 years old) with a diagnosis of disorder of arousal (including sleep terrors) compared to healthy controls.¹⁶

While these studies suggest a positive link between sleep terrors and emotional-behavioral symptoms in school-aged children, adolescents, and adults, studies assessing toddlers are scarce. Furthermore, apart from Petit et al⁸ and Fisher et al,¹³ studies evaluating these associations were cross-sectional or retrospective and very few of them included covariables that could influence emotional-behavioral measures, such as nocturnal sleep duration and maternal well-being. Considering that sleep terrors are particularly prevalent in children younger than 5 years old,¹⁰ it is unfortunate that the majority of studies describing emotional-behavioral functioning in individuals with this sleep disorder have focused on older children and adults. Besides, toddlerhood is a crucial period for the development of emotional regulation in children. Poor emotion regulation is linked to internalizing and externalizing problems in preschoolers and predicts psychopathology later in life.¹⁷⁻¹⁹ It is thus crucial to investigate whether associations between sleep terrors and mental health problems emerge during early childhood. Moreover, longitudinal assessments (as opposed to retrospective or cross-sectional studies) of sleep terrors and internalizing and externalizing symptoms in children are clearly lacking.

As such, the objective of this study is to longitudinally assess the associations between sleep terrors in early childhood and emotional-behavioral problems in preschoolers. To take into consideration the several time points and the frequency of sleep terrors at each time point, the average frequency of sleep terrors during early childhood will be calculated. Considering previous findings in older children and adults, sleep terrors in early childhood are expected to be associated with increased subsequent internalizing and externalizing problems in preschoolers. To further identify which type of emotional-behavioral problems are associated with sleep terrors, specific subscales will also be considered in a second step: emotionally reactive, anxious/depressed, somatic complaints, withdrawn, attention problems, and aggressive behavior. Finally, important confounding variables related to the child, the mother, and the environment will be included.

METHODS

Participants

This study is part of the Maternal Adversity, Vulnerability, and Neurodevelopment (MAVAN) project.²⁰ The MAVAN study was approved by the ethics committee of the Douglas Mental Health University Institute (Montreal, Quebec) and by the ethics committee of St. Joseph's Healthcare/McMaster University (Hamilton, Ontario). Mothers-to-be were recruited during pregnancy in obstetric clinics in Montreal and Hamilton. To be included in the cohort, mothers had to be at least 18 years old and not have any severe health conditions or chronic illness. Exclusion criteria were an APGAR score under 7, prematurity (≤ 37 weeks of gestation), or severe health conditions. Written consent was obtained from all participants (N = 629). A total of 324 mother-child dyads were included in the present study

(54.5% male children). Participants were excluded either because they dropped out of the study or failed to complete some critical study measures. Included and excluded participants had similar demographic characteristics (child's sex and socioeconomic status [SES]), birth weight, and maternal age at birth. Additionally, maternal depressive symptoms at 48 and 60 months postpartum did not differ between included and excluded participants ($P > .05$). Internalizing problems were higher in excluded participants at 48 months ($P = .024$) and 60 months ($P = .016$). Externalizing problems were higher in excluded participants, but only at 60 months ($P = .049$). Trained research assistants collected data during home and laboratory visits from pregnancy until the child was 5 years old.

Measures

Sleep terrors

At 12, 18, 24, and 36 months, mothers completed the Questions About Sleep Habits questionnaire, a questionnaire adapted from the Quebec Longitudinal Study of Child Development.⁸ Sleep terrors were assessed using the question "Does your child have night terrors (wakes up crying or screaming, she/he is confused, looks terrified, and is in a sweat)?" Response options were "No" (1), "Sometimes" (2), "Often" (3), or "Every night" (4).

First, descriptive statistics were used to document the frequency of sleep terrors at each time point and percentages of children presenting a borderline-clinical degree of emotional-behavioral problems among those who experienced sleep terrors and those who did not. The frequency of sleep terrors was dichotomized into the presence and absence of sleep terrors in that first descriptive section. Children who presented sleep terrors at least sometimes were considered to experience sleep terrors (presence), as in Petit et al.⁸

For the main analyses, the average frequency of sleep terrors in early childhood (12, 18, 24, and 36 months) was used as a continuous variable. The average frequency of sleep terrors in early childhood was calculated across the four time points. This led to a score between 1 and 4, with a higher score representing a higher average frequency of sleep terrors in early childhood. Analyses of variance did not reveal a significant difference between participants with 1, 2, 3, or 4 time-point measurements of sleep terror in early childhood in terms of birth weight, maternal age, frequency of sleep terrors, internalizing problems, or externalizing problems ($P > .05$).

Children's emotional and behavioral problems

The Child Behavior Checklist (CBCL) was completed by the mother when her child was 48 and 60 months old.^{21,22} Statements regarding the child's behaviors are listed. The mother selected the frequency of these behaviors on a 5-point Likert-type scale. The total score, the internalizing problems score, and the externalizing problems score were used at both time points. Children with a T-score of 60 and above are considered in the borderline-clinical range²¹ and this threshold was used in the descriptive statistics. While the CBCL alone is not a diagnostic tool, a score in the borderline-clinical range is of concern and should warrant further diagnostic assessment.²¹ Moreover, to further specify which internalizing and externalizing problems were associated with sleep

terrors, the syndrome scales (emotionally reactive, anxious/depressed, somatic complaints, withdrawn, attention problems, and aggressive behavior) were also calculated at both time points.

Maternal depression

The mother completed the Center for Epidemiologic Studies Depression scale when her child was 48 and 60 months old.²³ This scale assesses depressive symptoms, with a higher score indicating more depressive symptoms. The total score of the Center for Epidemiologic Studies Depression scale was used as a control variable to control for mood biases and the reported association between maternal mood and child's emotional-behavioral problems.^{24,25}

Sleep duration

Nighttime sleep duration at 48 and 60 months was assessed using the Children Sleep Habits Questionnaire.^{26,27} It was used as a control variable supported by the extensive literature on the association between sleep duration and emotional-behavioral problems.^{28,29}

Sociodemographics

Family SES was assessed at 12 months postpartum. Mothers reported their education level and family income; both variables were dichotomized into high and low groups. Statistics Canada's low-income cutoff was used.³⁰ Maternal education was considered high if the mother attended college or university. Dyads who had low maternal education and low income were categorized into the low SES group. Dyads who had high maternal education and high income were categorized in the high SES group. Dyads who were high for one variable and low

for the other formed the middle SES group. Since this sample mainly comprised high-SES mothers, the low-SES dyads ($n = 7$) were merged with the middle-SES group. SES was used as a control variable given its well-known association with our main outcome (children's emotional-behavioral problems).³¹

Statistical analyses

Generalized estimating equation (GEE) method for repeated measures assessed the associations between the average frequency of sleep terrors in early childhood (12, 18, 24, and 36 months) and emotional-behavioral problems in toddlerhood (48 and 60 months). Covariates included child's sex, SES, concurrent nocturnal sleep duration (48 and 60 months), and concurrent maternal depressive symptoms (48 and 60 months). A linear GEE model was used to estimate population effects in analyzing longitudinal data. The total CBCL score, the internalizing problems score, the externalizing problems score, and the syndrome scales of the CBCL were used as outcome variables.

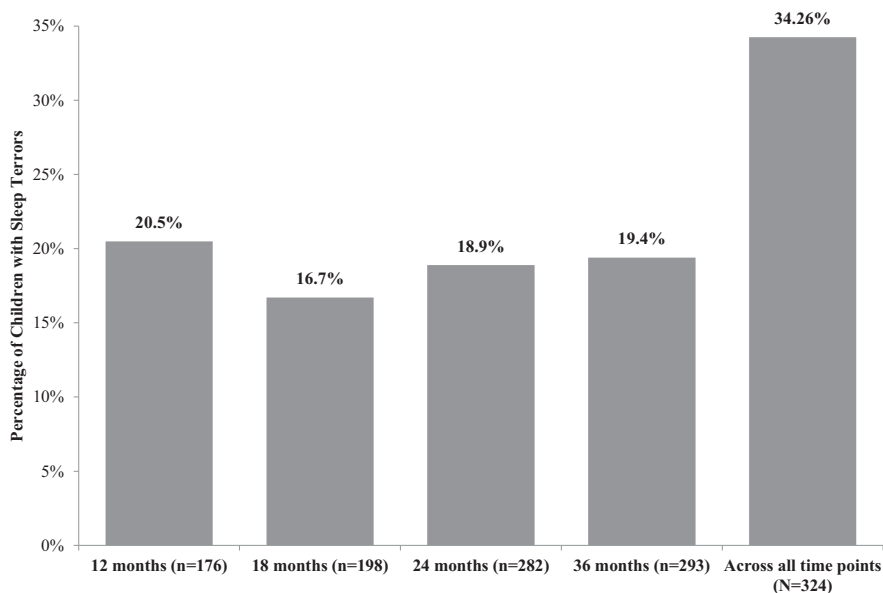
Statistical analyses were performed using IBM Statistical Package for the Social Sciences Version 24 for Windows (IBM, Armonk, NY). Statistical significance was defined as $P < .05$. The Holm-Bonferroni method was used to correct for multiple comparisons.

RESULTS

Frequency of sleep terrors

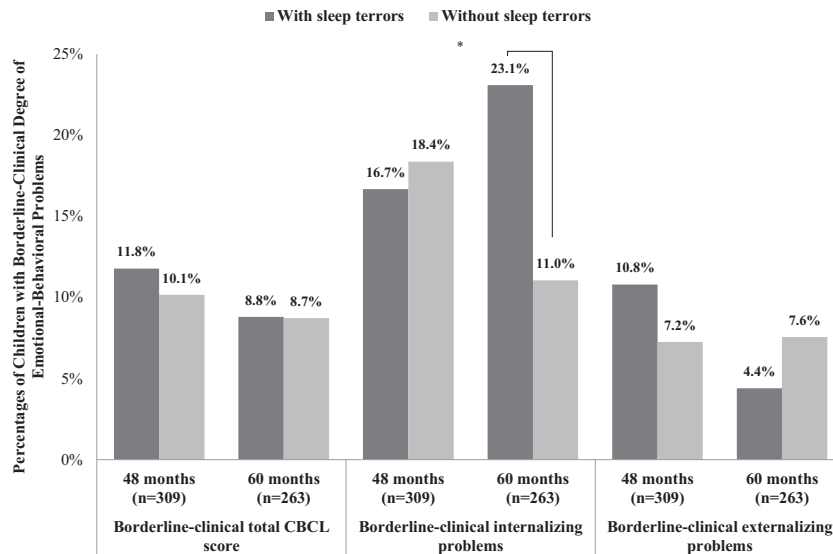
Frequencies of the presence of sleep terrors (at least sometimes) between 12 and 36 months in the MAVAN cohort appear in **Figure 1**. Sleep terrors were least frequent in

Figure 1—Frequency of sleep terrors in the MAVAN cohort.



The figure shows the percentage of children at each time point who presented sleep terrors at least sometimes according to maternal report. The reported frequency of sleep terrors was relatively stable across time (16.7–20.5%). Across all time points, 34.26% ($n = 111$) children of the sample ($N = 324$) presented sleep terrors at least once during early childhood (12–36 months).

Figure 2—Percentages of children with borderline-clinical degree of emotional-behavioral problems as a function of the presence or absence of sleep terrors.



The figure shows the percentages of children presenting a borderline or clinical degree of emotional-behavioral problems (T score of 60 and above) for the three scales of the Child Behavior Checklist (total score, internalizing problems, and externalizing problems) measured at 48 and 60 months as a function of the presence or absence of sleep terrors in early childhood (12–36 months). Among the 309 participants at 48 months, 102 of them presented sleep terrors during early childhood (12–36 months). Among the 263 participants at 60 months, 91 of them presented sleep terrors during early childhood (12–36 months). The percentage of children with a borderline-clinical degree of internalizing problems at 60 months was significantly higher among children with sleep terrors (23.1%) than among children without sleep terrors (11.0%) ($\chi^2 = 6.679, P = .010$). CBCL = Child Behavior Checklist.

children at 18 months (16.7%) and most frequent at 12 months (20.5%). **Figure 2** shows the percentages of children with a borderline-clinical degree of emotional-behavioral problems among those with and without sleep terrors.

Emotional-behavioral problems

Results of the first GEE model showed that higher average frequency of sleep terrors in early childhood was associated with more emotional-behavioral problems in preschoolers (CBCL total score at 48 and 60 months) ($B = 9.489, P < .001$; **Table 1**) while controlling for maternal depressive symptoms, time, child’s sex, and total nocturnal sleep duration. The second GEE

model also showed a positive association between the average frequency of sleep terrors in early childhood and internalizing problems in preschoolers, controlling for the same covariates ($B = 3.505, P < .001$; **Table 2**). Results for the total CBCL score and internalizing problems remained significant even after applying the Holm-Bonferroni correction. Therefore, a higher average frequency of sleep terrors in early childhood was associated with more emotional-behavioral problems (total CBCL score) and more internalizing problems in preschoolers when controlling for confounders (maternal depressive symptoms, time, child’s sex, SES, and total nocturnal sleep duration in preschool) and applying the Holm-Bonferroni correction. The third GEE model initially showed an association between the average

Table 1—Associations between frequency of sleep terrors in early childhood and emotional-behavioral problems in preschool (total CBCL score).

Factors (Unit or Reference)	B	Standard Error	95% CI	P
Child’s sex (male)	−0.64	1.70	−3.97 to 2.69	.707
Time (months)	3.84	1.15	1.59 to 6.08	.001
Socioeconomic status (low)	6.60	2.06	2.57 to 10.62	.001
Nighttime sleep duration (hours)	−1.17	1.06	−3.25 to 0.92	.273
Maternal depressive symptoms (CES-D total score)	0.51	0.11	0.29 to 0.72	< .001
Sleep terrors (average frequency)	9.49	2.68	4.24 to 14.74	< .001

Frequency of sleep terrors is measured at 12, 18, 24, and 36 months. Socioeconomic status is measured at 12 months. Maternal depressive symptoms and nighttime sleep duration are measured at 48 and 60 months. CBCL = Child Behavior Checklist, CES-D = Center for Epidemiologic Studies Depression scale, CI = confidence interval.

Table 2—Associations between frequency of sleep terrors in early childhood and internalizing problems in preschool.

Factors (Unit or Reference)	B	Standard Error	95% CI	P
Child's sex (male)	−0.64	0.57	−1.75 to 0.48	.262
Time (months)	0.51	0.38	−0.23 to 1.26	.179
Socioeconomic status (low)	1.61	0.71	0.23 to 3.00	.023
Nighttime sleep duration (hours)	−0.31	0.34	−0.98 to 0.37	.372
Maternal depressive symptoms (CES-D total score)	0.16	0.04	0.09 to 0.23	< .001
Sleep terrors (average frequency)	3.51	1.63	1.63 to 5.38	< .001

Frequency of sleep terrors is measured at 12, 18, 24, and 36 months. Socioeconomic status is measured at 12 months. Maternal depressive symptoms and nighttime sleep duration are measured at 48 and 60 months. CES-D = Center for Epidemiologic Studies Depression scale, CI = confidence interval.

frequency of sleep terrors in early childhood and externalizing problems in preschoolers, but this relationship became nonsignificant after the Holm-Bonferroni correction was applied ($B = 2.295$, $P = .026$; **Table 3**).

Posthoc binary logistic GEE showed that the frequency of sleep terrors in early childhood was not significantly associated with a borderline-clinical degree for the total CBCL score ($P = .065$). However, there was a significant association between a higher average frequency of sleep terrors in early childhood and a borderline-clinical degree of internalizing problems in preschoolers ($P = .014$; **Table S1** and **Table S2** in the supplemental material). In other words, a higher average frequency of sleep terrors in early childhood significantly increased the odds of presenting a borderline-clinical degree of internalizing problems in preschool.

Table 4 shows the beta coefficients obtained from GEE, analyzing the associations between frequency of sleep terrors in early childhood (12–36 months) and all the syndrome scales (48–60 months). Again, control variables were child's sex, time, SES, maternal depressive symptoms (48 and 60 months), and nighttime sleep duration (48 and 60 months). After applying the Holm-Bonferroni correction, associations remained significant for the emotionally reactive scale ($B = 0.837$, $P = .008$), anxious/depressed scale ($B = 1.219$, $P < .001$), and the somatic complaints scale ($B = 0.931$, $P = .002$). The associations between frequency of sleep terrors and the withdrawn and aggressive behavior scales showed marginal associations but were no longer statistically significant after applying the Holm-Bonferroni correction ($B = 0.505$,

$P = .041$; $B = 2.027$, $P = .022$; **Table 4**). There was no significant association between frequency of sleep terrors and attention problems ($B = 0.253$, $P = .267$; **Table 4**).

DISCUSSION

The frequency of sleep terrors in the MAVAN cohort was relatively stable in early childhood, with between 16.7 and 20.5% of children presenting with this parasomnia between the ages of 12 and 36 months. A greater frequency of sleep terrors in early childhood was associated with more emotional-behavioral problems in preschoolers, particularly internalizing problems.

To our knowledge, only 2 epidemiological studies investigated sleep terrors in toddlers.^{9,10} They documented a prevalence of around 35% at 18 months and 20% at 30 months, which is slightly higher than what was observed in the present sample.^{9,10} In most studies, including the present one, the presence of sleep terrors was assessed using parental reports. As noted by other authors, this method of data collection could result in either overestimating or underestimating the presence of this parasomnia. For instance, it is often challenging for parents to differentiate sleep terrors from nightmares.¹⁰ Exclusion criteria for the current sample may also contribute to this discrepancy. Indeed, the current sample excluded children born prematurely or with severe health conditions, whereas epidemiological studies did not necessarily exclude these participants.

Table 3—Associations between frequency of sleep terrors in early childhood and externalizing problems in preschool.

Factors (Unit or Reference)	B	Standard Error	95% CI	P
Child's sex (male)	0.40	0.71	−0.99 to 1.79	.571
Time (months)	1.53	0.45	0.64 to 2.41	.001
Socioeconomic status (low)	2.63	0.80	1.06 to 4.20	.001
Nighttime sleep duration (hours)	−0.15	0.34	−0.83 to 0.52	.662
Maternal depressive symptoms (total score CES-D)	0.17	0.04	0.08 to 0.25	< .001
Sleep terrors (average frequency)	2.30	1.03	0.27 to 4.32	.026

Frequency of sleep terrors is measured at 12, 18, 24, and 36 months. Socioeconomic status is measured at 12 months. Maternal depressive symptoms and nighttime sleep duration are measured at 48 and 60 months. CES-D = Center for Epidemiologic Studies Depression scale, CI = confidence interval.

Table 4—Associations between frequency of sleep terrors in early childhood and emotional–behavioral problems in preschool (syndrome scales).

Child Behavior Checklist Subscale	B	Standard Error	95% CI	P
Emotionally reactive	0.84	0.31	0.22 to 1.45	.008
Anxious/depressed	1.22	0.33	0.58 to 1.86	< .001
Somatic complaints	0.93	0.30	0.35 to 1.51	.002
Withdrawn	0.51	0.25	0.02 to 0.99	.041
Attention problems	0.25	0.23	−0.19 to 0.70	.267
Aggressive behavior	2.03	0.88	0.30 to 3.76	.022

Controlled for child's sex, time, socioeconomic status (measured at 12 months), maternal depressive symptoms (measured at 48 and 60 months), and nighttime sleep duration (measured at 48 and 60 months). Underscored *P* values represent significant associations after Holm-Bonferonni correction. CI = confidence interval.

Present results showed an association between a higher frequency of sleep terrors in early childhood and internalizing problems at 4–5 years old. Moreover, a higher frequency of sleep terrors in early childhood significantly increased the likelihood of presenting a clinically significant degree of internalizing problems in preschool. These results are consistent with previous studies documenting links between the presence of sleep terrors with anxiety symptoms separation anxiety, and other psychological and psychiatric symptoms in children aged 2.5–15 years old.^{8,9,11,13,15} A recent study also showed an association between disorder of arousal and internalizing symptoms using the same questionnaire (CBCL) in a smaller clinical sample of 41 participants aged 6–17 years old.¹⁶ However, very few studies considered those relationships in early childhood, during the peak prevalence period of sleep terrors.^{8,9} Present results are also consistent with longitudinal studies showing that sleep disturbances often precede symptoms of anxiety and depression in children.^{32–35}

As mentioned, very few studies have investigated the association between externalizing problems and sleep terrors. In the present study, while the frequency of sleep terrors was marginally associated with externalizing problems (more specifically aggressive behavior), these associations were nonsignificant after adjusting the threshold for multiple comparisons. Previous studies have found associations between aggressivity, delinquent behavior, and sleep terrors in children.^{15,36} Other studies report associations between parasomnias and externalizing behaviors but are not specific to sleep terrors.^{13,16,37–41} While we cannot draw conclusions about the nonexistence of such an association, results from this study showed a much clearer association between frequency of sleep terrors in early childhood and internalizing than externalizing problems in toddlerhood.

A strength of the present study was the use of a longitudinal design, allowing for the prediction of more emotional–behavioral symptoms at 4 and 5 years old based on the presence of sleep terrors earlier in development, while controlling for concurrent maternal depression, nocturnal sleep duration, child's sex, and SES. It is notable that the association between sleep terrors and internalizing problems was maintained even when controlling for sleep duration. Indeed, shorter sleep duration is a well-known factor influencing mental health difficulties.^{28,29,42} Results of the present study show

that even if sleep terrors potentially impacted sleep duration, shorter sleep duration did not completely explain the association between sleep terrors and the development of internalizing problems. Similarly, while SES and maternal mood were both significantly associated with CBCL scores in our models, the relationship between the frequency of sleep terrors in early childhood and later emotional–behavioral problems remained statistically significant when controlling for these confounding factors. Therefore, the link found between sleep terrors and emotional–behavioral problems was independent from the effects of confounders.

Most children who experience sleep terrors in early childhood will often naturally stop experiencing them around age 5.^{8–11,14} Therefore, in several children, this manifestation appears to be part of a normal developmental process. Still, for other children, sleep terrors may be an early warning sign for future internalizing problems, particularly depressive and anxiety symptoms. While it is not clear yet how to identify this specific subgroup, the results of this study suggest that some internalizing symptoms may be detected as early as age 4 years and that higher frequency of sleep terrors in early childhood might be a marker of this subgroup. This is consistent with results from Castelnovo et al,¹⁶ who reported a positive correlation between emotional–behavioral problems in children and the severity of disorder of arousal episodes, measured with the Paris Arousal Disorders Severity Scale,⁴³ a measure that includes the complexity of episodes, their frequency, and negative consequence. Therefore, a high frequency of sleep terrors in early childhood might represent a prodromal manifestation of emotional difficulties.

Different mechanisms could be contributing to this relationship. Sleep terrors might interfere with sleep continuity, which would in turn negatively impact the development of emotion regulation in these children. Further longitudinal research in this age group would be needed to clarify this hypothesis and to identify other potential markers. For instance, the contribution of genetics should also be explored, considering the documented familial aggregation.¹⁰ Following this hypothesis, it is possible that some children are more genetically at risk of developing both sleep disorders and emotional–behavioral difficulties.

Despite the association between sleep terrors and internalizing problems, sleep terrors alone should not warrant a cause for major concern among parents and clinicians, and the present

study results should not be used as an argument for the prescription of medication to treat sleep terrors in children. As discussed earlier, sleep terrors are likely to stop without treatment for most children as they age. Instead, parents and clinicians should be mindful of symptoms of internalizing problems (ie, indicators of depression or anxiety) in children who present sleep terrors to ensure they receive appropriate support for their internalizing difficulties.

Limitations

Certain limitations should be kept in mind when interpreting the results of the present study. First, measures were obtained through maternal reports and, while maternal depressive symptoms were used as a control variable to minimize negative mood bias, reporting and common-method biases may still be influencing results. Although maternal depression was controlled to minimize this bias, using an objective measure of sleep such as polysomnography or actigraphy to record sleep would be ideal to confirm these results. Our sample comprised mostly high-SES participants; thus, results may not be generalizable to the general population. The presence of obstructive sleep apnea was not assessed in the present study, but future studies should include this variable since studies have shown associations with emotional-behavioral problems.¹⁶ Finally, as it is often the case in longitudinal studies, it is likely that most vulnerable families dropped out the study. Therefore, this might contribute to explain some of the nonsignificant associations after applying the Holm-Bonferroni correction. Indeed, participants who were excluded from the study for not completing sufficient study measures had more emotional-behavioral problems in general than families who completed the study.

CONCLUSIONS

Despite these limitations, the present study offers novel insights into childhood sleep terrors. Longitudinal studies on sleep terrors in early childhood are lacking and are most often conducted on clinical populations. Our research with a healthy cohort of children further reinforces that higher frequency of sleep terrors is associated with internalizing symptoms, even in a younger population of preschoolers.

ABBREVIATIONS

CBCL, Child Behavior Checklist
 GEE, generalized estimating equation
 MAVAN, Maternal Adversity, Vulnerability, and Neurodevelopment
 SES, socioeconomic status

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ACKNOWLEDGMENTS

The authors thank all families who participated in the MAVAN project and all current and past research staff for their contribution.

SUBMISSION & CORRESPONDENCE INFORMATION

Submitted for publication August 16, 2021

Submitted in final revised form April 18, 2022

Accepted for publication April 18, 2022

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DISCLOSURE STATEMENT

All authors have read and approved the final version of the manuscript. Work for this study was performed at McGill University. This study was funded by the Ludmer Foundation (M. Meaney) and the Fonds de recherche en santé du Québec under grant 268331 (C. Laganière) and 265486 (M.H. Pennestri). The authors report no conflicts of interest.