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Original Article

Prevalence of excessive daytime sleepiness in a sample of the Australian adult population

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Abstract

Objectives: Excessive daytime sleepiness (EDS) is associated with significant personal and medical burden. However, there is little indication of the impact of these symptoms in the broader population.

Participants and methods: We studied 946 men ages 24 to 92 years (median age, 59.4 [interquartile range {IQR}, 45–73 years]) and 1104 women ages 20 to 94 years (median age, 50 [IQR, 34–65 years]) who resided in the Barwon Statistical Division, South-Eastern Australia, and participated in the Geelong Osteoporosis Study (GOS) between the years of 2001 and 2008. EDS was defined as an Epworth Sleepiness Scale (ESS) score of ≥ 10 . Lifestyle factors, history of medical conditions, and medication history were documented by self-report.

Results: For men, the age-specific prevalence of EDS was 5.1% (ages 20–29 years), 6.4% (ages 30–39 years), 9.8% (ages 40–49 years), 15.5% (ages 50–59 years), 12.0% (ages 60–69 years), 12.0% (ages 70–79 years), and 29.0% (ages ≥ 80 years). For women, the age-specific prevalence of EDS was 14.7% (ages 20–29 years), 8.7% (ages 30–39 years), 15.0% (ages 40–49 years), 16.0% (ages 50–59 years), 12.6% (ages 60–69 years), 13.2% (ages 70–79 years), and 17.0% (ages ≥ 80 years). Overall standardized prevalence of EDS was 10.4% (95% confidence interval, 9.7–11.2) for men and 13.6% (95% confidence interval, 12.8–14.4) for women.

Conclusions: The prevalence of EDS increased with age, affecting approximately one-third of those aged ≥ 80 years. Because EDS has been associated with poorer health outcomes in the older

age strata, these findings suggest that routine screening may be beneficial in ongoing health assessments for these individuals. Overall, over one-tenth of the Australian adult population has EDS, which is indicative of possible underlying sleep pathology.

1. Introduction:

Excessive daytime sleepiness (EDS) is considered an important clinical feature of sleep medicine and constitutes a significant phenomenon for personal and public health outcomes. Functionally, EDS refers to an objective or subjective state in which there is an inclination or compulsion to sleep or take naps when intending to stay awake [1-3]. The causes of EDS are multifaceted, with possible risk factors previously identified as intrinsic sleep disorders, such as narcolepsy, obstructive sleep apnea; circadian rhythm disorders such as shift-work disorder; extrinsic sleep disorders, such as poor sleep hygiene and insufficient sleep; [4], and other contributory lifestyle and health factors [5]. The immediate effects of EDS can be debilitating, and in some cases life threatening [6]. EDS is considered to represent a considerable contributing factor towards poorer occupational and social functioning [1], and it is strongly associated with an increased risk for both workplace and road traffic accidents [7].

Despite the effects of sleepiness being well-recognized in public and clinical health setting, accurate representations of the burden of EDS can vary in psychometric tools and differ in pathologic thresholds used among study populations. Indeed little standardized information is available regarding the general Australian population, as much of the literature available often is restricted to specific sleep-disordered patient groups [8], working populations [2], or geographically confined populations [9], and thus gives little indication of the burden of these

symptoms among the broader population. Therefore, the accurate representation of EDS and identification of possible health and lifestyle correlates in an Australian representative population requires further elucidation. The aim of our study was to determine the prevalence of EDS measured by the Epworth Sleepiness Scale (ESS) in a representative Australian population-based sample, spanning the full adult age spectrum. Characteristics of men and women with and without EDS in a number of lifestyle and health factors also were identified.

2. Methods

2.1. *Participants:*

Our study examined data collected from men and women enrolled in the Geelong Osteoporosis Study (GOS). Individuals were randomly selected from the Barwon Statistical Division electoral role, South-East Australia. Both men and women were recruited utilizing an age-stratified sampling method including 12 strata for each gender. Population characteristics of the Barwon Statistical Division are considered comparable with national levels for each census taken in the years 1996, 2001, and 2006. Differences did not exceed 1.1% for age, 9.5% for country of birth, 7.5% for school leavers' age, 2.6% for marital status, and 2.1% for weekly income [10].

Between the years of 1993 and 1997, a random recruitment of 1494 women was performed representing a participation rate of 77.1% [10]. At the 10-year follow-up (2004-2008), 881 women from the original sample returned (82.1%) and were complemented by the inclusion of an additional 246 randomly selected women between the ages of 20 and 29 years to allow for

the continued investigation of the full adult age range. Of the 1127 women who participated in the 10-year follow-up, participants for whom sleep data were not available were excluded (n=23) resulting in a total of 1104 eligible women aged 20 to 94 years (inclusion rate of 73.9%). Between the years of 2001 and 2006, a random recruitment of 1540 men was performed (response 67.0%) [10], and the participants have since returned for follow-up (n=978; response rate, 81.0%). Of the 978 men who participated in the 5-year follow up, participants for whom sleep data were not available were excluded from analysis (n=32) resulting in a total of 946 eligible men between the ages of 24 and 92 years.

Our study was conducted with the approval of the Barwon Health Human Research Ethics Committee, and written informed consent was obtained from each participant.

2.2. Measurements

2.2.1. Epworth Sleepiness Scale

EDS was assessed using the Epworth Sleepiness Scale (ESS) [8]. The ESS is a self-administered 8-item questionnaire that has been widely used as a simple, reliable, and valid method for assessing daytime sleepiness in adults. Participants are required to respond to items regarding perceived levels of sleepiness on a 4-point rating scale (0=would never doze; 1=slight chance of dozing; 2=moderate chance of dozing; and 3=high chance of dozing). Possible scores range from 0 to 24, with higher scores reflecting greater subjective sleepiness [8]. The use of the ESS is advantageous for population-based research, as it is recognized to effectively assess participants' levels of daytime sleepiness, sleep propensity, and dozing likelihood during both soporific and nonsoporific tasks. The ESS also is considered an effective tool for differentiating

sleepiness among varied populations [2]. Although there is no universally accepted cutoff point to rate excessive sleepiness in healthy populations, many studies [2,11,12] have chosen the pragmatic score of ≥ 10 to indicate pathologic levels of sleepiness. For the purpose of our study, we made the a priori decision that scores between 0 and 9 would indicate normal levels of sleepiness and scores of 10 to 24 would indicate excessive sleepiness.

2.3. Demographic, lifestyle, and medical information

We documented information regarding demographics, history of medical conditions, health, and additional lifestyle factors. Habitual physical activity was self-reported and transformed into a binary variable. Participants were classified as active if vigorous or light exercise was performed most days; otherwise, participants were classified as sedentary (for more detailed descriptions of criteria see [10]). Similar studies assessing physical activity levels at a population level also have employed dichotomized criteria [13]. Medication use was classified as current if participants noted use through self-report at the time of assessment. Tobacco smoking was documented and grouped as current or not. Information regarding alcohol consumption was obtained from the Cancer Council food frequency questionnaire [14] and daily intake was expressed as gram intake per day (g/day). Weight and height were measured and body mass index (BMI) was calculated as $\text{weight}/\text{height}^2$ (kg/m^2). Socioeconomic status was determined by use of the Socio-Economic Index for Areas index values ascertained from the 2006 Australian Bureau of Statistics data. The Socio-Economic Index for Areas values were applied to obtain an aggregated Index of Relative Socio-Economic Advantage and Disadvantage, and participants were categorized into 5 groups according to quintiles of the Index of Relative Socio-Economic

Advantage and Disadvantage for the study region. Quintile 1 represented the most disadvantaged group and quintile 5 the most advantaged. Participants' perceived general health status was obtained through self-report and classified on a 5-point Likert-type scale (1=excellent, 2=very good, 3=good, 4=fair, and 5=poor) [15]. Exposure to medical conditions from a number of disease groups commonly associated with EDS were documented by self-report and grouped as zero, 1, 2, or 3 or more present during the past 12 months. Cardiovascular and neurologic disease included stroke, blackouts or fainting, dizzy spells, Parkinson disease (PD), and muscle weakness or muscle disease. The presence of diabetes mellitus (DM) was identified by combination of self-report and use of oral or insulin hypoglycemic agents. Cancer included that of the lung, bowel, breast, uterus, cervical, throat, melanoma, nonmelanoma skin cancer, leukemia, myeloma, and brain tumor. Respiratory illnesses included asthma, emphysema, chronic bronchitis, and other unspecified lung disease. Musculoskeletal diseases included self-reported osteogenesis imperfecta, osteoarthritis, or rheumatoid arthritis. Osteoporosis was independently identified using bone mineral density scans of the femoral neck and posterior-anterior spine (L2–L4) performed using Lunar DPX-L or Prodigy (Lunar, Madison, WI, USA) densitometers. The Australian reference ranges for men and women were used to identify bone mineral density cutoff points for osteoporosis at the femoral neck or spine, corresponding to a T score of -2.5 [16,17].

2.4. Statistical analysis

Values are given as median (interquartile range [IQR]), mean (\pm standard deviation), or n (%). Characteristic differences between participants with and without EDS were analyzed using *t*

tests for parametric continuous variables, Mann-Whitney U tests for nonparametric continuous variables, and χ^2 tests for categorical variables. The Fisher exact test was used for categorical variables when cell sizes were less than 5. Continuous ESS data were dichotomized at 0 to 9 and 10 to 24, to represent the absence or presence of EDS, respectively. Self-reported sleep duration was grouped into predetermined cutoff ranges (>6 , 6–7.5, 7.5–8, and <8 hours per night), and age was grouped into categories (20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and ≥ 80 years) to determine age-specific prevalence rates. Overall standardized prevalence was standardized to the Australian bureau of Statistics 2006 census data. All statistical analyses were completed using Minitab (Version 15; Minitab, State College, PA, USA).

3. Results

3.1. Characteristics

Characteristic data for men and women with and without EDS are shown in Table 1. Overall, 153 women (13.9%) and 128 men (13.5%) reported EDS. Women with EDS were more likely to have a higher BMI and be less active than those who reported no daytime sleepiness; they also were more likely to report poor self-rated health status. Men who reported EDS were older, had an increased BMI, reported a lower alcohol intake, and were more likely to be using antidepressant medication than those who were not sleepy. No differences were found for socioeconomic status, smoking status, or sedative medication use between those with and without EDS for men or women. Among women with EDS, a higher proportion reported having DM or a neurologic or cardiovascular disorder than those without EDS. Among men with EDS, a

higher proportion reported having respiratory illness, osteoporosis, or cancer; they also had an overall increased comorbidity than those without EDS.

3.2. Prevalence of EDS

The median level of sleepiness as measured by the ESS was comparable for both men (median ESS score, 4 [IQR, 4–7]) and women (median ESS score, 4 [IQR, 2–7]) ($P=.67$). Age-specific prevalence of EDS ($ESS \geq 10$) for men and women is shown in Fig. 1. Overall age-standardized prevalence of EDS was 10.4% (95% confidence interval, 9.7–11.2) for men and 13.6% (95% confidence interval, 12.8–14.4) for women. For men, the age-specific prevalence of EDS was 5.1% (ages 20–29 years), 6.4% (ages 30–39 years), 9.8% (ages 40–49 years), 15.5% (ages 50–59 years), 12.0% (ages 60–69 years), 12.0% (ages 70–79 years), and 29.0% (≥ 80 years) (Fig. 1). For women, the age-specific prevalence of EDS was 14.7% (ages 20–29 years), 8.7% (ages 30–39 years), 15.0% (ages 40–49 years), 16.0% (ages 50–59 years), 12.6% (ages 60–69 years), 13.2% (ages 70–79 years), and 17.0% (ages ≥ 80 years) (Fig. 1).

3.3. Self-reported sleep duration

The median self-reported sleep duration was 8 hours (IQR, 6–8 hours) for women and 7 hours (IQR, 6–8 hours) for men ($P=.06$). However, this figure varied among age groups, with younger women (ages 20–29 years) reporting more sleep per night than older women (ages ≥ 30 years). Fig. 2 shows the age- and gender-specific distribution of self-reported hours of sleep per night. For men, those in the older age groups (ages ≥ 60 years) reported more sleep than those in

the younger age groups. Fig. 3 shows the percentage of men and women in each group who reported sleeping less than 6 hours per night. Both genders in the age group of 50 to 59 years reported the highest percentage of less than 6 hours of sleep per night

4. Discussion

In our study we present new data that describe the prevalence of EDS and associated lifestyle and health factors in a randomly selected population-based sample of Australian men and women. We found that EDS was common in this population, affecting 10.4% of men and 13.6% of women.

These data are comparable to a number of studies conducted in Western countries using similar metrics and cutoff points [18,19]. We report that EDS was more common among women than men, which contrasts with a number of studies that have found male gender to be an independent predictor of EDS [19,20]. Although men have been found to be more likely to endorse sleepiness items in questionnaires [21], women have been shown to be more likely to complain of daytime sleepiness and score higher on measures of sleepiness in community-based studies [22]. Indeed several population-based studies have found no significant gender difference for EDS [5,23] or reported a higher overall ESS score [24] and increased prevalence rate in women compared to men [25,26]. This inconsistency may in part be attributed to differences in sampling methods used, differential participation rates among women in these types of studies, or differences in the way measurements of daytime sleepiness were obtained.

Both men and women in our study had a high prevalence of EDS during middle (ages 50–59 years) and old (ages ≥ 80 years) age. This finding may be attributed to a number of health

and lifestyle factors that have been shown to influence EDS within these cohorts [27], such as a reduction in child-rearing duties or changes to work schedules, which may contribute to greater opportunity for voluntary activities that are highly soporific; reduced activity levels from illnesses that affect general health (i.e., metabolic disease, cardiovascular disease); and declining sleep quality, particularly in those ages ≥ 80 years [28]. For women between the ages of 50 and 59 years in particular, these findings may in part be explained by hormonal changes that occur during menopause and the consequent influence on sleep patterns during pre- and postmenstrual periods [29,30].

Additional lifestyle correlates of EDS for women in our cohort include being overweight, being physically inactive, and having low perceived health status. For men older age, lower self-reported alcohol use, and higher rates of antidepressant use was associated with increased daytime sleepiness. Physical inactivity has been found to be strongly associated with obesity and high BMI [31] and physical activity, obesity, and perceived health status are interrelated [32,33]. Although the cross-sectional nature of our study does not allow for interpretation of these factors as a causative feature of EDS, it is possible that the culmination of physical inactivity and perception of general health contributed to higher rates of EDS through a combination of possible comorbid diseases and environmental factors associated with obesity that may impair exercise levels (e.g., DM, motivation levels) [34]. As expected, both men and women who reported EDS in our study had a higher BMI than those who reported no EDS. Obesity has been shown to be a significant predictor of sleepiness in both clinical and epidemiologic samples, independent of underlying obstructive sleep apnea (OSA) symptoms [35,36]. Although it is possible that a proportion of the men and women in our sample may have had underlying sleep-disordered pathology, several community-based samples have demonstrated that OSA symptoms

poorly correlate with sleepiness [37-39]. Therefore, it is possible that reported EDS may result from alternate maladaptive lifestyle factors.

Medication use has been cited as a significant contributory factor in the experience of EDS [40]. Despite this finding, no differences were found between men and women for those with and without EDS for sedative use, and overall reported usage in our sample was low. Therefore, it is unlikely that the EDS found in our study was associated with additional underlying sleep pathology often requiring these medications such as insomnia. Antidepressant use has been similarly associated with increased EDS in a number of studies [41]. Moreover, depression is considered both an independent associated factor [42] and a robust risk factor for EDS among nonclinical population-based samples [5]. Interestingly no association was found between antidepressant use and EDS for women, which is not in agreement with previous studies that have demonstrated increased sleepiness among medicated groups [41].

An inverse relationship was proposed to exist between hours of nocturnal sleep and the experience of EDS [23,43]. Men, but not women, who reported EDS in our sample reported fewer hours of nocturnal sleep than those who reported no EDS. However, because self-reported sleep has previously been noted as having only moderate reliability when compared to objective measures [44], it is possible some individuals may have overestimated or underestimated actual nocturnal sleep [44,45].

Alcohol use has been recognized as an additional contributory lifestyle factor in the experience of EDS [46] through the expression of disturbed sleep architecture [47-49]. We found that men with EDS reported lower alcohol use than those with no EDS. It may be possible that the men in our study underreported alcohol use. Nevertheless, this finding does not adequately explain the differences between groups, as self-report measures of alcohol use have been found

by others to be accurate in these types of studies [50]. Further analysis is warranted to assess this relationship at a population level.

We observed that women who reported EDS were more likely have DM, which is consistent with previous research that demonstrated a link between sleepiness and the presence of underlying metabolic syndrome [51]. Untreated EDS has previously been identified as a risk factor for DM among women, both in conjunction with and independent of underlying snoring [52]. Clinically, this finding highlights the need to routinely screen for instances of DM whenever symptoms of EDS are present in women, particularly when there is no history of underlying sleep-related breathing disorder. In our sample, women who reported EDS also were more likely to self-report instances of cardiovascular or neurologic disease. EDS has previously been found to be a common symptom of PD [53] and a risk factor the disorder, independent of possible explanatory lifestyle factors [54]. Because persistent EDS has previously been found to be associated with impaired functional outcomes in PD patients [55], adequate identification and treatment of these symptoms may assist in improving quality of life in these individuals. Respiratory illness has previously been reported as common among those with EDS [56]; however, this finding is not universal [57]. Both chronic respiratory illness and a variety of cancers are possible contributors to EDS through disturbed sleep, frequent awakenings, and increased instances of nocturnal hypoxemia [58,59]. We observed that men with EDS were more likely to report respiratory illness, osteoporosis, or cancer than those men who were not sleepy. It may be that the men who reported such illnesses were more likely to be within the older age group, and thus more likely to report such illnesses. Indeed men who reported any type of respiratory illness in our sample had a median age of 64.4 years (IQR, 54.4–78.49 years), which

is consistent with previous findings [60]. However, further research is warranted to explore possible links between age groups and disease representation at a population level.

To our knowledge, our study is the first epidemiologic study to demonstrate that men of all ages who report medical comorbidity are more likely to exhibit EDS. Previous studies have shown that disease comorbidity considerably influences daytime symptoms, particularly among older populations [42]. Therefore, the findings from our study may be beneficial in the understanding of the link between disease severity and functional sleep outcomes, particularly in men. However, further investigation is required to determine the possible influence of particular disease groups on functional daytime outcomes, thus enhancing the specificity of any future public health messages.

Interpretation of the findings presented in our study must consider several identifiable limitations. First, the cross-sectional nature of our study means that no inferences can be made regarding causality. Furthermore, these data pertain to individuals assessed at follow-up appointments as part of their participation in an ongoing study. It would seem unlikely that loss to follow-up would be differentially biased by EDS and this bias combined with the high retention of eligible participants in the study (83% of women and 81% of men) sustain the validity of the data. Second, the self-report nature of questionnaire items used in our study may mean that sleepiness and associated factors may be under -or overreported. Specifically, differing situational and emotional states may influence how questionnaire items are endorsed [61]. An individual in a negative state typically will report higher EDS and more illness than an individual in a more positive state [25,62-64]. Thus an inflation of the associations reported in our study cannot be excluded. Despite this limitation, self-report measures regarding lifestyle and health factors have been found to be reliable in similar studies [65,66]. Moreover, several studies have

demonstrated that self-report data on perceived sleepiness yields moderate correlation with comparable laboratory data regarding objective measures of sleepiness, such as the multiple sleep latency test or maintenance of wakefulness test [11]. Both of these tests are widely used within a clinical setting and are considered to have adequate test-retest validity [67], and thus present as an effective measure of objective sleepiness. Despite this benefit, both measures are relatively time consuming and labor intensive, and thus are inappropriate for large-scale research [68]. Similarly both methods lack specificity in general levels of sleepiness and instead are thought to represent sleepiness on the day of the test only [8,69]. Third, it is acknowledged that not all conditions that may affect EDS were assessed, including insomnia, OSA, or to a lesser extent narcolepsy. There are limited data regarding the prevalence of narcolepsy within Australian samples; however, international studies generally have cited low instances of between 0.03% and 0.05% in the general population [70,71]. Therefore, it is unlikely that this condition considerably influenced the present results. However, it is possible that individuals with OSA were included in our sample. Although the presence of OSA pathology was not explicitly assessed within our study, several biologic and lifestyle predictors of the disorder were indeed identified, such as age, BMI, and physical activity levels, all of which are associated with OSA symptoms [72].

Over one-tenth of the Australian population has EDS, which is most common in elderly men and women, affecting approximately one-third of individuals aged 80 years and older. EDS is associated with a number of adverse health and lifestyle outcomes. These findings suggest the need for both ongoing research assessing trends in EDS prevalence rates in the Australian population over time, assessment of possible links to disease comorbidity, and the potential utility of additional routine screening in ongoing health evaluations for these individuals.

Conflict of interest

Amie Hayley, Gerard Kennedy, Sharon Brennan and Julie Pasco have no conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript.

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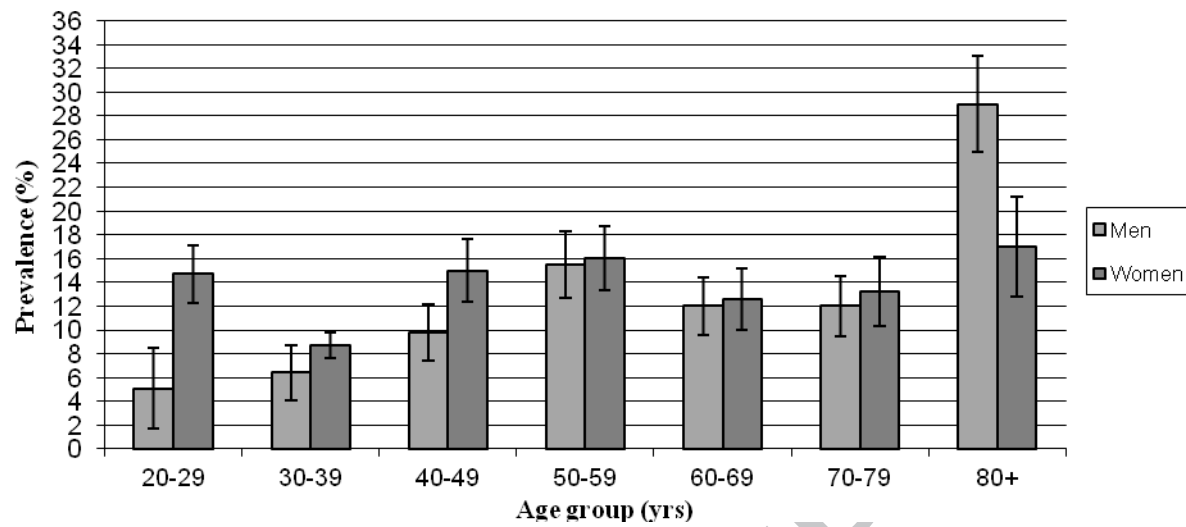


Fig. 1

Prevalence of excessive daytime sleepiness according to age group for men and women. Error bars represent standard error.

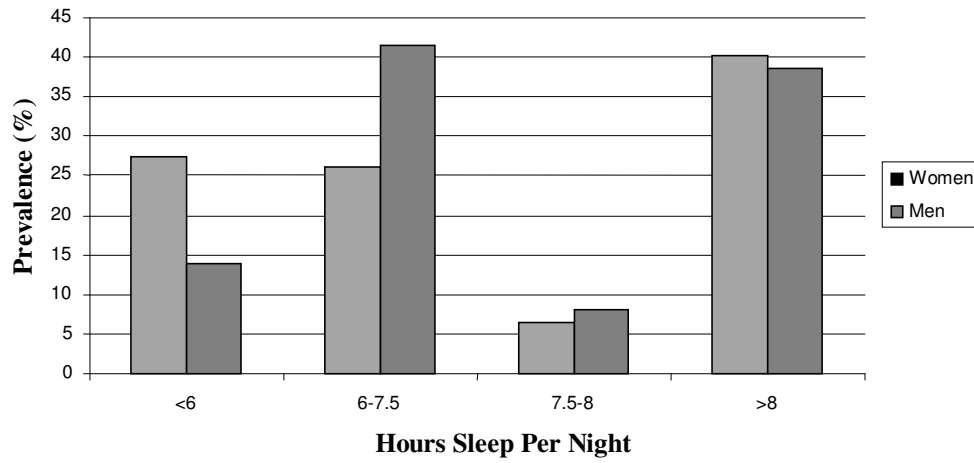


Fig. 2
Self-reported hours of sleep per night for both men and women (%).

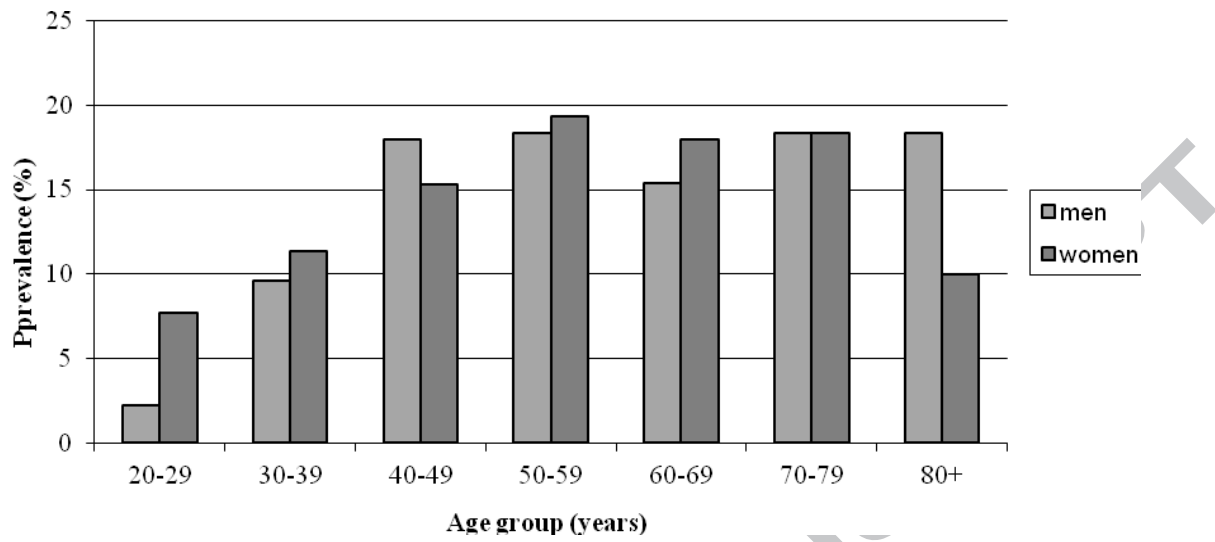


Fig. 3
Percentage of men and women participants who report less than 6 hours of sleep per night.

Table 1

Characteristics of men and women with and without excessive daytime sleepiness*.

	Women				Men			
	All	No	Yes*	<i>P</i> value	All	No	Yes*	<i>P</i> value
	n=1104	n=951	n=153		n=945	n=817	n=128	
Age (y)	50.7 (34.0–65.6)	50.4 (33.8–66.0)	51.2 (36.2–64.3)	.51	59.4 (45.7–72.8)	58.5 (44.5–71.6)	66.3 (53.0–80.5)	.001
BMI (kg/m ²)	26.3 (23.4–30.9)	26.1 (23.3–30.5)	27.9 (24.4–32.7)	.01	27.2 (24.7–29.6)	27.0 (24.7–29.6)	27.9 (25.3–30.4)	.06
Smoking (current)	156 (14.1%)	139 (89.1%)	17 (11.0%)	.25	104 (11.0%)	95 (91.4%)	9 (8.7%)	.12
Physically active	854 (77.5%)	745 (87.2%)	109 (12.8%)	.05	678 (71.7%)	589 (86.9%)	89 (13.1%) ¹	.56
Alcohol intake (g/d)	2.7 (0.3–11.7)	3.1 (0.3–11.9)	1.6 (0.3–10.1)	.11	12.0 (2.1–28.6)	12.8 (2.4–29.7)	8.0 (0.9–26.6)	.01
Hours of sleep/night	7.0 (6.0–8.0)	7.0 (6.0–8.0)	7.0 (6.0–8.0)	.54	7.0 (6.0–8.0)	7.0 (6.0–8.0)	7.0 (6.0–8.0)	.001
Health status (current)				.03				.36
Excellent	173 (15.7%)	153 (16.1%)	20 (13.1%)		124 (13.1%)	114 (14.0%)	10 (7.8%)	
Very good	468 (42.4%)	411 (43.3%)	57 (37.6%)		416 (44.0%)	358 (43.8%)	58 (45.3%)	
Good	333 (30.2%)	281 (29.6%)	52 (34.0%)		310 (32.8%)	265 (32.4%)	45 (35.2%)	
Fair	109 (9.9%)	92 (9.7%)	52 (11.1%)		81 (8.6%)	69 (8.5%)	12 (9.4%)	
Poor	20 (1.8%)	13 (1.4%)	7 (4.6%)		14 (1.5%)	11 (1.4%)	3 (1.5%)	

Socioeconomic status (current)				.24				.78
Quintile 1 (most disadvantaged)	175 (16.0%)	144 (15.3%)	31 (20.4%)		155 (16.4%)	132 (16.4%)	23 (18.0%)	
Quintile 2	230 (21.1%)	206 (21.9%)	24 (15.8%)		188 (19.9%)	166 (20.3%)	22 (17.2%)	
Quintile 3	249 (22.8%)	211 (22.5%)	38 (25.0%)		180 (19.0%)	156 (19.1%)	24. (18.8%)	
Quintile 4	216 (19.8%)	184 (19.6%)	32 (21.1%)		205 (21.7%)	173 (21.2%)	32 (25.0%)	
Quintile 5	222 (20.3%)	195 (20.7%)	27 (17.8%)		218 (23.0%)	191 (23.3%)	27 (21.1%)	
Medication use (current)								
Sedatives	30 (2.7%)	26 (2.7%)	4 (2.6%)	1.00	10 (1.1%)	10 (1.2%)	0 (-)	.40
Antidepressants	135 (12.2%)	111 (11.7 %)	24 (15.7%)	.16	65 (6.9%)	51 (6.2%)	14 (10.9%)	.05
Medical conditions								
Respiratory	315 (28.5%)	269 (28.3%)	46 (30.1%)	.65	77 (8.1%)	59 (7.2%)	18 (14.1%)	.008
Neurological/cardio ²	112 (10.4%)	86 (9.0%)	26 (17%)	.003	61 (6.5%)	51 (6.2%)	10 (7.8%)	.50
Musculoskeletal ³	12 (1.1%)	10 (1.7%)	2 (1.3%)	.68	85 (9.0%)	70 (8.6%)	15 (11.7%)	.25
Osteoporosis	95 (8.6%)	87 (9.1%)	8 (5.2%)	.11	43 (4.5%)	31 (3.8%)	12 (9.4%)	.005

Cancer	14 (1.3%)	13 (1.4%)	1 (0.7%)	.71	23 (2.4%)	13 (1.6%)	10 (7.8%)	.001
Diabetes mellitus	64 (5.8%)	48 (5.1%)	16 (10.5%)	.008	51 (5.4%)	45 (5.5%)	6 (4.7%)	.70
Medical comorbidities				.25				.002
None	610 (55.3%)	533 (56.1%)	77 (50.3%)		674 (71.3%)	598 (73.1%)	76 (59.3%)	
One condition	391 (35.4%)	334 (35.1%)	57 (37.3%)		219 (23.2%)	182 (22.3%)	37 (28.9%)	
Two conditions	89 (8.1%)	74 (7.8%)	15 (9.8%)		40 (4.2%)	29 (3.6%)	11 (8.6%)	
≥3 conditions	14 (1.3%)	10 (1.1%)	4 (2.6%)		13 (1.4%)	9 (1.1%)	4 (3.1%)	

Values are expressed as median (interquartile range), mean (\pm standard deviation), or n (%).

Abbreviations: y, years; BMI, body mass index; g/d, grams per day.

*Epworth Sleepiness Scale (ESS) score \geq 10.

¹n=1 missing value.

²Cardio=Self-reported cardiovascular disease.

³Musculoskeletal=Self-reported osteogenesis imperfecta, osteoarthritis, or rheumatoid arthritis.

Highlights:

- Excessive daytime sleepiness (EDS) is common, affecting approximately one-tenth of the Australian population
- EDS is more common among women who are of peri- and postmenopausal age
- Men who report EDS are more likely to have medical comorbidities
- Further research is warranted to assess prevalence trends over time