Frequent Nightmares in Children: Familial Aggregation and Associations with Parent-Reported Behavioral and Mood Problems

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Study Objectives: To conduct a systematic investigation on the prevalence, correlates, and familial aggregation of frequent nightmares in children, and to scrutinize the associations between frequent nightmares and parent-reported behavioral and mood problems in children.

Design: A cross-sectional study was conducted by collecting the data on sociodemographic, sleep, behavioral, and family-related information from a total of 6359 children (age: mean [SD] = 9.2 [1.8] years; girls: 49.9%) and their reported biological parents.

Setting: Community.

Interventions: N/A

Measurements and Results: Prevalence of frequent nightmares with a criterion of at least once per week was 5.2%. Multinomial regression analysis indicated that monthly family income, paternal and maternal nightmares, insomnia symptoms, parasomniac symptoms, and daytime consequences were significantly associated with nightmares in children. Frequent nightmares in children were significantly associated with hyperactivity (odds ratio [OR] = 1.68, 95% CI 1.16-2.44), frequent temper outbursts/mood disturbance (OR = 1.76, 95%CI 1.27-2.44), and poor academic performance (OR = 1.62, 95% CI 1.11-2.36), after controlling for potential confounding factors. Approximately 20% of children with frequent nightmares experienced comorbid frequent insomnia. Comorbid nightmares and insomnia were associated with increased odds of hyperactivity (OR = 4.13, 95% CI 2.13-8.00) and frequent temper outbursts/mood disturbance (OR = 2.41, 95%CI 1.27-4.60).

Conclusions: Frequent nightmares in children are associated with a constellation of child-, sleep-, and family-related factors, including comorbid sleep problems, such as insomnia and parasomnia, family economic status, and parental predisposition. Frequent nightmares are independently associated with emotional and behavioral problems in children.

Keywords: Nightmares, children, familial aggregation, behavioral and mood problems

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INTRODUCTION

Nightmares are characterized by vivid and terrifying dreams accompanied by sudden awakenings from sleep.[1] Occasional nightmares were traditionally regarded as ubiquitous and self-limiting in children. However, recent studies have suggested that chronic and frequent nightmares in children could cause not only considerable personal distress,[2] but could also be associated with a broad spectrum of psychopathological symptoms in children and adolescents, including elevated anxiety trait, difficult temperament, and emotional and behavioral problems.[2-7] A community-based retrospective study suggested a link between nightmare disturbances in childhood and future psychopathology in adulthood.[8] Meanwhile, an increasing number of clinical and community-based studies in adult populations have revealed a prognostic implication of frequent nightmare disturbances in predisposing to enhanced suicidal risk.[9-13] The close interplay between childhood nightmare disturbance and psychopathology necessitates closer scrutiny of the associated factors of frequent nightmares in children.

Most previous studies on childhood nightmares, however, have methodological shortcomings, including a lack of investigation of appropriate covariates, especially comorbid sleep problems and family characteristics. Frequent nightmares could often occur in conjunction with other sleep complaints, particularly difficulty initiating and maintaining sleep,[15-17] which were also independently associated with behavioral and emotional problems in children.[18-20] In addition, frequent nightmares in preschool-aged children were associated with several sociodemographic characteristics, including non-working status of mothers and being a single child.[3] Nonetheless, there have been limited studies of investigating nightmare disturbances on childhood mood and behavioral problems in the context of the potential confounding effect of comorbid sleep disturbances and family and environmental influences.

Longitudinal studies have suggested that having bad dreams and nightmares is a relatively stable trait in childhood.[3,4] In addition, studies on adult nightmare sufferers found that frequent nightmares often started during childhood or adolescence.[21-24] Two twin studies on nightmares showed a combination of environmental and genetic contribution.[7,8] On the other hand, to our knowledge, there has only been one study in investigating the familial aggregation of nightmares, in which Schredl and colleagues reported a positive correlation of nightmare frequency between probands and mothers.[25] Nonetheless, their study was confined by a relatively small sample size and a selected sample population on university students.

The present study aimed to conduct a systematic investigation on childhood nightmares in a large community-based sample of school-aged children by: (1) examining the prevalence rate and correlates of frequent nightmares, (2) exploring the familial aggregation of frequent nightmares, and (3) scrutinizing

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the association between frequent nightmares and parent-reported behavioral and mood problems in children with consideration of potential confounding factors.

METHODS

Study Design and Subjects

The present study was part of an ongoing epidemiologic study of sleep problems in Hong Kong Chinese families, which was initiated in 2003-2004. The study protocol was approved by the institutional ethics committee. Detailed procedures of the present study can be found elsewhere.[26-30] Briefly, an envelope containing a set of sleep questionnaires for parents and children and an invitation letter were sent to a total of 9172 primary school children (age range: 5-15 years old) and their parents or caregivers from 13 randomly selected primary school in late 2003. Written informed consent was obtained, along with returned questionnaires from 6447 (70.3%) children and 10,381 parents (67.9%, 4977 fathers and 5404 mothers). The questionnaires without valid information on nightmare frequency were excluded from the subsequent analyses. The final study population consisted of 6359 children (age: mean [SD] = 9.2 [1.8] years; girls: 49.9%), with 4711 reported biological fathers and 5144 reported biological mothers.

Instruments

Questionnaire for children

A 54-item sleep questionnaire (Hong Kong Children Sleep Questionnaire, HK-CSQ) written in Chinese for parental completion was used in the present study.[26-30] The questionnaire was designed to collect data on sleep-related behavioral and environmental factors, based on parents' retrospective observations on their children over the past 12 months. The questionnaire consisted of items on demographic characteristics, sleep environment, sleep habits, specific sleep problems, and neurobehavioral and medical conditions. There were 25 items in this questionnaire, covering a wide range of childhood sleep problems. The question used to elicit parental response was: "during the past 12 months, how often has your child had the following sleep symptoms?" The item we used to assess nightmare was the term "nightmare (in Chinese)" without particular definition given. To help parents recognize 2 sleep phenomena (i.e., sleep terror and sleepwalking), we provided detailed descriptions in the questionnaire as follows: "in the past one year, did he/she suddenly scream out or appear confused upon awakening from sleep and you could not get his/her response, but he/she had little recall of these events in the next morning?" and "did he/she sleepwalk (e.g., leaving the bed and walking around while sleeping)?" Frequency of different sleep disturbances was rated on a 5-point scale (0 = none, 1 = less than once per month, 2 = 1-2 times per month, 3 = 1-2 times per week, 4 = 3 or more times/week).

To assess behavioral problems and mood disturbances of children, we asked the parents the following questions: (1) "In your opinion, is he/she more hyperactive as compared to the other children of the same age?" (2) "Does he/she have frequent temper outburst or have a difficulty in managing his/her mood?" Parents were asked to indicate their responses on the dichotomized scales (yes/no). We also asked the parents to indicate their children's academic performance in the past year when compared to the previous year on a 5-point scale (0 = very poor, 1 = poor, 2 = general, 3 = good, 4 = very good).

Questionnaire for parents

The sleep questionnaire for parents comprised of 25 items including demographic features, sleep habits, different sleep problems, and lifestyle such as frequency of tea, coffee and alcohol drinking, smoking habits, and chronic use of medication(s).[16,27,28] The items on specific sleep problems included various sleep symptoms and daytime consequences, which were similar to those for children and were modified from our previous epidemiological studies.[31,32] Nightmare was assessed using the same term as the one in the children's questionnaire. The same 5-point scale in the children' questionnaire was used to evaluate the frequency of different sleep problems in parents. This abbreviated questionnaire for parents had good psychometric properties, with Cronbach α coefficients of 0.859 and 0.862 for the father and mother groups, respectively.[27] Factor analysis on the questionnaire for parents revealed 3 factors that corresponded to insomnia symptoms, sleep disordered breathing symptoms, and sleep-related daytime consequences, which accounted for 55.8% of the scale variance.[27]

Statistical Analyses

Frequent nightmares were defined as having nightmares at least once per week.[8,14,22,23,33] Frequent insomnia was defined by having one or more of the following sleep problems ≥ 3 times per week: difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), and early morning awakening (EMA).[27,34,35] We combined the children with "very poor" and "poor" academic performance into one group (i.e., poor academic performance) as an outcome measure. Comparisons among groups of different nightmare frequency were performed by the χ^2 test for discrete variables, or by one-way analysis of variance (ANOVA) and Tukey post hoc test for continuous variables. Correlations between the frequency of nightmares and other sleep symptoms were assessed using Spearman correlation coefficients. Exploratory factor analysis was performed to examine the structure of other sleep symptoms relating to frequent nightmares. An eigenvalue exceeding one and the scree plot inspection were used as initial criteria for extraction of factors. Multinomial logistic regression was used to identify the child-related, sleep-related, and family-related factors that were associated with frequent nightmares. Multiple logistic regression models were established to examine the strength of associations between childhood nightmare frequency and hyperactivity, frequent temper outburst/mood disturbance as well as poor academic performance, controlling for children's age, gender, physical health condition, chronic use of medication in the past year, and history of medical illness requiring treatment(s), as well as family socioeconomic status, including parental education level, employment status, and monthly family income. To control for the potential confounding effect of comorbid sleep problems on mood and behavior as well as academic performance in children, all analyses were repeated with additional covariates including insomniac and sleep disordered breathing symptoms, which were selected on the basis of previous

research.[18-20,35,36] An additional logistic regression model was constructed to evaluate the relationship of comorbid frequent nightmares and insomnia to children's mood and behavioral problems. Logistic regression coefficients and their standard errors were exponentiated and presented as odds ratio (OR) with 95% confidence intervals (CI). All statistical procedures were conducted using the Statistical Package for the Social Science 17.0 for Windows (SPSS, Inc., Chicago, IL, USA).

RESULTS

Prevalence and Associated Factors of Frequent Nightmares

There was no significant difference in age, gender, or socioeconomic status of families of study children and those excluded from the present analyses. Prevalence of frequent nightmares, as defined by at least once per week, was 5.2%. The prevalence of frequent nightmares in children did not differ by age (mean [SD]: frequent nightmares: 9.3 (1.9) years vs. non-frequent nightmares: 9.2 [1.8] years) or gender (girls: 5.5% vs. boys: 5.0%). In addition, there was no significant difference in the source of informants (e.g., mothers, fathers, or both parents) between children with frequent nightmares and their counterparts, except that there were more "other relatives" (e.g., grandparents, siblings) as the informants in the group of children with frequent nightmares (frequent nightmares: 11.4% vs. non-frequent nightmares: 7.8%, $\chi^2 = 5.19$, df = 1, $P < 0.05$). Sociodemographic features, sleep environment, physical health condition, and parental characteristics of the study children by nightmare frequency are summarized in Table 1.

Nightmares were found to be related to the presence of other sleep symptoms (Table 2). Factor analysis of these sleep symptoms revealed 5 major clinical factors, including insomnia, sleep disordered breathing, parasomnia, other nocturnal sleep symptoms, and sleep-related daytime consequences, which accounted for 50.1% of scale variance. Children with frequent nightmares scored significantly higher on all these sleep-related factors than their peers without frequent nightmares (mean [SD]: insomnia: 5.4 [3.3] vs. 2.3 [2.3], t = 16.3, $P < 0.001$; sleep disordered breathing: 3.5 [3.4] vs. 2.1 [2.5], t = 7.36, $P < 0.001$; parasomnia: 2.8 [2.4] vs. 1.2 [1.3], t = 12.3, $P < 0.001$; other nocturnal sleep symptoms: 7.1 [3.7] vs. 4.1 [3.2], t = 14.5, $P < 0.001$; and sleep related daytime consequences: 8.3 [4.6] vs. 4.1 [3.6], t = 15.9, $P < 0.001$).

Linear by linear association testing revealed that frequent nightmares were increasingly observed in the children with parents who had more frequent nightmare disturbances (mothers: $P < 0.001$; fathers: $P < 0.001$). Results of the multinomial logistic regression analysis on factors associated with nightmare frequency in children are presented in Table 3. Monthly family income, paternal and maternal nightmares, insomnia symptoms, parasomniac symptoms, and sleep-related daytime consequences were significantly associated with nightmares in children.

Association of Frequent Nightmares with Parent-Reported Mood, Behavior, and Academic Performance

Children with more nightmare disturbances were more likely to be reported by parents as being hyperactive ($P < 0.001$), having frequent temper outbursts/mood disturbance ($P < 0.001$), and poor academic performance ($P < 0.001$). Results of multiple logistic regression analyses on the association of parent-reported mood, behavior, and academic performance with nightmare frequency in children are presented in Table 4. Using the group of children without nightmares as a reference, the odds ratio (ORs) for hyperactivity, frequent temper outbursts/mood disturbance, and poor academic performance were 1.66 (95% CI 1.13-2.42), 1.81 (95%CI 1.30-2.53), and 1.64 (95% CI 1.12-2.40), respectively, for children with frequent nightmares, after controlling for potential confounding factors (including demographic features, physical health condition, parental characteristics, and comorbid sleep problems). More importantly, among children with frequent nightmares (n = 333), approximately 20% experienced comorbid frequent insomnia. The adjusted odds ratio for hyperactivity and frequent temper outbursts/mood disturbance for these children increased to 4.13 (95% CI 2.13-8.00) and 2.41 (95%CI 1.27-4.60), respectively, compared to their peers without comorbid nightmares and insomnia disturbances.

DISCUSSION

The present study presents data on the correlates of frequent childhood nightmares through a comprehensive investigation of individual-, sleep-, and parent-related factors in a large community-based sample of school-aged children. The prevalence of frequent nightmares in our study cohort was 5.2%, which was generally comparable to the figures (2% to 5%) reported in other community-based studies on school-aged children using weekly basis as defining criteria.[14,33,38] A slight variation in the prevalence rates across studies was noted as a result of a difference in the age range of study samples. Converging with other studies,[15-17] insomnia emerged as one of the important sleep correlates of frequent nightmares in children. Importantly, insomnia has also been implicated in the development of psychopathology in children and adolescents,[19] but our study highlighted the significantly stronger associations between comorbid nightmare and insomnia disturbances and parent-reported psychopathology in children. Thus, enhanced clinical attention should be directed to the children with complaints of both frequent insomnia and nightmares. In addition, there was an association between frequent nightmares and NREM-related parasomnias such as sleep terrors and sleepwalking, although nightmares were usually considered as a REM-related parasomnia.[34] One possible explanation is that parents may not be able to differentiate the phenomena of different parasomnias such as nightmares and sleep terror. Meanwhile, anecdotal reports[39-41] and a recent systematic study[42] suggested a distinct possibility of dream-like mentation during sleepwalking and sleep terrors in adults. Hence, further study is required to better delineate the relationship between nightmares and other parasomniac symptoms.

To our knowledge, this is the first community-based study to provide data on the familial aggregation of frequent nightmares. We found that children with frequent nightmares were more likely to have a mother or a father with increased nightmare disturbances. Interestingly, we observed a slightly stronger effect of paternal nightmares on the occurrence of frequent nightmares in children, which differed from the pattern of the familial aggregation for childhood insomnia with a stronger maternal influence.[27] In another family study of nightmares with university students,[25] Schredl et al. found a positive cor-

Table 1—Nightmare frequency in association with sociodemographic features, sleep environment, health conditions, and parental characteristics in school-aged children

	Children's nightmare frequency				P value
	Never	< 1x/month	1-2x/month	≥ 1x/week	
No. of subjects (%)	2705 (42.5%)	2445 (38.4%)	876 (13.8%)	333 (5.2%)	
Age, years: mean (SD)	9.30 (1.80)	9.11 (1.78)	9.24 (1.79)	9.28 (1.86)	n.s.
Gender, female, n (%)	1280 (47.3%)	1249 (51.1%)	441 (50.3%)	172 (51.7%)	< 0.05
Sleep environment of the children, n (%)					
Shared room	1972 (73.6%)	1765 (72.7%)	663 (75.9%)	257 (77.9%)	n.s.
Shared bed	774 (28.9%)	633 (26.1%)	243 (27.9%)	87 (26.6%)	n.s.
Health condition of the children					
Physical health condition in the past year, n (%)					< 0.001*
Poor to worse	30 (1.1%)	24 (1.0%)	22 (2.6%)	19 (6.0%)	
General to good	2583 (98.9%)	2365 (99.0%)	829 (97.4%)	300 (94.0%)	
On chronic medication(s) in the past year, n (%)	51 (2.0%)	69 (2.9%)	40 (4.8%)	22 (7.0%)	< 0.001*
History of medical illness requiring treatment(s), n (%)	261 (10.9%)	314 (14.5%)	119 (15.2%)	57 (18.9%)	< 0.001
Parental marital status, n (%)					< 0.01
Married	2139 (81.3%)	2024 (84.6%)	703 (81.9%)	255 (77.5%)	
Non-married	492 (18.7%)	369 (15.4%)	155 (18.1%)	74 (22.5%)	
Paternal characteristics					
Paternal age, years: mean (SD)	43.3 (5.6)	42.8 (5.4)	43.3 (5.9)	43.2 (5.8)	n.s.
Paternal frequent nightmares, n (%)	36 (1.8%)	72 (3.9%)	34 (5.4%)	32 (13.6%)	< 0.001*
Paternal education, n (%)					< 0.001*
Primary school or below	518 (21.3%)	350 (15.5%)	139 (17.5%)	60 (20.0%)	
Secondary school	1615 (66.5%)	1474 (65.5%)	513 (64.5%)	188 (62.7%)	
College degree or above	295 (12.1%)	427 (19.0%)	143 (18.0%)	52 (17.3%)	
Paternal employment status: employed, n (%)	2321 (95.8%)	2176 (96.9%)	758 (95.9%)	286 (95.7%)	n.s.
Paternal frequent smoking, n (%)	436 (21.6%)	440 (23.9%)	159 (24.7%)	66 (27.6%)	< 0.05*
Father with chronic and frequent use of medication	132 (6.5%)	153 (8.3%)	48 (7.4%)	34 (14.3%)	< 0.01*
Maternal characteristics					
Maternal age, years: mean (SD)	38.8 (4.7)	38.8 (4.7)	38.8 (4.5)	38.7 (4.8)	n.s.
Maternal frequent nightmares, n (%)	87 (4.1%)	117 (5.8%)	67 (9.4%)	45 (16.7%)	< 0.001*
Maternal education, n (%)					< 0.001*
Primary school or below	544 (22.2%)	367 (16.0%)	148 (18.4%)	68 (22.7%)	
Secondary school	1721 (70.2%)	1644 (71.8%)	558 (69.4%)	205 (68.6%)	
College degree or above	187 (7.6%)	279 (12.2%)	98 (12.2%)	26 (8.7%)	
Maternal employment status: employed, n (%)	939 (39.8%)	948 (43.1%)	336 (43.0%)	120 (40.4%)	n.s.
Mother with chronic and frequent use of medication, n (%)	129 (6.0%)	164 (8.1%)	73 (10.2%)	27 (10.1%)	< 0.001*
Maternal smoking, n (%)					n.s.
No/seldom/sometimes	2106 (97.7%)	1966 (96.9%)	698 (96.9%)	257 (95.9%)	
Often	50 (2.3%)	63 (3.1%)	22 (3.1%)	11 (4.1%)	
Socioeconomic status of the family					
Housing type, n (%)					< 0.01*
Public	1685 (63.6%)	1357 (56.1%)	492 (56.8%)	205 (62.1%)	
Private	695 (26.2%)	780 (32.2%)	285 (32.9%)	89 (27.0%)	
Others	269 (10.2%)	282 (11.7%)	89 (10.3%)	36 (10.9%)	
Housing area, n (%)					< 0.001
≤ 400 Sq.Ft.	875 (33.6%)	701 (29.2%)	258 (30.3%)	117 (35.9%)	
401-600 Sq.Ft.	902 (34.6%)	755 (31.5%)	261 (30.6%)	107 (32.8%)	
> 600 Sq.Ft	829 (31.8%)	944 (39.3%)	333 (39.1%)	102 (31.3%)	
Monthly family income, n (%)					< 0.05*
≤ HK $10,000	846 (33.4%)	617 (26.3%)	246 (29.6%)	119 (37.3%)	
HK $10,001-15,000	611 (24.1%)	511 (21.8%)	177 (21.3%)	61 (19.1%)	
> HK $15,000	1078 (42.5%)	1216 (51.9%)	408 (49.1%)	139 (43.6%)	

*Linear-by-linear association. US $1.00 = HK $7.80. Sq.Ft. = Square feet.

relation in nightmare frequency between children and mothers but a negative correlation between children and fathers. Thus, the stronger paternal association of nightmares in our children would need further confirmation. Given recent evidence pointing to a genetic basis of personality trait[43] and increasing studies suggesting a close link between nightmares and neuroticism personality,[16,24,44] the familial predisposition of frequent nightmares may be possibly mediated by sharing similar personality traits between children and parents. However, shared environmental risk factors may also play a significant role in the familial aggregation of nightmares, as suggested by the association between lower family income and reports of frequent nightmares in both children and adults in our study.[16] Nonetheless, in light of the close association between nightmare disturbances and psychopathology, the familial aggregation of frequent nightmares merits further exploration, particularly for the elucidation of the interactive genetic and environment effects on the development of frequent nightmares.

Our findings indicated that hyperactivity, frequent temper outbursts, and poor academic performance were associated with frequent nightmares in children. A marked gradient of these associations persisted even after controlling for other confounding factors. Most prior research in children examining the link between nightmare disturbances and behavioral and mood problems did not consistently control for the effects of other comorbid sleep problems.[4,6,7] However, neurocognitive deficits, mood disturbances and behavioral problems have also been commonly reported among those children with insomnia and sleep disordered breathing.[18-20,36,37] Hence, the result of our study may complement previous research in suggesting that nightmare disturbances could be independently associated with behavioral problems and mood disturbances in children.

The recruitment of community-based subjects in the present study may permit greater generalization of the results. However, the findings of the current study should be interpreted in light of several limitations. Adoption of a loose definition of nightmares in the current study might potentially include bad dreams and nightmares.[44] Although the operational definitions of NREM-parasomnias were provided in the questionnaire, there was still a possibility that parents might have sometimes mistaken night terrors for nightmares. In addition, the use of a single item for measurement of nightmares might provide limited information on the severity and intensity of the nightmares. As the informants of nightmare frequency in children were the parents/caregivers, a reporting bias with potential underestimation of nightmare frequency and other sleep problems of their children may exist.[45,46] Nonetheless, in our previous validation study of the questionnaire for diagnosing sleep disordered

Table 2—Correlations between nightmares frequency and frequency of other sleep related symptoms

Variables	Nightmare frequency *r* †
Frequency of insomnia symptoms	
Difficulty initiating sleep	0.31*
Difficulty maintaining sleep	0.39*
Early morning awakening	0.28*
Sleep-related anxiety	0.35*
Frequency of sleep disordered breathing symptoms	
Nocturnal breathing difficulty	0.18*
Nocturnal mouth breathing	0.19*
Gasps for breath or unable to breathe during sleep	0.07*
Snoring	0.16*
Frequency of parasomnia symptoms	
Sleepwalking	0.12*
Sleep terror	0.28*
Sleep talking	0.38*
Frequency of other nocturnal sleep symptoms	
Restless sleep	0.25*
Sleep in prone position with buttocks up and neck extended	0.17*
Bruxism	0.15*
Nocturnal sweating	0.22*
Frequency of sleep related daytime consequences	
Unrefreshed in morning	0.26*
Daytime fatigue	0.31*
Difficulty getting out of bed in the morning	0.24*
Morning headache	0.24*
Morning dry mouth	0.27*

†Spearman rank correlation coefficients. *P < 0.001.

Table 3—Results of multinomial logistic regression with forward stepwise procedure on the factors associated with nightmare frequency in children

	Nightmare frequency					
	< 1x/month		1-2x/month		≥ 1x/week	
Variables	OR[a]	95% C.I.	OR[a]	95% C.I.	OR[a]	95% C.I.
Monthly family income						
> HK $15,000	1		1		1	
HK $10,001-$15,000	0.74	0.62-0.88	0.99	0.75-1.30	1.26	0.82-1.93
≤ HK $10,000	0.87	0.72-1.05	1.06	0.82-1.39	1.64*	1.11-2.40
Paternal frequent nightmares	1.46	0.91-2.36	1.77	0.98-3.16	3.74**	1.95-7.20
Maternal frequent nightmares	1.06	0.73-1.53	1.40	0.88-2.22	1.71#	0.96-3.04
Sleep variables in children						
Sleep related daytime consequences	1.05**	1.03-1.08	1.12**	1.09-1.15	1.23**	1.18-1.28
Parasomniac symptoms	1.56**	1.45-1.68	1.91**	1.75-2.08	2.25**	2.02-2.50
Insomnia symptoms	1.30**	1.25-1.35	1.51**	1.43-1.59	1.62**	1.51-1.73

[a]Reference group = Children with no nightmares in the past 12 months. Paternal/maternal frequent nightmares were defined as having nightmares ≥ once per week. *P < 0.05, **P < 0.001, #P = 0.069. US $1.00 = HK $7.80.

Table 4—Associations between nightmare frequency, neurobehavioral outcomes, and academic performance in school-aged children

Hyperactivity				
Nightmare frequency	Prevalence, n (%)	Model 1[a] Odds (95% C.I.)	Model 2[b] Odds (95% C.I.)	Model 3[c] Odds (95% C.I.)
Never	346 (13.2)	1	1	1
< 1x/month	362 (15.0)	1.16 (0.99-1.36)	1.28* (1.05-1.56)	1.10 (0.89-1.36)
1-2x/month	154 (17.9)	1.44** (1.17-1.77)	1.54** (1.19-2.00)	1.09 (0.82-1.46)
≥ 1x/week	96 (29.4)	2.74*** (2.10-3.56)	2.68*** (1.91-3.75)	1.66** (1.13-2.42)
Frequent temper outburst				
Nightmare frequency	Prevalence, n (%)	Model 1[a] Odds (95% C.I.)	Model 2[b] Odds (95% C.I.)	Model 3[c] Odds (95% C.I.)
Never	486 (19.1)	1	1	1
< 1x/month	533 (22.5)	1.23** (1.07-1.42)	1.28** (1.08-1.51)	1.09 (0.91-1.31)
1-2x/month	278 (33.0)	2.09*** (1.75-2.49)	2.12*** (1.71-2.62)	1.48** (1.16-1.88)
≥ 1x/week	141(43.7)	3.28*** (2.58-4.18)	3.09*** (2.29-4.15)	1.81*** (1.30-2.53)
Poor academic performance				
Nightmare frequency	Prevalence, n (%)	Model 1[a] Odds (95% C.I.)	Model 2[b] Odds (95% C.I.)	Model 3[c] Odds (95% C.I.)
Never	344 (13.0)	1	1	1
< 1x/month	346 (14.3)	1.12 (0.95-1.31)	1.25* (1.02-1.53)	1.10 (0.89-1.37)
1-2x/month	149 (17.2)	1.39** (1.13-1.72)	1.49** (1.15-1.95)	1.14 (0.85-1.53)
≥ 1x/week	75 (22.9)	1.98*** (1.50-2.63)	2.30*** (1.63-3.25)	1.64* (1.12-2.40)

*P < 0.05, **P < 0.01, ***P < 0.001. [a]Model 1: Uncorrected odds ratio. [b]Model 2: Adjusted for age, gender, physical health condition, and chronic medications in the past year, history of medical illness requiring treatment(s), and family socioeconomic status (i.e., parental education, employment status, and monthly family income). [c]Model 3: Adjusted for covariates in model 2 plus symptoms of insomnia and sleep disordered breathing.

breathing,[30] the face and construct validity of the questionnaire as reflected by the results of factor analysis and further analysis of a subsample of our study subjects who were recruited for an additional polysomnographic study generally supported the validity of children's information provided by parents in our survey study.[26,47] For example, a moderately high correlation was found between parental reports in the questionnaire and objective measurements of anthropometric data of the children ($r = 0.85$, $P < 0.001$; $n = 512$).[26,47] Although parental information is essential in the assessment of psychopathology in children and adolescents, the behavioral and mood measures in the present study were solely based on the parental reports without further systematic clinical assessments. In addition, our study may be limited by a lack of measurement of posttraumatic stress disorder (PTSD) in our study children, as nightmare disturbance is one of the most prominent clinical symptoms of PTSD.[48] In this regard, future in-depth studies using a more explicit operational definition of nightmares and more rigorous measures of psychopathology with both parental and children's measures are warranted.

In conclusion, frequent nightmares are not uncommon in children of the general population and could be associated with a constellation of factors, including comorbid sleep problems, family economic status and familial aggregation. In addition, a close link was found between frequent nightmares, particularly comorbid nightmares and insomnia, to that of childhood emotional and behavioral problems. Clinicians should be attentive to the complaints of nightmare disturbances and the associated psychopathology in children.

ABBREVIATIONS

OR, odds ratio
CI, confidence interval
SD, standard deviation
df, degree of freedom
DIS, difficulty initiating sleep
DMS, difficulty maintaining sleep
EMA, early morning awakening

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