Night sweats in children: prevalence and associated factors

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ABSTRACT

Objective The authors aimed to examine the prevalence and factors associated with night sweats (NS) in primary school children.

Study design Cross-sectional design.

Results Among 6381 children (median age 9.2 (7.7–10.7) years) with complete information on NS, 3225 were boys (50.5%). 747 children (11.7%) were reported to have weekly NS in the past 12 months. Boys were more likely than girls to have NS ($p<0.0001$). Children with NS were more likely to have sleep-related symptoms and respiratory and atopic diseases. In addition, they were more likely to be hyperactive and have frequent temper outbursts. Using an ordinal regression model, NS was found to be significantly associated with male gender, younger age, allergic rhinitis, tonsillitis and symptoms suggestive of obstructive sleep apnoea, insomnia and parasomnia.

Conclusion NS is prevalent among school-aged children and is associated with the presence of sleep-related symptoms and respiratory and atopic diseases.

INTRODUCTION

Night sweats (NS) is defined as sweating that occurs only or mainly at night.[1] Our understanding of NS comes mainly from adult clinical population studies which suggest NS as a common symptom in the primary care setting.[1 2] Among 2267 adults assessed in a cross-sectional study, 23% reported NS which was defined as 'sweating at night even when it isn't excessively hot in your bedroom' within the past 4 weeks.[2]

The clinical significance of NS, however, is controversial. Although severe NS can be distressing and disruptive to sleep, it is commonly regarded as a relatively harmless condition.[3] On the other hand, some serious medical conditions such as infections, cancers, autoimmune diseases and obstructive sleep apnoea (OSA) may be associated with NS.[1] Nonetheless, little research has systemically examined the factors associated with NS. In the only study that specifically addressed the causes of NS in an ambulatory adult clinical population, Reynolds evaluated 200 consecutive adult patients: 70% from a primary care practice and 30% from a gastroenterology practice.[4] Of the 81 patients who reported an episode of NS for at least once a week, oesophageal reflux and menopause were associated with NS.[4] To the best of our knowledge, there is a dearth of information on the magnitude and factors associated with NS in children. In this community-based survey study, we aimed to examine the prevalence and associated factors of NS in primary school children.

METHODS

Study population

As part of our childhood OSA epidemiology study,[5] we had chosen two primary school districts (Shatin and Tai Po) out of a total of 18 for subject recruitment. The two districts had a similar social class and income distribution to the rest of the territory, thus the results obtained from this study would be a true representation of Hong Kong (http://www.censtatd.gov.hk/hong_kong_statistics/statistical_tables). There were 76 primary schools in the two districts. The selection of a school was based on computer-generated random numbers, and if the selected school declined to participate, the next randomly selected school was invited. Thirteen primary schools in the two districts were randomly chosen to participate in this study. The protocol was approved by the Institutional Ethics Review Committee.

Questionnaire

A questionnaire based on parental report was used (Hong Kong Children Sleep Questionnaire).[6] The following information from the questionnaire was extracted for analysis: (1) age, gender, sleep duration (average of 7 days) and presence of any chronic medical conditions rated by parents as 'yes' or 'no'; (2) history of respiratory diseases in the past 12 months including allergic rhinitis, nasosinusitis, tonsillitis and laryngopharyngitis; (3) daytime behaviour including hyperactivity and frequent temper outbursts, nocturnal and daytime OSA-related symptoms; (4) family information. NS and 20 sleep-related symptoms were rated on a 5-point scale (0–4): 0, 'never'; 1, 'rarely' for 0–1 night per month; 2, 'sometimes' for 1–2 nights per month; 3, 'often' for 1–2 nights per week; 4, 'frequently' for 3 nights or more per week. NS was assessed by the question 'Did your child have night sweats in the past 12 months?'

Statistics

Descriptive data were presented as percentages for discrete variables and as means (SD) for continuous variables. The χ^2 test and Mann–Whitney U test were used to compare the variables between children with and without NS as appropriate.

Exploratory factor analysis using principal components analysis was performed to identify

subscales reflective of sleep-related symptoms, which could then be examined in association with NS. The following three steps were followed: (1) extraction of the factors to produce a minimum number of factors that explain the variance in the data; (2) rotation of the extracted factors to transform them into uncorrelated interpretable factors; (3) interpretation of the rotated factors solution. An eigenvalue of >1 was used for extraction of factors with subsequent varimax rotation. Variables with factor loading ≥0.4 were used for interpretation on the rotated matrix. Bartlett's test of sphericity was highly significant (p<0.001), indicating good model acceptability. Factor analysis categorised the 20 items of sleep-related symptoms into five factors, namely anxiety/insomniac symptoms, daytime symptoms, nocturnal OSA symptoms, breathing symptoms and parasomniac symptoms.

To perform an adjusted analysis to determine which factors were associated with NS, we used an ordinal regression model with NS as the dependent variable. All variables with a p value <0.1 in univariate analysis were included. The negative log-log link was used to analyse the relationship between NS and all associated factors using the PLUM (Polytomous Universal Model) procedure. All analyses were performed using SPSS version 15.0.

RESULTS

Among 6381 children with completed information on NS, 3225 were boys (50.5%) and the mean age of the study sample was 9.2 (7.7–10.7) years. Seven hundred and forty-seven children (11.7%) were reported to have had NS in the past 12 months, defined as NS occurring ≥1 night per week. Boys were more likely than girls to have NS (p<0.0001). Children with NS were more likely to have eye, respiratory and atopic diseases and sleep-related symptoms. In addition, these children were more likely to be hyperactive and have frequent temper outbursts. Table 1 shows significantly different characteristics for children with and without NS. Overall, the frequencies of NS among studied subjects were: never, 63.5%; <1 night per month, 15.6%; 1–2 nights per month, 9.2%; 1–2 nights per week, 5.0%; ≥3 nights per week, 6.7%.

Five factors were needed to explain the association between the sleep-related symptoms which are shown in table 2. The total variance explained by this five-factor model was 47.5%. The ordinal regression model is shown in table 3. Several risk factors were found to be significantly associated with NS and they included gender: boys (OR 1.47, 95% CI 1.35 to 1.60, p<0.0001), age (OR 0.87, 95% CI 0.85 to 0.89, p<0.0001), allergic rhinitis (OR 1.20, 95% CI 1.10 to 1.31, p<0.0001), tonsillitis (OR 1.28, 95% CI 1.14 to 1.45, p<0.0001), anxiety/insomniac symptoms (OR 1.47, 95% CI 1.42 to 1.53, p<0.0001), morning (OR 1.25, 95% CI 1.20 to 1.30, p<0.0001) and nocturnal OSA symptoms (OR 1.39, 95% CI 1.34 to 1.45, p<0.0001), sleep-related breathing (OR 1.22, 95% CI 1.18 to 1.23, p<0.0001) and parasomniac symptoms (OR 1.11, 95% CI 1.08 to 1.15, p<0.0001).

DISCUSSION

To the best of our knowledge, this is the first systematic study on the prevalence and correlates of NS in community-based school-aged children. Our results indicated that a significant proportion of children aged 6–13 years had NS as reported by their parents, and the prevalence varied from 6.7% to 36.5% depending on the frequency criteria. Using an ordinal regression model, NS was found to be significantly associated with male gender, younger age symptoms of OSA and atopic and respiratory diseases. These findings confirmed the commonality and clinical significance of NS occurring in association with sleep-related symptoms and atopic and respiratory diseases.

Gender difference in the prevalence of NS was demonstrated in the study as boys were more prone to have NS than girls. In general, male subjects were suggested to have a higher maximal sweat secretion than female subjects. Androgens have been shown to have a stimulatory effect on sweat glands.[7] The majority of the children surveyed in our study were prepubertal as their mean age was 9.2 (1.8) years.[8] Nonetheless, Main *et al*[9] suggested that even prepubertal boys also had a higher sweat secretion rate than girls. Hence, the observed gender difference in NS was probably a genuine finding.

OSA is often included as one of the differential causes for NS.[1 6] In this study, NS was found to be significantly associated with both daytime and nocturnal OSA symptoms. In addition, NS could also be a manifestation of arousal response during sleep in association with emotionally charged dreams or nightmares during rapid eye movement sleep, which are prevalent in the community.[10 11] Anxiety/insomniac and parasomniac symptoms were also found to be significantly associated with NS in our study. The activation of the autonomic

Table 1 Characteristics of children with and without night sweats (NS)*

	All (n=6381)	No NS (n=5634)	NS (n=747)	p Value†
Age (year)	9.2 (7.7–10.7)	9.3 (7.9–10.8)	8.3 (7.1–9.7)	<0.0001
Chronic medical conditions				
Eye diseases (%)	1.5	1.3	2.9	<0.0001
Eczema (%)	4.7	4.4	7.2	<0.0001
Behaviour				
Hyperactivity (%)	15.1	13.9	23.7	<0.0001
Frequent temper outbursts (%)	22.7	21.2	33.5	<0.0001
History of respiratory diseases				
Allergic rhinitis (%)	41.7	39.5	58.4	<0.0001
Nasosinusitis (%)	2.0	1.7	4.1	<0.0001
Asthma (%)	4.4	3.7	9.2	<0.0001
Tonsillitis (%)	9.7	8.7	17.7	<0.0001
Laryngopharyngitis (%)	49.0	46.4	67.7	<0.0001

*Categorical data were presented as percentages; continuous data were presented as median values (IQR).
†NS versus no NS.

nervous system during anxiety/panic attacks and during parasomniac attacks might contribute to the development of NS.[3 12] In this regard, the autonomic nervous system has an essential role in human thermoregulation. The skin's blood vessels and sweat glands are both innervated by sympathetic fibres. Thus, the skin's blood flow fluctuation and its accompanied NS may result in activation of the autonomic nervous system which is commonly seen in various sleep problems. Nevertheless, the clinical implication is that the presence of NS should alert clinicians to enquire about other nocturnal sleep disturbances such as OSA and insomnia, as early identification and treatment of these nocturnal sleep disorders will have important long-term health impacts.[13–15]

There are some limitations in this study. First, only association rather than causation of NS in children could be established because of the cross-sectional nature of the study design. Second, the reliability of the parents' response might be questionable as they may not have slept with their child. As the questionnaires were completed by parents/caretakers based on recollection of their children's sleep symptoms over the past 12 months, parents of older children might be less likely to check on their children during night-time. Third, this study was limited by a lack of clinical confirmation with objective or quantified data on NS. Fourth, the effect of climate on NS could not be ruled out completely. However, as our questionnaire assessed symptoms over the past 12 months, it might have minimised any potential seasonal effect. Besides, the prevalence of NS among adults was reported to be quite constant across seasons.[2] Thus, we believe that our results are a true reflection of this common symptom among Hong Kong children and in children from other countries as well. Nonetheless, a prospective cohort and intervention study should be carried out to evaluate the natural history and the treatment effects of associated conditions such as OSA on the course of NS.

Table 2 Summary of items and factor loadings for the five identified factors

Item	Factor loading
Factor 1: anxiety/insomniac symptoms	
Feeling anxious or afraid when falling asleep	0.690
Difficultly falling asleep	0.645
Sudden awakening during sleep	0.578
Nightmares	0.566
Early morning awakening	0.552
Startles or jerks parts of body while falling asleep	0.408
Factor 2: morning symptoms	
Unrefreshed in the morning	0.771
Daytime fatigue	0.730
Difficulty getting out of bed in the morning	0.658
Morning headache	0.497
Morning dry-mouth	0.421
Factor 3: nocturnal symptoms	
Restless sleep	0.699
Prone position	0.653
Bruxism	0.549
Factor 4: breathing symptoms	
Breathing difficulty	0.739
Mouth breathing	0.710
Gasps for breath or unable to breathe during sleep	0.581
Factor 5: parasomniac symptoms	
Sleep walking	0.757
Sleep terror	0.719
Sleep talking	0.456

CONCLUSION

NS is common among Hong Kong Chinese children, as nearly one out of eight children (11.5%) were reported to have weekly NS. NS was significantly associated with symptoms suggestive of inflammatory diseases of the upper respiratory tract, anxiety, insomnia and other sleep-related symptoms. The findings provided important information on a common nocturnal symptom and could help paediatricians in their clinical assessment of children presenting with NS.

Table 3 Association between independent variables and night sweats in ordinal regression model*

	OR	Estimate	SE	Wald	p Value	95% CI for OR (lower to upper)
Age (year)	0.868	−0.142	0.012	131.608	<0.0001	0.847 to 0.889
Sleep-related symptoms						
Anxiety/insomniac symptoms	1.473	0.387	0.018	447.271	<0.0001	1.421 to 1.527
Morning symptoms	1.251	0.224	0.019	134.608	<0.0001	1.205 to 1.300
Nocturnal OSA symptoms	1.394	0.332	0.020	265.512	<0.0001	1.339 to 1.450
Breathing symptoms	1.222	0.201	0.018	127.877	<0.0001	1.181 to 1.266
Parasomniac symptoms	1.114	0.108	0.018	37.462	<0.0001	1.076 to 1.153
Sex						
Boys	1.474	0.388	0.043	81.066	<0.0001	1.355 to 1.604
Girls	Reference	Reference				
Allergic rhinitis						
Yes	1.204	0.186	0.044	17.616	<0.0001	1.104 to 1.313
No	Reference	Reference				
Tonsillitis						
Yes	1.285	0.251	0.061	16.826	<0.0001	1.140 to 1.449
No	Reference	Reference				

The model was adjusted for habitual snoring, sleep duration, chronic medical condition (eye disease, heart disease and eczema), behaviour (hyperactivity and frequent temper outbursts), history of respiratory diseases (nasosinusitis, laryngopharyngitis and asthma) and family information (parental education level, parental age and home living area).
*Link function: negative log-log.
OSA, obstructive sleep apnoea.

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Patient consent Obtained.

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