ORIGINAL ARTICLE

Epidemiology of sleep disorders in the elderly – A questionnaire survey

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Abstract

A questionnaire based survey was conducted to determine the prevalence of common sleep-related disorders in the elderly population of Delhi. The study population included in this analysis comprised 1240 grandparents of school-going children. The overall prevalence of SDB was 10.3%.; (9.9% in males and 10.8% in female subjects) It was found to correlate with increasing BMI ($p < 0.064$) The overall prevalence of snoring was found to be 41.4% (Males = 41.6%, Females = 41.2%). It correlated positively with body mass index (BMI) ($p < 0.033$), age ($p < 0.076$), and excessive daytime sleepiness ($p < 0.036$). Habitual snoring was found to be prevalent in 27.2% of the elderly subjects and was found to correlate with BMI ($p < 0.03$), and rising socio-economic strata ($p < 0.014$). Approximately 41.5% of the elderly population was seen to suffer from excessive daytime sleepiness. It correlated significantly with lower socio-economic strata The overall prevalence of symptoms suggestive of restless leg syndrome was 14.3%. It was found to correlate significantly with BMI ($p < 0.018$), and female gender ($p < 0.052$) The overall prevalence of sleepwalking in the elderly population studied was 6.9%. It was found to correlate negatively with increasing BMI ($p < 0.041$) and age and positively with rising socio-economic strata ($p < 0.076$). The prevalence of nightmares in the elderly population studied was 21.7%. It was found to correlate inversely with age ($p < 0.019$). Bruxism was observed to be present in 9.2% of the elderly population studied. It correlated significantly with rising socio-economic strata ($p < 0.017$) and snoring ($p < 0.002$). Approximately 8% of the entire elderly study population admitted that they consumed sleeping pills. Its use correlated with rising socio-economic strata ($p < 0.033$) and symptoms suggestive of disorders of initiation & maintenance of sleep (DIMS) ($p < 0.072$).

Keywords: elderly, snoring, sleep-disordered breathing (SDB), Excessive daytime sleepiness, Restless leg syndrome (RLS), sleepwalking, nightmares, bruxism, Disorders of initiation and maintenance of sleep (DIMS), SES (Socio economic strata)

Introduction

A questionnaire based survey was conducted to determine the prevalence of common sleep-related disorders in an elderly population of Delhi. The National Capital Region (NCR) is the metropolitan area of Delhi comprising cities like Faridabad, Gurgaon, Ghaziabad and Noida. The population of this region is approximately 12.8 million that resides in area of nearly 1483 sq km.

Material and Methods

The study population included in this analysis comprised the grandparents of school-going children. The latter were randomly selected for inclusion from another study,

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the results of which were published earlier in the journal as a part of a family survey [1]. In addition to a set of two child questionnaires (one for the child and another for his/her sibling) a second set of two other elderly questionnaires (one each to be filled up by the grandparents) were also handed over to each child. Informed consent was duly obtained from each participant. A covering letter from the Principal Investigator that was addressed to the parents was included in the set. Two different types of schools were selected for recruitment of subjects. One type of schools catered to children from the relatively middle and upper classes of society; the other comprised children from the relatively lower and economically challenged section. This was deliberately so designed so as to cover a fairly large socio-economic cross-section of the population.

The field investigator duly explained the procedure for filling up the questionnaire and extended all possible help in answering it. A total of 4000 questionnaires were distributed of which 1376 were received back. And finally 1240 questionnaires were selected for analysis as they satisfied all criteria for acceptance. Appropriate statistical methods were applied using SPSS software.

The questionnaire

The questionnaire used for the purposes of this study was adapted from those by Chervin and the Stanford Sleep Clinic questionnaire [2,3] It included questions pertaining to demography, any past and present medical problem, family history of snoring, sleep terror, and nightmare.

It also included questions pertaining to snoring, excessive daytime sleepiness (Epworth sleepiness score), sleep disordered breathing, disorders of initiation and maintenance of sleep, restless legs syndrome and sleep deprivation. The total number of questions in the questionnaire was 39 in addition to questions pertaining to past/present medical problems, if any.

A randomly selected sub-group of forty subjects in whom any sleep disorder was diagnosed, on the basis of their response to the questionnaire, were also examined clinically in the Sleep Clinic. Sensitivity and specificity scores, compared with clinical diagnoses from the Sleep Clinic, were good for all sleep disorders namely, SDB (sleep disordered breathing), disorders of initiation and maintenance of sleep, restless legs, sleepwalking, sleep-bruxism and nightmares. The agreement between clinical diagnoses and questionnaire classification of sleep disorders was thus observed to be good.

Interpretation

Sleep disordered breathing (SDB) was clinically suspected if, in a subject with habitual snoring in whom breathing pauses were noticed and in whom the Epworth Sleepiness Score (ESS) was > 10

A subgroup of 95 subjects (a number that was considered to be statistically significant) was randomly selected from the total pool of adults that reported snoring and were then subjected to whole night in-lab supervised polysomnography (PSG) (Alice 5, Respironics, Murrysville, PA). The PSG study was conducted on snoring adults only because, (a) snoring was a high risk factor for SDB; (b) it was extremely difficult to convince a normal adult who had volunteered to respond to the questionnaire to undergo PSG. On the basis of the results obtained from this sample, the prevalence of SDB in the whole population was calculated. This method may have missed some cases of SDB who under-reported snoring. The following parameters were measured: 2 channels each for electroencephalography (EEG); electro-oculography (EOG);and electromyography (EMG); airflow recording through nose and mouth by thermistor and nasal pressure cannula; thoracic and abdominal efforts by plethysmography; oxygen saturation through pulse oximetery; and tracheal sound recording by using a microphone attached to the neck.

Obstructive apnea was defined as cessation of airflow at the nose and mouth, as measured by thermistor/ nasal canula while the respiratory effort continued for at least ten seconds. Hypopnea was scored when the nasal pressure signal excursions dropped by $\geq$ 50% of the baseline for a duration of at least 10 seconds and was associated with a drop of saturation of $\geq$ 3% from the pre-event baseline or if it was associated with arousal [4] Respiratory effort related arousal (RERA) was scored when there was a sequence of breaths lasting at least ten seconds characterized by increasing respiratory effort or flattening of the nasal pressure waveform, leading to an arousal from sleep when the sequence of breaths did not meet the criteria for an apnea or hypopnea. [4] Excessive daytime sleepiness (EDS) was scored in the presence of questionnaire response of excessive daytime sleepiness along with Epworth Sleepiness Score (ESS) of $\geq$10. SDB was diagnosed when a patient with symptoms suggesting SDB has an RDI (apneas + hypopneas + RERAs) was > 5 per hour. Snoring adults with RDI of less than or equal to five hours of total sleep time (TST) with no clinically significant hypoxemia, hypercapnia or excessive daytime sleepiness were considered to have primary snoring [5]. The diagnosis of other sleep disorders (such as restless leg

syndrome, bruxism, nightmare, sleepwalking and disorders of initiation and maintenance of sleep) was based on the criteria laid down in the International Classification of Sleep Disorders-Diagnostic & Scoring manual [6]

Statistical Methods

All the data analysis was performed using statistical software SPSS 11.0, Chi-square test and t-test were used to determine significance of correlation and testing the differences in the prevalences by characteristics.

Results

The overall prevalence of various sleep disorders in the elderly is depicted in Table 1.

Table 1: Overall prevalence of sleep disorders amongst the elderly in the community

S.No	Sleep Disorder	Prevalence(%)		
		Total	Male	Female
1	Snoring	41.4	41.6	41.2
2	Habitual snoring	27.2	24.8	30.3
3	Sleep disordered breathing	10.3	9.9	10.8
4	Excessive daytime sleepiness	41.5	43	40
5	Restless leg syndrome	14.3	10.1	17.6
6	Sleepwalking	6.9	5.4	6.7
7.	Nightmare	21.7	17.4	23.5
8.	Bruxism	10.6	11.4	7.6
9.	Consumption of sleeping pills	8	8.7	7
10.	Disorders of initiation & maintenance of sleep (DIMS)	59	50	63.5

Snoring

The overall prevalence of snoring was found to be 41.4% (Males=41.6%, Females =41.2%). It correlated positively with body mass index (BMI) ($p<0.033$), age ($p<0.076$), and excessive daytime sleepiness ($p<0.036$). (Table 2). Habitual snoring was found to be prevalent in 27.2% of the elderly subjects. (Table 3). It was again found to correlate with BMI ($p<0.03$), and rising socio-economic strata ($p<0.014$)

Table 2 : Snoring(%) and its correlates

Snoring = 41.4 %					
					p-value
BMI	<18.5 34.6	(18.5-24.9) 34.8	(25-29.9) 43.9	(>=30) 55.6	0.033
SES	Low 42	High 40.9			0.479
Sex	Male 41.6	Female 41.2			0.521
Age	60-70 38	71-80 42.3	>80 57.1		0.076
EDS	Yes 50.6	No 36.6			0.036

Table 3 : Prevalence of habitual snoring (%) and its correlates

Habitual snoring = 27.2%					
					p-value
BMI	<18.5 19.2	(18.5-24.9) 20.2	(25-29.9) 30.3	(>=30) 44.4	0.03
SES	Low 18.2	High 31.5			0.014
Sex	Male 24.8	Female 30.3			0.197
Age	60-70 28.8	71-80 23.1	>80 28.6		0.632

Sleep Disordered Breathing (SDB)

The overall prevalence of SDB was 10.3%.; (9.9% in males and 10.8% in female subjects) It was found to correlate with increasing BMI ($p< 0.064$) (Table 4).

Table 4: Sleep disordered breathing (%) and its correlates

SDB = 10.3%					
BMI	<18.5	18.5 - 24.9	25 - 29.9	>=30	p-value
	9.3	8.2	11	15	0.064
SES	Low 11.3	High 9.8			0.226
SEX	Male 9.9	Female 10.8			0.614
Age	60-70 9.7	71-80 10.4	>80 13.4		0.381
With morning tiredness			6.7		
With mood changes			5.1		

Excessive daytime sleepiness:

Approximately 41.5 % of the elderly population was seen to suffer from excessive daytime sleepiness. It correlated significantly with lower socio-economic strata (Table 5).

Table 5 : Excessive daytime sleepiness (%) and its correlates

EDS = 41.5					
					p-value
BMI	<18.5 58.8	(18.5-24.9) 38.6	(25-29.9) 42.3	(>=30) 52	0.409
SES	Low 70	High 29.3			0
Sex	Male 43	Female 40			0.394
Age	60-70 44.5	71-80 34.5	>80 47.4		0.408

Restless leg syndrome (RLS)

The overall prevalence of symptoms suggestive of restless leg syndrome was 14.3% (Table 6). It was found to correlate significantly with BMI (p<0.018), and female gender (p<0.052)

Table 6 : Restless les syndrome (%) and its correlates

RLS = 14.3					
					p-value
BMI	<18.5 7.7	(18.5-24.9) 7.9	(25-29.9) 18.2	(>=30) 27.8	0.018
SES	Low 12.5	High 13.8			0.464
Sex	Male 10.1	Female 17.6			0.052
Age	60-70 12.9	71-80 11.5	>80 21.4		0.401

Sleepwalking

The overall prevalence of sleepwalking in the elderly population studied was 6.9% (Table 7). It was found to correlate negatively with increasing BMI (p<0.041) and age and positively with rising socio-economic strata (p<0.076).

Table 7 : Sleep walking (%) and its correlates

Sleep walking= 6.9					
					p-value
BMI	<18.5 15.4	(18.5-24.9) 10.1	(25-29.9) 1.5	(>=30) 2.8	0.041
SES	Low 2.3	High 7.7			0.076
Sex	Male 5.4	Female 6.7			0.796
Age	60-70 4.3	71-80 7.7	>80 10.7		0.308

Nightmare

The prevalence of nightmares in the elderly population studied was 21.7% (Table 8). It was found to correlate inversely with age (p<0.019). However, no significant correlation was observed with BMI.

Table 8 : Nightmare (%) and its correlates

Nightmare = 21.7					
					p-value
BMI	<18.5 26.9	(18.5-24.9) 20.2	(25-29.9) 15.2	(>=30) 33.3	0.167
SES	Low 19.3	High 20.4			0.483
Sex	Male 17.4	Female 23.5			0.14
Age	60-70 22.7	71-80 10.3	>80 32.1		0.019

Bruxism

Bruxism was observed to be present in 9.2% of the elderly population studied (Table 9). It correlated significantly with rising socio-economic strata (p<0.017) and snoring (p<0.002).

Consumption of sleeping pills

Approximately 8% of the entire elderly study population admitted that they consumed sleeping pills (Table10). Its use correlated with rising socio-economic strata (p<0.033) and symptoms suggestive of disorders of initiation & maintenance of sleep (DIMS) (p<0.072).

Table 9 : Bruxism (%) and its correlates

Bruxism = 10.6					
					p-value
BMI	<18.5 15.4	(18.5-24.9) 14.6	(25-29.9) 7.6	(>=30) 2.8	0.165
SES	Low 4.3	High 12.2			0.034
Sex	Male 11.4	Female 7.6			0.199
Age	60-70 6.7	71-80 11.5	>80 21.4		0.042

Table 10: Consumption of sleeping pills (%) and its correlates

Sleeping Pills = 8%					
					p-value
BMI	<18.5 0	(18.5-24.9) 9.5	(25-29.9) 6.2	(>=30) 13.9	0.233
SES	Low 8.3	High 7			0.8
Sex	Male 6.5	Female 8.6			0.634
Age	60-70 4.6	71-80 10.7	>80 14.3		0.087

Disorders of initiation and maintenance of sleep (DIMS)

Approximately 59% of the elderly population was observed to have complaints suggestive of disorders of initiation and maintenance of sleep .It was found to correlate with female gender (p<0.013) (Table11)

Table 11: Prevalence of disorders of initiation & maintenance of sleep (DIMS) (%) and its correlates

DIMS = 59%					
					p-value
BMI	<18.5 38.5	(18.5-24.9) 64	(25-29.9) 54.5	(>=30) 77.8	0.011
SES	Low 50	High 63.5			0.024
Sex	 53	Male 67.2	Female		0.013
Age	 58.3	60-70 56.4	71-80 71.4	>80	0.361

Discussion

The elderly population experiences sleep problems quite commonly. Sleep quality, quantity, and architecture undergo changes with ageing. The ability to initiate and maintain sleep is associated with a decrease in the proportion of deeper, more restorative slow-wave sleep and REM sleep [28]. This impaired ability to initiate and maintain sleep may be a marker of increased mortality and neuro-cognitive dysfunction. [28] The mechanisms related to age-related changes in sleep include age-related modifications in circadian modulation, homeostatic factors, cardio-pulmonary function, and endocrine function. Older subjects have more night-time arousals, awakenings, and sleep stage shifts. A reduction occurs in total sleep time, sleep efficiency, slow-wave sleep and the duration of nocturnal awakenings is increased[17]. There may also be co-morbid conditions like medical and psychiatric disorders in the geriatric age group. Social and environmental factors may also play a role in certain situations.

Comprehensive epidemiological data on sleep disorders in the elderly is virtually non-existent in our country. It is with this background that a population-based study was undertaken in our center.

Sleep-disordered breathing

The prevalence of OSA (defined as AHI $\geq$ 5)is 9% for women and 24% in men aged 30-60 years; and the prevalence of OSA syndrome (AHI $\geq$ 5 and daytime hypersomnolence) is 2% for women and 4% for men. [7] In adults more than 60 years old, the prevalence rates of OSA are significantly higher and ranges between 37.5% to 62% [8,9]. A step-wise increase in the prevalence of sleep-disordered breathing was documented in the elderly population in another study; 2.9% of 60-year olds, 33.3% of 70-year olds and 39.5% of 80-year olds having AHI of 5 or higher [10]. The Sleep Heart Health Study also found a similar stepwise increase in the prevalence of sleep-disordered breathing with increasing age[11]. Some studies opine that increased prevalence rates of SDB with rising age may be due to increased occurrence of central events; peaking at 55years age and then actually declining [12]. The prevalence of sleep apnea (AHI$\geq$ 10) has also been found to be higher in post-menopausal women than pre-menopausal women (47% vs 21%); and post-menopausal women have also been observed to be having a significantly higher mean AHI compared to pre- menopausal women after adjusting for body mass index and neck circumference (13). Similar

trends have been observed in the Wisconsin Sleep Cohort study and other studies [14-16].

Age related changes, like increased adipose tissue deposition in upper airway, pharyngeal bony changes due to remodeling, longer pharyngeal airway, diminished protective dilator reflexes against airway collapse, reduced upper airway occlusion during obstructive apnea, may all contribute to the increasing prevalence of SDB in the elderly [17]. Demented patients experience higher rates of OSA, perhaps due to degenerative changes in the respiratory and autonomic centers in the brain-stem [18]. The prevalence of SDB (AHI $\geq$ 5), in a survey of general population aged 50-70 years, was 28.9% and that of a sleep apnea syndrome (SAS) was found to be 6.8% [19]. The estimated prevalence of OSA among older adults may vary from 13% to 28% in men and 4% to 20% in women [8,17 ,31]. The prevalence of SDB in the present study was estimated to be 10.3%; it was also found to correlate with increasing BMI ($p<0.064$) (Table 4).

Restless legs syndrome

In elderly patients, the prevalence of restless legs syndrome (RLS) varies from 8.3% to 20% [17,20-22] and occurs more commonly in older women than in older men [22,23]. In the present study also, the prevalence of symptoms suggestive of RLS was 14.3% and it correlated significantly with female gender.

Disorders of initiation and maintenance of sleep (DIMS)

In the older adult population, the prevalence of insomnia has been reported to be between 20% and 40% (24,25). Its annual incidence is about 5% (26). In a large sample of community-dwelling elders, approximately 50% of elderly subjects reported symptoms of insomnia at least few nights per week (27). In older adults, sleep tends to become shorter more shallow and disrupted as evidenced by increased number of sleep stage shifts, arousals and awakening (28,29). In the present study, the prevalence of DIMS was observed to be 59% and it correlated with female gender. In any case presenting with insomnia the possibility of physical illness disrupting sleep (cardiovascular, gastro-intestinal, respiratory), age-related complaints (prostatism), psychiatric disorders (depression, dementia) and iatrogenic causes (theophylline, diuretics) should be considered[30].

Consumption of sleeping pills

An increase in prescription and use of hypnotic drugs with age (10-15%, among elderly people and higher among those over 75, women and those in hospital and old-age homes) has been often noted[30]. In the present study, approximately 8% of the entire elderly study population consumed sleeping pills, its use correlated with rising socio-economic strata and symptoms suggestive of DIMS. Keeping in view the magnitude of the problem of DIMS (59% approximately), the proportion of elderly subjects consuming sleeping pills was found to be much lower in this study as compared to the Western population.

Nightmares

In one study the mean annual nightmare frequency was about 65% as high among elderly healthy subjects as compared to college students; the elderly were about one-fifth as likely as college students to report a problem with nightmares[31].

Sleepwalking

In the elderly, sleepwalking most often is associated with an organic brain syndrome, commonly nocturnal delirium[32]. In the present study the overall prevalence of sleepwalking in the elderly population studied was 6.9% (Table 7). It was found to correlate negatively with increasing BMI ($p<0.041$) and age and positively with rising socio-economic strata ($p<0.076$).

Conclusions

It may be concluded from the observations of this study that common sleep problems are prevalent in a large proportion of the elderly subjects of our community. None of these individuals is undergoing any form of treatment for the same. It is likely that most of these subjects may be taking such problems as a part of growing old. There is, therefore, a need to create awareness about sleep disorders in this segment of society in general, and people of this age group in particular, as well as among the medical community that is engaged in the healthcare of the elderly. There is a likelihood that these sleep disorders are having an impact on the quality of life, morbidity and mortality in this segment of the population. It is ,thus, imperative that future studies should focus on studying the impact of sleep disorders on the quality of life, morbidity and mortality in the elderly subjects.

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