ORIGINAL RESEARCH

Commuting time to work and behaviour-related health: a fixed-effect analysis

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ABSTRACT

Objectives Long commuting times are linked to poor health outcomes, but the evidence is mainly cross-sectional. We examined longitudinal within-individual associations between commuting time and behaviour-related health.

Methods Data were from the Swedish Longitudinal Occupational Survey of Health study. We selected workers who responded to a minimum of two surveys conducted every other year between 2008 and 2018. We included all study waves with self-reported commuting time (ie, the exposure, 1–5, 6–10, 11–15 or ≥15 hours/week), body mass index (based on weight and height), physical (in)activity, smoking, alcohol use and sleep problems (ie, the outcomes) ($N_{individuals}$=20 376, $N_{observations}$=46 169). We used conditional logistic regression for fixed effects analyses that controls for time-varying confounders by design. Analyses were stratified by working hours: normal (30–40 hours/week) or longer than normal (>40 hours/week) and adjusted for time dependent covariates: age, marital status, occupational position, presence of children, chronic disease, depressive symptoms, job strain and shift work.

Results Those working >40 hours/week had higher odds of physical inactivity (OR 1.25, 95% CI 1.03 to 1.51) and sleep problems (OR 1.16, 95% CI 1.00 to 1.35) when they were commuting >5 hours/week than when they were commuting 1–5 hours/week. Among women working normal hours, longer commuting time associated with lower odds of problem drinking.

Conclusion Our findings suggest that lengthy commuting time increases the risk of physical inactivity and sleep problems if individuals have longer than normal weekly working hours. Effects of work arrangements that decrease commuting time should be examined in relation to health behaviours.

Key messages

What is already known about this subject?

- ► Most adults' daily schedules are determined by their work including the time spent on working and commuting to the workplace that affect their use of time and health behaviours.
- ► Associations between long commuting time and poor health behaviours have been observed, mostly in studies from the USA or Australia.
- ► Few of the prior studies have examined these associations longitudinally using within-individual approach that controls for time-invariant unmeasured confounders.

What are the new findings?

- ► In a relatively representative sample of Swedish working population, we observed that individuals working >40 hours/week had higher odds of physical inactivity and sleep problems when they commuted more than an hour a day when compared with time when they commuted less.
- ► Women working 30-40 hours/week had lower odds of problem drinking when they commuted more than an hour a day when compared with time when they commuted less.

How might this impact on policy or clinical practice in the foreseeable future?

- ► Different work arrangements should be examined as possible factors that could decrease the weekly commuting time, and increase time used for physical activity and sleep.

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BACKGROUND

Poor health behaviours and obesity are risk factors for several non-communicable diseases including cardiovascular diseases that are still the leading cause of death globally.[1] People's behaviours are affected by their use of time. Part of most adults' daily schedules is determined by their work including the time spent on working and commuting to the workplace. Long working hours have been associated with lower levels of physical activity in some[2] but not all[3] studies. Associations have been reported also for smoking,[2] shortage of sleep,[2] higher weight and waist circumferences,[4] and weight gain.[5] Commuting may cause further time restrictions to an individual which may limit adherence to healthy lifestyle. Indeed, associations have been reported between long commuting times and health-related factors including lower physical activity levels,[6] shorter sleep duration,[6 7] poorer perceived sleep quality,[8] poorer mental health,[9] lower psychological well-being (if commuting mode was other than walking)[10] and health satisfaction[11] as well as higher level of health complaints.[12] In one study, average commuting time of workers age 16 years and older living in a residential neighbourhood was associated with obesity, although the associations varied by the degree of urbanisation.[13]

The suggested mechanisms for these associations include scarcity of time available for sleep, physical

activity or preparation or access to of healthy food.[6 14] Fast-food or quickly prepared meals, for example, are often processed or non-grocery meals that are less healthy than self-prepared ones possibly contributing to weight gain. Most of the evidence regarding associations between commuting time and health is, however, from cross-sectional studies,[6–8 13] and this setting may also explain the null findings reported for an association between commuting time and waist circumference.[15] Moreover, most of the studies have been conducted in the USA[6 7 13] or Australia,[9] while the commuting cultures may be different in Europe.

To shed light on the role of commuting time in health behaviours and the obesity epidemic in Europe, we examined longitudinal associations between commuting time and overweight, obesity, physical inactivity, smoking, problem drinking and sleep problems adjusting for possible confounders. We used repeated measurements of the commuting time and the outcomes and applied a fixed-effect analysis which uses individuals as their own controls. This approach controls for all time-invariant measured and unmeasured confounders by design.[16] The associations were examined separately among those with normal and longer than normal weekly working hours because the effect of commuting time may depend on working hours and long working hours are associated with obesity and related health behaviours.[2 3 5 17]

METHODS

Study population

The study population consisted of the Swedish Longitudinal Occupational Survey of Health (SLOSH) study participants. This nationally representative longitudinal cohort study focuses on work life participation, social situation, as well as health and well-being. The SLOSH cohort comprises participants of Swedish Work Environment Surveys (SWES),[18] who have originally been sampled from the Labor Force Survey by Statistics Sweden.[19] Participants were from the entire country, gainfully employed and 16–64 years of age at the time of enrolment into the SWES. The first SLOSH survey was conducted in 2006 to which respondents of SWES 2003 were invited. They responded to self-completion questionnaires that were different for those continuing to work or working very little or not at all at the time. Since then, the SLOSH follow-up surveys have been conducted in 2-year intervals, and the cohort has successively grown with new participants recruited from the 2005, 2007, 2009 and 2011 SWES participants.[18]

For this study, the first SLOSH survey from 2006 was excluded as the data on the variables needed in our analyses were differently collected. We included participants who responded to a minimum of two SLOSH surveys between 2008 and 2018 (N individuals=29 008, N observations=174 048). Thus, the time between two surveys could vary between 2 (subsequent surveys) and 10 years (if responded in 2008 and 2018). We excluded those individuals who had missing data for commuting time or reported commuting 0 hours/week (n=5754), those who had missing data for working hours (n=183) and those who had missing data on any of the covariates (n=447). Thus, the study sample included 22 624 participants with 55 256 observations. Many of the excluded individuals had responded to more than two surveys contributing to the higher total N of observations (174 048), and thus the exclusions reduced the total observations of our study sample.

Exposure

Information on time used for commuting was identically collected by surveys in 2-year intervals between 2008 and 2018 by requesting the hours used for commuting to work and back during a normal work week. The response alternatives were: 0 hours/week, 1–5 hours/week, 6–10 hours/week, 11–15 hours/week and >15 hours/week. In the analyses, we excluded those reporting 0 hours/week and used the 1–5 hours/week as the reference group. In addition to the multicategory commuting time variable that was based on the response alternatives, analyses were conducted using a dichotomised commuting time variable categorised into >5 vs 1–5 hours/week. Commuting >5 hours/week corresponds on average to >30 min/one-way commute on 5 days a week.

Outcomes

All outcome variables were collected in each survey between 2008 and 2018. The questions used were identical in each survey for all variables except alcohol use. The participants reported their weight in kg and height in cm and body mass index (BMI) was calculated as weight in kg divided by height in m^2. BMI was dichotomised as: overweight (BMI 25–29.9) versus normal weight (BMI 18–24.9), and as obese (BMI ≥30) versus overweight (BMI 25–29.9).

Physical activity was inquired by asking respondents how much they exercised in general, including walking or biking to work and leisure time activities. Physical inactivity was categorised as 'inactive' if response alternative was never or seldom performing physical activity versus 'active' (the reference group) if response alternative was physically active every now and then or regularly.

Smoking status was based on a question: *Do you smoke?* and it was dichotomised into 'smokers' (daily or occasional smokers) and 'non-smokers' (never or former smokers).

Excessive alcohol consumption was determined using the alcohol use disorders identification test (AUDIT) in 2008 and the Cut-Annoyed-Guilty-Eye Questionnaire (CAGE) in 2010–2018. Men reporting drinking ≥21 units/week and women ≥14 units/week, or drinking six or more units per occasion at least weekly based on AUDIT, and men and women reporting at least two problem drinking behaviours according to CAGE indicated problem drinking.[20]

Sleep problems were assessed based on the sleep disturbance scale of the Karolinska Sleep Questionnaire[21 22] with questions on difficulties falling asleep, restless sleep, repeated nocturnal awakenings and premature awakening. For each question, there were six response alternatives: (1) never, (2) rarely, (3) few times per month, (4) 1–2 times per week, (5) 3–4 times per week and (6) five or more times per week. Presence of sleep problems was defined as having one or more sleep problems 3–4 times a week or more often.[23 24]

Covariates

As covariates, we selected factors acknowledged in prior literature to be related to commuting activities or health behaviours.[6–8] Demographic variables age and occupational position (low, intermediate, high, self-employed) were from registers. Information on civil status (married/cohabiting vs not) and all other possible covariates were self-reported. Presence of children was defined as reporting having one or more children under 12 years. Working hours were reported as weekly hours; number of hours in 2008, by 5-hour categories in 2010 (starting from <35 hour/week), by 10 hours categories in 2012 and 2014 (starting from

<10 hours/week), and by 5-hour categories in 2016 (starting from <10 hours/week). Short working hours were defined as <30 hours/week, except for year 2010 where this category was <35 hour/week. Normal working hours were 30–40 hours/week (for 2010 36–40 hours/week), and longer than normal hours were defined as >40 hours/week.

Of health-related variables, we included chronic diseases (any of the following, during past 2 years, indicated a chronic disease: hypertension, cardiovascular disease, diabetes, rheumatic disorders and musculoskeletal disorders), and symptoms of depression. The latter were assessed using a six-item subscale of the (Hopkins) Symptom Checklist (SCL) resulting in SCL-Core Depression scale.[25 26] Respondents were instructed to score on a 5-category scale the extent that they (1) felt blue, (2) had no interests in things, (3) were lethargic or low in energy, (4) were worrying too much about things, (5) blamed oneself for things and (6) felt everything is an effort. We summed the responses for each item to get a continuous scale assessing the severity of depression. For the analyses, we formed a binary variable for depressive symptoms using a cut-off score of ≥17 which has been suggested as a suitable threshold value for major depression in epidemiological research.[25] Based on Karasek's job demand-control model,[27] a Demand Control Questionnaire with five job demand items and six control items was used to measure job demands and control.[28] The cut-offs for high psychological demand and low degree of control were set to the median for each survey. Those classified as having both high psychological demands and low level of job control were classified as having job strain. Work schedules were requested in nine categories and were used to define shift work. No shift work meant daytime work between 06:00 and 18:00, and any other type of scheduling system was classified as shift work; evening and night work, shift work with and without night work, roster work with and without night work, and irregular and 'other' work times.

Statistical analyses

We used fixed effects method with conditional logistic regression models (LOGISTIC procedure of SAS). In this method, individual serves as his/her own control and the time invariant factors such as sex, genetics and personality are controlled for by the design. These models used information from those that in relation to the outcome were in one survey cases (ie, obese, inactive, smoker or had sleep problems) and in another survey non-cases (ie, controls; normal or overweight, active, non-smoker or no sleep problems). Thus, all participants providing information for the analysis must have had a change in the outcome, and some participants must have had change in the exposure. The analyses examined whether commuting times differed when the participant was case compared with time when she/he was her/his own control. Thus, changes in the outcome to both directions are considered. The effect estimates in this work indicated the odds of the outcome at a time point when commuting time was longer (6–10, 11–15 and >15 hours) compared with a time point when commuting time was 1–5 hours/week (reference) for that same person.

Long working hours are known to be associated with the included outcomes,[2 4 5 29] thus, the associations were a priori stratified by length of weekly working hours. P values for interactions between working hours and commuting time varied between <0.001 for sleep problems and 0.89 for obesity. As the fixed effects models used information only from those who were cases in one survey and non-cases in another survey, and for whom the commuting time also changed, the group with short working hours lacked power for feasible analyses (eg, n=221 for smoking and n=231 for problem drinking). Thus, all analyses were carried out only in the groups of normal (30/36–40 hours/week) and longer than normal (>40 hours/week) working hours form 20 376 individuals with 46 169 observations. We first ran models adjusting for age (model 1). These models were further adjusted for time-dependent covariates: occupational position, marital status and presence of children (model 2); chronic disease and depressive symptoms (model 3); job strain and shift work (model 4). Prevalence of poor health behaviours[30 31] and long working hours[32] often varied by sex, thus, effect modification by sex was assessed including an interaction term 'commuting time×sex' in the regression models for each outcome. Finally, as the time interval between two surveys could be up to 10 years, we did a sensitivity analysis by restricting the study sample to those with maximum of 4 years between the two surveys. Results are presented as ORs with 95% CIs. All analyses were performed using SAS V.9.4.

RESULTS

Descriptive statistics of the study population at the first survey by working hours and commuting time are presented in table 1. Sex distributions varied by working hour groups; the longer the working hours, the smaller the proportion of women. The proportion of those with high occupational position also increased with longer working hours. Mean age of the study population at baseline was 48.2 (SD=10.5) among those with normal working hours, and 48.4 (SD=10.2) among those with longer than normal working hours. Of the commuters, 2270 (14%) had one, 871 (4%) had two, 173 (1%) had three, 38 (0.2%) had four and 5 (<0.1) had five changes in commuting time.

Table 2 presents the age-adjusted associations for all outcomes for normal and longer than normal working hour categories. Among those with normal working hours, no associations were observed with any of the outcomes. Among those with longer than normal working hours, the odds of physical inactivity and sleep problems were increased if commuting time was >5 vs 1–5 hours/week. Effect estimates for overweight and obesity increased with increasing commuting time (p value for trend <0.001), but the associations were statistically non-significant. Of the tested interactions, only that between commuting time and sex was statistically significant in the model for problem drinking among those with normal working hours (p value for interaction 0.03). When commuting time was >5 vs 1–5 hours/week, the age-adjusted effect estimate for problem drinking was positive (OR 1.25, 95% CI 0.65 to 2.41) for men, but negative (OR 0.51, 95% CI 0.25 to 0.98) for women.

In online supplementary table 1, we present the effect estimates from models adjusted for the other covariates among those with normal working hours. The adjustments had minor effect on the effect estimates and no associations were observed with any of the outcomes.

Table 3 presents the effect estimates from models adjusted for the other covariates among those with longer than normal working hours. Odds of physical inactivity were increased and reached statistical significance in the commuting category 6–10 vs 1–5 hours/week: OR 1.28 (95% CI 1.05 to 1.56). For sleep problems, the magnitude of the effect estimates increased with increasing commuting time, but only the estimate for >5 vs 1–5 hours/week reached statistical significance (OR 1.16, 95% CI 1.00 to 1.35). The protective association between commuting time and problem drinking among women with normal working

Table 1 Description of the study participants in the first and last measurement points by duration of weekly working hours

	Normal working hours (30/36–40 hours/week) n=7645		Long working hours (>40 hours/week) n=11 690	
Commuting time	**1–5 hours/week**	**>5 hours/week**	**1–5 hours/week**	**>5 hours/week**
Covariates	**N (%)**	**N (%)**	**N (%)**	**N (%)**
All participants	5968 (87)	975 (13)	8738 (75)	2952 (25)
Women	3741 (62)	975 (58)	4037 (46)	1300 (44)
Presence of children	1768 (27)	540 (32)	2352 (27)	803 (27)
Marital status				
Cohabiting	4721 (79)	1326 (79)	7026 (80)	2316 (78)
Occupational position				
Low	2404 (40)	483 (29)	2133 (25)	521 (18)
Intermediate	2685 (45)	800 (48)	4037 (46)	1317 (45)
High	769 (13)	370 (22)	2290 (26)	1039 (35)
Self-employed	110 (2)	24 (1)	278 (3)	75 (2)
Chronic disease	2365 (40)	636 (38)	3432 (39)	1188 (40)
Depressive symptoms	933 (16)	271 (16)	1384 (16)	511 (17)
Job strain	1218 (20)	366 (22)	1716 (20)	590 (20)
Shift work	1725 (29)	384 (23)	1526 (17)	500 (17)
Outcomes				
BMI				
Normal weight	2959 (51)	799 (49)	4000 (47)	1309 (46)
Overweight	2156 (37)	624 (38)	3337 (39)	1139 (40)
Obese	713 (12)	212 (13)	1138 (14)	400 (14)
Physically inactive	933 (17)	317 (21)	1582 (20)	614 (23)
Smoking	817 (14)	207 (12)	987 (11)	318 (11)
Problem drinking	353 (6)	113 (7)	591 (7)	203 (7)
Sleep problems	1042 (18)	352 (21)	1584 (18)	592 (20)

BMI, body mass index.

hours remained similar after full adjustments (OR 0.50, 95% CI 0.25 to 1.00, for >5 vs 1–5 hours/week).

Restricting the analysis to those with maximum of 4 years between the two surveys decreased the sample size and attenuated the effect estimates slightly; fully adjusted OR for physical inactivity was 1.23 (95% CI 0.95 to 1.59, N observations informative 2156) and that for sleep problems 1.13 (95% CI 0.93 to 1.38, N observations informative 3718).

DISCUSSION

These longitudinal findings suggest that commuting for more than an hour per day increases the odds of physical inactivity and sleep problems among those working more than 40 hours/week. The only association observed among those reporting normal weekly working hours was that between longer commuting time and lower odds of problem drinking among women.

As most prior studies on commuting time and health behaviours have been cross-sectional and not examined the associations by length of working hours, those findings and ours are not directly comparable. However, prior cross-sectional studies from the USA have reported associations between longer commuting times and shorter sleep duration,[6 7] and one Swedish study has also reported associations between commuting 30–60 min/day by car or >60 min/day by public transportation and poor perceived sleep quality,[8] while adjusting for working hours. These findings are in line with ours for sleep problems, though the associations were observed only among those with longer than normal working hours. In this group, we also observed that longer commuting time was associated with physical inactivity, which agrees with the cross-sectional findings by Christian et al.[6] Possible mechanisms for this include scarcity of time for physical activity, but also fatigue due to long working hours and commuting time that may affect the level of activity.

Sex-differences were observed only for problem drinking when weekly working hours were normal. Reasons for the observed association between longer commuting time and lower odds of problem drinking among women, but not among men, are unclear. In an earlier meta-analysis, no sex-difference was observed for association between long working hours and risky alcohol use.[29] One possible explanation for our findings is that longer commuting time is associated with a higher probability of driving for commuting which could lead to avoidance of problem drinking.

In these data, a trend between longer commuting time and an increased risk of obesity was observed among those working longer than normal weekly hours, although the associations were non-significant possibly due to limited power. Association between commuting time and obesity has previously been reported only for neighbourhood-level commuting time,[13] while a longitudinal study from the UK reported no association between commuting time and continuous BMI.[11] Our findings for decreased physical activity and positive trend for obesity in relation to commuting time suggest that the mediating role of physical inactivity and sleep problems in the associations between long commuting time and obesity should be further examined.

Limitations and strengths

There are limitations to this study that should be considered when interpreting the findings. Both exposure and outcome variables were self-reported, which may introduce same source

Table 2 Age adjusted associations between commuting time and behaviour-related health outcomes

	Normal working hours			Long working hours		
Commuting time	$N_{observations}$*	OR	95% CI	$N_{observations}$*	OR	95% CI
Overweight (vs normal)	1469			3371		
1–5		1			1	
6–10		1.00	0.70 to 1.43		1.07	0.85 to 1.35
11–15		0.97	0.45 to 2.11		1.13	0.73 to 1.74
>15		1.17	0.35 to 3.86		1.44	0.65 to 3.17
1–5		1			1	
>5		1.01	0.72 to 1.41		1.08	0.87 to 1.36
Obesity (vs overweight)	861			1966		
1–5		1			1	
6–10		0.87	0.51 to 1.49		0.98	0.71 to 1.34
11–15		0.87	0.29 to 2.62		1.28	0.73 to 2.24
>15		1.69	0.32 to 8.97		1.36	0.62 to 2.97
1–5		1			1	
>5		0.89	0.53 to 1.50		1.03	0.76 to 1.40
Physical inactivity	1720			474		
1–5		1			1	
6–10		1.10	0.80 to 1.51		1.28	1.05 to 1.56
11–15		1.00	0.50 to 1.99		1.18	0.82 to 1.71
>15		1.17	0.37 to 3.68		0.91	0.50 to 1.66
1–5		1			1	
>5		1.09	0.80 to 1.48		1.24	1.03 to 1.51
Smoking	668			1376		
1–5		1			1	
6–10		1.01	0.59 to 1.74		0.95	0.67 to 1.35
11–15		0.57	0.17 to 1.97		1.05	0.50 to 2.20
>15		1.29	0.11 to 15.27		1.10	0.37 to 3.30
1–5		1			1	
>5		0.99	0.58 to 1.70		0.97	0.69 to 1.35
Problem drinking	798			2183		
1–5		1			1	
6–10		0.91	0.57 to 1.47		1.20	0.91 to 1.59
11–15		0.40	0.16 to 1.02		1.05	0.60 to 1.83
>15		0.42	0.09 to 1.91		1.32	0.51 to 3.45
1–5		1			1	
>5		0.80	0.51 to 1.25		1.19	0.91 to 1.55
Sleep problems	2811			6720		
1–5		1			1	
6–10		1.09	0.84 to 1.41		1.12	0.96 to 1.30
11–15		0.95	0.56 to 1.61		1.30	0.98 to 1.74
>15		0.55	0.23 to 1.34		1.39	0.86 to 2.24
1–5		1			1	
>5		1.04	0.81 to 1.33		1.15	0.99 to 1.33

*Number of observations informative in the analysis, that is, those with change in the outcome. Observations with no change in the outcome were excluded from the analyses.

bias, which relates to the possibility that those reporting longer commuting times may also report poorer health outcomes, or vice versa. If this was the case, the findings could overestimate the true associations. On the other hand, people are often more likely to report their health behaviours in the more positive direction (desirability bias)[33] which may have attenuated the observed associations. However, we used fixed effect analyses, a method controlling for all stable differences between the participants, such as negative affectivity or response style. Thus, same source and desirability are unlikely as major sources of bias. Another limitation is that our physical activity measure included possible active commuting to work, and overall, we had no information on the mode of commuting, which may have confounded the investigated relations. For example, active transport has been associated with lower body weight[34] and public transportation has been linked to higher levels of low to moderate activity,[35] while these commuting modes are also likely to increase commuting time when compared with driving. We had no information on the reasons for change in commuting time. It is possible that, for instance, an onset of an illness is associated with both a change in health behaviours and commuting time. Future studies could examine whether voluntary change in commuting time affects less the health behaviours when compared with involuntary change. Furthermore, the number of participants in the highest commuting time category was low and we thus may have lacked power to detect associations in this category.

Table 3 ORs for physical inactivity and sleep problems by commuting time among those with long working hours with additional adjustments

	Model 2		Model 3		Model 4	
Commuting time ($N_{observations}$)*	OR	95% CI	OR	95% CI	OR	95% CI
Overweight (vs normal) (3317)						
1–5	1		1		1	
6–10	1.08	0.86 to 1.37	1.09	0.86 to 1.37	1.09	0.86 to 1.37
11–15	1.12	0.72 to 1.74	1.13	0.72 to 1.76	1.13	0.72 to 1.76
>15	1.57	0.71 to 3.47	1.53	0.69 to 3.39	1.53	0.69 to 3.38
1–5	1		1		1	
>5	1.10	0.87 to 1.38	1.10	0.88 to 1.38	1.10	0.88 to 1.38
Obesity (vs overweight) (1966)						
1–5	1		1		1	
6–10	0.96	0.70 to 1.31	0.96	0.70 to 1.32	0.96	0.70 to 1.32
11–15	1.24	0.71 to 2.19	1.26	0.71 to 2.21	1.24	0.70 to 2.19
>15	1.28	0.58 to 2.81	1.30	0.59 to 2.86	1.26	0.57 to 2.77
1–5	1		1		1	
>5	1.01	0.74 to 1.36	1.01	0.75 to 1.38	1.01	0.74 to 1.37
Physical inactivity (4074)						
1–5	1		1		1	
6–10	1.27	1.04 to 1.55	1.28	1.05 to 1.56	1.28	1.05 to 1.56
11–15	1.17	0.81 to 1.69	1.16	0.80 to 1.67	1.16	0.80 to 1.68
>15	0.89	0.49 to 1.63	0.89	0.49 to 1.64	0.90	0.49 to 1.66
1–5	1		1		1	
>5	1.23	1.02 to 1.49	1.24	1.02 to 1.50	1.25	1.03 to 1.51
Smoking (1376)						
1–5	1		1		1	
6–10	0.94	0.66 to 1.33	0.92	0.65 to 1.32	0.92	0.64 to 1.31
11–15	1.02	0.49 to 2.14	1.03	0.49 to 2.16	1.04	0.50 to 2.17
>15	1.15	0.38 to 3.48	1.16	0.38 to 3.49	1.06	0.35 to 3.24
1–5	1		1		1	
>5	0.95	0.68 to 1.34	0.94	0.67 to 1.33	0.93	0.66 to 1.31
Problem drinking (2183)						
1–5	1		1		1	
6–10	1.20	0.91 to 1.59	1.20	0.91 to 1.59	1.19	0.90 to 1.58
11–15	1.05	0.60 to 1.83	1.05	0.61 to 1.84	0.99	0.56 to 1.73
>15	1.32	0.51 to 3.45	1.28	0.49 to 3.34	1.07	0.41 to 2.82
1–5	1		1		1	
>5	1.19	0.91 to 1.55	1.16	0.89 to 1.53	1.17	0.89 to 1.53
Sleep problems (6720)						
1–5	1		1		1	
6–10	1.12	0.96 to 1.30	1.12	0.96 to 1.31	1.13	0.97 to 1.32
11–15	1.30	0.98 to 1.74	1.31	0.98 to 1.75	1.29	0.96 to 1.74
>15	1.39	0.86 to 2.24	1.40	0.87 to 2.26	1.45	0.88 to 2.38
1–5	1		1		1	
>5	1.15	0.99 to 1.33	1.16	1.00 to 1.34	1.16	1.00 to 1.35

Model 2 adjusted for age, cohabiting, presence of children and occupational position.
Model 3 adjusted for age, cohabiting, presence of children, occupational position, chronic disease and depressive symptoms.
Model 4 adjusted for age, cohabiting, presence of children, occupational position, chronic disease, depressive symptoms, job strain and shift work.
*Number of observations informative in the analysis, that is, those with change in the outcome. Observations with no change in the outcome were excluded from the analyses.

However, we also used the dichotomised exposure variable to ensure enough participants in the examined exposure groups. Nevertheless, new studies from regions where commuting times are generally longer would provide more insight into how much commuting time affects health behaviours and health.

The main strengths of this study include the large study sample relatively representative of the Swedish working population. Thus, the findings are generalisable to Swedish workers in general, while generalisability to specific groups of workers or countries where working cultures are broadly different should be done with caution. Additional strengths are the longitudinal study setting and use of the fixed-effects method where everyone is his/her own reference and thereby all time-invariant confounders are controlled for by the study design.

In summary, our findings suggest that commuting more than an hour per day increases the odds of being physically inactive and having sleep problems if combined with working hours exceeding 40 hours/week. Different work arrangements should be examined as possible factors that could decrease the weekly

commuting time, and increase time used for physical activity and sleep.

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