

## Magnitude and influencing factors of parasomnia in schoolchildren

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### Abstract

**Background** Parasomnias are undesirable events occurring in the sleep-wake transition period. Several predisposing factors are reported to induce parasomnia in preschool children.

**Objective** To estimate the magnitude of parasomnia in school children and to evaluate its relationship with possible predisposing factors.

**Methods** Five hundred children aged 5-16 years from a boys' school and a girls' school in Khulna City, Bangladesh, were randomly selected for the study conducted from July to December 2011. The survey was done in two steps: self-administered questionnaire and clinical interviews of affected students and their parents. Apart from demographic features, questionnaires included details of perinatal and personal factors as well as familial and socioeconomic factors. The diagnoses of variants of parasomnias was based on the criteria for category-based classification by the American Academy of Sleep Medicine.

**Results** Seven hundred thirteen filled questionnaires revealed parasomnia in 187 (26.2%) children. Most parasomnias were accompanied by other sleep disorders, in which 23 (12.3%) having primary dyssomnias including 18 (9.3%) obstructive sleep apnea, and 10 (5.3%) parasomnias with hypersomnias. Nightmares (7.4%) were highest among the parasomnias followed by nocturnal enuresis (4.1%) and sleep terrors (3.4%). More girls experienced parasomnias than boys (107/360 vs. 80/353, respectively;  $P=0.039$ ). Perinatal factors such as problems during pregnancy (17.1%) or eventful delivery (25.7%), and socioeconomic factors such as familial disharmony (11.8%) and low socioeconomic level (31.6%) had positive associations with parasomnia.

**Conclusion** One-quarter of school children experience parasomnia. We found perinatal factors particularly problem during pregnancy, and socioeconomic factors particularly familial disharmony have significant influences on this condition.

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**Keywords:** *parasomnia, predisposing factors, perinatal factors, socioeconomic factors*

Normal sleep and sleep disorders in children are characteristically different features from those in adults. Sleep organization, timing, and structure, differ significantly across the age spectrum, from infancy to preschool to adolescence.<sup>1</sup> In schoolchildren, sleep problems adversely impact behavior, functioning at school, and health-related quality of life.<sup>2-4</sup> Sleep is not a quiescent state, but can involve complex episodes of movement, ranging from subtle to dramatic and complex. Studies of children and adolescents in the general population have indicated that 20-30% have sleep problems of concern to parents.<sup>1</sup> Such problems can be grouped into three general categories: initiating and maintaining sleep, sleep-wake transition disorders (parasomnia), and arousal disorders.<sup>1,5,6</sup> Parasomnias are episodic nocturnal events that often involve cognitive disorientation, as well as autonomic and skeletal muscle dysfunction.<sup>7</sup> These undesirable events and experiences may occur anytime during entry into sleep, within sleep, or during arousal from sleep. All disorders are considered as part of a continuum, as they share many overlapping features.<sup>8</sup> In some

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cases it is difficult to differentiate between subsets of parasomnias. Early night hazards (sleepwalking, sleep terrors) are different from late night disorders (nightmares, sleep paralysis) as the former emerge during first one-third of the night when children exit non-rapid eye movement (NREM) sleep and may lead to accidents. Parasomnias can lead to psychological problems, if the child is frightened, embarrassed or upset by the reaction of others around him.<sup>9</sup>

Prevalence estimates in childhood for different parasomnias are as follows: sleep terrors (6%), sleepwalking (17%) and confusional arousal (18%), peaking at 8-12 years of age.<sup>8</sup> The frequency of these disorders significantly decreases after adolescence and no sex difference persists in adults.<sup>10</sup> A wide range of possible causes of parasomnias have been reported, most of which apply to preschool children. Their relevance to older children is uncertain, but the risk of sleep problems increase at school age if the child had problems at preschool age.<sup>11,12</sup> Many factors have been shown to be significantly associated with sleep disturbances, in particular, maternal age at the child's birth, method of delivery, Indian and African origin, and fine motor dysfunction.<sup>6</sup> Most available reports on parasomnia focus mainly on preschool children, as parasomnia is reported to be higher in young children.<sup>13</sup> However, even the limited studies of parasomnia in schoolchildren revealed differences from preschool children in magnitude, nature, and predisposing factors.<sup>11</sup> Therefore, we conducted this survey to examine the prevalence of parasomnia in schoolchildren and to evaluate the impact of possible predisposing factors.

## Methods

Parasomnia was studied in schoolchildren of Khulna, a divisional city of Bangladesh. There are 18 secondary schools in Khulna City which house around 25,000 children between 5 to 16 years of age. Selection of schools was purposive in order to get a large number of students belonging to wide range of socio-economic backgrounds. The two biggest schools in Khulna are Coronation Girls School and Khulna Zilla (boys') School, each of which accommodates around 3,000 students in double shift (morning and afternoon). We expected a prevalence of sleep problems in

schoolchildren of around 30%. Using a precision level of  $\pm 5\%$  and 95% confidence level (CI), the minimum required sample size was estimated to be 400 in each school cluster. To maintain a non-response rate of 25%, a total minimum required sample of 500 students per school was finally estimated. Permission was granted from both heads of institutes to carry out the study from July to December 2012.

Most large-scale surveys on child health problems are based on parental perception.<sup>11</sup> Our study was performed in two steps as per the design of Guilleminault and colleagues: questionnaire and direct interviews of the affected children and parents, to minimize the weakness of recall bias and diagnostic confusion.<sup>14</sup> Initially, the students of each class were clustered into groups of five and then study case was selected randomly, one from each group. Parents of the selected students and the school teachers were invited to a meeting for an explanation of the purpose of the study. Parents were given questionnaires and guidelines on how to fill the questionnaire, as well as the characteristics of 20 different sleep disorders including 10 parasomnias, as mentioned in the illustrations. Children who did not return the questionnaire within two weeks were sent a reminder through a class teacher. In the second step, parents of children having sleep problems were invited to a sleep clinic in our hospital for the clinical interview. A detailed history was taken and physical examination of the student was performed to cross-check the information in the questionnaire. A few mothers who failed to visit the clinic were interviewed by telephone. The diagnosis of the parasomnia was based on the criteria for category-based classification set by American Academy of Sleep Medicine (AASM).<sup>8</sup>

The questionnaire was written in the local language (Bangla) based on the survey questionnaire developed by the sleep centre of Sydney Children's Hospital.<sup>11,15</sup> In the self-administered questionnaire, parents were asked if their child had disturbed sleep at night excluding periods of illness. The parents had to tick one of the alternatives that best fit their child's condition. The alternatives were yes/ no/ not known. Information gathered included age and sex, gestational period, mode of delivery, infant feeding and history of physical or psychological trauma. Socio-demographic factors questioned family structure,

housing condition, as well as educational level and economic status of parents.<sup>14,16</sup>

A test–retest reliability of the questionnaire was conducted one week prior to study by distributing the questionnaire among a small group (30) of parents of schoolchildren. Responses to these questions were verified and the questionnaire was subsequently revised to make it more easily understood by the parents. Two investigators were recruited for the survey and trained to explain the questions in a uniform manner to ensure quality and consistency of findings. A forwarding letter attached to the questionnaire included a brief description of the study and completion of the questionnaire was taken to be parental informed consent. The study was also approved by the Ethical Review Committee of Khulna Medical College and Hospital.

Data from questionnaires and interviews were checked for validity, coded and entered in *the Statistical Program for Social Science (SPSS version 12, SPSS Inc., Chicago)* for analysis. For continuous variables, we calculated means, standard deviations and proportions. Chi-square test was used for categorical variables to assess statistical significance. In all tests  $P$  value  $< 0.05$  was considered to be significant.

## Results

One thousand questionnaires were distributed among the 6,000 school children in the two schools, 500 in the boys' school and the same number in the girls' school. After an initial response of 55%, reminders

were given twice at two-week intervals. The final response rate was 71.3% (713/1,000), with 353 boys and 360 girls. The male to female ratio of the study population aged 5 to 16 years was 1:1.02. A total of 392 sleep disorders were found in 202 children, with overlapping problems. The male to female ratio of affected children was 94:108 (1:1.5) and the mean (SD) age of those affected was 139 (32) months, ranging from 63 to 198 months.

Of the 713 study population, 187 (26.2%) children suffered from parasomnia, which comprised nearly all the children (187/202; 92.6%) who had sleep disorders. Most (177; 94.7%) of the parasomnia cases were accompanied by other sleep disorders: 23 (12.3%) parasomnia subjects had primary dyssomnia, including obstructive sleep apnea (18; 9.3%), 10 parasomnia subjects (5.3%) had primary hypersomnias, and 144 (77%) subjects had secondary sleep disorders, including sleep-related asthma (17; 9.1%). Among the total study population, nightmares were highest in frequency (53; 7.4%), followed by nocturnal enuresis (4.1%) and sleep terrors (3.4%). Other major problems such as restless leg syndrome (1.8%), sleepwalking (1.5%) and sleep paralysis (0.6%) were found in a small number of children (**Table 1**).

All parasomnia cases were categorized according to age and sex in **Table 2**. Within parasomnia cases, the proportion of females (107/187; 57.2%) was significantly higher ( $P < 0.001$ ) than the proportion of males (80/187; 42.8%). In addition, there were significantly more children over 10 years of age (128/187; 68.4%) than those under 10 years (59/187; 31.6%) ( $P < 0.001$ ). The percentage of females with

**Table 1.** Frequency of parasomnias in school children

Sleep disorders	Number of children	Percentage	
		Of 713 children	Of 187 children with parasomnia
Restless leg syndrome	13	1.8	7.0
Bruxism	18	2.5	9.6
Sleepwalking	11	1.5	5.8
Sleep terrors	24	3.4	12.8
Nightmares	53	7.4	28.3
Sleep paralysis	4	0.6	2.1
Behavioral disorders	12	1.7	6.4
Hallucinations	2	0.3	1.0
Sleep talking	21	2.9	11.2
Nocturnal enuresis	29	4.1	15.5
Total	187	26.2	100

**Table 2.** Age and gender variation of parasomnias

Age and gender	60-120 months			121-200 months			Total (%)
	Male	Female	Total (%)	Male	Female	Total (%)	
Restless leg syndrome	3	4	7 (3.7)	3	3	6 (3.2)	13 (7.0)
Bruxism	5	2	7 (3.7)	9	2	11 (5.9)	18 (9.6)
Sleepwalking	0	5	5 (2.7)	1	5	6 (3.2)	11 (5.8)
Sleep terrors	2	3	5 (2.7)	5	14	19 (10.2)	24 (12.8)
Nightmares	3	6	9 (4.8)	12	32	44 (23.5)	53 (28.3)
Sleep paralysis	1	0	1 (0.5)	1	2	3 (1.6)	4 (2.1)
Behavioral disorders	2	1	3 (1.6)	2	7	9 (4.8)	12 (6.4)
Hallucination	1	0	1 (0.5)	1	0	1 (0.5)	2 (1.0)
Sleep talking	5	2	7 (3.7)	10	4	14 (7.5)	21 (11.2)
Nocturnal enuresis	4	10	14 (7.5)	10	5	15 (8.1)	29 (15.5)
Total (%)	26 (13.9)	33 (17.6)	59 (31.5)	54 (28.9)	74 (39.6)	128 (68.5)	187 (100)

**Table 3.** Perinatal and personal factors related to parasomnia

Factors	Normal children N=511	Parasomnia children N=187	P value
<b>Pregnancy period, n (%)</b>			
No problem	470 (92.0)	155 (82.9)	0.002
Minor problem	16 (3.1)	12 (6.4)	
Major problem	25 (4.9)	20 (10.7)	
<b>Delivery events, n (%)</b>			
Hosp-uneventful	310 (60.7)	91 (48.7)	0.003
Hosp-eventful	72 (14.1)	36 (19.3)	
Home-uneventful	118 (23.1)	48 (25.7)	
Home-eventful	11 (2.2)	12 (6.4)	
<b>Infant feeding, n (%)</b>			
Exclusive breastfeeding	362 (70.8)	131 (70.1)	0.284
Mixed feeding	126 (24.7)	52 (27.8)	
No breastfeeding	23 (4.5)	4 (2.1)	
<b>Developmental milestones, n (%)</b>			
No problem	445 (87.1)	150 (80.2)	0.093
Gross motor delay	32 (6.3)	19 (10.1)	
Fine motor delay	10 (2.0)	3 (1.6)	
Cognitive dysfunction	24 (4.7)	15 (8.1)	
<b>Associated health problems, n (%)</b>			
None	457 (89.4)	134 (71.7)	<0.001
Physical	38 (7.4)	36 (19.3)	
Psychological	16 (3.1)	17 (9.1)	

parasomnias was significantly greater than males in the study population (107/360 vs. 80/353, respectively;  $P=0.039$ ), but when comparisons were made between age groups over and under 10 years, the difference was not significant (128/465 vs. 59/248;  $P=0.321$ ). Of the individual problems, nightmares and sleepwalking were found to be significantly higher in girls. But com-

paring between age groups, nightmares were found in more children > 10 years of age and sleepwalking was found in more children < 10 years of age.

The influence of perinatal and personal factors was compared between parasomnia cases and the normal population (Table 3). Study children who had no sleep-related problems were considered to be the

**Table 4.** Familial & socio-economic factors related with parasomnia

Factors	Normal children N=511	Parasomnia children N=187	P value
<b>Family dynamics, n (%)</b>			
No problem	446 (87.3)	135 (72.2)	<0.001
Disharmony	34 (6.7)	22 (11.8)	
Bereavment	10 (2.0)	9 (4.8)	
Sleep Disorder in sibs	21 (4.1)	21 (11.2)	
<b>Home ownership status, n (%)</b>			
Own apartment	240 (47.0)	39 (20.9)	<0.001
Tenant	194 (38.0)	119 (63.6)	
Tin shed	77 (15.1)	29 (15.5)	
<b>Socioeconomic status, n (%)</b>			
Affluent	153 (29.9)	64 (34.2)	0.012
Middle class	237 (46.4)	64 (34.2)	
Poor	121 (23.7)	59 (31.6)	
<b>Maternal education, n (%)</b>			
University	136 (26.6)	40 (21.4)	0.216
College	261 (51.1)	103 (55.1)	
Schools*	108 (21.1)	44 (23.5)	
Illiterate	6 (1.2)	0 (0.0)	
<b>Paternal education, n (%)</b>			
University	239 (46.8)	80 (42.8)	0.174
College	203 (39.7)	90 (48.1)	
Schools*	64 (12.5)	16 (8.6)	
Illiterate	5 (1.0)	1 (0.5)	

\*Schools: from elementary to high school

normal population (511). Problems during pregnancy, both minor (6.4%) and major (10.7%), eventful delivery either at home (6.4%) or hospital (19.3%), and health problems, both physical (19.3%) and psychological (9.1%), had a significant relationship to parasomnia. No associations were found with infant feeding or developmental milestones. The impact of familial and socioeconomic factors on parasomnia is highlighted in **Table 4**. Family dynamics [disharmony (11.8%), bereavement (4.8%), and sleep disorder in siblings (11.2%)], home ownership status [own apartment (20.9%), and tenant (63.6%)] and economic status [affluent (34.2%) and low income (31.6%)] all had significant influences on parasomnia. We also observed that more educated parents had fewer affected children, but the difference was not statistically significant.

## Discussion

In our study, parasomnia was found in 187 (26.2%) children, with the most prominent disorders being

nightmares (7.4% of all children), nocturnal enuresis (4.1%), and sleep terrors (3.4%). Twenty-three (12.3%) parasomnia cases were accompanied by primary dyssomnia including obstructive sleep apnea (9.3%). Parasomnia in children is reported to be fairly common, and often more frequent than in adults. Most cases are benign and self-limiting.<sup>17</sup> Sleepwalking is said to occur frequently in 3-4% of children aged 4 - 8 years; sleep terrors occur in 2-3% of children in later childhood and nightmares persist in 10-30% of children.<sup>9,18</sup> A study observed that sleep terrors (6%) and sleepwalking (17%) were more prevalent at 8 - 12 years and gradually decreased in adolescence.<sup>10</sup> Nearly two-thirds of children with parasomnia had a diagnosis of additional sleep disorders. The majority were sleep disordered breathing and a few with restless leg syndrome.<sup>14</sup> Restless leg syndrome, an uncomfortable leg sensation making it difficult to fall sleep, is thought to account for some cases of growing pains.<sup>19</sup> A study reported that at 5 years of age, approximately 15-25% of children had nocturnal enuresis, while at adolescence only 1-3% of children

wet the bed.<sup>20</sup> The disappearance of parasomnia after treatment of sleep disordered breathing and restless leg syndrome suggests that the latter may trigger the former.<sup>14</sup> Although the prevalence rate varies with the age of the study population, our figures were similar to the western studies, though other accompanying sleep disorders were more frequent in our study.

Among the study population, female (29.7%) children experienced more parasomnia than male (22.7%) children. Nightmares and sleepwalking were both significantly higher in girls than in boys. However, a high frequency of nightmares was seen in later childhood, while sleepwalking was more common in early childhood. Klackenberg, in his landmark study, reported that the presence of sleepwalking was highest at 11-12 years of age, with males and females equally affected.<sup>21</sup> Sleep terrors are more prevalent in childhood than in later life, with a peak prevalence between 5-7 years and resolution typically occurring before adolescence.<sup>10,17</sup> During childhood, boys and girls are equally affected, but in adults, women appear to be significantly more affected.<sup>18</sup> A small number (1-3%) of adolescents wet the bed, occurring approximately 2 times more frequently in boys than girls.<sup>20</sup> Our findings for nightmares and sleepwalking were different, but those of nocturnal enuresis agreed. It should be mentioned here that nocturnal enuresis appeared to be underreported due to cultural barriers.

We found that problems during pregnancy (17.1%) and eventful deliveries (25.7%) had significant associations with parasomnia. Perinatal factors had not been highlighted previously, but a previous study observed that a large percentage of children with severely disturbed sleep had wheezing (30%) and chest tightness due to inappropriately managed asthma.<sup>11</sup> The high association of sleep disturbances (18.6%) in wheezing children is also supported by an international study on British subjects.<sup>22</sup> Sleep problems in preschool children have a strong positive association with behavior which adversely affects the transition to school. Moderate-to-severe sleep problems make the child 3-12 times more vulnerable for a psychological disorder.<sup>16,18</sup> Only 9.3% of parasomnia cases had sleep-related asthma in our study, but in 9.1% of the cases there was a preexisting behavioral problem.

We have observed that parasomnias were

highly influenced by family dynamics (disharmony 11.8%) and economic status (low income 31.6%). Researchers from other parts reported significant differences between regions in the prevalence of snoring, mouth breathing and restless sleep, all higher in city areas than rural areas probably due to living conditions, economic and cultural factors.<sup>15, 23, 24</sup> Sociocultural factors, i.e., ethnicity, maternal education level, paternal social class, and maternal smoking at home were associated with disturbed sleep. In addition, children of illiterate mothers originating from the Indian subcontinent had more sleep disorders.<sup>11</sup> Pollock reported that children of fathers from a lower social class and mothers who smoke were at greater risk of disturbed sleep.<sup>6</sup> Our study population from city schools did not allow us to differentiate between rural and urban children, but the subjects' parents' home ownership status reflected the subjects' low social position and insecurity.

The principal limitation of our study was that diagnoses were based on sleep questionnaires and interviews, but without confirmation by polysomnography due to lack of facilities. Other limitations were convenient sampling, possible recall bias of parents and lack of follow-up of these children for the subsequent year.

In conclusion, one-fourth of schoolchildren in Khulna City, Bangladesh experience parasomnia. Females and children over 10 years of age suffer more than males and younger children, respectively. We found the influencing factors of parasomnia to be eventful pregnancy period, delivery events, family dynamics, and economic status. These factors have significant impacts on parasomnia in childhood. Further large scale studies are necessary to explore the multifactorial aetiologies of this fascinating condition.

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