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Working hours and sleep duration in midlife as determinants of health-related quality of life among older businessmen

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Key points

- In older businessmen, long working hours and short sleep duration in midlife were linked with old age poor physical functioning
- Allowing for age, smoking and SRH attenuated the association, but it remained significant
- Useful knowledge since managers, entrepreneurs, and executives as well as the general workforce are continuously faced with long working hours

Running head: work and sleep hours and quality of life

ABSTRACT

Background. Long working hours and short sleep duration are associated with a range of adverse health consequences. However, the combined effect of these two exposures on health-related quality of life (HRQoL) has not been investigated.

Methods. We studied white men born between 1919 and 1934 in the Helsinki Businessmen Study (HBS, initial n=3490). Data on clinical variables, self-rated health (SRH), working hours and sleep duration in 1974, and RAND-36 (SF-36) HRQoL survey in the year 2000 was available for 1527 men. Follow-up time was 26 years. By combining working hours and sleep duration four categories were formed: 1) normal work (≤50 hours/week) and normal sleep (>47 hours/week); 2) long work (>50 hours/week) and normal sleep; 3) normal work and short sleep (≤47 hours/week); and 4) long work and short sleep. The association with RAND-36 domains was examined using multiple linear regression models adjusted for age, smoking, and SRH.

Results. Compared to those with normal work and sleep in midlife, men with long work and short sleep had poorer RAND-36 scores for Physical functioning, Vitality and General health, and those with long work and normal sleep had poorer scores for Physical functioning in old age. Adjustment for midlife smoking and SRH attenuated the associations, but the one for long work and short sleep and Physical functioning remained significant (difference in mean Physical functioning score -4.58, 95% CI -9.00 to -0.15).

Conclusions. Businessmen who had long working hours coupled with short sleep duration in midlife had poorer physical health in old age.

Key words working hours, sleep duration, health-related quality of life, disability, ageing

INTRODUCTION

A number of studies have shown that longer working hours are associated with a range of adverse health consequences such as higher prevalence of stroke [1], coronary heart disease [2], metabolic disorders [3] and mental disorders [4]. Shorter as well as longer sleep duration has also been shown to increase the prevalence of several chronic illnesses, poorer self-rated health and lower quality of life [5-8]. Although some evidence exists that longer working hours and shorter sleep duration are related to premature mortality [8,9], less is known about the relation between working hours and sleep duration and other relevant outcomes in older age such as functioning and quality of life. Furthermore, although working hours and sleep duration are related to each other e.g. insufficient recovery due to sleep deprivation is more common in individuals who have longer working hours [10], the combined association between these two has not been extensively investigated. Long working hours coupled with sleep deprivation might serve as a proxy to higher job strain [10], which, in turn, is associated with disability and premature mortality in older age [11,12]. Using data from a cohort of Finnish businessmen (the Helsinki Businessmen Study, HBS) we investigated whether work and sleep hours in midlife are associated with health-related quality of life (HRQoL) in old age, and if smoking and self-rated health (SRH) would explain the potential associations. This knowledge is useful since managers, entrepreneurs, and executives as well as also the general workforce, are continuously faced with long working hours [13], coupled with high pressures in terms of performance and extensive personnel responsibilities.

MATERIALS AND METHODS

The HBS cohort has been described in detail earlier [14]. Briefly, the present study population consisted of white men born between 1919 and 1934 who belonged to the highest social class with similar socioeconomic and working status. 2748 members of the original study cohort of 3490 had data available on work hours and sleep duration in 1974, and of these 1527 men completed the validated Finnish version of the RAND 36-Item Health Survey 1.0 (similar to the SF-36 Health Survey) [15] questionnaire in the year 2000. The follow-up studies of the HBS have been approved by the Ethics Committee of the Department of Medicine, Helsinki University Hospital, Finland.

In 1974 the cohort members were asked how many hours per week they had worked on average during the previous year regardless of where the work was done. Working hours were coded into normal work (≤50 hours/week, three highest quartiles) and long work (>50 hours/week, bottom quartile). The participants were asked how many hours per week they had slept on average during

the previous year including weekends. Sleep duration was coded into normal sleep (>47 hours/week, three lowest quartiles) and short sleep (≤47 hours/week, highest quartile). The cohort members were asked in 1974 about current smoking status (yes vs. no) and baseline SRH (answering alternatives were very good, fairly good, average, fairly poor and very poor of which the two latter ones were coded into one category "poor" due to few cases in the very poor category). [16]

The RAND-36 survey,[15] used for assessing HRQoL, comprises eight domains: Physical functioning (10 items), Role limitations caused by physical health problems (4 items), Role limitations caused by emotional problems (3 items), Vitality (4 items), Mental health (5 items), Social functioning (2 items), Bodily pain (2 items) and General health (5 items). Scores range from 0 to 100, with 100 representing the best level of functioning or wellbeing. A difference of 3–5 points in the RAND-36 domains is considered to be clinically important. [17]

Using generalized linear regression models we investigated the associations between working hours and sleep duration in midlife and HRQoL in old age. First we tested the interaction term for working hours*sleep duration in midlife on RAND-36 domains in old age and some of the terms were statistically significant (all $p>0.043$). Four categories of the combined variable of working hours and sleep duration were formed: 1) normal work and sleep n=942; 2) long work and normal sleep n=247; 3) normal work and short sleep n=233; and 4) long work and short sleep n=105. Adjustment was first made for age and then additionally for baseline smoking status and SRH. Modeling was performed with IBM SPSS version 22.0.

RESULTS

The mean age at baseline in 1974 was 47.2 (SD 4.0) and 73.2 (SD 4.0) years in 2000. The men who did not have the necessary data available both in 1974 and 2000 were older and they had poorer SRH (all $p<0.001$) at baseline, but there were no statistically significant differences in the amount of working hours or sleep duration in 1974. The age-adjusted mean values for each of the 8 RAND-36 domains according to the binary working hours and sleep duration variables are presented in Figure 1. In the age-adjusted analysis, the men with long compared to those with normal work had significantly poorer scores for Physical functioning and General health in old age ($p=0.007$ and $p=0.024$, respectively), and those with short sleep compared to those with normal sleep had a trend for poorer scores for Mental health ($p=0.054$).

Age-adjusted analyses on the combined categories of working hours and sleep duration are presented in Table 1. Although the effect sizes were small, compared to men with normal work and sleep in midlife, those with long work and short sleep had the poorest scores of Physical functioning, Vitality and General health, and those with long work and normal sleep reported poor Physical functioning in old age. After further adjustment for baseline smoking and SRH, only the association for long work and short sleep and Physical functioning remained statistically significant (difference in mean Physical functioning score -4.58, 95% CI -9.00 to -0.15, $p<0.043$) whereas the others were attenuated.

DISCUSSION

In this homogeneous cohort of older businessmen and executives, long working hours coupled with short sleep duration in midlife was associated with poorer physical functioning in old age during the 26-year follow-up. Allowing for age, smoking and SRH attenuated the association, but it remained significant suggesting an independent relationship. Although the effect sizes were small this is the first study to investigate these associations in midlife and old age in the highest socioeconomic strata.

Among businessmen, long working hours are likely to co-occur with high job demands [18] which are known to be related to adverse health outcomes and decreased physical and mental functioning in older age [19]. On the other hand, businessmen and executives are likely to have higher job control which has been shown to buffer the negative effects of high job demands [20].

There are several potential mechanisms that might explain the association between working hours and sleep duration and subsequent HRQoL. Long working hours limit the time that is left for recovery from the strain of the work day [10]. This insufficient recovery is related to a range of physiological changes such as elevated blood pressure and nervous system activity which subsequently may result in physical and psychological health problems. Furthermore, long working hours and sleep deprivation have been linked with an unhealthy lifestyle such as smoking and excessive use of alcohol [21], which are further linked with adverse health outcomes. This might also be why adjustment for smoking and SRH diluted the association between the combined midlife work/sleep variable and the RAND-36 domains in old age. These adjustments did not explain the entire relationship between working hours and sleep duration and subsequent HRQoL

in old age, which indicates that there was an independent association between the amount of work and sleep in midlife and the HRQoL assessed decades later.

The strengths of our study include the well-characterized sample of businessmen and executives who came from a homogenous background, and which has been followed up across several decades. HRQoL was assessed using the validated RAND-36 questionnaire [15]. Some limitations of the study should be recognized. The cohort comprised of men only. We did not have other measures of the work (e.g. job demand or control) available, also we used a self-reported measure of sleep and details of the quality of sleep are lacking. Furthermore, we had information on working hours and sleep duration from only one data collection point. However, the cohort members were asked to recall the previous year, and not only the previous few weeks. We categorized working hours and sleep duration according to quartiles rather than using standard cut-points. This was done because our study population did not represent the general labor force[18] and because of the timing of data collection. Employee working hours are regulated by the Working Hour Act [22], however, this Act does not apply to higher management. Additionally, we tested the quadratic terms for working hours and sleep duration and later HRQoL, but they were non-significant. This was done because there have been findings of u-shaped associations particularly between sleep duration and health outcomes.[8] Finally, as in all studies where individuals are followed up for a long time, cohort effects may limit the generalizability of the results to the present time. We studied businessmen, however, nowadays many employees are also subjected to long working hours and several administrative obligations and thus the present findings are likely to apply to a larger segment of the workforce than only businessmen.

In conclusion, we found that longer working hours coupled with shorter sleep duration in midlife was associated with poorer physical functioning in old age. Lifestyle factors such as smoking and health status did not entirely explain this association. The study showed that the working conditions in midlife, in this case work and sleep time, had long-term associations with physical functioning in old age several decades later. This finding indicates that the consequences of the work are apparent also in old age and should be therefore tackled in midlife or earlier in order to promote better health-related quality of life in older age.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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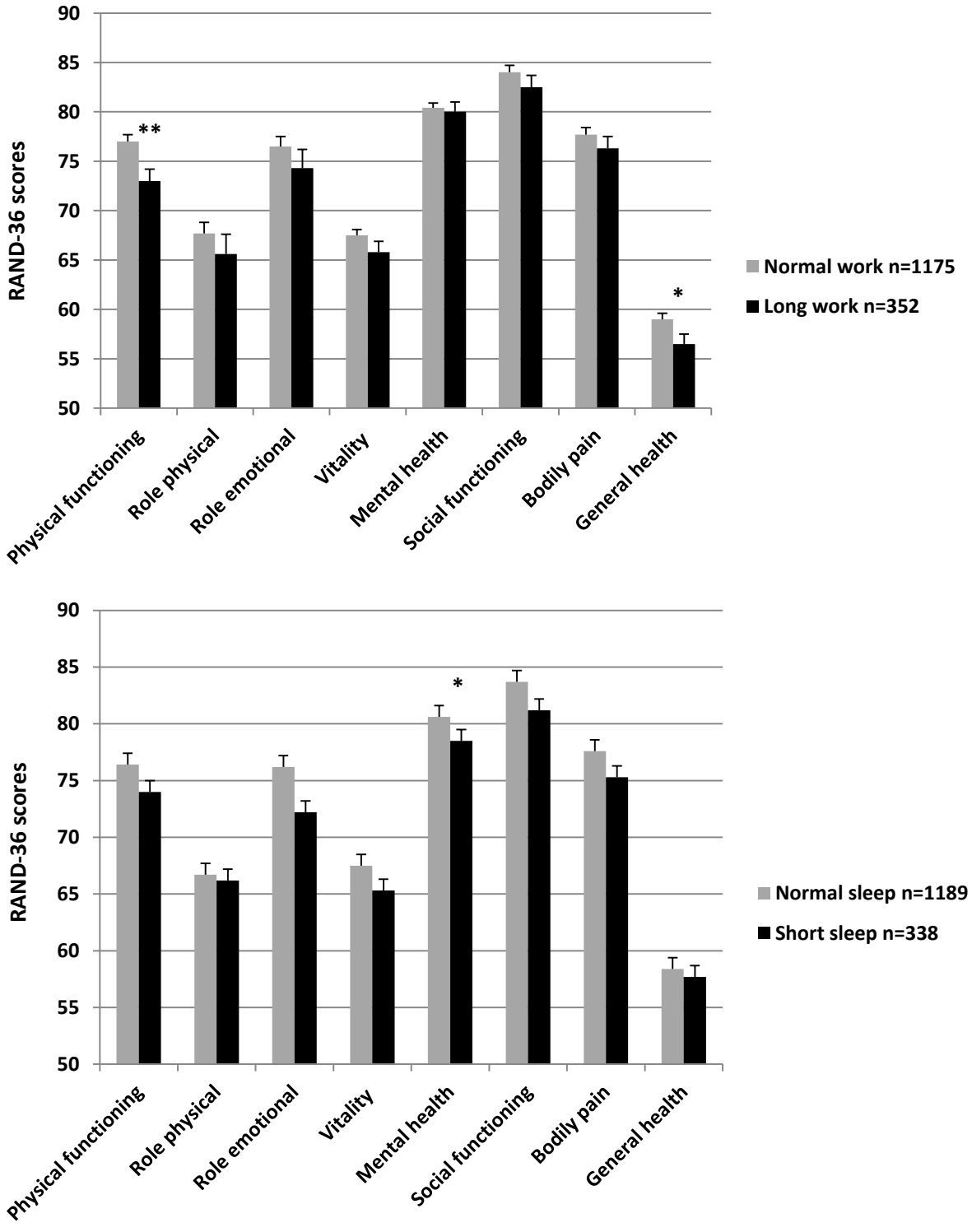
Figure 1 legend

Scores of the RAND-36 Domains in Old Age According to Working Hours and Sleep Duration in Midlife (Age-adjusted Means and Standard Errors Shown as Whiskers).

Figure 1.



Normal work: ≤50 hours/week; long work: >50 hours/week
Normal sleep: ≥48 hours/week; short sleep: <48 hours/week
*p<0.05, **p>0.01

Table 1. Unstandardized Regression Coefficients (β) and 95% Confidence Intervals (CI) for Scores of RAND-36 Domains in Old Age According to Work and Sleep Groups in Midlife

	Model 1 β (95% CI)*	**p**	**Model 2** β (95% CI)*	**p**
Physical functioning				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-3.38 (-6.45, -0.22)	0.036	-2.82 (-5.90, 0.26)	0.072
Normal work & short sleep	-1.55 (-4.76, 1.66)	0.35	-1.00 (-4.18, 2.18)	0.54
Long work & short sleep	-6.10 (-10.59, -1.62)	0.008	-4.58 (-9.00, -0.15)	0.043
Role limitations, physical				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-0.66 (-5.79, 4.48)	0.80	-0.20 (-5.31, 4.92)	0.94
Normal work & short sleep	1.11 (-4.22, 6.45)	0.68	1.62 (-3.72, 6.97)	0.55
Long work & short sleep	-4.48 (-12.01, 3.04)	0.24	-2.53 (-10.03, 4.98)	0.51
Role limitations, emotional				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-1.91 (-6.62, 2.80)	0.43	-0.53 (-5.31, 4.26)	0.83
Normal work & short sleep	-3.56 (-8.47, 1.36)	0.16	-1.43 (-6.08, 3.21)	0.55
Long work & short sleep	-6.40 (-13.35, 0.56)	0.072	-6.00 (-12.59, 0.60)	0.075
Vitality				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-0.24 (-3.04, 2.57)	0.87	0.07 (-2.67, 2.81)	0.96
Normal work & short sleep	-1.28 (-4.24, 1.67)	0.40	-0.48 (-3.38, 2.42)	0.75
Long work & short sleep	-4.26 (-8.41, -0.12)	0.044	-3.02 (-7.07, 1.04)	0.15
Mental health				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	0.86 (-1.52, 3.24)	0.48	0.97 (-1.38, 3.31)	0.42
Normal work & short sleep	-1.27 (-3.77, 1.24)	0.32	-0.63 (-2.98, 1.72)	0.60
Long work & short sleep	-3.20 (-6.70, 0.30)	0.073	-2.56 (-6.01, 0.90)	0.15
Social functioning				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-0.17 (-3.26, 2.91)	0.91	0.34 (-2.70, 3.38)	0.83
Normal work & short sleep	-1.67 (-4.93, 1.58)	0.31	-1.06 (-4.28, 2.17)	0.52
Long work & short sleep	-4.39 (-8.98, 0.21)	0.061	-3.15 (-7.68, 1.38)	0.17
Bodily pain				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-0.25 (-3.26, 2.76)	0.87	0.08 (-2.91, 3.07)	0.96
Normal work & short sleep	-1.61 (-4.75, 1.53)	0.31	-1.20 (-4.33, 1.93)	0.45
Long work & short sleep	-3.91 (-8.38, 0.56)	0.086	-2.69 (-7.13, 1.76)	0.24
General health				
Normal work & normal sleep	1.00		1.00	
Long work & normal sleep	-1.99 (-4.48, 0.50)	0.12	-1.35 (-3.75, 1.05)	0.27
Normal work & short sleep	0.06 (-2.56, 2.68)	0.97	1.05 (-1.48, 3.59)	0.42
Long work & short sleep	-3.78 (-7.45, -0.11)	0.043	-2.07 (-5.61 1.47)	0.25

Normal work: ≤50 hours/week; long work: >50 hours/week

Normal sleep: ≥48 hours/week; short sleep: <48 hours/week

Model 1 adjusted for age; Model 2 adjusted for age, smoking status, and SRH