

BMJ Open Effect of work schedule on prospective antidepressant prescriptions in Sweden: a 2-year sex-stratified analysis using national drug registry data

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ABSTRACT

Introduction Depression-related mood disorders affect millions of people worldwide and contribute to substantial morbidity and disability, yet little is known about the effects of work scheduling on depression. This study used a large Swedish survey to prospectively examine the effects of work schedule on registry-based antidepressant prescriptions in females and males over a 2-year period.

Methods The study was based on an approximately representative sample (n=3980 males, 4663 females) of gainfully employed participants in the Swedish Longitudinal Occupational Survey of Health. Sex-stratified analyses were conducted using logistic regression. For exposure, eight categories described work schedule in 2008: 'regular days' (three categories of night work history: none, ≤3 years, 4+ years), 'night shift work', 'regular shift work (no nights)', 'rostered work (no nights)', 'flexible/non-regulated hours' and 'other'. For the primary outcome measure, all prescriptions coded N06A according to the Anatomical Therapeutic Chemical System were obtained from the Swedish National Prescribed Drug Register and dichotomised into 'any' or 'no' prescriptions between 2008 and 2010. Estimates were adjusted for potential sociodemographic, health and work confounders, and for prior depressive symptoms.

Results In 2008, 22% of females versus 19% of males worked outside of regular daytime schedule. Registered antidepressant prescription rates in the postsurvey period were 11.4% for females versus 5.8% for males. In fully adjusted models, females in 'flexible/non-regulated' schedules showed an increased OR for prospective antidepressant prescriptions (OR=2.01, 95% CI=1.08 to 3.76). In males, odds ratios were most increased in those working 'other' schedules (OR=1.72, 95% CI=0.75 to 3.94) and 'Regular days with four or more years' history of night work' (OR=1.54, 95% CI=0.93 to 2.56).

Conclusions This study's findings support a relationship between work schedule and prospective antidepressant prescriptions in the Swedish workforce. Future research should continue to assess sex-stratified relationships, using detailed shift work exposure categories and objective registry data where possible.

INTRODUCTION

An individual's work schedule characteristics may bear an important influence on

Strengths and limitations of this study

- Two-year longitudinal design.
- Based on a large national survey (the Swedish Longitudinal Occupational Survey of Health) with detailed information on workplace, demographic and social characteristics.
- Addresses a number of common methodological limitations in shift work research through its use of detailed exposure assessment, objectively recorded health outcome measures and sex-stratified analyses.
- Other characteristics that have been linked with negative mental health outcomes, such as long weekly working hours, short shift durations and the presence/characteristics of shift rotations should also be considered in future studies.

their mental health. On the one hand, high levels of work time control have been linked to positive health outcomes such as affective well-being and perceived stress. On the other hand, shift work has been linked to increased symptoms of depression and negative mood compared with regular day work.¹⁻⁴ Shift workers may be at increased risk of developing mental disorders such as depression due to biological and social disturbances that are caused by their work schedules.^{5 6} Sleep disturbances in shift workers are well documented⁷⁻⁹; these represent the most widely reported circadian disruptions associated with depression.¹⁰ Exposure to light-at-night has also been linked to mental health effects, both directly and through its suppression of melatonin.¹¹⁻¹³ Finally, the social zeitgeber theory postulates that stressful life events may trigger depressive episodes by disrupting social routines.⁶

Depressive disorders are prevalent in western countries,¹⁴ and contribute to substantial morbidity and disability worldwide.^{15 16} However, studies of the association between work schedule and clinically

verified mental illness such as depression remain relatively scarce. Furthermore, methodological challenges are an important limitation when examining associations between work schedule and mental health.¹⁷ First, a lack of clear and well defined exposure definitions increase the potential for measurement error and misclassification bias¹⁸ that can attenuate effect estimates, as shown in prior analyses of shift work and depression.¹⁹ Second, mental health outcomes are often measured through subjective reporting, that is more susceptible to bias compared with objective health outcome data, particularly given the social stigma attached to poor mental health.²⁰ Third, sex-stratified analyses are biologically valid and important to conduct yet this is not always done; an important consideration since both work schedule²¹ and rates of reported depressive disorders¹⁶ are known to differ across males and females. There is some evidence of differential impacts of shift work on mental health by sex^{22 23} although the evidence is inconsistent across studies. Finally, self-selection of individuals in to and out of jobs with non-standard work hours (the 'healthy worker effect') can bias results towards underestimated effects and is particularly problematic when past exposures are not accounted for.

To address these challenges, the present study used data from the Swedish Longitudinal Occupational Survey of Health (SLOSH).²⁴ This large national survey collected detailed information on workplace, demographic and social characteristics, and can be linked to national health registries in Sweden. We examined the prospective effect of work schedule (using detailed categories that considered prior night work history) on antidepressant prescription rates (using objective measures obtained via linkage to a national health registry), in females and in males, over a 2-year period.

Shift work, especially where it involves night work, could be expected to increase rates of antidepressant prescriptions, due to the chronic disruption of circadian rhythms, sleep and social routines. Female shift workers are expected to show higher prescription rates than their male counterparts, due to the double burden of shift working and family responsibilities,²⁵ higher emotional job demands²⁶ and possible psychobiological gender differences in the impact of circadian disruption.²⁷ The impact of flexible work hours on antidepressant prescription rates is more difficult to predict. While having control over one's work hours is potentially beneficial, it may also lead to overwork. Thus, no predictions were made with respect to associations between flexible work and antidepressant prescription rates.

METHODS

Patient and public involvement

This study is based on an approximately representative sample of gainfully employed Swedish individuals participating in SLOSH. SLOSH is a follow-up of Swedish Work Environment Survey participants, a biennial sample of

gainfully employed individuals drawn from the Swedish Labor Force Survey. The general aim of SLOSH is to investigate longitudinal relationships between work environment (particularly psychosocial aspects), labour market participation, and health and well-being, among others.

Participants were not directly involved in any part of the current study; information about research results is provided to all participants by means of a public web page (www.slosh.se).

Study sample

The baseline study sample was drawn from the n=9756 participants who were currently working in the 2008 SLOSH survey wave (this wave was chosen since it yielded a relatively large number of respondents, and collected information on history of night work). This sample was limited to respondents who provided valid answers for work schedule (excluded n=195), who did not work a regular evening schedule due to small numbers in this category (excluded n=58), who worked between 8 and 70 hours per week (excluded n=25 reporting fewer than 8 hours per week, n=12 reporting more than 70 hours per week and n=355 with missing data) and who provided valid answers for all other variables included in the models. This produced an analytic sample of n=8643 respondents in the 2008 SLOSH wave.

Primary exposure and outcome

Eight categories were used to describe work schedule in 2008: 'regular days with no history of night work', 'regular days with history of night work ≤ 3 years', 'regular days with history of night work ≥ 4 years', 'night work (regular, rostered or rotating)', 'regular shift work (no nights)', 'rostered work (no nights)', 'flexible/non-regulated hours' and 'other'. Regular shift work involves working a set of invariantly timed shifts that cycle according to fixed sequence. Rostered work also involves invariantly timed shifts, but the sequence is more ad hoc such that the employee has relatively short notice of which shifts they will be working. Flexible/non-regulated hours involve duty-periods that could vary both with respect to the start and finish times, and which days are worked.

Data on antidepressant medication prescriptions were obtained from the Swedish National Prescribed Drug Register. This register contains information on all prescribed drugs dispensed from Swedish pharmacies since July 2005 (except for those given in hospitals or nursing homes). These data were anonymously linked to survey respondents through registered personal identification numbers. All Drug Register prescriptions coded N06A according to the Anatomical Therapeutic Chemical System²⁸ were extracted for the analyses. A dichotomous variable ('yes' or 'no' was created to describe any antidepressant prescriptions registered between 17 June 2008 and 31 December 2010, representing a period of approximately 2.5 years following the 2008 survey wave; 17 June 2008 represents the date on which 75% of responses were received from the 2008 SLOSH wave participants.

Analyses

Logistic regression models were used to examine the prospective association between work schedule reported in 2008 and subsequent antidepressant prescriptions for males and females separately. Model estimates were adjusted for the potentially confounding effects of other variables hypothesised as being risk factors for depression and also related to work schedule (see [table 1](#) for detail).

Demographic and social variables included age, self-described chronotype, significant other status, education and the presence of chronic conditions; work variables included employer type, weekly number of hours worked, emotional demands at work, demand-control at work and social support at work.

Previous depression and/or previous antidepressant prescriptions was described with two categories: 'yes' and 'no'. SLOSH respondents were assigned 'yes' if they reported depression in the prior SLOSH wave as assessed with the Symptom Checklist-core depression,²⁹ or if they had been prescribed any antidepressant medications (prescriptions coded N06A) in the Swedish National Prescribed Drug Register in the 3 years prior to the 2008 SLOSH wave (1 July 2005–17 June 2008).

Demographic, work variables and previous depression and/or previous antidepressant prescription variables were entered sequentially as covariates to examine how these factors impacted effect estimates.

RESULTS

[Table 1](#) summarises variables within the study sample (n=8643). Females represented 54% of the total sample. The majority of all respondents (n=6874, or 80%) reported regular daytime work in 2008; of these, n=1088 (16%) had previously worked nights. For females, n=3639 (78%) reported regular daytime work in 2008; of these, n=449 (12%) had previously worked nights. For males, n=3235 (81%) reported regular daytime work in 2008; of these, n=639 (20%) had previously worked nights. Registered antidepressant prescription rates in the postsurvey period were 11.4% for females versus 5.8% for males. The highest rates of registered antidepressant prescriptions occurred in both females and males reporting 'other' work hours. For females, this was followed by 'flexible/non-regulated' hours and 'roster work, days and evenings only'. For males, this was followed by 'regular days (4+ years of night work history)' and 'regular days (3 years or less of night work history)'.

In unadjusted analyses ([table 2](#)), an increased OR for depression was observed for 'other' work hours in both male (OR=1.87, 95% CI=0.95 to 3.67) and female (OR=1.62, 95% CI=1.05 to 2.51) models; in adjusted models these effects persisted but CIs widened to non-significance at the p=0.05 level for both sexes. In models adjusted for demographic and work variables as well as previous depressive symptoms, females in 'flexible/non-regulated' schedules showed an increased OR for depression (OR=2.01, 95% CI=1.08 to 3.76), while the

strongest increases in males were observed for those working 'other' schedules (OR = 1.72, 95% CI = 0.75 to 3.94) and 'regular days with 4 or more years' history of night work' (OR = 1.54, 95% CI = 0.93 to 2.56).

DISCUSSION

The SLOSH survey's extensive information on working time was used to develop an exposure variable with eight work schedule categories, a unique level of detail that reduced the potential for misclassification bias. This study's use of objective measures of antidepressant drug prescriptions from a comprehensive nation-wide registry minimized the potential for subjective bias in reporting, the latter being particularly important for a widely stigmatised outcome such as mental health.²⁰

Shift work involving nights and early mornings is generally thought to confer the greatest risk of circadian disruption^{30 31} and may negatively impact on mental health in a number of ways.⁵ Our results suggest that other work scheduling factors also play an important role in the development of depressive symptoms requiring pharmaceutical treatment.

In the final models adjusted for demographics, work and prior symptoms of depression, the strongest effect for prospective antidepressant prescription=yes was observed in females reporting flexible or non-regulated work hours. There are two (non-exclusive) forms of flexible working time arrangements: organisation-orientated flexibility, where the hours of work are determined by the employer (eg, on-call work); and employee-orientated flexibility which is associated with high levels of work-time control.³² Several strands of evidence suggest that employee-orientated flexibility was relatively high among those in the current sample working flexible or non-regulated hours. For example, work time control was higher in this category of work schedule than any other category.³³ The proportion of respondents with managerial roles (generally associated with greater work time control) was substantially higher in this category of work schedule (57.8% of males and 43.9% of females) than in the entire SLOSH sample (43.9% and 27.2%, respectively) (results not shown). Typical occupational categories within the flexible/non-regulated work hours category include several that are commonly associated with high levels of work time control and boundaryless working (ie, where employees can decide for themselves when and where to work³⁴); namely legislators (22.4% of males and 10.0% of females), professionals (33.6% of males and 61.0% of females) and technical and associate professionals (27.3% of males and 12.8% of females). It therefore seems likely the respondents in this schedule category were often in positions of high responsibility and were more likely to be engaged in boundaryless work.

High levels of work time control have been shown to positively influence mental health outcomes such as affective well-being and perceived stress.³⁵ The potentially beneficial effects of allowing employees control

Table 1 Baseline characteristics of study sample and univariate relationships with prospective antidepressant prescriptions between 2008 and 2010

	One or more antidepressant prescriptions registered between 17 June 2008 and 31 December 2010					
	Female			Male		
	Total (%)	No (%)	Yes (%)	Total (%)	No (%)	Yes (%)
Total	4663 (100)	4132 (88.6)	531 (11.4)	3980 (100)	3751 (94.2)	229 (5.8)
Work schedule, 2008						
Regular days (0 years hx night work)	3190	2842 (89.1)	348 (10.9)	2596	2452 (94.5)	144 (5.5)
Regular days (\leq 3 years night work hx)	253	222 (87.7)	31 (12.3)	315	294 (93.3)	21 (6.7)
Regular days (4+ years night work hx)	196	174 (88.8)	22 (11.2)	324	298 (92.0)	26 (8.0)
Nights (regular, roster or rotating)	282	251 (89.0)	31 (11.0)	298	283 (95.0)	15 (5.0)
Regular shift work, days and evenings only	229	204 (89.1)	25 (10.9)	148	144 (97.3)	4 (2.7)
Roster work, days and evenings only	233	202 (86.7)	31 (13.3)	63	60 (95.2)	3 (4.8)
Flexible/non-regulated hours	123	106 (86.2)	17 (13.8)	135	129 (95.6)	6 (4.4)
Other work hours	157	131 (83.4)	26 (16.6)	101	91 (90.1)	10 (9.9)
Age group						
20–35 years	640	582 (90.9)	58 (9.1)	604	579 (95.9)	25 (4.1)
36–50 years	1897	1672 (88.1)	225 (11.9)	1527	1433 (93.8)	94 (6.2)
51–70 years	2126	1878 (88.3)	248 (11.7)	1849	1739 (94.1)	110 (5.9)
Chronotype						
Distinctly or somewhat a morning person	1859	1675 (90.1)	184 (9.9)	1458	1383 (94.9)	75 (5.1)
Neither	1244	1076 (86.5)	168 (13.5)	1030	975 (94.7)	55 (5.3)
Distinctly or somewhat an evening person	1560	1381 (88.5)	179 (11.5)	1492	1393 (93.4)	99 (6.6)
Significant other status						
Single	1023	875 (85.5)	148 (14.5)	794	743 (93.6)	51 (6.4)
Married/cohabitating	3640	3257 (89.5)	383 (10.5)	3186	3008 (94.4)	178 (5.6)
Education						
Compulsory	622	530 (85.2)	92 (14.8)	607	564 (92.9)	43 (7.1)
Upper secondary/vocational training	1933	1725 (89.2)	208 (10.8)	2143	2039 (95.1)	104 (4.9)
University or equivalent	2108	1877 (89.0)	231 (11.0)	1230	1148 (93.3)	82 (6.7)
Chronic conditions*						
None	3132	2833 (90.5)	299 (9.5)	2609	2497 (95.7)	112 (4.3)
One or more	1531	1299 (84.8)	232 (15.2)	1371	1254 (91.5)	117 (8.5)
Employer type						
Private company	1499	1345 (89.7)	154 (10.3)	2565	2430 (94.7)	135 (5.3)
Other (association/non-profit, own business/farm or other)	367	327 (89.1)	40 (10.9)	413	388 (93.9)	25 (6.1)
Government (local, district or central)	2797	2460 (88.0)	337 (12.0)	1002	933 (93.1)	69 (6.9)
Work hours						
8–31 hours/week	993	829 (83.5)	164 (16.5)	251	218 (86.9)	33 (13.1)
\geq 32 hours/week	3670	3303 (90.0)	367 (10.0)	3729	3533 (94.7)	196 (5.3)
Demand-control at work†						
Low demands, low control	1122	1014 (90.4)	108 (9.6)	946	905 (95.7)	41 (4.3)
High demands, low control	897	762 (84.9)	135 (15.1)	671	629 (93.7)	42 (6.3)
Low demands, high control	1299	1153 (88.8)	146 (11.2)	1234	1157 (93.8)	77 (6.2)
High demands, high control	1345	1203 (89.4)	142 (10.6)	1129	1060 (93.9)	69 (6.1)

Continued

Table 1 Continued

	One or more antidepressant prescriptions registered between 17 June 2008 and 31 December 2010					
	Female			Male		
	Total (%)	No (%)	Yes (%)	Total (%)	No (%)	Yes (%)
Social support at work †						
Low	2367	2076 (87.7)	291 (12.3)	2164	2031 (93.9)	133 (6.1)
High	2296	2056 (89.5)	240 (10.5)	1816	1720 (94.7)	96 (5.3)
Emotional demands at work ‡						
Often or sometimes	2888	2526 (87.5)	362 (12.5)	1539	1441 (93.6)	98 (6.4)
Seldom or never	1775	1606 (90.5)	169 (9.5)	2441	2310 (94.6)	131 (5.4)
Depression in 2006 or antidepressant prescription, 2005–2008						
No	3895	3740 (96.0)	155 (4.0)	3647	3552 (97.4)	95 (2.6)
Yes	768	392 (51.0)	376 (49.0)	333	199 (59.8)	134 (40.2)

*Based on the questions ‘Has a doctor told you that you have’: ‘heart disease’, ‘diabetes’, ‘rheumatic disorder’, ‘musculoskeletal disorder’, ‘obstructive pulmonary disease’ or ‘asthma’.

†Based on the 17-question Swedish Demand-Control-Support Questionnaire scale.⁵⁴

‡Based on the question ‘Does your work put you in emotionally disturbing situations?’

hx, history.

over their work hours has been ascribed to the promotion of a positive balance between effort and recovery, and between work and non-work life.³⁵ However, the flexibility of boundaryless work may also have negative consequences.³⁶ When workloads are high and there are ambiguous norms about work hours, employees may feel pressured to restructure their personal time to work, resulting in overwork.³⁷ Mixing work and family time may also produce difficulties ‘switching off’ thoughts of work, such that work never stops, thereby increasing stress and impeding recovery.³²

While the potential negative effects of boundaryless work have been discussed elsewhere,^{32 37} the current study is the first to identify an association with objective measures of mental health. That the effect was greater among females is consistent with a scenario in which females with flexible work hours are more likely than males to use the flexibility to engage in additional non-work responsibilities, rather than using the increased control to fully recover and reduce strain outcomes.³⁸ In addition to leading to impaired recovery, such a scenario may increase work–life conflict that can negatively affect marital relationships and parental roles, and may also lead to increased sleep problems, chronic fatigue and psychosomatic symptoms,³⁹ with potentially negative consequences for mental health.⁴⁰

Strengths and limitations

SLOSH is based on a nationally representative sample of the Swedish working population, therefore results are generalisable to a wide range of occupations. Antidepressant prescription rates in this study are comparable with other Nordic countries, further strengthening the generalisability of our results. For example, antidepressant

prescription rates of 5.3% have been noted among public sector employees in Finland⁴¹ and 6.5% in Denmark.⁴²

SLOSH collected a breadth of detail on work and work-schedule characteristics, such as weekly work hours, history of night work and demand-control, social support and emotional demands at work. However, other characteristics that have been linked with negative mental health outcomes, such as long weekly working hours,⁴³ relatively short shift durations⁴⁴ and the presence/characteristics of shift rotations^{4 45 46} were not included, and should be considered in future studies.

This prospective study assessed antidepressant prescriptions in an approximately 2-year period following the assessment of work schedule in 2008, providing a stronger base for assessing causality as compared with a cross-sectional study design. Although a longer time lag would be necessary to reduce the possibility of reverse causality for chronic outcomes (such as cancer), depression is a relatively quick-onset disease, so a 2-year follow-up was deemed to be sufficient.

To further reduce the potential for reverse causality, the final models were adjusted for prior depression (as reported in the 2006 SLOSH) and prior antidepressant prescriptions in the 3 years prior to the 2008 SLOSH. While restriction to individuals without a prior history of depression or antidepressant prescriptions would have been most appropriate for an inception cohort, this is not the case with SLOSH, where individuals worked various types of schedules prior to their participation in the survey. If a ‘clean’ cohort had been assumed (ie, if prior exposures and outcomes at a participant’s time of entry into SLOSH were ignored), and work schedule affected antidepressant prescription rates, the effect of work schedule on antidepressant prescription rates

Table 2 Unadjusted and adjusted logistic regression ORs and CIs, modelling antidepressant prescriptions 2008–2010 = yes

	Unadjusted		Adjusted for demographic+work variables				Adjusted for demographic+work variables+previous depression or antidepressants					
	Females		Males		Females		Males		Females		Males	
	OR (95% CI)	Ref	OR (95% CI)	Ref	OR (95% CI)	Ref	OR (95% CI)	Ref	OR (95% CI)	Ref	OR (95% CI)	
Work schedule, 2008												
Regular days (0years hx night work)	Ref	Ref	1.14 (0.77 to 1.69)	Ref	1.03 (0.69 to 1.54)	Ref	1.28 (0.79 to 2.07)	Ref	0.73 (0.46 to 1.18)	Ref	1.23 (0.71 to 2.14)	
Regular days (≤3years hx night work)	1.03 (0.65 to 1.63)	1.49 (0.96 to 2.29)	0.93 (0.58 to 1.47)	1.31 (0.84 to 2.05)	0.64 (0.37 to 1.10)	1.54 (0.93 to 2.56)						
Regular days (4+ years hx night work)	1.31 (0.78 to 2.21)	0.79 (0.34 to 1.83)	1.36 (0.80 to 2.34)	0.67 (0.29 to 1.57)	2.01 (1.08 to 3.76)	0.88 (0.35 to 2.24)						
Flexible/non-regulated hours	1.01 (0.68 to 1.49)	0.90 (0.52 to 1.56)	0.74 (0.49 to 1.12)	0.84 (0.48 to 1.48)	1.01 (0.63 to 1.63)	0.85 (0.45 to 1.59)						
Nights (regular, roster or regular shift work)	1.62 (1.05 to 2.51)	1.87 (0.95 to 3.67)	1.32 (0.85 to 2.07)	1.63 (0.81 to 3.28)	1.39 (0.81 to 2.40)	1.72 (0.75 to 3.94)						
Other work hours	1.00 (0.65 to 1.54)	0.47 (0.17 to 1.30)	0.78 (0.50 to 1.21)	0.52 (0.19 to 1.44)	0.62 (0.37 to 1.05)	0.50 (0.17 to 1.49)						
Shift work (days and evenings only)	1.25 (0.85 to 1.86)	0.85 (0.26 to 2.75)	0.92 (0.61 to 1.40)	0.92 (0.28 to 3.01)	0.97 (0.60 to 1.57)	1.08 (0.28 to 4.14)						
Roster work (days and evenings only)												
Age group												
20–35 years	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
36–50 years	–	–	1.24 (0.91 to 1.70)	Ref	1.55 (0.98 to 2.47)	Ref	1.05 (0.73 to 1.50)	Ref	1.31 (0.78 to 2.18)	Ref	1.31 (0.78 to 2.18)	
51–70 years	–	–	1.02 (0.74 to 1.40)	Ref	1.14 (0.71 to 1.84)	Ref	0.97 (0.67 to 1.39)	Ref	1.13 (0.67 to 1.91)	Ref	1.13 (0.67 to 1.91)	
Chronotype												
Distinctly or somewhat a morning person	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
Distinctly or somewhat an evening person	–	–	1.21 (0.97 to 1.51)	Ref	1.37 (1.00 to 1.88)	Ref	1.15 (0.89 to 1.50)	Ref	1.12 (0.78 to 1.60)	Ref	1.12 (0.78 to 1.60)	
Neither	–	–	1.46 (1.16 to 1.83)	Ref	1.05 (0.73 to 1.52)	Ref	1.35 (1.03 to 1.76)	Ref	0.83 (0.55 to 1.25)	Ref	0.83 (0.55 to 1.25)	
Significant other status												
Married/cohabitating	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
Single	–	–	1.50 (1.22 to 1.85)	Ref	1.19 (0.85 to 1.65)	Ref	1.22 (0.95 to 1.57)	Ref	0.99 (0.68 to 1.43)	Ref	0.99 (0.68 to 1.43)	
Education												
Compulsory	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
Upper secondary/vocational	–	–	0.79 (0.60 to 1.05)	Ref	0.71 (0.48 to 1.04)	Ref	0.70 (0.50 to 0.98)	Ref	0.84 (0.55 to 1.30)	Ref	0.84 (0.55 to 1.30)	
University or equivalent	–	–	0.82 (0.61 to 1.09)	Ref	0.94 (0.62 to 1.44)	Ref	0.81 (0.57 to 1.14)	Ref	1.02 (0.64 to 1.63)	Ref	1.02 (0.64 to 1.63)	
Chronic conditions												
None	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
One or more	–	–	1.58 (1.30 to 1.91)	Ref	1.95 (1.47 to 2.58)	Ref	1.38 (1.10 to 1.74)	Ref	1.81 (1.32 to 2.49)	Ref	1.81 (1.32 to 2.49)	
Employer type												
Private company	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	
Government (local, district or central)	–	–	1.04 (0.83 to 1.31)	Ref	1.17 (0.84 to 1.63)	Ref	1.06 (0.81 to 1.38)	Ref	1.03 (0.71 to 1.49)	Ref	1.03 (0.71 to 1.49)	
Other (association/non-profit, own business/farm, other)	–	–	0.94 (0.64 to 1.38)	Ref	1.00 (0.63 to 1.58)	Ref	0.92 (0.59 to 1.43)	Ref	0.89 (0.53 to 1.50)	Ref	0.89 (0.53 to 1.50)	

Continued

Table 2 Continued

	Unadjusted				Adjusted for demographic+work variables				Adjusted for demographic+work variables+previous depression or antidepressants			
	Females		Males		Females		Males		Females		Males	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Work hours												
≥32 hours/week	–	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
8–31 hours/week	–	–	–	–	1.79 (1.46 to 2.21)	2.50 (1.64 to 3.81)	1.66 (1.29 to 2.12)	1.77 (1.07 to 2.92)	–	–	–	–
Demand-control at work												
High demands, low control	–	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High demands, high control	–	–	–	–	0.70 (0.54 to 0.92)	1.02 (0.67 to 1.55)	0.77 (0.55 to 1.06)	1.07 (0.67 to 1.71)	–	–	–	–
Low demands, high control	–	–	–	–	0.80 (0.61 to 1.05)	1.04 (0.69 to 1.58)	1.05 (0.76 to 1.46)	1.20 (0.75 to 1.93)	–	–	–	–
Low demands, low control	–	–	–	–	0.67 (0.50 to 0.89)	0.69 (0.44 to 1.10)	0.81 (0.58 to 1.13)	0.75 (0.45 to 1.26)	–	–	–	–
Social support at work												
High	–	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Low	–	–	–	–	1.12 (0.92 to 1.35)	1.12 (0.85 to 1.50)	0.94 (0.75 to 1.18)	0.90 (0.65 to 1.24)	–	–	–	–
Emotional demands												
Seldom or never	–	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Often or sometimes	–	–	–	–	1.29 (1.04 to 1.61)	1.05 (0.78 to 1.41)	1.15 (0.89 to 1.49)	0.85 (0.61 to 1.20)	–	–	–	–
Prior depression (2008) or prior antidepressant prescription (2005–2008)												
No	–	–	–	–	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Yes	–	–	–	–	23.3 (18.6 to 29.1)	24.2 (17.7 to 33.1)	–	–	–	–	–	–

Ref, reference.

would be underestimated to an unknown extent. The exclusion of over 1000 individuals with prior depression/antidepressant prescriptions would also have precluded the use of detailed exposure categories, a major goal of the analyses. For these reasons, adjustment was applied rather than restriction. This may have resulted in residual confounding, given the strength of the association with prior depression or prior antidepressant prescription (see table 2).

Self-selection in to and out of certain types of work schedule, where differential movement of workers out of 'harmful' schedules produces a workforce of shift workers that is healthier than day workers, is a common methodological challenge in shift work research.¹⁷ For example, recent longitudinal studies have shown that the presence of depressive symptoms³ and other depression-related outcomes⁴⁷ at baseline is associated with a change in work schedule (leaving night work). This phenomenon tends to bias results towards underestimated effects, due to a diluted reference group that contains both day and former shift workers. While this 'healthy worker' bias presents a challenge to any observational study, its impacts on observed effects can be better understood and accounted for using longitudinal study designs and information on past work history. In the current study, self-selection *out of* shift work was accounted for by creating a reference category of day workers with no prior history of working night shifts. This is a strength compared with many other studies where self-selection bias is simply ignored, however it still does not account for primary self-selection *in to* shift work (eg, at the start of an individual's working life). This 'clean' reference group also implicitly assumes that night work is the most disruptive form of shift work with respect to mental health outcomes which, as the current findings suggest, may not be the case. Despite these potential sources of misclassification, relationships between work schedule and antidepressant prescriptions were nonetheless observed in this study.

An additional strength of this study is the use of objective registry-based outcome measures, that are relatively rare in this area of the literature and may be used to support causal inference in an emerging area of shift work and health research.⁴² The Prescribed Drug Register provides good coverage of the Swedish population⁴⁸ and avoids issues of self-report bias. Our use of objective antidepressant prescriptions measures (that were recorded independently of survey participation) also precluded attrition-related bias, since outcomes were available regardless of participation in the subsequent survey wave. However, the cutpoint used to assess prospective antidepressant use (the date on which 75% of responses were received from participants in the 2008 SLOSH wave) may have introduced a small degree of misclassification, for example, if any of the 25% remaining individuals were prescribed antidepressants after the cutpoint but prior to submitting their survey responses.

Despite the benefits of this objective outcome measure, the use of antidepressant drug prescription rates as a proxy

for mood disorders is associated with a number of limitations. First, it should be acknowledged that various factors (eg, treatment seeking behaviours, clinician recognition and treatment of depressive disorders) influence drug prescription statistics.⁴⁹⁻⁵¹ Furthermore, not all individuals with depression or other mood disorders are treated with antidepressant medications.^{49,50} Finally, while antidepressant medications are primarily prescribed for the treatment of depression, they can also be used in the treatment of other mental disorders and somatic diseases such as sleeping problems, anxiety or pain.^{49,52} This being said, the validity of using antidepressant medication prescriptions as an outcome measure (12-month prevalence of 6.0% in 2008) is strengthened by its comparability with a prior Swedish sample from Stockholm county, where 12-month prevalence of depressive disorders was reported among 4.1% of males and 6.6% of females.⁵³

Specifying work schedule with eight exposure categories, along with the stratification by gender, meant that some cell sizes in the analyses were low. Thus, it is possible that some of the non-significant associations were a result of inadequate statistical power.

CONCLUSIONS

This 2-year prospective study addresses a number of known methodological issues in work schedule epidemiology through its use of a longitudinal design, detailed exposure assessment, health outcomes obtained from a national registry and sex-stratified analyses. Findings indicate the presence of a relationship between work schedule and subsequent antidepressant medication prescriptions. A clearer understanding of work schedule's effects on mental health may be facilitated by additional research using inception cohorts and enhanced detail on work factors with potential impacts on mental health.

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Contributors CL participated in Swedish Longitudinal Occupational Survey of Health (SLOSH) data collection. ALH, GK and PT conceptualised the current study design; ALH performed statistical analyses and drafted the manuscript. All authors participated in interpreting the data and revising the manuscript.

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Data sharing statement Due to legal restrictions, the SLOSH data cannot be made publicly available. We are not permitted to share the dataset underlying our findings

since this would compromise the integrity and privacy of study participants. For data requests please contact the SLOSH data manager, Constanze Leineweber, at constanze.leineweber@su.se

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