Prevalence and correlates of sleep problems at age 50

Initial results from the National Child Development Study

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Centre for Longitudinal Studies
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Abstract

Recent years have witnessed an increased interest in the contribution of social factors to sleep problems, given the importance of sleep for health and wellbeing. However, only a few large-scale social surveys gather information on sleep patterns. The National Child Development Study (NCDS) has collected data on the prevalence of sleep problems among its cohort members at age 50. The aim of this working paper is to introduce the sleep questions that were asked in NCDS and to provide a preliminary cross-sectional analysis of the correlates of sleep problems at age 50. Logistic regression models are specified in order to examine the characteristics of 'poor sleepers' and the relative contribution of a broad set of risk factors on sleep quality. Results demonstrate associations of poor sleep with gender, socio-economic circumstances, health status, health-related behaviour, and depression. Suggestions for future longitudinal analyses are made.

Non-technical summary

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We spend approximately one third of our lives asleep, and getting a good night's sleep is essential for our health and wellbeing. Previous biomedical research has provided consistent evidence that those who habitually sleep short hours are more likely to suffer from diabetes, hypertension, and obesity, and are also more prone to workplace and vehicle-related accidents. Quality of sleep is also important, with sleep disturbances linked to poor quality of life and daily functioning. It has been estimated that untreated sleep problems cost the NHS millions of pounds a year, and also result in significant productivity losses.

Recent years have witnessed an increased interest in the study of sleep within the social sciences. For example, it is now established that working time circumstances such as shift work and lengthy schedules, as well as increased family responsibilities, have an adverse impact on sleep duration and sleep quality. Women and individuals with low socio-economic status have also been found to have poor sleep outcomes.

However, previous sociological research on sleep has mostly relied on small, non-representative samples, while the majority of large-scale social surveys that provide data on sleep are cross-sectional, i.e. interviewing respondents only at one point in time. It has been recognized that longitudinal research on sleep can constitute a valuable tool to help us understand the onset and continuity of sleep problems over the lifecourse, and better discern the mechanisms that lead to poor sleep outcomes.

The National Child Development Study (NCDS) is a cohort-study that has been regularly gathering information on the circumstances of approximately 17,000 people that were born during a single week of 1958 in the UK. A number of sleep questions have been included in the survey over the years, which will be particularly useful for future research on sleep.

The current study has analysed sleep measures from the latest NCDS sweep (in 2008, at age 50) to gain insight into the prevalence and socio-economic correlates of sleep problems at age 50. The research focused on sleep quality and analysed three different measures that were included in the survey, relating to difficulties in sleep initiation and sleep maintenance, and to respondents' subjective assessment of their usual sleep (i.e. whether they felt it was adequate).

In accordance with previous research that made use of different sleep measures, the study found significant differences between men and women, with 25 per cent of women reporting they didn't get enough sleep compared to 20 per cent of men. 16 per cent of women had trouble maintaining sleep in contrast to 10 per cent of men who woke up during the night and had trouble falling back to sleep. 26 per cent of

women compared to 17 per cent of men also said they had trouble falling asleep at the beginning of the night.

An examination of the socio-economic correlates of 'poor sleep' showed that housing tenure and financial circumstances are also linked to sleep quality. The results showed that 34 per cent of men and 46 per cent of women with financial difficulties had trouble falling asleep, compared to only 13 per cent and 20 per cent of men and women living comfortably. Statistical models revealed that these socio-economic disparities were partly mediated by health factors.

Another important finding is the strong link between self-rated poor health and depression/psychological distress with 'poor sleep'. Those who reported high levels of psychological distress and rated their general health as poor/very poor were significantly more likely to report sleep disturbances and rate their sleep as inadequate in the NCDS interview. Drinking and smoking were not found to have a consistent influence in all three measures, while exercising frequently is consistently associated with better sleep.

The NCDS is a particularly important resource, providing a rich array of information on occupational, work, and family histories that can be used to better understand the configuration of socio-economic disparities in sleep quality at later ages.

Acknowledgements

Introduction

Sleep is a physiological activity that has spawned a vast research literature on health issues. Over 1000 biomedical studies have examined the consequences of sleep deprivation, and the resulting knowledge database has been remarkably consistent: Short sleep durations are associated with age-related chronic disorders, diabetes, hypertension, cardiovascular disorders, and self-rated poor health (Spiegel et al., 1999; Ayas et al., 2003; Steptoe et al., 2006). At the same time, habitually long sleep durations (i.e. over 9 hours) have also been shown to correlate with adverse health outcomes, and several epidemiological studies have reported a U-shaped relationship between sleep duration and morbidity/mortality (Heslop et al., 2002). Similarly, sleep quality has been linked to wellbeing and daily functioning, while it has also been identified as a potential mediator of the well-established relationship between socioeconomic status (SES) and health (Moore et al., 2002; Sekine et al., 2006). The overall cost of sleep problems is far from negligible: sleep disorders significantly reduce productivity and increase the risk of sleep-related vehicle accidents, which are more likely to result in death (Horne and Reyner, 1999). It has been estimated that obstructive sleep apnoea, a single sleep disorder, costs the NHS approximately £432 million a year.[1]

Despite the importance of sleep for health and wellbeing, social scientists have until recently displayed considerably little interest in the activity. This is partly because sleep constitutes a biological necessity for human survival, which has led researchers to assume that it will be largely impervious to social influences. However, despite its biological underpinnings, sleep is embedded in the social context of everyday life (Arber et al., 2007b), which suggests the likelihood of numerous environmental and social influences on its quality and duration.

In recent years, a considerable amount of qualitative research on sleep has emerged (for example see Bianchera and Arber, 2007; Venn et al., 2008; Maume et al., 2010). Sociologists have particularly focused on the influence of gender on sleep, showing the gender specialization in caring tasks may well extend into the night, which implies that women are more likely to feel responsible and 'on duty' and to interrupt their sleep in order to care for the needs of children and/or other relatives. It has been suggested that this 'night shift' leads to fragmented, poor quality sleep and curtails women's sleep duration (Maume et al., 2010), and that this is likely to be more pronounced in countries characterised by traditional gender roles and minimal care provision (Bianchera and Arber, 2007).

Statistical analyses of sleep duration and sleep quality have been relatively uncommon, as a result of the absence of sleep questions in large-scale social surveys. Representative data on habitual sleep duration have been mostly available through time-use surveys, which gather data on daily time allocation through 24-hour time diaries. Given the manifest difficulty of specifying the exact time one actually fell

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[1] The reader is referred to http://www.rospa.com/roadsafety/info/sleep.pdf for further information on this estimate.

asleep, time diary estimates are likely to overestimate sleep time, including 'time in bed' before and after actual sleep (Chatzitheochari and Arber, 2009).

Previous analyses of time diary data have demonstrated that aggregate sleep duration has remained remarkably constant over time in Western countries, refuting previous suggestions regarding a 'sleep deprivation epidemic' affecting post-industrial 24-hour societies (for a discussion of the 'sleep deprivation thesis' see Williams, 2005). However, economists' analyses of US time diaries showed that time spent sleeping is inversely related to wages and time spent in the workplace (Biddle and Hamermesh 1989). This finding has been supported by subsequent diary studies, which additionally demonstrated that a long hours culture, shift work, and lengthy commutes are negatively associated with sleep duration (Basner et al., 2007; Chatzitheochari and Arber, 2009). In contrast with qualitative studies on sleep, time-use studies find that women spend more time sleeping than men (Gershuny, 2003), and do not corroborate a negative influence of family roles and childcare responsibilities on women's sleep duration (Chatzitheochari and Arber, 2009)

Only a few questionnaire-based nationally-representative social surveys have included questions on sleep. The majority of such questions focus on sleep quality, and were previously designed for established sleep quality scales that are used in clinical studies, such as the Jenkins Scale and the Pittsburgh Sleep Quality Index[2]. Analyses of such surveys have corroborated the gender differences reported by qualitative studies, and made further steps to explain gender inequalities in sleep complaints. For example, an analysis of sleep disturbance that capitalised on data from the UK Psychiatric Morbidity Survey has revealed that low SES (measured by household income, educational qualifications, housing tenure, and employment status) is strongly associated with poorer sleep quality, and that it partly accounts for the gender differences in self-reported sleep disturbance (Arber et al., 2009).

A recent analysis of the Japanese Civil Servants Study has also found that gender differences in sleep quality are attenuated after controlling for work and family characteristics (Sekine et al., 2006). Apart from SES and gender differences, previous studies have also found associations with smoking and drinking, work-life conflict, and general worries (Patten et al., 2000; Arber et al., 2007a; Lallukka et al., 2010).

Another consistent finding in clinical and social sleep research is the strong associations of depression and health status with poor sleep quality (Tsuno et al., 2005; Dregan and Armstrong, 2011). However, in the absence of longitudinal analyses, the direction of causality is difficult to disentangle. Whether poor sleep is a secondary symptom of another condition like depression or a primary condition in its own right remains to be determined (Dregan and Armstrong, 2010). Similarly, the hypothesis that poor sleep may be mediating the relationship between SES and health (Moore et al., 2002; Sekine et al., 2006) cannot be tested with cross-sectional research designs.

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[2] Jenkins Sleep Scale: Self-rated questionnaire, 4 items, 6-point Likert Scales. Reference period is last month (Jenkins et al., 1988). Pittsburgh Sleep Quality Index (PSQI): Self-reported, 19 items, combination of free entry and 4-point Likert Scales. Reference period is last month (Buysse et al., 1989).

It has been previously suggested that longitudinal analyses of sleep problems can shed light on such questions, and contribute to scientific knowledge regarding the development, causes, and consequences of sleep problems. Having gathered data on sleep patterns in its last sweep, NCDS provides an opportunity for researchers to analyse the influence of family, occupational and health histories on the likelihood of suffering from sleep problems at age 50. This paper provides a preliminary cross-sectional analysis of the prevalence and socio-demographic correlates of sleep problems at age 50, and identifies future avenues for research on the topic.

Sleep measures in the National Child Development Study

The National Child Development Study (NCDS) began as a cross-sectional Perinatal Mortality Survey of over 17,000 infants born in a single week in 1958, and is also known as the 1958 British birth cohort. Cohort members were subsequently followed up at ages 7, 11, 16, 23, 33, 42, 46, and most recently at age 50. Additionally, during 2002-2004, 9,340 NCDS cohort members participated in a biomedical survey, carried out by qualified nurses. NCDS provides a wide range of information on cohort members' life course trajectories and circumstances, such as physical and mental health, education, employment, and housing.

The most recent sweep of NCDS (at age 50) was carried out in 2008-2009, when 9,790 cohort members completed a core interview. In addition to the core interview, a 16-page self-completion questionnaire was used to collect information on respondents' leisure activities, wellbeing and health (including sleep), neighbourhood cohesion, and attitudes. The response rate was almost 90 per cent, with 8,788 interviewed members also returning the self-completed questionnaire. A recent investigation of the non self-completers has shown that they were more likely to be male, with low educational qualifications, not living with a spouse/partner, and with poor self-reported general health. However, it was also noted that even among those groups, the response rate was above 80 per cent (Elliott and Brown, 2011). The potential effects of non-response on the sleep estimates presented in this working paper are discussed in a later section.

The self-completion questionnaire included 4 questions on sleep. These questions are part of a 12-item sleep scale, which is a subscale of the RAND Medical Outcomes Study (MOS) health status measure (Hays and Stewart, 1992). Previous studies have provided evidence on the validity and reliability of the MOS sleep measures[3] (Hays et al., 2005; Viala-Danten et al., 2008). Similar to other established sleep scales, the time frame for the responses in the MOS measures is 'the past 4 weeks' (Smith and Wegener, 2003).

The first question refers to the average hours of sleep per night. The second question asks how often the respondent has woken up feeling rested, and the third question refers to the frequency of sleep disturbances, namely the times the respondent woke up and had trouble falling asleep. A 6-point Likert Scale is used for these two questions: 1. All of the time, 2. Most of the time, 3. A good bit of the time, 4. Some of the time, 5. A little of the time, and 6. None of the time. Finally, the fourth question asks respondents about the usual time taken to fall asleep. A 5-point scale is employed: 1. 0-15 minutes, 2. 16-30 minutes, 3. 31-45 minutes, 4. 46-60 minutes, and 5. More than 60 minutes. Table 1 shows that these four items capture three different dimensions of sleep problems, relating to quantity of sleep/optimal sleep duration, perceived sleep adequacy, and sleep disturbance (variable names are provided in brackets).

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[3] Hays and colleagues reported internal consistency reliability measures of 0.73 and higher among the US general adult population (see Hays et al. 2005). Focusing in a painful diabetic peripheral neuropathic population from a clinical trial that was conducted in six countries, Viala-Danten and colleagues (2008) also found that Cronbach's alpha ranged from 0.71 to 0.81 for the multi-item dimensions.

Table 1. Item content and captured dimension of sleep problem

Sleep Problem	Item Content
Optimal sleep	Quantity of sleep (1) *(n8scq13)*
Sleep adequacy	Enough sleep/feeling rested (2) *(n8scq15)*
Sleep disturbance	Trouble maintaining sleep (3) *(ns8scq14)*
	Time taken to initiate sleep (4) *(ns8scq12)*

Item non-response was relatively low, with only 0.2 per cent (21) of self-completers not answering questions two and three. Thirty four (34) cohort members (0.4 per cent) did not provide a response on question four, while 141 (1.6 per cent) did not respond to question one regarding their usual sleep duration, possibly because of the difficulty of the calculation task and/or considerable variation in their night-time sleep duration. Tables A1-A4 of the Appendix display the exact wording of the questions and the frequency distributions for the four items by gender.

Having introduced the sleep measures that were used in sweep eight of the NCDS, I proceed to an analysis of the prevalence and socio-demographic correlates of sleep problems at age 50 in the UK, particularly focusing on sleep quality.

Dependent variables

This working paper focuses on sleep quality, which is captured by items 2, 3, and 4 (see Table 1). The aim is to estimate the prevalence of 'poor' sleep among NCDS cohort members at age 50 and to identify the characteristics of 'poor sleepers'. The concept of sleep quality theoretically captures broad information including sleep duration, physiologic factors, and psychosocial perception of sleep attained (Patel et al., 2010). It was therefore decided not to analyse sleep duration, which constitutes a research topic in its own right.

The majority of prior studies of sleep quality dichotomise responses to sleep items in order to compare those who frequently experience sleep problems with those that rarely have sleep problems (Ailshire and Burgard, 2012). In line with previous research, three binary variables measuring different dimensions of 'poor sleep' were constructed:

1) *Subjective Sleep Inadequacy (SSI)* - The 'yes' category consists of cohort members that responded 'a little of the time' or 'none of the time' in item 2 (see Table 1). All other responses were assigned the 'no' category.

2) *Difficulty Maintaining Sleep (DMS)* – Individuals that reported waking up and having trouble falling asleep 'all of the time' or 'most of the time' (item 3, Table 1) were assigned the 'yes' category. Remaining responses were coded as 'no'.

3) *Difficulty Initiating Sleep (DIS)* – The 'yes' category consists of respondents who needed over 30 minutes before falling asleep in the previous month (item 4, Table 1). The 'no' category consists of those who reported less than 30 minutes before sleep initiation.

The decision for these specific cut-off points was informed by existing sleep research on sleep quality (for example, see Yokoyama et al., 2010).

Finally, it should be noted that respondents with missing data in any of these items are excluded from the following analysis, which results in an analytic sample of 8,752 NCDS cohort members with valid answers in all three questions.

Independent variables

The associations of 'poor sleep' with a number of demographic, socio-economic, and health circumstances are examined. The following variables are employed[4]:

- Gender (male/female) (nd8sex)

- Cohabiting partner (yes/no): This derived binary variable *(nd8spphh)* is provided in the data file and refers to living circumstances, namely whether the respondent is cohabiting with a partner or not.

Given that the vast majority of NCDS cohort members do not have caring responsibilities for very young children or older adults, these family circumstances are not explicitly examined in the following analysis. It should be noted that including a binary variable on whether the cohort member is childless or not (regardless of whether children still live with the cohort member or not) in the multivariate models did not significantly alter the results, and no independent associations with any of the examined sleep problems were found[5].

- Housing tenure: The housing tenure variable *(n8ten)* was combined into four categories: outright owner, owner paying mortgage, renter, and living rent free. Apart from renters, the third category also includes those who pay part rent/part mortgage (shared/equity ownership). The fourth category includes those who live rent free in friends' property and squatters, as well as a negligible 'other' category.

- In paid work (yes/no): This binary variable identifies cohort members outside paid work (unemployed and seeking work, in full-time education, in a government scheme for employment training, temporarily or permanently sick or disabled, looking after home and family, or wholly retired). The variable was constructed from the detailed *n8econ02* variable provided in the data file.

- Assessment of financial situation: This variable refers to respondents' subjective assessments of their financial situation *(n8finnow)*. The categories for the following analysis are: 1. Living comfortably, 2. Doing all right, 3. Just about getting by, and 4. Finding it quite/very difficult. The initial 'quite difficult' and 'very difficult' categories were combined due to the small numbers of NCDS respondents in the 'very difficult category'.

- Self-assessed health status: The health variable *(n9hlthgn)* consists of four categories: 1. Excellent, 2. Very good, 3. Good, and 4. Fair/poor. The initial 'fair' and 'poor' categories were combined due to the small number of NCDS respondents in the 'poor' category.

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[4] Table A5 of the Appendix displays the percentages of respondents within each category of the independent variables.
[5] Bivariate associations for this variable are provided in Table A6 of the Appendix.

- *Smoking status:* This variable *(n8smokig)* refers to respondents' smoking habits. It distinguishes between those who have never smoked, ex-smokers, and current smokers (i.e. those reporting smoking cigarettes every day or occasionally).

-*Exercising frequently (yes/no):* This binary variable *(n8exerse)* comes from the core CAPI interview. Respondents were asked whether they exercise regularly (i.e. at least once a month for most of the year) or not.

- *Drinking status:* To measure problematic consumption, NCDS utilised the widely-employed AUDIT (Alcohol Use Disorders Identification Test) scale that consists of ten items, covering alcohol consumption, alcohol-related problems, and dependency. Scores of eight or more are associated with harmful or hazardous levels of drinking: scores of 13 or more for women and 15 or more for men are likely to indicate alcohol dependency. This analysis employs a derived variable *(nd8audg)* identifying absence of drinking (i.e. those respondents who never drink), unproblematic drinking, harmful/hazardous drinking, and alcohol dependency.

- *Depression:* Mental health is measured with the Malaise scale, which measures psychological distress and depression (Rutter et al., 1970). In the eighth sweep of NCDS, nine out of 24 questions of the Malaise Scale were asked of respondents (see Brown et al., 2012 for more information)**.** Respondents with a score below four are considered to have low levels of psychological distress, while a score of four or more indicates high levels of depression *(nd8malg)*. It should be noted that the short nine-item scale that was employed in NCDS does not include questions related to respondents' sleep. Additionally, using the Warwick-Edinburgh Wellbeing Scale, the SF-36 mental well-being scale, and the CASP-12 Quality of Life scale (which were also included in sweep 8the eighth sweep of NCDS) yielded very similar results regarding the association of depression and quality of life with different dimensions of 'poor sleep'.

Results

Bivariate analyses

Figure 1 displays the prevalence of sleep problems among NCDS cohort members at age 50 by gender. Similar to previous sleep studies, significant gender differences (p<0.001) are found for all three sleep problems examined. Twenty five per cent of women report inadequate sleep (SSI) as opposed to 20 per cent of men. A similar gender difference is found for difficulties maintaining sleep, with 16 per cent of women as opposed to ten per cent of men waking up and having trouble falling asleep most of the time or all of the time in the last four weeks. The gender difference is somewhat more pronounced for difficulties in sleep initiation (26 per cent of women as opposed to 17 per cent of men).

Figure 1. Prevalence of sleep problems among NCDS cohort members at age 50 by gender (n=8,752)
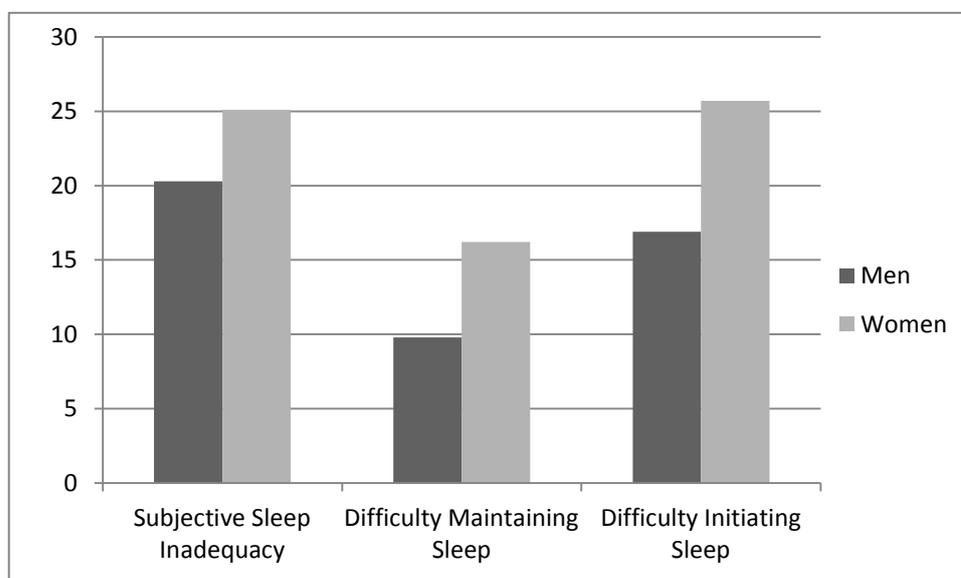
Note: Bars display percentages

Table 2 shows the percentages of 'poor sleepers' within different demographic, socio-economic, and health groups. Similar patterns of association are found for all three sleep problems examined. Both men and women who cohabit with a partner report better sleep quality than those who are single. Similarly, economically inactive cohort members have worse sleep than those in paid employment. For example,

Table 2. Percentages of cohort members reporting sleep problems at age 50 by demographic, SES, and health circumstances

	SSI		DMS		DIS	
	Men	Women	Men	Women	Men	Women
Cohabitating partner	***	**	***	**	***	***
Yes	19.0	24.2	8.5	15.2	13.9	23.3
No	25.3	28.7	15.3	20.1	29.4	34.4
In paid work	***	***	***	***	***	***
Yes	18.8	22.5	7.6	13.4	14.0	22.2
No	32.3	36.8	28.1	28.6	40.7	40.6
Housing tenure	***	***	***	***	***	***
Outright owner	17.5	20.7	9.7	15.4	16.6	24.1
Mortgage	19.7	24.1	7.5	14.2	13.3	22.0
Renter	27.7	37.4	20.2	26.6	32.7	43.3
Living rent free	19.6	29.0	6.5	10.1	18.5	31.9
Assessment of financial situation	***	***	***	***	***	***
Living comfortably	15.4	18.7	7.0	13.2	12.7	19.8
Doing all right	17.6	23,0	8.9	13.8	15.4	23.8
Just about getting by	25.7	34.8	10.9	19.4	20.5	32.3
Finding it quite/very difficult	40.6	41.9	24.8	32.4	34.2	46.2
Health status	***	***	***	***	***	***
Excellent	12.3	12.2	5.2	8.7	9.4	13.6
Very good	14.1	18.6	6.2	11.1	11.0	18.3
Good	21.2	25.9	8.6	15.1	17.3	28.8
Fair/poor	39.6	50.6	24.3	35.8	36.0	48.0
Smoking	**	***	**	***	***	***
Never smoked	19.0	22.4	8.9	13.8	13.9	21.5
Ex-smoker	19.3	23.8	9.3	16.1	15.5	22.9
Smoker	24.3	32.8	12.5	21.6	25.2	38.7
Drinking	***	***	***	***	***	***
Not drinking	29.7	23.6	22.9	24.0	30.7	37.4
Unproblematic drinking	18.3	24.3	7.7	14.8	14.5	23.8
Harmful/hazardous drinking	23.4	41.7	12.5	21.2	19.5	29.6
Alcohol dependency	32.2	35.6	22.4	30.0	30.8	35.0
Exercising frequently	***	***	***	***	***	***
Yes	18.3	22.6	8.8	14.5	15.4	22.9
No	27.4	33.2	13.7	21.9	22.1	37.4
Depression/Malaise scale	***	***	***	***	***	***
Low (0-3)	16.5	18.5	7.4	11.9	14.0	20.8
High (4 or more)	52.0	55.0	30.1	35.3	40.0	47.8

*Note: * $p < 0.05$,** $p < 0.005$,*** $p < 0.001$*

approximately one third of men who are not working work report inadequate sleep (SSI) as opposed to 19 per cent of those in work. A similar strong association is found for women (Table 1).

Housing tenure is strongly associated with all dimensions of sleep quality. The highest occurrences of 'poor sleep' are found among those who rent, while there are no pronounced differences between outright owners and those who are still paying a mortgage. Similarly, perceived financial status presents a strong linear association with sleep quality. Those who are 'finding it quite/very difficult' are significantly more likely to be 'poor sleepers'. For example, 34 per cent of men and 46 per cent of women in this category have serious difficulties initiating sleep (i.e. need more than 30 minutes before sleep initiation) as opposed to only 13 per cent and 20 per cent among those 'living comfortably'.

As expected, self-assessed health status is negatively associated with 'poor sleep'. The relationship is very strong, with more than a third of men and more than a half of women among the 'poor health' category reporting inadequate sleep (SSI) and difficulties maintaining sleep (DMS). The prevalence of sleep problems among those with excellent health is very low. It should be noted that there may be a certain amount of underestimation with regards to these differences, given that those with poor health were significantly more likely not to return the self-completion questionnaire (see section 2).

Strong associations are also found for the three health-related lifestyle variables included in the analysis. Smokers are somewhat more likely to experience 'poor sleep' compared to those that never smoked or ex-smokers. Those NCDS respondents that were assigned in the 'unproblematic drinking' category in the AUDIT scale consistently present the lowest percentages of 'poor sleep' in all three dimensions examined in this analysis. It is also interesting to note that those who never drink experience sleep problems more often than those who fall under the 'hazardous/harmful drinking' category. This may be understood by the fact that alcohol may be used as a self-medication for sleep problems so regular alcohol drinkers may potentially experience a subjective improvement in 'poor sleep' symptoms. As expected, lack of regular physical exercise is strongly associated with increased levels of 'poor sleep' among both men and women.

Finally, high levels of depression/psychological distress are very strongly correlated with poor sleep quality. For example, one in two cohort members with depression symptoms rarely feel their sleep was adequate and restorative (SSI dimension) as opposed to 17 per cent of men and 18 per cent of women with low scores of psychological distress (0-3) in the Malaise scale.

Overall, this bivariate analysis has demonstrated strong associations of 'poor sleep' with demographic, socio-economic, and health circumstances. In order to assess the independent associations of these factors with the sleep outcomes under study, the next section proceeds to a multivariate analysis of 'poor sleep'.

Multivariate analyses: Logistic regression models

To identify the characteristics of 'poor sleepers', additive logistic regression models are specified for the three outcomes under study. The first model controls for gender and cohabitation status. The second model adjusts for SES (housing tenure, employment status, and personal assessment of financial status) in order to examine whether gender differences in sleep problems are mediated by SES differences. Similarly, the third model adds self-assessed health status, while the final model adjusts for health-related lifestyle (smoking, drinking, and physical exercise) and depression/psychological distress in order to examine whether these factors are implicated in the association between general health and sleep problems. It should be noted that the sample is reduced by 1.7 per cent (152 cases) due to missing data on independent variables.

Table 3 presents the results for subjective sleep inadequacy (SSI). Model 1 controls for gender and living circumstances, which are both significantly associated with the outcome under study. Women are more likely to report insufficient sleep than men (OR=1.32, p<0.001), while those NCDS cohort members not living with a partner have significantly higher odds of reporting 'poor sleep' than those currently cohabiting (OR=1.35, p <0.001). However, controlling for SES renders the contribution of cohabitation insignificant, implying that those not living with a partner are likely to have lower SES. Housing tenure, employment status, and perceived financial status are all significant in the logistic model (see Model 2, Table 3). Overall, the inclusion of SES in the model reduces the log-likelihood statistic in the model and improves model fit, and also increases the pseudo R-square value by 0.05.

Adjusting for health status in Model 3 brings an even higher increase in the pseudo R-square (i.e. by 0.06). Those reporting fair/poor health are at a much higher risk (OR=8.30, p <0.001) of reporting inadequate sleep than those reporting excellent health (the reference category). It is important to note that the inclusion of health status in the logistic model renders the housing tenure and economic activity variables insignificant and significantly attenuates the odds ratios for perceived financial situation, which implies that the observed SES inequalities in sleep quality may be partly a function of health inequalities between different socio-economic groups.

The final model controls for health-related lifestyle factors and levels of depression. Smoking and drinking are not found to be significant. However, those who do not engage in frequent physical exercise are more likely to report 'poor sleep' than those who do (OR=1.25, p<0.01), holding demographic circumstances, SES and health status constant. Similar to previous sleep studies, depression has a strong independent association with SSI, and its inclusion in the logistic model significantly reduces the odds ratios for poor health status groups (see Model 4, Table 3). Finally, it should be noted that the gender difference in SSI is not reduced after adjusting for SES, health status, and depression (OR=1.32, p<0.001 in Model 1, OR=1.24, p<0.001 in Model 4).

Table 3. Odds ratios predicting reported sleep inadequacy (SSI)

	(1)	(2)	(3)	(4)
Sex	***	***	***	**
Male	1	1	1	1
Female	1.32***	1.30***	1.35***	1.22**
Cohabitating partner	***	NS	NS	NS
Yes	1	1	1	1
No	1.35***	1.01	1.00	0.94
In paid work		***	NS	NS
Yes		1	1	1
No		1.60***	1.14	1.00
Housing tenure		*	NS	NS
Outright owner		1	1	1
Mortgage		1.10	1.13	1.11
Renter		1.34*	1.17	1.06
Living rent free		1.1	1.1	1.11
Assessment of financial situation		***	***	***
Living comfortably		1	1	1
Doing all right		1.22*	1.11	1.00
Just about getting by		1.90*	1.54***	1.45***
Finding it quite/very difficult		2.73***	2.06***	1.77***
Health status			***	***
Excellent			1	1
Very good			136*	1.30
Good			2.07***	1.77***
Fair/poor			4.77***	3.24***
Smoking				NS
Never smoked				1
Ex-smoker				0.93
Smoker				1.03
Drinking				NS
Not drinking				1
Unproblematic drinking				0.93
Harmful/hazardous drinking				1.05
Alcohol dependency				1.12
Exercising frequently				**
Yes				1
No				1.27**
Depression/Malaise scale				***
Low (0-3)				1
High (4 or more)				3.54***

Nagelkerke R square	*0.09*	*0.06*	*0.12*	*0.17*
-2 Log Likelihood	9151.07***	8870.40***	8511.61***	8175.29***
N (sample size)	8,739	8,717	8,696	8,587

*Significance of difference from reference category : * p < 0.01, ** p <0.01, *** p < 0.001*

Table 4. Odds ratios predicting reported sleep disturbance (DMS)

	(1)	(2)	(3)	(4)
Sex	***	***	***	***
Male	1	1	1	1
Female	1.76***	1.66***	1.72***	1.69***
Cohabitating partner	***	NS	NS	NS
Yes	1	1	1	1
No	1.58***	1.14	1.13	1.06
In paid work		***	***	***
Yes		1	1	1
No		2.40***	1.75***	1.61***
Housing tenure		***	**	***
Outright owner		1	1	1
Mortgage		085*	0.85	0.83*
Renter		1.33*	1.14	1.06
Living rent free		0.50*	0.49*	0.47*
Assessment of financial situation		***	***	***
Living comfortably		1	1	1
Doing all right		1.11	1.01	1.00
Just about getting by		1.30*	1.04	0.98
Finding it quite/very difficult		2.43***	1.81***	1.58***
Health status			***	***
Excellent			1	1
Very good			1.24*	1.20
Good			1.70***	1.46***
Fair/poor			4.10***	2.92***
Smoking				NS
Never smoked				1
Ex-smoker				1.01
Smoker				0.96
Drinking				***
Not drinking				1
Unproblematic drinking				1.00
Harmful/hazardous drinking				1.44*
Alcohol dependency				1.56*
Exercising frequently				**

Yes			1
No			1.21**
Depression/Malaise scale			***
Low (0-3)			1
High (4 or more)			2.60***

Nagelkerke R square	*0.02*	*0.09*	*0.13*	*0.16*
-2 Log Likelihood	6532.42***	6231.63***	6020.67***	5855.86***
N (sample size)	8,739	8,717	8,696	8,587

*Significance of difference from reference category: * p < 0.01, ** p <0.01, *** p < 0.001*

Table 5. Odds ratios of reported difficulties in sleep initiation (DIS)

	(1)	(2)	(3)	(4)
Sex	***	***	***	***
Male	1	1	1	1
Female	1.69***	1.63***	1.70***	1.63***
Cohabitating partner	***	***	***	***
Yes	1	1	1	1
No	2.01***	1.47***	1.46***	1.40***
In paid work		***	***	**
Yes		1	1	1
No		2.13***	1.63***	1.52***
Housing tenure		***	***	***
Outright owner		1	1	1
Mortgage		084*	0.85*	0.82*
Renter		1.49***	1.32**	1.15
Living rent free		0.99	1	0.96
Assessment of financial situation		***	***	***
Living comfortably		1	1	1
Doing all right		1.21*	1.11	1.1
Just about getting by		1.48***	1.21*	1.15
Finding it quite/very difficult		2.23***	1.72***	1.45***
Health status			***	***
Excellent			1	1
Very good			1.27*	1.2
Good			2.10***	1.83***
Fair/poor			3.83***	2.76***
Smoking				***
Never smoked				1
Ex-smoker				0.97
Smoker				1.50***

Drinking	NS
Not drinking	1
Unproblematic drinking	0.87
Harmful/hazardous drinking	1.02
Alcohol dependency	0.92
Exercising frequently	**
Yes	1
No	1.22**
Depression/Malaise scale	***
Low (0-3)	1
High (4 or more)	2.16***

Nagelkerke R square	*0.04*	*0.10*	*0.15*	*0.17*
-2 Log Likelihood	8661.4***	8303.58***	8044.47***	7883.41***
N (sample size)	8,739	8,717	8,696	8,5

*Significance of difference from reference category: * p < 0.01, ** p <0.01, *** p < 0.001*

Logistic regression models for difficulties maintaining sleep (DMS) are presented in Table 4. As in the case of SSI, the association of cohabitation status with poor sleep is attenuated and rendered insignificant after controlling for SES variables in Model 2. The contribution of SES variables is also reduced after controlling for health status, lifestyle and depression (Model 4) but remains significant. Similar results regarding health status and levels of depression and their interrelationship are found (see Table 4). Those engaging in harmful/hazardous drinking and those that are classified as being alcohol dependent present a higher risk of experiencing sleep disturbances than those who never drink (OR = 1.48, p<0.001, OR=1.60, p <0.001 respectively). The specified model explains 17 per cent of the variance in poor sleep (Nagelkerke R square), which can be considered satisfactory given the nature of the outcome under study.

Finally, Table 5 presents odds ratios for difficulties in sleep initiation (DIS), which refers to those who need more than 30 minutes before falling asleep. The final fully-adjusted model (Model 4) explains 17 per cent of the variance in DIS. In contrast with the two previous models, this model demonstrates that not cohabiting with a partner is a risk factor for DIS, even after controlling for SES, health, and depression factors (OR=1.39, p<0.001). The findings for SES, health, and depression are similar to those of the logistic regression model for DMS, with the exception that it is smoking rather than drinking that is now independently associated with a higher risk of DIS (see Model 4, Table 5). It should also be noted that, similar to the previous models, gender differences are not explained by differences in health status, SES, and depression/psychological distress (OR=1.69, p<0.001 in Model 1, OR=1.64, p<0.001 in Model 4).

Concluding remarks

This working paper has introduced the sleep measures employed in the eighth sweep of NCDS, and provided a preliminary cross-sectional investigation of the prevalence of 'poor sleep' and its socio-economic correlates at age 50. Results are in accordance with those of previous sleep studies that have demonstrated independent associations of socio-economic and health circumstances with different dimensions of 'poor sleep'. The specified models show that SES disparities in sleep problems are partly mediated by health factors. A particularly strong association is found between depression and all three dimensions of 'poor sleep' that were examined in this working paper. The models do not provide evidence regarding consistent associations of smoking and drinking habits with the examined dimensions of sleep quality, while frequent engagement with physical leisure is associated with a lower likelihood of obtaining 'poor sleep' on a regular basis. Finally, gender differences in sleep quality were not explained by any of the other independent variables included in the logistic models.

Previous research has suggested several mechanisms regarding the impact of SES on sleep (Arber et al. 2009): For example, it is possible that poor quality housing in disadvantaged noisy areas has a direct impact on low SES individuals' sleep, or that 'poor sleep' is an outcome of the psychological and health consequences of low SES. In contrast with cross-sectional surveys that have been previously analysed to explore sleep problems and their correlates, NCDS is unique in providing relevant variables and rich information concerning respondents' occupational, family, and health histories that can be analysed to gain insight into the factors implicated in 'poor sleep' outcomes, and to further investigate the direction of causality between health, SES, and sleep.

It should be noted that previous sweeps of NCDS have included different measures of sleep quality that can be employed in future analyses: Information on sleep difficulties of cohort members goes back to age 16, when parents provided information on the nature of their child's sleep difficulties. Sweeps 4, 5, and 6 have gathered information on sleep problems through the Malaise Inventory, which included 2 items on sleep difficulties. Finally, the CAPI questionnaire of the Biomedical Survey has also included a number of questions surrounding sleep problems and sleep quality (researchers interested in the study of sleep can use the online Data Dictionary in the CLS website to explore the sleep measures that have been used in NCDS and other cohort studies http://cls.ioe.ac.uk/datadictionary/default.asp). These variables can be integrated in future analyses to gain insight into the onset and continuity of sleep problems and their association with different lifecourse events (for example, Dregan and Armstrong, 2010 have previously analysed NCDS longitudinally to examine the continuity of sleep disturbance over the lifecourse).

Additionally, future analyses can examine the cumulative influence of family and childrearing histories on sleep quality, a topic that has been mostly examined by qualitative researchers given the absence of representative datasets providing

information on sleep (see Introduction). Finally, another fruitful area of research concerns the impact of the quality of family relationships on troubled sleep, a topic that has been recently examined by US researchers working in the field (Ailshire and Burgard, 2012). Overall, NCDS is an excellent resource that can be analysed to contribute to our knowledge regarding the social aspects of sleep quality and its implications for quality of life.

References

Ailshire, J.A. and Burgard, S.A. (2012) 'Family relationships and troubled sleep among US adults: Examining the influences of contact frequency and relationship quality', *Journal of Health and Social Behavior, 53*: 248–262.

Arber, S., Bote, M., and Meadows, R. (2009) 'Gender and socio-economic patterning of self-reported sleep problems in Britain', *Social Science & Medicine, 68*: 281–289.

Arber, S., Hislop, J., Bote, M., and Meadows, R. (2007a) 'Gender roles and women's sleep in mid and later life: a quantitative approach', *Sociological Research Online, 12*: 3.

Arber, S., Hislop, J., and Williams, S. (2007b) 'Editors' introduction: Gender, sleep and the life course', *Sociological Research Online, 12*: 19.

Ayas, N.T., White, D.P., Manson, J.A.E., Stampfer, M.J., Speizer, F.E., Malhotra, A., and Hu, F.B. (2003)'A prospective study of sleep duration and coronary heart disease in women', *Archives of Internal Medicine, 163*: 205–209.

Basner, M., Fomberstein, K.M., Razavi, F.M., Banks, S., William, J.H., Rosa, R.R., and Dinges, D.F. (2007) 'American time use survey: sleep time and its relationship to waking activities', *Sleep,* 30: 1085–1095.

Bianchera, E. and Arber, S. (2007) 'Caring and sleep disruption among women in Italy', *Sociological Research Online*, 12: 4.

Biddle, J.E. and Hamermesh, D.S. (1989) 'Sleep and the allocation of time', *Journal of Political Economy*, 98: 922–943.

Brown, M., Elliott, J., Hancock, M., Shepherd, P., and Dodgeon, B. (2012) 'National Child Development Study, 2008-2009 follow up, User guide to the data', London: Centre for Longitudinal Studies.

Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., and Kupfer, D.J. (1989) 'The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research', *Psychiatry Research*, 28: 193–213.

Chatzitheochari, S. and Arber, S. (2009) 'Lack of sleep, work and the long hours culture: evidence from the UK Time Use Survey'. *Work, Employment & Society*, 23: 30–48.

Dregan, A. and Armstrong, D. (2010) 'Adolescence sleep disturbances as predictors of adulthood sleep disturbances — A cohort study', *Journal of Adolescent Health,* 46: 482–487.

Dregan, A. and Armstrong, D. (2011) 'Cross-country variation in sleep disturbance among working and older age groups: an analysis based on the European Social Survey', *International Psychogeriatrics*, 23: 1413–1420.

Elliott, J. and Brown, M. (2011) 'Response rates and potential response bias relating to the use of the paper self-completion questionnaire used as part of the 2008 sweep of the National Child Development Study', London: Centre for Longitudinal Studies.

Gershuny, J. (2003) 'Changing times: Work and leisure in post-industrial society', Oxford: Oxford University Press, USA.

Hays, R.D., Martin, S.A., Sesti, A.M., and Spritzer, K.L. (2005) 'Psychometric properties of the Medical Outcomes Study Sleep measure', *Sleep Medicine,* 6: 41–44.

Hays, R.D. and Stewart, A. (1992)'Sleep measures'. In A. Stewart and J.E. Ware (eds) *Measuring functioning and wellbeing: The Medical Outcomes Study*, Durham, NC: Duke University Press.

Heslop, P., Smith, G.D., Metcalfe, C., Macleod, J., and Hart, C. (2002) 'Sleep duration and mortality: the effect of short or long sleep duration on cardiovascular and all-cause mortality in working men and women', *Sleep Medicine*, 3: 305–314.

Horne, J. and Reyner, L. (1999)'Vehicle accidents related to sleep: a review', *Occupational and Environmental Medicine*, 56: 289–294.

Jenkins, C.D., Stanton, B.A., Niemcryk, S.J., and Rose, R.M. (1988) 'A scale for the estimation of sleep problems in clinical research', *Journal of Clinical Epidemiology*, 41: 313–321.

Lallukka, T., Chandola, T., Roos, E., Cable, N., Sekine, M., Kagamimori, S., Tatsuse, T., Marmot, M., and Lahelma, E. (2010) 'Work–family conflicts and health behaviors among British, Finnish, and Japanese employees', *International Journal of Behavioral Medicine*, 17: 134–142.

Maume, D.J., Sebastian, R.A., and Bardo, A.R. (2010) 'Gender, work-family responsibilities, and sleep'. *Gender & Society*, 24: 746–768.

Moore, P.J., Adler, N.E., Williams, D.R., and Jackson, J.S. (2002) 'Socioeconomic status and health: the role of sleep', *Psychosomatic Medicine*, 64:337–344.

Patel, N.P., Grandner, M.A., Xie, D., Branas, C.C., and Gooneratne, N. (2010). "Sleep disparity" in the population: poor sleep quality is strongly associated with poverty and ethnicity. *BMC Public Health 10*, 475.

Patten, C.A., Choi, W.S., Gillin, J.C., and Pierce, J.P. (2000) 'Depressive symptoms and cigarette smoking predict development and persistence of sleep problems in US Adolescents', *Pediatrics*, 106: e23–e23.

Rutter, M., Tizard, J., and Whitmore, K. (1970) *Education, health and behaviour,* New York: Wiley.

Sekine, M., Chandola, T., Martikainen, P., McGeoghegan, D., Marmot, M., and Kagamimori, S. (2006) 'Explaining social inequalities in health by sleep: the Japanese civil servants study', *Journal of Public Health*, 28: 63–70.

Smith, M.T. and Wegener, S.T. (2003) 'Measures of sleep: the Insomnia Severity Index, Medical Outcomes Study (MOS) Sleep Scale, Pittsburgh Sleep Diary (PSD), and Pittsburgh Sleep Quality Index (PSQI)', *Arthritis Care & Research*, 49: S184–S196.

Spiegel, K., Leproult, R., and Van Cauter, E. (1999) 'Impact of sleep debt on metabolic and endocrine function', *The Lancet*, 354: 1435–1439.

Steptoe, A., Peacey, V., and Wardle, J. (2006) 'Sleep duration and health in young adults', *Archives of Internal Medicine*, 166: 1689–1692.

Tsuno, N., Besset, A., and Ritchie, K. (2005) 'Sleep and depression', *Journal of Clinical Psychiatry*, 66: 1254–1269.

Venn, S., Arber, S., Meadows, R., and Hislop, J. (2008) 'The fourth shift: exploring the gendered nature of sleep disruption among couples with children', *The British Journal of Sociology*, 59: 79–97.

Viala-Danten, M., Martin, S., Guillemin, I., and Hays, R.D. (2008) 'Evaluation of the reliability and validity of the Medical Outcomes Study sleep scale in patients with painful diabetic peripheral neuropathy during an international clinical trial', *Health and Quality of Life Outcomes*, 6: 113–125.

Williams, S. (2005) *Sleep and society: Ventures into the (Un) known...*, London: Routledge.

Yokoyama, E., Kaneita, Y., Saito, Y., Uchiyama, M., Matsuzaki, Y., Tamaki, T., Munezawa, T., and Ohida, T. (2010)'Association between depression and insomnia subtypes: a longitudinal study on the elderly in Japan', *Sleep*, 33: 1693–1702.

Appendix

Table A.1. Average number of hours of sleep in last four weeks

	Men		Women	
	n	**%**	**n**	**%**
1	1	0	0	0
2	7	0.2	5	0.1
3	17	0.4	31	0.7
4	87	2.1	129	2.8
5	277	6.6	345	7.6
6	1013	24	969	21.3
7	1572	37.2	1460	32
8	1029	24.3	1215	26.6
9	102	2.4	252	5.5
10	47	1.1	73	1.6
11	4	0.1	3	0.1
12	6	0.1	3	0.1
Not answered	67	1.5	74	1.6
Total	4229	100	4559	100

Table A.2. How often slept enough to wake up feeling rested in last four weeks

	Men		Women	
	n	**%**	**n**	**%**
All of the time	382	9	282	6.2
Most of the time	1534	36.3	1407	30.9
A good bit of the time	591	14	656	14.4
Some of the time	852	20.1	1060	23.3
A little of the time	622	14.7	763	16.7
None of the time	236	5.6	382	8.4
Not answered	12	0.3	9	0.1
Total	4229	100	4559	100

Table A.3. How often woke up and had trouble falling back to sleep in last four weeks

	Men		Women	
	n	%	n	%
All of the time	145	3.4	273	6
Most of the time	271	6.4	467	10.2
A good bit of the time	401	9.5	576	12.6
Some of the time	852	20.2	1006	22.1
A little of the time	1486	35.1	1462	32.1
None of the time	1062	25.1	766	16.8
Not answered	12	0.3	9	0.2
Total	4229	100	4559	100

Table A.4. Usual time taken to fall asleep in last 4 weeks

	Men		Women	
	n	%	n	%
0-15 minutes	2363	55.9	2052	45
16-30 minutes	1135	26.8	1326	29.1
31-45 minutes	327	7.7	549	12
46-60 minutes	167	14	283	6.2
More than 60 minutes	217	5.1	335	7.4
Not answered	20	0.5	14	0.3
Total	4229	100	4559	100

Table A.5. Percentage distributions of independent variables by gender

	Men		Women	
	n	%	n	%
Cohabitating partner				
Yes	3395	80.9	3586	79
No	802	19.1	956	21
In paid work				
Yes	3753	89.3	3695	81.4
No	452	10.7	847	18.6
Housing tenure				
Outright owner	906	21.6	1239	27.4
Mortgage	2598	62.0	2591	57.2
Renter	593	14.2	631	13.9
Living rent free	92	2.2	69	1.5

Assessment of financial situation

Living comfortably	1667	39.7	1863	41.0
Doing all right	1296	30.8	1399	30.8
Just about getting by	911	21.7	911	20.1
Finding it quite/very difficult	330	7.8	370	8.1

Health status

Excellent	820	19.6	917	20.2
Very good	1387	33.1	1522	33.5
Good	1263	30.1	1288	28.4
Fair/poor	720	17.2	810	17.9

Smoking

Never smoked	1897	45.3	2196	48.4
Ex-smoker	1391	33.2	1346	29.7
Smoker	904	21.6	995	21.9

Drinking

Not drinking	192	4.6	348	7.8
Unproblematic drinking	2975	71.8	3663	81.6
Harmful/hazardous drinking	835	20.1	358	8.0
Alcohol dependency	143	3.4	120	2.7

Exercising frequently

Yes	3302	78.8	3473	76.5
No	890	21.2	1064	23.5

Depression/Malaise scale

Low (0-3)	3719	89.5	3701	82.1
High (4 or more)	435	10.5	805	17.9

Table A.6. Percentages reporting sleep problems by parental status

	SSI		DMS		DIS	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Has Children	**NS**	**NS**	**NS**	*****	*******	**NS**
Yes	20.6	25.2	9.6	16.7	15.8	25.3
No	18.3	25	10.8	13.5	22	27.7

*Note: * p < 0.05, ** p < 0.005, *** p < 0.001*

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