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How well does Europe sleep? A cross-national study of sleep problems in European older adults

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Abstract
Objectives In this study, we aim to provide insight into the socio-demographic, family-related and socio-economic determinants of sleep problems in European older adults.
Methods Data from the Survey of Health Ageing and Retirement in Europe (2011/2012) were used to perform multilevel logistic regression analyses on whether one has been bothered by sleep problems for at least 6 months. The final sample consisted of 54,722 respondents aged 50 and older from 16 countries.
Results Prevalence rates varied from 16.6 % in Denmark and Italy to 31.2 % in Poland. The odds ratio of 2.014 confirmed a higher likelihood of sleep problems in women. People aged 60–69 (OR 0.898) reported less sleep problems than people between 50 and 59 years old. Finally, marriage compared to divorce and widowhood and having a higher socio-economic status were associated with less sleep problems.
Conclusions This study confirms sleep problems to be quite prevalent in the European older population. Increased awareness of the importance of sleep for health is needed, as well as further cross-national comparative research to explain the existing cross-country variation in sleep problems.

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Introduction

About one third of our lives is spent asleep, which makes it the activity that occupies most of our time (Biddle and Hamermesh 1990). The most important reason to spend such a significant part of our lives in bed is that getting enough sleep is vital for daily functioning, health and well-being (Ailshire and Burgard 2012; Arber et al. 2007). People are often unaware of the importance of sleep, and the impact sleep deprivation might have on everyday life. Many individuals seem to consider sleep disorders to be normal, rather than a pathology that may jeopardize their health and affect their lives (Soldatos et al. 2005). Nevertheless, poor sleep is repeatedly found to be related to a wide range of negative health outcomes (Asplund 1999; Colten and Altevogt 2006; Henry et al. 2013). Although this strong association between impaired sleep and ill health highlights the importance of identifying its potential determinants, research concerning sleep problems remains fairly limited.

When sleep problems are studied, researchers often focus on insomnia. Although this term is repeatedly used, suggesting a fixed definition, it tends to be defined in widely differing ways and rules regarding its assessment are lacking (Ohayon 2002; Taylor et al. 2005). These differences are also part of the reason why little is known about cross-country variation. Besides, few epidemiological surveys have been conducted using one single method to simultaneously evaluate impaired sleep in different countries (Soldatos et al. 2005). This makes the cross-cultural dimension one of the most understudied aspects of sleep problems (Knutson 2013).

Nevertheless, the country of study seems to be rather important, especially when the association with age is concerned. While being in an older age group tends to be associated with worsening sleep in most of the 23 European countries studied by Dregan and Armstrong (2011), there are also several countries in which a significant deterioration with age is not present. When four Western European countries were compared with Japan and the US, only the Japanese elderly turned out to report more sleep problems than their younger counterparts (Leger et al. 2008). Besides, a study in the US shows a higher odds of frequent sleep insufficiency in younger age groups than in an older age group (Strine and Chapman 2005). Similar results are found in the UK, where sleep problems are found to be negatively related to age (Dregan and Armstrong 2009). These findings suggest, as Dregan and Armstrong (2011) also concluded from their European study, that the ageing experience might vary considerably across countries. Since the ageing population is one of the most pressing societal challenges of this century (Börsch-Supan et al. 2013), we will continue the work of Dregan and Armstrong using data from the Survey of Health Ageing and Retirement in Europe (SHARE), so we can specifically focus on sleep problems in an ageing population. This focus and the use of random effect models will be our main additions to their work.

Previous research shows that, besides age, several other socio-demographic and socio-economic factors are important for poor sleep. Generally, women more often report sleep problems (Arber et al. 2009), sleep complaints (Fok et al. 2010; Roberts et al. 2000), and insomnia symptoms than men (Léger et al. 2000). Since gender is theorized to be relational, and sleep is a dyadic experience for most adults, research should not ignore that many individuals live within such dyads through marriage (Meadows and Arber 2012; Troxel et al. 2007). When marital status and partner status are concerned, living alone, as well as being divorced, separated or widowed compared to being married are associated with a higher risk of sleep complaints (Grandner et al. 2010) and insomnia-related symptoms (Lallukka et al. 2012). Mixed results are found for the relation between having children and the experience of sleep problems. In Britain, the number of children in the household is negatively associated with the sleep duration of men (Groeger et al. 2004), whereas in Finland not having children is shown to be related to frequent insomnia-related symptoms (Lallukka et al. 2012). Williams (2007) states that people need to feel safe and at ease in order to be able to sleep. Since a lower socio-economic status is often associated with greater levels of worries, anxieties and psychological distress (Arber et al. 2009), socio-economic status may also be negatively related with our ability to feel at ease, and in turn our ability to sleep. Sleep problems are indeed reported more by individuals with economic difficulties, a lower educational level and a lower socio-economic status compared to those in more advantaged circumstances (Arber et al. 2009; Grandner et al. 2010; Morin and Jarrin 2013).

In this study, we aim to further explore the cross-country variation in impaired sleep using one measure to evaluate the prevalence of sleep problems in a representative sample of the European older population. We focus specifically on this older age group to shed light on the association between age and sleep problems. Finally, we investigate gender differences and the influence of the aforementioned family-related and socio-economic factors on the experience of sleep problems, as well as how these associations may vary between countries.

Methods

Data

The Survey of Health Ageing and Retirement in Europe (SHARE) is a cross-national panel study focussing on a representative sample of the non-institutionalized population aged 50 and over and their partner. Surveys were conducted in the respondent's home via computer-assisted personal interviewing (CAPI). The study design and methodology of SHARE have previously been described in more detail by members of the SHARE coordination team (Börsch-Supan et al. 2013; Börsch-Supan and Jürges 2005; Malter and Börsch-Supan 2013). In this study, data from wave 4 (release 1.1.1) were used. Data were collected in 2010/2011 and include information from 16 countries. For those respondents who are part of the longitudinal sample, demographic information was taken from wave 1 or 2 (release 2.6.0).

The final sample was restricted to the respondents aged 50 and over. Since none of the included variables contained more than 2 % missing values, respondents with missing values on any of these variables were omitted from the sample. As a result, the final sample consisted of 54,722 respondents, 24,063 men and 30,659 women.

Measurement

Sleep problems were measured using a single-item measure. Respondents were asked to look at a card with health conditions, sleeping problems being the sixth of twelve conditions listed. They were then requested to name the health conditions they had been bothered by, for at least the past 6 months. The respondents who reported to be bothered by sleep problems were coded '1' and those who did not report any sleep problems were coded '0'.

Gender and age were included as socio-demographic variables. For gender, men formed the reference category. Age was included as a categorical variable, using the following categories: 50–59, 60–69, 70–79 years old and respondents over the age of 80. The youngest age group served as the reference category.

Two family-related variables were taken into account. Marital status was divided into five categories: (1) married or in a registered partnership, (2) separated or divorced, (3) widowed, (4) separated, divorced or widowed with a new partner, and (5) never married. The first category forms the reference category. The number of children was a metric variable that ranged from 0 to 17.

We also included three measures for socio-economic status. For the measurement of educational attainment, the highest educational degree obtained was used. The chosen categories were derived from the International Standard Classification of Education from 1997 (UNESCO 2006), and range from 'no education', 'primary education or first stage of basic education' (ISCED1), 'lower secondary or second stage of basic education' (ISCED2), 'upper secondary education' (ISCED3), 'post-secondary non-tertiary education' (ISCED4) to 'tertiary education' (ISCED5–6). The category capturing ISCED1 was chosen to be the reference category.

The current job situation was divided into five categories: (1) retired, (2) employed or self-employed, (3) unemployed, (4) permanently sick or disabled and (5) homemaker. Since 57.9 % of all respondents are retired, this job situation was chosen as the reference category.

The final SES-indicator we included is the household net worth. This generated variable is offered by SHARE, and it incorporates the sum of the real assets, net of any debts, and the net financial assets of the household. The multiple imputation procedure used to create this variable is described by Christellis (2011). The scores were divided by 100,000 to enlarge unstandardized parameter estimates.

Table 1 Descriptive statistics of the 54,722 European study participants from the Survey of Health Ageing and Retirement in Europe (SHARE, 2010/2011)

	Mean	SD
Number of children	2.140	1.340
Household net worth (divided by 100,000)	2.442	5.924
	%	*N*
Sleep problems		
Not reported	75.8	41,466
Reported	24.2	13,256
Gender		
Men	44.0	24,063
Women	56.0	30,659
Age in categories		
50–59 years old	26.8	14,645
60–69 years old	34.8	19,062
70–79 years old	25.0	13,668
80 years and older	13.4	7347
Marital status		
Married/registered partnership	70.2	38,391
Separated/divorced	7.8	4269
Widowed	13.6	7448
Separated/divorced/widowed—with new partner	2.9	1573
Never married	5.6	3041
Highest level of education		
No education	2.8	1542
ISCED1: primary education or first stage of basic education	18.8	10,305
ISCED2: lower secondary or second stage of basic education	19.3	10,573
ISCED3–4: upper secondary or post-secondary non-tertiary education	38.7	21,155
ISCED5–6: tertiary education	20.4	11,147
Current job situation		
Retired	57.9	31,711
Employed/self-employed	27.0	14,771
Unemployed	3.3	1816
Permanently sick or disabled	3.7	2008
Homemaker	8.1	4416

Statistical analyses

In Table 1 results of the descriptive analyses are shown. Additionally, cross tabulations with χ^2 tests were used to get a general idea of country and gender differences in sleep problems, results can be found in Table 2. Finally, Table 3 shows the associations between socio-demographic and socio-economic characteristics and sleep problems that were tested using multilevel logistic regression analysis, with individuals (level 1) nested within countries (level 2). In addition to an analysis of the total sample, we also report gender-differentiated models, because research continuously shows the prevalence of sleep problems, sleep disorders and insomnia-related symptoms to be strongly gender dependent (Arber et al. 2009; Fok et al. 2010; Hale et al. 2007; Léger et al. 2000; Roberts et al. 2000). As a result, we can get a more detailed picture of how socio-demographic and socio-economic characteristics are related to sleep problems in men and women. Additionally, random effects models were estimated for all variables in all three samples, but only significant random effects are reported in Table 3. Because of the multiple imputation procedure, all models were estimated five times, in MLwiN version 2.29, and the parameters were

averaged across estimations. Standard errors were calculated using the "Rubin rules" (Royston 2004; Rubin 1987).

Results

A description of the sample can be found in Table 1. Fifty-six percent of the sample was female. The mean age was 67.1 years, and consistent with a focus on adults over the age of 50, 57.9 % was retired. On average 24.2 % of the total European population reported to have been bothered by sleep problems in the past 6 months.

In Table 2 the prevalence rates by country and gender are reported. Prevalence rates significantly varied between countries ($\chi^2 = 716.955$, $df = 15$, $p < 0.000$), ranging from as low as 16.6 % in Denmark and Italy to as high as 31.2 % in Poland. The table also clearly shows that in every country prevalence rates are higher in women than in men. Poland (38.7 %) and Denmark (20.7 %) were the countries with the highest and lowest prevalence rate in women. For men, the prevalence rate was highest in Estonia and lowest in the Netherlands, 21.6 and 10.5 %, respectively. The biggest gender gap was found in Germany (OR 2.620), whereas the difference in risk of sleep problems between men and women was smallest in Austria (OR 1.510).

Although the χ^2 test showed significant cross-country variation, a calculation of the variance decomposition of the null-model (not shown) for the total sample, as well as the male and female sample, showed relatively little variance in sleep problems on the country level. Only 2.5 % of the sleep problems in the total population were influenced by the country in which they were studied [variance partition coefficient = σ^2country/(σ^2country + 3.29)]. For the male and female population, the variance partition coefficient (VPC) was respectively 2.1 and 2.7 %.

As can be read from Table 3, the gender-effect in the total sample remained very strong when the effect was controlled for age and the family-related and socio-economic characteristics in our multilevel logistic regression analysis ($OR_{gender} = 2.014$). Because of these gender differences, the model was estimated separately for men and women to see whether the effects of age and the family-related and socio-economic characteristics were different for men and women. Most effects were similar to those in the total model, however, there were several notable differences, which will be described in the following sections.

For the effect of age, the only significant difference was found for the 60–69 years old compared to their younger counterparts, with the older group reporting less sleep problems ($OR_{60–69} = 0.898$). Furthermore, in the total model, a significant random age-effect revealed the age-effect to differ between countries ($OR_{60–69\ random} = 1.018$; $OR_{70–79\ random} = 1.046$; $OR_{80+\ random} = 1.103$). Similar effects were found for women ($OR_{60–69} = 0.900$; $OR_{60–69\ random} = 1.012$; $OR_{70–79\ random} = 1.036$; $OR_{80+\ random} = 1.083$), but not for men.

Table 2 The prevalence rates of sleep problems in European older adults for the male, female, and total sample, followed by odds ratio's (95 % confidence intervals) for gender differences in the total sample from the Survey of Health Ageing and Retirement in Europe (SHARE, 2010/2011)

	Men ($N = 24{,}063$) (%)	Women ($N = 30{,}659$) (%)	Total ($N = 54{,}722$) (%)	OR_{gender} (95 % CI) ($N = 54{,}722$) (%)
Austria	16.8	23.4	20.5	1.510 (1.308–1.743)
Belgium	19.0	33.6	27.0	2.151 (1.883–2.457)
Czech Republic	17.8	30.4	25.0	2.018 (1.777–2.291)
Denmark	11.8	20.7	16.6	1.964 (1.544–2.499)
Estonia	21.6	36.6	30.5	2.103 (1.881–2.353)
France	19.3	34.8	28.0	2.234 (1.968–2.536)
Germany	17.1	35.1	26.7	2.620 (2.044–3.360)
Hungary	20.5	34.1	28.1	2.002 (1.690–2.370)
Italy	11.6	20.9	16.6	2.017 (1.665–2.442)
The Netherlands	10.5	21.8	16.8	2.368 (1.883–2.978)
Poland	21.4	38.7	31.2	2.324 (1.837–2.940)
Portugal	20.8	36.8	29.8	2.217 (1802–2.727)
Slovenia	16.2	27.7	22.7	1.979 (1.632–2.400)
Spain	15.5	31.7	24.3	2.538 (2.134–3019)
Sweden	12.9	24.1	19.0	2.134 (1.665–2.442)
Switzerland	12.0	22.1	17.4	2.076 (1.725–2.499)

Table 3 Sleep problems regressed on socio-demographic, family-related and socio-economic individual level variables in the European population over the age of 50 ($N_{country} = 16$) from the Survey of Health Ageing and Retirement in Europe (SHARE, 2010/2011)

	Total ($N = 54{,}722$) OR (95 % CI)	Men ($N_{men} = 24{,}063$) OR (95 % CI)	Women ($N_{women} = 30{,}659$) OR (95 % CI)
Fixed effects			
Intercept	0.240 (0.240–0.240)***	0.211 (0.211–0.211)***	0.506 (0.506–0.507)***
Gender (Ref. = male)	2.014 (2.013–2.014)***	–	–
Age in categories (Ref. = 50–59 years old)			
60–69 years old	0.898 (0.897–0.898)*	0.899 (0.898–0.899)	0.900 (0.900–0.901)*
70–79 years old	1.013 (1.013–1.014)	1.070 (1.069–1.071)	1.022 (1.021–1.023)
80 years and older	1.053 (1.053–1.054)	1.148 (1.147–1.149)	1.031 (1.030–1.033)
Family-related characteristics			
Marital status (Ref. = married/in registered partnership)			
Separated or divorced	1.276 (1.276–1.277)***	1.246 (1.245–1.247)**	1.287 (1.286–1.287)***
Widowed	1.103 (1.103–1.103)***	1.208 (1.207–1.209)**	1.084 (1.084–1.085)*
Separated/divorced/widowed–with new partner	1.049 (1.049–1.050)	1.120 (1.118–1.121)	0.994 (0.993–0.995)
Never married	0.943 (0.942–0.943)	1.031 (1.030– 1.033)	0.886 (0.885–0.887)
Number of children	1.019 (1.019–1.019)	1.027 (1.027–1.028)*	1.009 (1.009–1.009)
Socio-economic characteristics			
Highest level of education (Ref. = ISCED1: primary education or first stage of basic education)			
No education	1.134 (1.134–1.135)*	1.150 (1.149–1.152)	1.112 (1.111–1.113)
ISCED2: lower secondary or second stage of basic education	0.963 (0.962–0.963)	0.997 (0.996–0.998)	0.959 (0.958–0.959)
ISCED3–4: upper secondary education or post-secondary non-tertiary education	0.793 (0.793–0.793)***	0.834 (0.834–0.835)***	0.770 (0.770–0.771)***
ISCED5–6: tertiary education	0.720 (0.719–0.720)***	0.782 (0.781–0.783)***	0.691 (0.691–0.692)***
Current job situation (Ref. = retired)			
Employed or self-employed	0.683 (0.683–0.683)***	0.672 (0.672–0.673)***	0.694 (0.693–0.694)***
Unemployed	1.028 (1.028–1.029)	1.021 (1.020–1.023)	1.023 (1.022–1.024)
Permanently sick or disabled	2.075 (2.074–2.076)***	2.411 (2.408–2.413)***	1.853 (1.852–1.855)***
Homemaker	0.901 (0.901–0.902)**	0.919 (0.916–0.923)	0.870 (0.870–0.871)***
Household net worth	0.994 (0.994–0.994)*	0.993 (0.993–0.993)	0.993 (0.993–0.993)**
Random effects			
Intercept	1.060 (1.060–1.060)	1.063 (1.063–1.063)	1.061 (1.060–1.061)
Age in categories (Ref. = 50–59 years old)			
60–69 years old	1.018 (1.018–1.018)	n.s.	1.012 (1.012–1.012)
70–79 years old	1.046 (1.046–1.046)	n.s.	1.036 (1.035–1.036)
80 years and older	1.103 (1.103–1.103)	n.s.	1.083 (1.083–1.084)
Number of children	1.002 (1.002–1.002)	n.s.	1.004 (1.004–1.004)

n.s. overall variable is not significant

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

The two family-related characteristics that were included in the model were both found to be associated with sleep problems. For marital status, both people who were separated or divorced ($OR_{total} = 1.276$; $OR_{men} = 1.246$; $OR_{women} = 1.287$), and those who were widowed ($OR_{total} = 1.103$; $OR_{men} = 1.208$; $OR_{women} = 1.084$) were more likely to report sleep problems than married people. Those people who had a new partner, after separation, divorce or widowhood, did not differ from the married individuals, neither did the people who remained unmarried throughout their lives. In men, the number of children was positively related to sleep problems, with every extra child the odds of reporting sleep problems compared to not reporting sleep problems increased with 2.7 %. Both in the total and the

female sample, we found a random effect for the number of children ($OR_{total} = 1.002$; $OR_{female} = 1.004$), so there were between-country differences in the association between the number of children and sleep problems in the total population, as well as the female population.

In addition to the family-related characteristics, the following three measures for socio-economic status were taken into account: educational level, current job situation and household net worth. A higher level of education ($OR_{no\ education} = 1.134$; $OR_{ISCED3–4} = 0.793$; $OR_{ISCED5–6} = 0.720$) and a higher household net worth ($OR_{total} = 0.994$) were both associated with less sleep problems. Except for unemployment, all categories of current job situation had significantly different influences on sleep problems than retirement. Those who were permanently sick or disabled ($OR_{total} = 2.075$; $OR_{men} = 2.411$; $OR_{women} = 1.853$) were the only category that reported more sleep problems than those who were retired. Employed or self-employed individuals ($OR_{total} = 0.683$; $OR_{men} = 0.672$; $OR_{women} = 0.694$), as well as homemakers ($OR_{total} = 0.901$), reported less sleep problems than retired individuals. The likelihood of having trouble sleeping did not differ for male homemakers compared to male retired individuals, but for female homemakers the likelihood of sleep problems was lower than that of their retired counterparts ($OR_{women} = 0.870$). Finally, household net worth was of importance for women ($OR_{women} = 0.993$), but not for men.

Discussion

In our study, we aimed to give more insight in the prevalence of sleep problems in the older population of 16 European countries, and the associations with socio-demographic, family-related and socio-economic characteristics, using the fourth wave of the Survey of Health Ageing and Retirement in Europe. As we used cross-sectional data, the causal direction of the associations is unclear, so we are unable to distinguish the cause from the effect in our conclusions.

The primary weakness of our study is the indicator that was used to measure sleep problems was a crude single-item measure, which implies that we could not evaluate the severity or exact type of sleep disturbance. Nevertheless, a single-item measure has been used repeatedly because it gives a general idea of the overall prevalence of sleep problems (Burgard and Ailshire 2009; Dregan and Armstrong 2009, 2011; Grandner et al. 2010; Kutner et al. 2001), which is also what we were interested in for this exploratory study of sleep problems in the older European population. Besides, people who are asked to rate their sleep quality with one item do this deliberately, the different components of sleep they consider to be important are taken into account to decide on their general sleep experience (Cappelleri et al. 2009).

Because the measure was the same for all countries, we have been able to add to the limited knowledge about cross-country variation in sleep problems. Our study demonstrates significant between-country differences, with particularly high prevalence rates in Poland and Estonia and much lower rates in Denmark and Italy. Although these prevalence rates seem to vary quite a lot, we need to acknowledge that the country level accounts for a small proportion of the total variance in sleep problems. Moreover, cultural differences in attitudes to sleep may have an impact on how respondents in different countries interpret sleep problems and subsequently rate their sleep (Leger and Poursain 2005), which is likely to explain at least part of the between-country variation in sleep problems we found.

In line with the literature, women are more likely to report sleep problems than men (Arber et al. 2009; Lallukka et al. 2012). The effect of gender does not vary between countries, but we do find some interesting gender differences in the associations. While a higher number of children is only related to a higher level of reported sleep problems in men, a higher household income only signifies a decrease in the likelihood of reporting sleep problems in women. Additionally, we find the association between the number of children and sleep problems to vary between countries in women, but not in men.

As regards marital status, separated or divorced and widowed people experience more sleep problems than married people, while those with a new partner and those who were never married do not differ from those who were married. The finding that married individuals do not differ from individuals with a new partner in their experience of sleep problems is largely consistent with the findings of Troxel et al. (2010), although in their study only women were studied. However, overall they suggest stability in the marital history to be most favourable for sleep, which would both explain why those who were never married do not differ from those who are married, and why separation, divorce and widowhood is related with more sleep problems. Corresponding with previous research from Arber et al. (2009), we also found that a higher socio-economic status was associated with less sleep problems.

Finally, a significant aim of our study was to explore the association between age and sleep problems. In future research the longitudinal SHARE data could be used to further disentangle how age is associated with the emergence and persistence of sleep problems in European older adults. Nevertheless, from our study, we can already conclude that the effect of age differs between countries amongst women, but not amongst men. For women these

findings are in line with the suggested cross-country variation in the ageing experience from Dregan and Armstrong (2011). Hislop and Arber (2003) report sleep problems in ageing women to be strongly related to increased caring responsibilities when the health of their partner declines. Country differences in the availability and use of (in)formal care for health problems may, therefore, be an important factor in this association, which underlines the importance of cross-national comparative research with a specific focus on gender differences. The currently dominant social-epidemiological perspective could be enriched with sociological perspectives to explain both individual and country-level differences in the ageing experience across Europe, and how this is associated with sleep problems. The experience of retirement is another example of an important aspect of the ageing experience. Obviously, retirement involves a radical change in the daily schedule of people who have worked their entire lives (Jonsson et al. 2000), which is likely to have an impact on how they get through the night as well. The retirement policy of a specific country may then be an important country-level characteristic to take into account in order to further study cross-country variation in the association between age, the ageing experience and sleep problems.

To conclude, our study shows that sleep problems are a common health condition in the European older population. Several risk groups, such as women, divorced or separated and widowed individuals, and people in adverse socio-economic conditions, could be identified, but together they capture such a significant proportion of the population that, in fact, the entire population should be targeted when public health interventions are developed. More public awareness of both the widespread nature and the health consequences of sleep problems is needed, so people no longer take them for granted, as they seem to do now (Soldatos et al. 2005).

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