DOI: 10.5665/SLEEP.1172

Insomnia Subtypes and Their Relationship to Excessive Daytime Sleepiness in Brazilian Community-Dwelling Older Adults

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Study Objectives: To investigate the association between different types of insomnia as exposures and excessive daytime sleepiness (EDS) as a binary outcome in older Brazilian residents.

Design: The baseline examination of the Bambuí Health and Ageing Study (BHAS), which is an ongoing population-based prospective cohort study of older adults.

Setting: Bambuí (15,000 inhabitants), a city in the State of Minas Gerais, Southeast Brazil

Participants: All residents aged ≥ 60 years were eligible to take part in the BHAS baseline. Of 1742 residents identified who were ≥ 60 years, 1606 (92.2%) were interviewed and received comprehensive examinations of health status.

Interventions: None

Measurements and Results: EDS was defined as the presence of sleepiness ≥ 3 times per week in the last month, causing any interference in usual activities. All insomnia subtypes were significantly associated with EDS in unadjusted analyses, and these associations were only modestly altered after adjusting incrementally for the other covariates. In a final model, the 3 insomnia subtypes were entered into a fully adjusted model simultaneously to investigate mutual independence, giving prevalence ratios of 1.63 (95% CI 1.14-2.31) for initial insomnia, 2.13 (95% CI 1.48-3.07) for middle insomnia, and 1.36 (95% CI 0.94-1.96) for terminal insomnia. The population attributable fractions for initial, middle, and terminal insomnia on prevalence of EDS were 17.6%, 32.9%, and 9.7%, respectively.

Conclusions: Middle insomnia emerged as the insomnia subtype most strongly associated with EDS. Further research is required to clarify causal pathways underlying this cross-sectional association.

Keywords: Excessive daytime sleepiness, subtypes of insomnia, elderly, community

Citation: Hara C; Stewart R; Lima-Costa MF; Rocha FL; Fuzikawa C; Uchoa E; Firmo JOA; Castro-Costa É. Insomnia subtypes and their relationship to excessive daytime sleepiness in Brazilian community-dwelling older adults. *SLEEP* 2011;34(8):1111-1117.

INTRODUCTION

Sleep propensity during wakefulness in situations of diminished attention is generally referred to as "excessive daytime sleepiness," although its definition and measurement have been found to vary substantially.[1] In older persons, complaints of excessive daytime sleepiness (EDS) and insomnia are highly prevalent and are associated with adverse outcomes.[2] EDS is a symptom with high clinical and public health importance because of its impact on older people's health, safety, and quality of life.[3] The association between general insomnia and EDS has been well established in studies of working-age adults[4-7] and also recently in an older population.[8,9] However, the associations between insomnia subtypes and EDS have not been investigated in older people.

The pattern of insomnia is often related to its etiology.[10] Initial insomnia (difficulty in falling asleep at the beginning of the night) is often associated with anxiety disorders,[11] while middle insomnia (difficulty in maintaining sleep) and terminal insomnia (early morning awakening) are often associated with disorders causing pain, adverse general health, and depression.[12,13]

To date, the only study to investigate the association between insomnia subtypes and daytime sleepiness evaluated working-age adults with obstructive sleep apnea. This association varied according to insomnia subtypes. Participants with repeated wakening during the night had more severe subjective sleepiness, while those with initial insomnia had less daytime sleepiness. No association was found between terminal insomnia and EDS.[14]

The study described here tested hypothesized associations between different types of insomnia as exposures and EDS as a binary outcome in older Brazilian residents, and compared the strengths of these associations after controlling for potential confounders including sociodemographic factors, lifestyle characteristics, mental health, and chronic diseases.

METHODS

The Bambuí Health and Ageing Study (BHAS)

The BHAS is an ongoing population-based prospective cohort study of older adults carried out in Bambuí (15,000 inhabitants), a city in the State of Minas Gerais, Southeast Brazil. The data presented in this paper were collected at the baseline

Submitted for publication August, 2010
Submitted in final revised form February, 2011
Accepted for publication March, 2011

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examination. A detailed description of the study design and methods has been published previously.[15]

Study Population

All residents aged ≥ 60 years were eligible to take part in the BHAS baseline and were identified through a complete census of the city, carried out by the research team between November and December 1996. Of 1742 residents ≥ 60 years identified, 1606 (92.2%) were interviewed and received comprehensive examinations of health status. Those interviewed and those examined were similar to the total population aged ≥ 60 years with respect to all sociodemographic characteristics considered, including age, gender, number of residents in the household, marital status, and education.[15]

Excessive Daytime Sleepiness

In this study, the information about EDS was calculated from the response to the following question "During the last month, how often did you feel daytime sleepiness," collected using a structured and validated sleep questionnaire adapted from a previously Brazilian instrument.[16] EDS was defined as the presence of sleepiness ≥ 3 times per week in the last month, causing any interference in usual activities. This interference was determined subjectively by the interviewee answering the following question: "During the last month, has daytime sleepiness caused any impairment (problems) in your usual activities." Interference was defined as the presence of a self-rated substantial problem.[6,16,17]

Insomnia

Insomnia was defined as difficulty in falling asleep (initial insomnia), difficulty in maintaining sleep (middle insomnia) and/or early morning awakening (terminal insomnia), ≥ 3 times a week during the previous 30 days, causing any distress during the last 30 days, as previously described.[16,18]

Covariates

Information on gender, age, marital status, and schooling level (number of complete years of schooling) was obtained in the baseline BHAS interview. Body mass index (weight [kg] divided by height [m^2]) was calculated from height and weight measurements; scores > 25 were categorized as overweight. Participants were asked about the following lifestyle characteristics: caffeine consumption (number of cups/day in the previous 12 months), current smoking, and regular physical activity. Current smokers were defined as those who had smoked ≥ 100 cigarettes during their lifetime and were still smoking. Regular physical activity was defined as any exercise during leisure time ≥ 20-30 min, ≥ 3 times a week in the previous 90 days.[19] Information about insomnia and the use of hypnotic or sedative medication was collected using the sleep questionnaire previously described. Current use of hypnotic or sedative medication was defined as any number of pills taken in the last month. The Mini Mental State Examination (MMSE) was used as a measure of cognitive function.[21,22] The presence of psychological distress, a construct, which includes states of anxiety, depression, and somatization, was defined as a score > 4 on the 12-item General Health Questionnaire (GHQ-12).[22] This Brazilian validated version of GHQ-12 has been found to be equivalent to the 30-item Geriatric Depression Scale (GDS-30) for detecting depression symptoms in this elderly sample.[23] Angina pectoris was ascertained using the Rose questionnaire.[24] Arthritis was self-reported and defined as a physician diagnosis of arthritis or rheumatism, and/or chronic hand and knee symptoms.[25] Diabetes mellitus was defined as fasting blood glucose ≥ 126 mg/dL and/or current treatment for diabetes, following the 2003 American Diabetes Association updated criteria.[26] Consistent with the seventh Joint National Committee criteria, hypertension was defined as systolic blood pressure ≥ 140 mm Hg, and/or diastolic blood pressure ≥ 90 mm Hg and/or the use of antihypertensive drugs.[27] Stroke was defined as previously reported (CDC, 1994). Functional disability was defined as the inability to perform ≥ 1 of 5 activities of daily living: dressing, eating, walking around inside the house, bathing, and maintaining urinary continence.[28]

The interviews were carried out by community members with ≥ 11 years of schooling selected by the research team. When a person was unable to participate because of cognitive impairment or some other health reason, a proxy was used (such as a family member or informal caregiver). Proxies were not asked questions that involved personal judgment or subjective self-appraisal (such as the EDS complaint), and therefore this group was excluded for the analyses described in this paper. The interviewers were trained by a psychiatrist with large experience in different countries and cultures (E. Uchoa).[15]

The BHAS was approved by the Ethics Committee of the Oswaldo Cruz Foundation. All participants (and proxies for participants lacking capacity to provide informed consent due to cognitive impairment or some other health reason) were informed about the objectives and procedures of the project and gave full informed written consent.[15]

Statistical Analysis

Correlations between insomnia subtypes were tested using Spearman rank correlation coefficients. Unadjusted associations of EDS with sociodemographic factors, lifestyle characteristics, mental health, and chronic diseases were evaluated using Pearson χ^2 tests, χ^2 tests for linear trend, or Student *t*-tests. The same procedures were used to assess associations with the different types of insomnia. Categorical variables were: gender, age, marital status, schooling level, body mass index, smoking, regular physical activity, current use of hypnotic or sedative medication, depressive symptoms, angina, arthritis, diabetes, hypertension, stroke, and functional disability. Caffeine intake and MMSE scores were treated as continuous variables.

Unadjusted and adjusted prevalence ratios (PRs) were estimated in Poisson regression with robust error variance to assess the association between each insomnia subtype (initial, middle, terminal, or any insomnia) and EDS. First we estimated the crude association, then each of these 4 models was adjusted incrementally for (1) demographic variables (gender, age, marital status, and schooling—considered *a priori* as potential confounding variables in this study), followed by other potential confounders: (2) lifestyle characteristics (body mass index, caffeine intake, current smoking, regular physical activity) and current use of hypnotic or sedative medication; (3) mental health (cognitive function, common mental disorder); and (4) chronic diseases (angina, arthritis, diabetes, hypertension, stroke) and functional disability.

Table 1—Characteristics of study sample and unadjusted associations between covariates and excessive daytime sleepiness

Characteristics	Total (n = 1514)	Excessive daytime sleepiness		P Value
		Yes (n = 197)	No (n = 1317)	
Sociodemographic*				
Female (%)	61.0	73.6	59.1	< 0.001
Age group, years (%)**				
60-64	33.8	33.5	33.9	0.903
65-69	26.1	27.4	25.9	
70+	40.1	39.1	40.2	
Marital status (%)				
Married or living together	49.5	46.7	50.0	0.111
Single	9.7	7.1	10.1	
Divorced or separated	5.2	8.1	4.8	
Widowed	35.6	38.1	35.2	
Schooling level, years (%)**				
None	31.1	37.1	30.2	0.008
1-3	33.4	33.0	33.5	
4-7	27.5	26.9	27.5	
≥ 8	8.0	3.0	8.8	
Sleep related characteristics				
Excessive daytime sleepiness in previous 30 days	13.0	-	-	-
Insomnia in previous 30 days (%)				
Initial	19.8	46.2	15.8	< 0.001
Middle	29.1	62.4	24.2	< 0.001
Terminal	15.1	35.5	12.0	< 0.001
Current use of hypnotic or sedative medication (%)	25.1	16.9	11.7	0.01
Lifestyle				
Body mass index (≥ 25 kg/m^2)	49.1	59.6	47.5	0.002
Number of cups of coffee per day in the previous 12 months, mean (SD)	4.8 (4.6)	4.8 (4.7)	4.9 (4.7)	0.915
Current smoking, Yes (%)	18.3	20.3	18.0	0.434
Regular physical activity in the previous 90 days (%)	13.3	11.7	13.5	0.478
Mental health				
MMSE score, mean (SD)	24.7 (4.2)	24.0 (4.3)	24.8 (4.2)	0.010
Common mental disorder (%)	38.5	67.2	34.3	< 0.001
Chronic diseases				
Angina pectoris (%)	9.2	14.7	8.4	0.006
Arthritis (%)	52.2	66.5	50.1	0.001
Diabetes mellitus (%)	15.2	20.0	14.2	0.039
Hypertension (%)	61.9	64.3	61.5	0.387
Stroke (%)	3.4	7.0	2.9	0.004
Functional disability (%)	11.4	17.8	10.1	0.001

*Pearson χ^2 test for differences between categorical variables and Student *t*-test for differences between means, **χ^2 test for linear trend (1df).

In a final model, the 3 insomnia subtypes were entered into a fully adjusted model simultaneously to investigate mutual independence. The population attributable prevalence fraction for EDS was then estimated from these models using the STATA for Windows 10.1, whose "aflogit" command estimates the attributable fraction from within the Poisson regression framework, thus enabling confounders to be taken into account. Population attributable prevalence fractions when calculated from prevalence ratios in cross-sectional studies represent the proportion of prevalent EDS that could theoretically be avoided if the exposure (a given insomnia subtype) could be removed from the population, taking into account the effect of the exposure (insomnia) on both incidence and duration of the outcome (EDS), assuming a causal relationship estimated free of confounding. The STATA Software Package (version 10.1, College Station, TX, USA) was used for all analyses.[29]

RESULTS

Characteristics of the sample are summarized in Table 1. The 1514 participants in this study had a mean (SD) age of 69.9

Table 2—Unadjusted associations between insomnia subtypes and covariates

Factors	Initial insomnia			Middle insomnia			Terminal insomnia		
	Yes (n = 299)	No (n = 1215)	P Value	Yes (n = 441)	No (n = 1072)	P Value	Yes (n = 228)	No (n = 1283)	P Value
Sociodemographic characteristics*									
Female (%)	75.2	57.4	< 0.001	71.2	56.8	< 0.001	27.2	58.8	< 0.001
Age group, years (%)**									
60-64	31.1	34.5		33.8	33.9		33.8	33.8	
65-69	29.8	25.2		27.0	25.6		27.2	25.9	
70+	39.1	40.3	0.243	39.2	40.5	0.845	39.0	40.3	0.909
Marital status (%)									
Married or living together	41.1	51.6		43.5	52.0		44.3	50.4	
Single	8.4	10.0		7.9	10.4		8.3	10.0	
Separated or divorced	7.4	4.7		6.4	4.8		5.3	5.2	
Widowed	43.1	33.7	0.002	42.2	32.8	0.001	42.1	34.4	0.153
Schooling level, years (%)**									
None	34.5	30.3		30.1	33.6		39.0	30.3	
1-3	36.8	32.6		31.3	38.5		35.1	32.6	
4-7	22.7	28.6		29.8	21.8		21.9		
≥ 8	6.0	8.5	0.058	8.8	6.1	0.001	4.0	8.5	0.003
Current use of hypnotic or sedative medication (%)	35.6	22.5	< 0.001	31.3	22.5	< 0.001	32.0	23.8	0.008
Lifestyle characteristics									
Body mass index (% ≥ 25 kg/m^2)	51.1	48.6	0.455	51.5	48.0	0.243	51.0	48.6	0.455
Mean (SD) number of cups of coffee per day in the previous 12 months	4.4 (4.3)	4.9 (4.7)	0.1223	4.4 (4.0)	4.9 (4.7)	0.022	4.4 (4.0)	4.9 (4.8)	0.167
Current smoking (%)	17.4	18.5	0.652	15.4	19.5	0.062	15.8	18.7	0.294
Regular physical activity in the previous 90 days (%)	14.9	6.7	< 0.001	14.3	7.0	0.003	14.6	10.0	0.017
Mental health									
Mean (SD) MMSE score	24.1 (4.3)	24.9 (4.2)	0.004	24.2 (4.2)	24.9 (4.2)	0.013	24.0 (3.9)	24.8 (4.2)	0.004
Common mental disorder (%)	62.5	32.6	< 0.001	60.3	29.5	< 0.001	66.7	33.6	< 0.001
Chronic diseases									
Angina pectoris (%)	14.0	8.1	0.002	12.2	8.0	0.015	12.4	8.7	0.077
Arthritis (%)	68.9	48.2	< 0.001	62.9	47.9	< 0.001	67.1	49.4	< 0.001
Diabetes mellitus (%)	15.1	15.6	0.828	15.0	15.7	0.739	16.1	10.7	0.044
Hypertension (%)	62.2	61.9	0.923	66.6	60.1	0.023	67.9	60.8	0.049
Stroke (%)	5.4	3.0	0.048	5.3	2.7	0.012	6.0	3.0	0.026
Functional disability (%)	16.0	9.8	0.002	16.6	8.8	< 0.001	16.2	10.1	0.007

*Pearson χ^2 test for differences between categorical variables and Student *t*-test for differences between means; **χ^2 test for linear trend (1df).

(7.1) years; the majority was female; and low schooling predominated. The prevalence of EDS was 13.0%, and middle insomnia was the most prevalent subtype (29.1%). The Spearman correlation coefficients of initial insomnia with intermittent and terminal insomnia were 0.38 (P < 0.001) and 0.36 (P < 0.001), respectively, and that between intermittent and terminal insomnia was 0.39 (P < 0.001). Table 1 also summarizes unadjusted analyses of factors associated with EDS. Female gender, lower education level, current use of hypnotic or sedative medication, higher body mass index, lower MMSE score, angina pectoris, arthritis, diabetes mellitus, stroke, and functional disability were all found to be significantly associated with EDS.

Regarding the subtypes of insomnia, being female, marital status (separated, divorced, or widowed), regular physical activity, hypnotic or sedative use, common mental disorders, angina, arthritis, hypertension, functional disability, and lower MMSE scores were significantly associated with most, if not all, insomnia subtypes as can be seen in Table 2.

The prevalence ratios (PRs) for the associations between each insomnia subtype separately and EDS are shown in Table 3. All insomnia subtypes were significantly associated with EDS in unadjusted analyses, and these associations were only modestly altered after adjusting incrementally for the other covariates.

A final model, simultaneously entering the 3 insomnia subtypes in addition to all other covariates, gave rise to prevalence ratios of 1.63 (95% CI 1.14-2.31, P = 0.006) for initial insomnia, 2.13 (95% CI 1.48-3.07, P < 0.001) for middle insomnia, and 1.36 (95% CI 0.94-1.96, P = 0.094) for terminal insomnia

Table 3—Results of analyses of associations between excessive daytime sleepiness and insomnia subtypes (unadjusted and adjusted prevalence ratios [PRs] estimated by Poisson regression)

Insomnia	PR (95% CI) Unadjusted	PR (95% CI) Adjusted[1]	PR (95% CI) Adjusted[2]	PR (95% CI) Adjusted[3]	PR (95% CI) Adjusted[4]
Initial	3.48 (2.63-4.61)	3.17 (2.37-4.22)	3.04 (2.24-4.11)	2.44 (1.78-3.34)	2.28 (1.65-3.16)
Middle	4.04 (3.02-5.39)	3.77 (2.81-5.06)	3.59 (2.64-4.88)	2.93 (2.12-4.05)	2.74 (1.97-3.81)
Terminal	3.10 (2.31-4.15)	2.79 (2.07-3.76)	2.73 (2.00-3.72)	2.12 (1.53-2.93)	2.17 (1.55-3.02)

[1]Adjusted for sociodemographic characteristics (gender, age group, marital status, and schooling level). [2]Adjusted for sociodemographic characteristics and lifestyle characteristics (body mass index, caffeine consumption, current smoking, and regular physical activity) and current use of hypnotic or sedative medications. [3]Adjusted for sociodemographic characteristics, lifestyle characteristics, and mental health (MMSE score and psychological distress). [4]Adjusted for sociodemographic characteristics, lifestyle characteristics, mental health, and chronic diseases (angina pectoris, arthritis, diabetes mellitus, hypertension, and stroke) and functional disability.

(not presented). Population attributable fraction (PAF) calculations derived from these prevalence ratios suggested 17.6% of EDS prevalence attributable to initial insomnia, 32.9% to middle insomnia, and 9.7% to terminal insomnia.

Finally, the analyses were repeated for a broader category of EDS—i.e., presence of sleepiness in the last month regardless of interference—which gave rise to similar findings (data not shown). Also, prevalence ratios were re-estimated using log-binomial regression which again gave similar results (data not shown)

DISCUSSION

This paper describes what we believe to be the first investigation of the association between EDS and types of insomnia in community-dwelling older people, taking into account a range of potential confounding factors. In Bambuí, EDS was associated with all three types of insomnia—initial, middle, and terminal—and these associations persisted after controlling for sociodemographic status, lifestyle characteristics, mental health, and chronic diseases. Similar strengths of association were found for all three insomnia categories. However, after entering the three of these insomnia subtypes into the same model, middle insomnia was the strongest correlate with EDS followed by initial and then terminal insomnia.

The study had a number of strengths including the large sample size, the high response rate, the use of standardized and validated procedures and instruments, the intensive training of the field and laboratory teams, the set of strict and well-defined clinical diagnostic criteria for chronic diseases, psychological distress (anxiety, depression, and somatization symptoms) and cognitive impairment, and the use of EDS and insomnia definitions in accordance with *International Classification of Sleep Disorders* criteria considering the presence, frequency, and distress in usual activities.[16-18,30]

However the study has limitations. First, we did not have objective data regarding sleep-wake patterns. EDS and insomnia were self-reported measures dependent upon answers to a questionnaire, and their validity had not been tested against polysomnography. However, although objective measures are desirable, their incorporation into community-based epidemiological studies poses substantial logistical challenges and self-report and interview-based measures remain the most widely used instruments in these studies.[1,31,32] Second, other sleep disorders such sleep related breathing disorders, restless legs syndrome, and periodic limb movement disorder were not ascertained. Third, because the analysis was cross-sectional, it is not possible to draw definite causal inferences from the relationships found. This is particularly important for the interpretation of PAF statistics. Although these provide further information on potential impact than prevalence ratios alone (since they take into account relative prevalences of exposures) and were therefore felt appropriate to calculate here, the concept of "attribution" assumes an unconfounded direct causative influence, which clearly cannot be conclusively inferred from cross-sectional data. Finally, it should be borne in mind that, in common with most epidemiological data, no attempt was made to define the cause of EDS or insomnia. All of these may have complex interactions at an individual level and there are limits to the extent to which they can be disentangled at a group level in epidemiological research.

EDS is one of the most frequent sleep complaints in the population and affects 10% to 30% of older adults aged 65 years and older.[1] EDS has been consistently associated with an adverse risk profile including a higher risk of total and cardiovascular mortality in community-dwelling elders.[33] In the very few previous studies, which have been undertaken in this area, inconsistent results have been reported concerning the association between insomnia and EDS. Su and colleagues investigated the presence of "desire to sleep during work and meals" in a sample of 2045 non-institutionalized older individuals aged 65 years or older from an urban community of Taiwan,[7] and found an association between insomnia and EDS even after adjustments for demographic and lifestyle characteristics (cigarette smoking, alcohol drinking, and hypnotics) and health status (chronic diseases, depression, and cognitive impairment). Also, Ohayon and colleagues,[34] investigating normative data on sleep-wake characteristics in 1,026 individuals aged 60 years and older from the metropolitan area of Paris, demonstrated that daytime sleep duration of one hour or more was associated with many factors including insomnia. However, another French study of 2,259 non-institutionalized persons aged 65 years and over, assessing EDS using a cut-off > 10 on the ESS,[8] found an association between terminal insomnia and EDS in unadjusted analysis, which was not sustained after adjustments for demographic characteristics, physical health, and mental disorder.[9]

In the study described here, EDS was strictly defined as the presence of sleepiness three or more times per week in the last month, causing any interference in usual activities. All subtypes

of insomnia were associated with EDS, with very similar prevalence ratios in separate models. Although the three subtypes of insomnia were not highly correlated variables (rho statistics ranging from 0.36 to 0.39), it is difficult to determine the effect of one independent of the others. However, a final model, where the three subtypes of insomnia were simultaneously entered with all other covariates, indicated differences in the strengths of association between insomnia subtypes and EDS, with the strongest associations for middle insomnia followed by initial insomnia and the weakest association with terminal insomnia. The population attributable fraction for EDS prevalence associated with terminal insomnia was also the lowest (9.3%). Interestingly our findings in this respect were similar to those from a study of daytime sleepiness in people with obstructive sleep apnea,[14] where the strongest relationship was also found with middle insomnia and the weakest with terminal insomnia, despite the fact that the samples were very different.

Despite the common belief that older people sleep less, surveys examining sleep duration in different age groups have shown that in general, older adults report sleeping around seven hours a night, an amount not very different from that reported by younger age groups.[34,35] Although sleep architecture changes with age, nearly all age-related changes in architecture occur in early and middle age.[34] Slow wave sleep decreases dramatically from 16 years to approximately 35 years but stabilizes from 60 years onward, as do most sleep parameters.[33] Only sleep efficiency continues to decline with age.[34] While controversy remains about the need for sleep changes with age, it is clear that the ability to sleep decreases with age.[36,37] While numerous studies have shown that the prevalence of insomnia is higher in older adults than younger adults,[38,39] after adjustment for comorbidities, the prevalence of insomnia is very low in healthy older adults. It appears, therefore, that insomnia is associated with other age-related conditions, rather than age per se.[40-42] It is, therefore, utmost importance to make the correct medical and psychiatric diagnoses and treat these problems along with appropriate management of the underlying sleep disturbances in old adults.

Further research is clearly required to clarify the apparent differences in relationships between insomnia subtypes and EDS. For example, it is possible that middle insomnia results in a more substantial reduction in sleep duration or quality (i.e., is more disruptive) than the other two subtypes, accounting for the strongest association with EDS. Also, in the context of an older population, natural reductions in sleep duration, which would be less expected to cause functional deficits, may be more likely referred to in terms of initial or terminal insomnia. Furthermore, comparability with younger populations cannot be assumed because initial and terminal insomnia might have different etiologies and/or impacts in different age groups.

A drawback to research in this area is lack of a universally accepted definition of EDS. Prevalence estimates from studies using different diagnostic criteria yield results that vary so widely that firm comparisons cannot be made.[32,43] The prevalence in our study was at the low end of the 10% to 30% range usually reported, but this might reflect a more restrictive definition applied—in the case of our study, requiring that the symptom was reported as occurring at least three times per week over the previous month and causing some difficulties in functioning. The use of a broad or narrow definition of EDS would be expected to have a stronger influence on observed prevalence than observed correlates; however, heterogeneity in this cannot be excluded.

ACKNOWLEDGMENTS

This study was sponsored by the Supporting Agency of Studies and Projects (FINEP) and by the Oswaldo Cruz Foundation, Brazil. The Brazilian National Research Council (CNPq) provided Dr. Lima-Costa and Dr. Uchoa's scholarships. Dr. Castro-Costa is supported by the Programa Nacional de Pós-doutorado em Saúde-PNDS. Dr. Stewart is funded by the NIHR Specialist Biomedical Research Centre for Mental Health at the South London and Maudsley NHS Foundation Trust and Institute of Psychiatry, King's College London.

DISCLOSURE STATEMENT

This was not an industry supported study. The authors have indicated no financial conflicts of interest.

REFERENCES

1. Ohayon MM. From wakefulness to excessive sleepiness: what we know and still need to know. Sleep Med Rev 2008;12:129-41.
2. Vaz Fragoso CA, Gill TM. Sleep complaints in community-living older persons: a multifactorial geriatric syndrome. J Am Geriatr Soc 2007;55:1853-66.
3. Young TB. Epidemiology of daytime sleepiness: definitions, symptomatology, and prevalence. J Clin Psychiatry 2004;65 Suppl 16:12-6.
4. Hublin C, Kaprio J, Partinen M, et al. Daytime sleepiness in an adult, Finnish population. J Intern Med 1996;239:417-23.
5. Breslau N, Roth T, Rosenthal L, et al. Daytime sleepiness: an epidemiological study of young adults. Am J Public Health 1997;87:1649-53.
6. Hasler G, Buysse DJ, Gamma A, et al. Excessive daytime sleepiness in young adults: a 20-year prospective community study. J Clin Psychiatry 2005;66:521-9.
7. Kao CC, Huang CJ, Wang MY, et al. Insomnia: prevalence and its impact on excessive daytime sleepiness and psychological well-being in the adult Taiwanese population. Qual Life Res 2008;17:1073-80.
8. Su TP, Huang SR, Chou P. Prevalence and risk factors of insomnia in community-dwelling Chinese elderly: a Taiwanese urban area survey. Aust N Z J Psychiatry 2004;38:706-13.
9. Tsuno N, Jaussent I, Dauvilliers Y, et al. Determinants of excessive daytime sleepiness in a French community-dwelling elderly population. J Sleep Res 2007;16:364-71.
10. Roth T. Insomnia: definition, prevalence, etiology, and consequences. J Clin Sleep Med 2007;3(5 Suppl): S7-10.
11. Johnson EO, Roth T, Breslau N. The association of insomnia with anxiety disorders and depression: exploration of the direction of risk. J Psychiatr Res 2006;40:700-8.
12. Franzen PL, Buysse DJ. Sleep disturbances and depression: risk relationships for subsequent depression and therapeutic implications. Dialogues Clin Neurosci 2008;10:473-81.
13. Young JS, Bourgeois JA, Hilty DM, et al. Sleep in hospitalized medical patients, Part 1: Factors affecting sleep. J Hosp Med 2008;3:473-82.
14. Chung KF, Insomnia subtypes and their relationships to daytime sleepiness in patients with obstructive sleep apnea. Respiration 2005;72:460-65.
15. Costa MF, Uchoa E, Guerra HL, et al. The Bambui health and ageing study (BHAS): methodological approach and preliminary results of a population-based cohort study of the elderly in Brazil. Rev Saude Publica 2000;34:126-35.
16. Giglio S. Estudo da Ocorrência das queixas de insônia, sonolência excessiva diurna e das relativas às parassonias na população adulta da cidade de São Paulo. 1988, Escola Paulista de Medicina: São Paulo.
17. Hara C, Rocha FL, Costa E, et al. Prevalence of excessive daytime sleepiness in Brazilian community-dwelling older adults with very low levels of schooling, and its association with sociodemographic characteristics and lifestyle characteristics: the Bambuí Health and Ageing Study (BAHS). J Bras Psiquiatr 2008;57:91-7.

18. Rocha FL, Guerra HL, Lima-Costa MF. Prevalence of insomnia and associated socio-demographic factors in a Brazilian community: the Bambui study. Sleep Med 2002;3:121-6.
19. Lima-Costa MF, Barreto SM, Uchoa E, et al. The Bambui Health and Aging Study (BHAS): prevalence of risk factors and use of preventive health care services. Rev Panam Salud Publica 2001;9:219-27.
20. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-98.
21. Castro-Costa E, Fuzikawa C, Ferri CP, et al. Dimensions underlying the Mini-mental State Examination in a sample with low education levels. The Bambui Health and Aging Study (BHAS). Am J Geriatr Psychiatry 2009;17:863-72.
22. Golderberg D, Williams P. A user's guide to the General Health questionnaire. Windsor, UK: NFER-Nelson; 1988.
23. Costa E, Barreto SM, Uchoa E, et al. Is the GDS-30 better than the GHQ-12 for screening depression in elderly people in the community? The Bambui Health Aging Study (BHAS). Int Psychogeriatr 2006;18:493-03.
24. Rose G, Cardiovascular survey methods. WHO: Geneva, 1996.
25. Machado GM, Barreto SM, Passos VM, et al. Health status indicators among community-dwelling elders with arthritis: the Bambui health and aging study. J Rheumatol 2006; 33:342-47.
26. Genuth S, Alberti KG, Bennett P, et al. Follow-up report on the diagnosis of diabetes mellitus. Diabetes Care 2003; 26:3160-67.
27. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA 2003;289:2560-72.
28. Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged. the index of ADL: a standardized measure of biological and psychosocial function. JAMA 1963;185:914-19.
29. StataCorp, Stata Statistical Software, R.C.S., TX: StataCorp LP. 2005.
30. American Academy of Sleep Medicine. International classification of sleep disorders, 2nd ed: diagnostic and coding manual. Westchester, IL: American Academy of Sleep Medicine, 2005.
31. Newman AB, Spiekerman CF, Enright P, et al. Daytime sleepiness predicts mortality and cardiovascular disease in older adults. The Cardiovascular Health Study Research Group. J Am Geriatr Soc 2000;48:115-23.
32. Roberts RE, Shema SJ, Kaplan GA, et al. Sleep complaints and depression in an aging cohort: A prospective perspective. Am J Psychiatry 2000 157:81-8.
33. Empana JP, Dauvilliers Y, Dartigues JF, et al. Excessive daytime sleepiness is an independent risk indicator for cardiovascular mortality in community-dwelling elderly: The three city study. Stroke 2009;40:1219-24.
34. Ohayon MM, Vecchierini MF. Normative sleep data, cognitive function and daily living activities in older adults in the community. Sleep 2005;28:981-89.
35. Ancoli-Israel S. Sleep and its disorders in aging populations. Sleep Med 2009;10:S7-11.
36. Ancoli-Israel S. Sleep problems in older adults: putting myths to bed. Geriatrics 1997;52:20-30.
37. Ancoli-Israel S, Poceta JS, Stepnowsky C, Martin J, Gehrman P. Identification and treatment of sleep problems in the elderly. Sleep Med Rev 1997 1:3-17
38. Mellinger GD, Balter MB, Uhlenhuth EH. Insomnia and its treatment. Prevalence and correlates. Arch Gen Psychiatry 1985:42:225-32
39. Paudel ML, Taylor BC, Diem SJ, et al. Association between depressive symptoms and sleep disturbances in community-dwelling older men. J Am Geriatr Soc 2008;56:1228-35.
40. Foley DJ, Monjan A, Simonsick EM, Wallace RB, Blazer DG. Incidence and remission of insomnia among elderly adults: an epidemiologic study of 6,800 persons over three years. Sleep 1999; 22(Suppl. 2): S366-72.
41. Vitiello MV, Moe KE, Prinz PN. Sleep complaints cosegregate with illness in older adults: clinical research informed by and informing epidemiological studies of sleep. J Psychosom Res 2002;53:555-9.
42. Foley D, Ancoli-Israel S, Britz P, Walsh J. Sleep disturbances and chronic disease in older adults: results of the 2003 National Sleep Foundation Sleep in America Survey. J Psychosom Res 2004;56:497-502.
43. Stradling JR, Davies RJ. Sleep. 1: Obstructive sleep apnoea/hypopnoea syndrome: definitions, epidemiology, and natural history. Thorax 2004;59:73-8.