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Original Article

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

Amie C. Hayley [a,*], Lana J. Williams [a,b], Gerard A. Kennedy [c], Michael Berk [a,b,e,f], Sharon L. Brennan [d,g], Julie A. Pasco [a,d]

[a] School of Medicine, Deakin University, Geelong, Australia
[b] Department of Psychiatry, The University of Melbourne, Parkville, Australia
[c] Department of Psychology, College of Arts, Victoria University, Melbourne, Australia
[d] NorthWest Academic Centre, Department of Medicine, The University of Melbourne, St Albans, Australia
[e] Orygen Research Centre, Parkville, Australia
[f] Florey Institute for Neuroscience and Mental Health, Parkville, Australia
[g] Australian Institute for Musculoskeletal Science, NorthWest Academic Centre, Department of Medicine, The University of Melbourne, St Albans, Australia

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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 24–92 years (median age, 59.4 [interquartile range {IQR}, 45–73 years]) and 1104 women ages 20–94 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 $\geqslant$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 $\geqslant$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 $\geqslant$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 $\geqslant$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, more than 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, (i.e., narcolepsy, obstructive sleep apnea), circadian rhythm disorders (i.e., shift-work disorder), extrinsic sleep disorders, (i.e., 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 standard-

* Corresponding author. Address: School of Medicine, Deakin University, PO Box 281, Geelong 3220, Australia. Tel.: +61 3 5260 3564; fax: +61 3 5246 5165.
E-mail address: achayley@deakin.edu.au (A.C. Hayley).

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ized 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 20–94 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 $\geqslant 10$ 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 10–24 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 weight/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 five 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 (±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 five. Continuous ESS data were