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Socio-economic position and sleep quantity in UK adults

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ABSTRACT

Study objective To investigate the relationship between markers of socio-economic position (years of full-time education, access to a car or van, and occupational social class) and mid-range sleep quantity (6.5 to 8.5 hours).

Data source Office of National Statistics Omnibus Survey, May 1999.

Participants 3000 households were randomly selected from the UK postcode address file and one individual aged over 16 years from each household was randomly selected to be invited to take part in the survey. All respondents aged 25 and over (n=1473) were included in the analyses where appropriate data were available.

Main results Total sleep quantity was greater in more deprived women as measured by years in full-time education. There was no linear relationship between total sleep quantity and any of the markers of socio-economic position in men. Mid-range sleep quantity was more common in more educated women. Similar, non-significant, trends were seen in men.

Conclusion There is little evidence that more socio-economically deprived individuals obtain less sleep than more advantaged ones – indeed, the reverse may be true – but some evidence that more advantaged women are more likely to report mid-range sleep. Any hypothesis implicating sleep in socio-economic inequalities in health should take into account mid-range, rather than total, sleep quantity. Further work should focus both on mid-range, or ‘healthy’ sleep quantity as well as sleep quality.

There is evidence that sleep deprivation is associated with impaired glucose tolerance and hypertension.[1][2] As these disease markers, as well as numerous disease outcomes, vary according to socio-economic position (SEP),[3] it has been suggested that variations in sleep quantity may mediate the relationship between SEP and health.[4] Theoretical reasons for this include known socio-economic variations in stress,[5] housing quality[6] and overcrowding.[7] However, the relationship between sleep quantity and both morbidity and mortality appears to be U-shaped with lowest risk at around six-eight hours of sleep per night.[8][9][10][11]

Published data on SEP and sleep quantity is sparse but has failed, to date, to document a linear relationship.[12][13][14] In fact, there is some evidence of an inverse linear relationship between SEP and sleep.[14] One recent analysis of US data investigated socio-economic variations in short (<6.5 hours), midrange (6.5-8.5 hours) and long (>8.5 hours) sleep finding that lower educational attainment was associated with increased risk of being a short or long sleeper.[15]

In order to provide further information on the relationship between SEP and sleep quantity, and the first such data from the UK, data from the UK Office for National Statistics' (ONS) Omnibus Survey was analysed.

METHODS

The ONS Omnibus Survey is a regular, multi-purpose, survey.[16][17] Each month 3000 private households in the UK are randomly selected using the postcode address file and one randomly selected individual aged over 16 from each household is invited to take part in the survey. In May 1999, respondents were asked to complete a time use survey for one 24 hour period from the last seven days, recording their main activity in each of 96 15-minute periods.

Total sleep quantity was calculated by assuming that each 15-minute period where the main activity reported was sleep or rest consisted entirely of sleep. Individuals were also dichotomised into mid-range and other sleepers with healthy sleepers defined as those reporting between 6.5 and 8.5 hours of sleep.[15]

Age when respondents left full-time education (collapsed into three groups), whether or not a car or van was available to the household, and occupational social class of the respondent, or their head of household if they were not currently working (collapsed into three groups using the customary groupings of classes I&II, class III, and classes IV&V), were used as markers of SEP – all known to be useful measures of SEP in the context of socio-economic inequalities in health.[18][19] The association between markers of SEP and sleep quantity, after control for age, was assessed using linear regression. The odds of individuals in different social groups being mid-range sleepers, after control for age, was assessed using logistic regression.

As SEP may not be stable in young adulthood, individuals aged less than 25 were excluded throughout. All analyses were conducted separately in men and women as there are a number of examples of the relationship between SEP and health variables differing between men and women.[20][21][22] Individuals were excluded from specific analyses if the required data for those analyses were missing. All analyses were conducted in Stata v8.0 using population sampling weights from the original dataset.

RESULTS

A total of 1626 individuals responded to the survey, of whom 1473 (647 men and 826 women) were aged 25 or over. Total sleep was approximately normally distributed (mean 8.40 hours, standard error 0.05). Women reported significantly more sleep than men (mean 8.59 versus 8.17 hours; $p < 0.001$). There was no difference in the proportion of men and women reporting mid-range sleep (54.3% of men and 51.0% of women, $p = 0.203$).

Table 1 shows mean hours of sleep according to age groups and markers of SEP for men and women separately, along with regression coefficients of the ability of the markers of SEP to predict sleep quantity after control for age where appropriate. The relationship between age and sleep quantity was U-shaped, particularly in women, with men aged 45-54 and women aged 35-44 reporting the least amount of sleep. There was evidence that education could predict sleep quantity in women ($p < 0.05$), but not men, with those leaving education earlier reporting more sleep. There was no evidence of a linear

relationship between social class or car or van availability and sleep quantity in either men or women.

Table 1 – Mean weighted hours of sleep in previous 24 hours by markers of socio-economic position with regression coefficients

	Men		Women	
	weighted percent	mean hours of sleep (standard error)	weighted percent	mean hours of sleep (standard error)
Age group				
25-34	19.7	8.02 (0.18)	20.8	8.43 (0.12)
35-44	20.3	8.14 (0.21)	21.4	8.36 (0.12)
45-54	20.5	7.77 (0.15)	19.6	8.38 (0.13)
55-64	15.7	8.29 (0.21)	16.6	8.50 (0.14)
65-74	15.4	8.35 (0.17)	13.0	9.15 (0.18)
75+	8.5	8.97 (0.26)	8.5	9.42 (0.21)
Coefficient (95% CI)*	0.136 (0.040 to 0.233)**		0.184 (0.108 to 0.259)**	
Age left full-time education				
>19	19.4	8.19 (0.18)	17.9	8.27 (0.13)
15 to 19	65.6	8.04 (0.07)	65.4	8.52 (0.07)
<15	15.0	8.66 (0.21)	16.8	9.19 (0.16)
Coefficient (95% CI)	0.040 (-0.253 to 0.333)		0.273 (0.042 to 0.504)**	
Car or van available to household?				
Yes	82.9	8.10 (0.08)	77.4	8.49 (0.07)
No	17.1	8.49 (0.23)	22.5	8.94 (0.12)
Coefficient (95% CI)	0.298 (-0.209 to 0.805)		0.257 (-0.017 to 0.531)	
Occupational social class				
I&II (professional & managerial)	40.4	8.19 (0.13)	27.9	8.57 (0.11)
III (intermediate)	41.1	8.23 (0.12)	45.1	8.54 (0.09)
IV&V (semi-skilled & unskilled)	18.5	7.98 (0.18)	27.0	8.58 (0.11)
Coefficient (95% CI)	-0.103 (-0.314 to 0.109)		-0.057 (-0.209 to 0.095)	

*linear regression coefficient (95% confidence intervals) of ability of variable (entered with categories listed coded as a single continuous variable) to predict sleep quantity in hours, with control for age where appropriate

**p<0.05

Table 2 shows the proportion of men and women reporting mid-range sleep quantities by age group and markers of SEP along with odds ratios of the chance of reporting mid-range sleep quantities compared to the most advantaged group. There was a general trend for the likelihood of reporting mid-range sleep to decrease with age with men and women aged over 75 being least likely to report mid-range sleep. Whilst the odds of reporting mid-range sleep showed an overall decrease with decreasing advantage in both men and

women for all markers of SEP, this was only statistically significant ($p < 0.05$) in relation to education in women.

Table 2 – Proportion of individuals reporting mid-range sleep (6.5-8.5 hours/24 hours) by markers of socio-economic position with odds ratios

	Men		Women	
	Weighted proportion reporting mid-range sleep	Odds ratio (95% CI)*	Weighted proportion reporting mid-range sleep	Odds ratio (95% CI)
Age group				
25-34	61.3	1.00	59.8	1.00
35-44	59.8	0.94 (0.55 to 1.62)	56.2	0.86 (0.55 to 1.37)
45-54	54.2	0.75 (0.43 to 1.29)	55.6	0.84 (0.52 to 1.36)
55-64	46.4	0.55 (0.31 to 0.95)**	52.5	0.74 (0.46 to 1.21)
65-74	55.3	0.78 (0.44 to 1.37)	33.5	0.34 (0.20 to 0.57)**
75+	38.1	0.39 (0.20 to 0.75)**	29.8	0.29 (0.16 to 0.50)**
Age left full-time education				
>19	55.2	1.00	62.7	1.00
15 to 19	56.7	1.13 (0.73 to 1.75)	52.6	0.68 (0.45 to 1.03)
<15	43.8	0.90 (0.47 to 1.74)	33.6	0.47 (0.26 to 0.86)**
Car or van available to household?				
Yes	55.6	1.00	53.9	1.00
No	47.9	0.82 (0.54 to 1.25)	41.1	0.75 (0.53 to 1.06)
Occupational social class				
I&II	56.8	1.00	54.5	1.00
III	54.1	0.92 (0.63 to 1.34)	52.3	0.97 (0.67 to 1.40)
IV&V	49.6	0.78 (0.49 to 1.26)	49.5	0.94 (0.62 to 1.43)

*odds ratio (95% confidence intervals) of reporting mid-range sleep quantity compared to most advantaged group with control for age where appropriate

** $p < 0.05$

DISCUSSION

Data from the 1999 UK ONS Omnibus survey reveals evidence, in women but not men, that total sleep quantity increases with increasing deprivation (as measured by age at completion of education, but not occupational social class or car or van access), but that the chances of sleeping for a mid-range length of time decreases with increasing deprivation. Similar trends, for mid-range sleep quantity, were seen in men but these did not reach conventional levels of statistically significant, perhaps due to smaller numbers.

The overall response rate for the May 1999 ONS Omnibus Survey was 54%. Any bias that this apparently low response rate may have introduced will be, at least partially, overcome by the population weights used. Respondents were asked to assign the main activity they were engaged in for every 15-minute period of a single day to one of 33 pre-defined time use codes with sleep and rest included in a single code. It is, therefore, possible that not all time that we have included in our calculation of sleep quantity were actually spent asleep with both rest and attempting to sleep included. However, self report may be the only feasible method of assessing sleep quantity at a population level and time use data is likely to be more accurate than simply asking respondents to estimate the average amount of sleep they get per night – as done in previous work.[12][13] Self report information from more than one 24 hour period would, however, be likely to increase the accuracy of such data. In addition, no account was taken of sleep quality and it is possible that individuals increase time spent in sleep, or trying to sleep, to compensate for poor sleep quality.

In addition to limitations of data availability, as factors such as household composition, working conditions and housing quality have been proposed as possible explanatory variables in a possible relationship between SEP and sleep, these variables were not controlled for. Control for such variables in future analyses may help explain the pattern of results reported here.

These results corroborate previous reports that there is little evidence that more deprived individuals obtain less sleep than more advantaged ones[12][13] – and that the reverse may be true[14] – but there is some evidence that mid-range levels of sleep do seem to be socio-economically patterned – particularly in women.[15] These findings suggest that any hypothesis implicating sleep in socio-economic inequalities in health should take into account mid-range, rather than total, sleep quantities. Further work should focus both on healthy sleep quantity as well as sleep quality and make use of longitudinal data to explore the possibility of a causal relationship between SEP and sleep.

WHAT IS ALREADY KNOWN ABOUT THIS TOPIC

It has been suggested that sleep deprivation may mediate the relationship between socio-economic position and health. The relationship between sleep quantity and morbidity and mortality appears to be U-shaped. Previous work has failed to show a linear relationship between SEP and sleep quantity but few have investigated the socio-economic distribution of mid-range sleep quantity (around 6.5-8.5 hours).

WHAT THIS PAPER ADDS

Socio-economic deprivation appears to be associated with greater total sleep but less likelihood of mid-range sleep quantity – particularly in women.

POLICY IMPLICATIONS

If sleep quantity is confirmed as a mediator of inequalities in health, interventions to promote and enable healthy sleep patterns, particularly amongst more deprived individuals, may help to reduce socio-economic inequalities in health.

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COMPETING INTERESTS

The author is not aware of any competing interests in relation to this article.

ETHICS

This analysis of publicly available routine data did not require ethical approval.

REFERENCES

1. Spiegel K, Leproult R, Van Cauter E. Impact of sleep debt on metabolic and endocrine function. *The Lancet* 1999;**354**:1435-1439.
2. Tochikubo O, Ikeda A, Miyajima E, et al. Effects of Insufficient Sleep on Blood Pressure Monitored by a New Multibiomedical Recorder. *Hypertension* 1996;**27**:1318-1324.
3. Drever F, Whitehead M, editors. Health inequalities decennial supplement. London: The Stationary Office; 1997.
4. Van Cauter E, Spiegel K. Sleep as a mediator of the relationship between socioeconomic status and health: a hypothesis. *Annals of the New York Academy of Science* 1999;**896**:254-261.
5. Brunner E. Socioeconomic determinants of health: stress and the biology of inequality. *British Medical Journal* 1997;**314**:1472.
6. Lowry S. Health and housing. Plymouth: BMJ; 1991.
7. Townsend P, Phillimore P, Beattie A. Health and deprivation: inequality and the North. Bristol: Croom Helm; 1988.
8. Kripke D, Garfinkel L, Wingard D, et al. Mortality associated with sleep duration and insomnia. *Archives of General Psychiatry* 2002;**59**:131-136.
9. Ayas NT, White DP, Manson JE, et al. A Prospective Study of Sleep Duration and Coronary Heart Disease in Women. *Arch Intern Med* 2003;**163**:205-209.
10. Wingard D, Berkman L. Mortality risk associated with sleeping patterns among adults. *Sleep* 1983;**6**:102-107.
11. Tamakoshi A, Ohno Y. Self-reported sleep duration as a predictor of all-cause mortality: results from the JACC study, Japan. *Sleep* 2004;**27**:51-54.
12. Guerin N, Reinberg A, Testu F, et al. Role of school schedule, age, and parental socioeconomic status on sleep duration and sleepiness of Parisian children. *Chronobiology International* 2001;**18**:1005-1017.
13. Moore P, Adler N, Williams D, et al. Socioeconomic status and health: the role of sleep. *Psychosomatic Medicine* 2002;**64**:337-344.
14. Biddle J, Hamermesh D. Sleep and the allocation of time. *Journal of Political Economy* 1990;**98**:922-943.
15. Hale L. Who has time to sleep? *Journal of Public Health* 2005;**27**:205-211.

16. Valdes A, Andrew T, Gardner J, et al. Obesity, cigarette smoking, and telomere length in women. *The Lancet* 2005;DOI:10.1016/S0140-6736(05)66630-5.
17. Office for National Statistics Social Survey Division. ONS Omnibus Survey, May 1999. Colchester, Essex: UK Data Archive; 2001.
18. Krieger N, Williams D, Moss N. Measuring social class in US public health research: concepts, methodologies and guidelines. *Annual review of Public Health* 1997;18:341-78.
19. Macintyre S, Ellaway A, Der G, et al. Do housing tenure and car access predict health because they are simply markers of income or self esteem? A Scottish study. *Journal of Epidemiology & Community Health* 1998;52:657-664.
20. Adams J, White M, Pearce M, et al. Lifecourse measures of socio-economic position and self reported health at age 50: prospective cohort study. *Journal of Epidemiology & Community Health* 2004;58:1028-1029.
21. Walker B, McConnachie A, Noon J, et al. Contribution of parental blood pressures to association between low birth weight and adult high blood pressure: cross sectional study. *British Medical Journal* 1998;316:834-837.
22. Stocks N, Ryan P, McElroy H, et al. Statin prescribing in Australia: socioeconomic and sex differences: A cross-sectional study. *Medical Journal of Australia* 2004;180:229-231.