Long working hours and symptoms of anxiety and depression: a 5-year follow-up of the Whitehall II study.

Marianna Virtanen, Jane Ferrie, Archana Singh-Manoux, Martin Shipley, Stephen Stansfeld, Michael Marmot, Kirsi Ahola, Jussi Vahtera, Mika Kivimäki

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Marianna Virtanen [1 *] **, Jane E. Ferrie** [2] **, Archana Singh-Manoux** [2 3 4] **, Martin J. Shipley** [2] **, Stephen A. Stansfeld** [5] **, Michael G. Marmot** [2] **, Kirsi Ahola** [1] **, Jussi Vahtera** [1 6 7] **, Mika Kivimäki** [2]

[1] *Finnish Institute of Occupational Health , FI*

[2] *Department of Epidemiology and Public Health University College of London (UCL) , 1-19 Torrington Place London WC1E 6BT,GB*

[3] *Centre de Gérontologie Assistance publique - Hôpitaux de Paris (AP-HP) , Hôpital Ste Périne , FR*

[4] *Santé publique et épidémiologie des déterminants professionnels et sociaux de la santé INSERM : U687 , IFR69 , Université Paris Sud - Paris XI , Université de Versailles-Saint Quentin en Yvelines , Hôpital Paul Brousse 16, av Paul Vaillant Couturier 94807 VILLEJUIF,FR*

[5] *Centre for Psychiatry Wolfson Institute of Preventive Medicine , Queen Mary's School of Medicine and Dentistry , Charterhouse Square, London EC1M 6BQ,GB*

[6] *Department of Public Health University of Turku , Lemminkäinengatan 14 20540 Turku,FI*

[7] *Turku University Hospital Turku University Hospital , PO Box 52, 20521 Turku,FI*

* Correspondence should be adressed to: Marianna Virtanen <marianna.virtanen@ttl.fi >

Abstract

Background

Although long working hours are common in working populations, little is known about the effect of long working hours on mental health.

Method

We examined the association between long working hours and onset of depressive and anxiety symptoms in middle-aged employees. Participants were 2960 full-time employees aged 44 to 66 (2248 men, 712 women) from the prospective Whitehall II cohort study of British civil servants. Working hours, anxiety and depressive symptoms, and covariates were measured at baseline (1997–1999) followed by two subsequent measurements of depressive and anxiety symptoms (2001 and 2002–2004).

Results

In prospective analysis of participants with no depressive symptoms (n=2549) or anxiety symptoms (n=2618) at baseline, Cox proportional hazard analysis adjusted for baseline covariates showed a 1.66-fold (95% CI 1.06–2.61) risk of depressive symptoms and a 1.74-fold (1.15–2.61) risk of anxiety symptoms among employees working more than 55 hours a week compared with employees working 35–40 hours a week. Sex-stratified analysis showed an excess risk of depression and anxiety associated with long working hours among women [hazard ratios 2.67 (1.07–6.68) and 2.84 (1.27–6.34)] but not men [1.30 (0.77–2.19) and 1.43 (0.89–2.30)].

Conclusions

Working long hours is a risk factor for development of depressive and anxiety symptoms in women.

Author Keywords Work hours ; depression ; anxiety ; overtime work ; prospective

Introduction

Common mental disorders, such as depression and anxiety disorders, are a growing cause of work disability and impaired quality of life among working-age populations (Mathers & Loncar, 2006 ; Ormel, Oldehinkel, Nolen, & Vollebergh, 2004 ; Thomas & Morris, 2003). The number of employees who work long hours is substantial (Vaguer & Van Bastelaer, 2004) and it has been hypothesised that this might contribute to symptoms of anxiety and depression among employees (Bildt & Michelsen, 2002 ; Caruso, Hitchcock, Dick, Russo, & Schmit, 2004 ; Fujino, Horie, Hoshuyama, Tsutsui, & Tanaka, 2006 ; Kleppa, Sanne, & Tell, 2008 ; Michelsen & Bildt, 2003 ; Park, Kim, Chung, & Hisanaga, 2001 ; Shields, 1999 ; Sparks, Cooper, Fried, & Shirom, 1997 ; Spurgeon, Harrington, & Cooper, 1997 ; van der Hulst, 2003 ; Yamazaki et al., 2007).

To date, several cross-sectional studies have shown an association between long working hours and mental ill health and fatigue symptoms, but prospective evidence is scarce and inconsistent (Bildt & Michelsen, 2002 ; Michelsen & Bildt, 2003 ; Shields, 1999 ; Steptoe et al., 1998). One longitudinal study reported no association between long working hours and depression (Bildt & Michelsen, 2002 ; Michelsen & Bildt, 2003), while another reported an association only for women (Shields, 1999). In one study (Steptoe et al., 1998

), 71 participants were followed for six months and a within-subjects analysis of four assessments showed no change in psychological distress in relation to overtime work periods. Another experimental field study of 16 subjects found that overtime work was associated with increased exhaustion and irritation (Dahlgren, Kecklund, & Akerstedt, 2006). Studies from Japan using the 12-item General Health Questionnaire (GHQ-12) score (Suwazono, Okubo, Kobayashi, Kido, & Nogawa, 2003) and records of diagnosed mental disorders from the employee insurance company (Tarumi, Hagihara, & Morimoto, 2003) found no association between long working hours and mental disorders. None of the earlier prospective studies examined anxiety as an outcome.

Several factors may have contributed to the mixed findings on the relationship between long working hours and mental health, including heterogeneity in the assessment of exposure, outcome, and potential confounding factors; small sample size in some studies; as well as insufficient control for bias. For example, the thresholds selected for long working hours have ranged from 41 hours to as high as 70 hours a week, and in some studies, part-time employees have been included in the reference group. However, this creates a potential source of reverse causation bias, because part-time work may be a response to health problems rather than a risk factor. Indeed, part-time work has been found to be associated with morbidity and mortality (Nylen, Voss, & Floderus, 2001 ; Sokejima & Kagamimori, 1998), and psychological distress in one study predicted a shift from ≥36 hours per week to <36 hours (De Raeve, Kant, Jansen, Vasse, & van den Brandt, 2009). In addition, given that mental health problems tend to fluctuate over time, the predictive value of working hours for mental health may have been underestimated in these studies as they were based on only one assessment of symptoms at follow-up.

Further issues relate to controlling for relevant confounders and mediators. The mechanisms for the associations between long working hours and mental ill health may be related to unhealthy lifestyles and stress-related physical diseases, such as cardiovascular diseases (Caruso et al., 2006 ; Sparks et al., 1997 ; Virtanen et al., 2010). It is therefore important to take into account these factors in the analysis alongside more conventional risk factors, such as age, sex, socioeconomic position, and marital status. Furthermore, the association may be sex specific, as women who are employed full time may be at a higher risk of work-related health problems than men due to the combined load from paid and unpaid work (Alfredsson, Spetz, & Theorell, 1985 ; Artazcoz, Borrell, & Benach, 2001 ; Gjerdingen, McGovern, Bekker, Lundberg, & Willemsen, 2000 ; Lundberg & Hellström, 2002 ; Lundberg & Parr, 2000 ; Matthews & Power, 2002).

In this study of British civil servants, we therefore examined the associations between working hours and symptoms of anxiety and depression using a prospective study design with three repeat measurements of anxiety and depressive symptoms and controlling for important potential mediators and confounding factors. Our aim is to determine whether long working hours predict future symptoms of depression and anxiety in a cohort of middle-aged full-time employees without these symptoms at baseline. To take into account reverse causation, we additionally examined whether pre-existing depressive or anxiety symptoms predict a transfer from shorter to longer working hours or from longer to shorter working hours.

Method

Participants and study design

Recruitment to the Whitehall II study (phase 1) took place between late 1985 and early 1988 among all office staff, aged 35 to 55 years, from 20 London-based Civil Service departments (Marmot & Brunner, 2005). The response rate was 73% (6895 men and 3413 women) and since recruitment there have been 7 further data collection phases. Informed consent was gained from all participants and the University College London Medical School Committee on the Ethics of Human Research approved the protocol.

Data for the exposure and outcome measures for the present study are drawn from three survey phases; phase 5, 1997–9 (the baseline for these analyses) when working hours were measured comprehensively for the first time in the Whitehall II study. The assessment of depression and anxiety symptoms was repeated at two subsequent phases (phase 6, 2001 and phase 7, 2002–4). Participants were followed up until phase 7, or if these data were missing, until phase 6. Those with missing data at phase 6 were excluded from all analyses. Covariates were assessed at baseline.

The number of participants who worked full time (≥35 hours per week) with complete data on covariates at baseline was 3536 (2678 [76%] men 858 [24%] women, mean age at time of survey 52.4, SD=4.3). Of those, 2960 (84%) responded to the first follow-up survey, 2248 (76%) men and 712 (24%) women (mean age at time of survey 55.3, SD=4.3). Altogether 2764 (78%) responded to both follow-up surveys and of them, 2096 (76%) were men and 668 (24%) were women (mean age at time of survey 57.7, SD=4.3). Of the study sample, 85% was employed at the time of the first follow-up while the corresponding percentage at the second follow-up was 75%. Participants with no depressive symptoms (n=2549) and those free of anxiety symptoms (n=2618) at baseline formed the analytic samples for the study.

Measures

Working hours were ascertained from the following 2 questions: “How many hours do you work per average week in your main job, including work brought home?”, and “How many hours do you work in an average week in your additional employment?” with response alternatives ranging from 0 to 100+ and 0 to 99, respectively. As there is no consensus on the definition of long working hours, we chose

to follow a definition used in 2 recent studies showing an association between long working hours and poor sleep quality (Sekine, Chandola, Martikainen, Marmot, & Kagamimori, 2006), and myocardial infarction (Sokejima & Kagamimori, 1998). Based on the reported number of hours worked, the participants were divided into 3 groups: 1 = 35–40 hours; 2 = 41–55 hours; and 3 = more than 55 hours per week.

Depressive symptom score (Stansfeld, Head, & Marmot, 1998) was drawn from the 30-item General Health Questionnaire (GHQ-30)(Goldberg, 1972) and included the following four items: been thinking of yourself as a worthless person, felt that life is entirely hopeless, felt that life isn't worth living, and found at times you couldn't do anything because your nerves were too bad (Cronbach's alpha=.88). These 4 items, assessed on a 4-point Likert scale, range 0–3, are a subset of the 7 items in the depression subscale of the GHQ-28 (Goldberg, 1972). A sum score was calculated and, as previously, a total score of 4 or more was used to define the presence of depressive symptoms (Hamer, Kivimaki, Lahiri, Marmot, & Steptoe, 2010 ; Singh-Manoux et al., 2010 ; Stafford, Chandola, & Marmot, 2007 ; Stansfeld, Head, Fuhrer, Wardle, & Cattell, 2003).

A five-item anxiety symptom score (lost much sleep over worry, felt constantly under strain, been getting scared or panicky for no good reason, found everything getting on top of you, been feeling nervous and strung up all the time; (Cronbach's alpha=.86) was also drawn from the GHQ. These five items, which are a subset of the 7 items of the GHQ-28 anxiety scale, were rated on a 4 point scale (range 0 to 3) and scores in the top decile (8 or more points of the total of 15 points) used to define anxiety cases (Virtanen et al., 2009); this classification leads to a prevalence rate that closely matches that of anxiety disorders in the general UK population (Jenkins et al. , 1997).

Data on sociodemographic factors, health-related behaviours and physical health at baseline were used as covariates in the analyses. Sociodemographic factors included sex, age, marital status (married/cohabiting vs not), and occupational grade grouped into six levels. Alcohol consumption was classified as 0, 1 to 14 and >14 units/week for women and 0, 1 to 21, >21 units/week for men (the latter category for each sex representing alcohol consumption over the recommended limits) (White, Altmann, & Nanchahal, 2004). Smoking was assessed by a single question on whether the respondent was a current smoker. Poor physical health was indicated by the presence of at least one of the following conditions: (1) report of longstanding illness, disease, or medical condition for which the participant had sought treatment in the 12 months before the survey; (2) presence of coronary heart disease (CHD), as previously defined (Kivimaki et al., 2007), at phase 5. Employment status at follow-up (employed vs not) was derived from the last follow-up questionnaire.

To examine whether individuals with anxiety or depressive symptoms are more likely to be selected into, or remain in, jobs with long working hours (ie, reverse causality), we ran additional analyses among participants who responded to the questionnaire at phase 3 in addition to phase 5 (n=3416). Assessment of working hours at phase 3 was not as accurate as at phase 5 including hours worked only on an average weekday. However, using these data we examined whether depressive and anxiety symptoms predicted a shift from shorter to longer working hours or from longer to shorter working hours. We used three different definitions for change in working hours as follows: increased working hours (shift from 7–8 hours/day to >40 hours/week; shift from 7–8 hours/day to >55 hours/week; shift from 7–10 hours/day to >55 hours/week) and decreased working hours (shift from >8 hours/day to <40 hours/week; shift from ≥11 hours/day to <40 hours/week; and shift from ≥11 hours/day to 35–54 hours/week. The reference group in all analyses was those who stayed in the baseline category in question.

Statistical analysis

For dichotomous measures, we tested for a trend in the prevalence of the baseline characteristic across the working hours' categories using a chi-square test. We used Cox proportional hazard models with follow-up period as the time scale, to examine the relationship between working hours and incident depressive and anxiety symptoms among participants free from symptoms at baseline. Those with 35–40 hours per week formed the reference category against which the hazard ratio was calculated. In order to examine the linear trend in the association between working hours and new onset depressive or anxiety symptoms, we repeated the analysis treating working hours as a continuous variable and expressed as the effect per 10-hour increase in weekly working hours.

The models were serially adjusted for covariates: (1) sociodemographic factors, and (2) health and health behaviours in order to examine the effect of covariates on the association. Interaction terms between sex and categories of working hours were used to assess whether the effect of working hours on mental health was dependent on sex. In a sensitivity analysis, we restricted the sample to those who were employed during the whole follow-up period and therefore were not misclassified in relation to working hours due to non-employment during the follow-up (n=1924 for depression analysis n=1988 for anxiety analysis). We used binary logistic regression analysis to assess reverse causality (shift from shorter to longer hours and shift from longer to shorter hours). SAS statistical software, version 9.2 (SAS Institute, Cary, NC) was used for all analyses.

Results

Participants in the first and second follow-up did not markedly differ from all 3536 baseline participants in terms of working hours: 40 % of those who responded to the first follow-up survey only and 39% of those who responded to both follow-up surveys vs 40% of all the respondents in the baseline survey worked 35–40 hours per week at baseline. Proportions of employees working 41–55 hours per week were 52% for both follow-up groups vs 51% at baseline, and for those working >55 hours 9% at baseline and both follow-up groups. Thus, there were no major differences in drop-out between the groups defined by working hours.

Table 1 presents the association between working hours and covariates among the participants at baseline. Employees working long hours (>55/week) were more often men, married or cohabiting, were in higher occupational grades, more likely to drink over the recommended limits and less often current smokers. Employees working 41 to 55 hours were slightly younger than the other two groups.

During the mean follow-up period of 5.3 (SD=0.9) years, 274 new-onset depressive symptom cases were identified. The mean follow-up time for anxiety symptoms was 5.2 (SD=0.9) years, during which 313 new-onset cases were recorded. Associations between working hours at baseline and onset of depressive and anxiety symptoms at follow-up are presented in Table 2 . In the model adjusted for sociodemographic factors, working more than 55 hours per week was related to a 1.65-fold risk of symptoms of depression and 1.68-fold risk of symptoms of anxiety in those without those symptoms at baseline. The hazard ratio for depressive symptoms per 10 hour increase in working hours was 1.18, and the hazard ratio for anxiety symptoms was 1.22. The hazard ratios were all robust to further adjustment for baseline health and health behaviours.

We found a significant interaction between working hours and sex predicting onset of depressive and anxiety symptoms (P -values for interaction <.001 and 0.016, respectively). Therefore the results are presented separately for women and men in Table 2 . Fully adjusted hazard ratio for depressive symptoms in the longest working hours group was 2.67 among women and 1.30 (non-significant) among men. Corresponding hazard ratios for each 10-hour increase in working hours were 1.40 and 1.02 among women and men, respectively. The hazard ratio for anxiety symptoms in the longest working hours group was 2.84 among women and 1.43 (non-significant) among men. Corresponding hazard ratios for each 10-hour increase in working hours predicting anxiety symptoms were 1.31 and 1.19 among women and men, respectively.

Sensitivity analysis

In this analysis, we restricted the sample to those who were employed during the whole follow-up period (n=1924 for depression analysis and n=1988 for anxiety analysis) and found a hazard ratio of 1.71 (1.03–2.84) for new-onset depressive symptoms among employees who worked >55 hours at baseline (HR 1.20, 1.01–1.43 for each 10-hour increase), and a hazard ratio of 1.95 (1.24–3.07) for new-onset anxiety symptoms (HR 1.30, 1.11–1.52 for each 10-hour increase). There was also a clear sex interaction in these sub-samples (p <0.001 for depression, p= 0.003 for anxiety). Sex-stratified analyses showed a hazard ratio of 2.13 (0.66–6.91) for depression among women working >55 hours and a hazard ratio of 1.48 (0.84–2.61) among men. The middle group (41–55 weekly hours) among women had a HR of 2.66 (1.45–4.85) for depression. Corresponding figures regarding depression for each 10-hour increase among women and men were HR 1.35 (1.04–1.75) and HR 1.10 (0.87–1.39), respectively. Regarding anxiety, working >55 hours compared to 35–40 hours was related to a HR of 4.09 (1.65–10.11) among women and a HR of 1.51 (0.89–2.56) among men. The middle group (41–55 weekly hours) among women had a HR of 2.26 (1.24–4.12) for anxiety. Corresponding figures for anxiety for each 10-hour increase among women and men were HR 1.47 (1.10–1.97) and HR 1.24 (1.03–1.50), respectively.

Test of reverse causality

To examine whether individuals with anxiety or depressive symptoms are more likely to change their working hours, we ran additional analyses among participants (n=3416) who responded to questionnaires at phase 3 (1991–94) and phase 5 (1997–99). We examined whether depressive and anxiety symptoms at phase 3 predicted selection into or reduced selection out of, jobs with long working hours between phases 3 and 5. We used three definitions of change in working hours and adjusted the analyses for sex, age, marital status and occupational grade. Among the 12 tests performed, the only association that was close to statistical significance was a decreased, although non-significant probability for employees with anxiety symptoms to reduce their working hours from more than 10 hours a day to less than 55 hours a week (OR 0.53, 95% CI 0.27–1.05).

Discussion

We examined long working hours as a predictor of depressive and anxiety symptoms in a sample of middle-aged British civil servants. Among participants free from such symptoms at baseline followed-up over five years, working more than 55 hours per week predicted subsequent depressive and anxiety symptoms. In the fully adjusted models, each 10 hours' increase was related to a 17% and 22% increase in risk of depressive and anxiety symptoms, respectively. Sex-stratified analyses revealed that in women, working more than 55 hours per week was related to 2.67-fold risk of depression and 2.84-fold risk of anxiety, and each 10-hour increase in working hours was associated with 40% and 31% increase in risk of depression and anxiety, respectively. Among men, the associations were weaker and the only

significant association we found was between a linear association between each 10-hour increase in working hours and the onset of anxiety symptoms. In contrast, among women even moderate overtime work (41–55 hours) seems to increase the probability of mental health problems. Our findings are in line with those of an earlier cross-sectional study showing a relationship between overtime work and anxiety symptoms (Kleppa et al ., 2008), and a prospective study showing overtime work to be a risk factor for new-onset depressive disorder among women but not among men whose weekly working hours exceeded 40 hours (Shields, 1999).

Several factors may underlie these findings. One mechanism suggested to explain the association between long working hours and mental health symptoms is the behavioural pathway, such as unhealthy alcohol consumption, or smoking (van der Hulst, 2003). We found that participants working long hours used more alcohol but were less often current smokers than other participants. Their alcohol use, however, did not explain the association between long working hours and onset of depressive and anxiety symptoms.

Second, long working hours may indicate the adverse effects of work exposures and stress. There is some evidence that, for example, work overload is specifically related to anxiety symptoms whereas low decision latitude, implying loss of or insufficient control over work, is more often associated with depression (Broadbent, 1985 ; Warr, 1990). Our finding indicating that long working hours is a greater risk for anxiety and depression in women may reflect the fact that women often also have an extra burden due to extended hours of work and domestic chores (Artazcoz et al., 2001 ; Gjerdingen et al., 2000 ; Lundberg & Hellström, 2002 ; Lundberg & Parr, 2000 ; Matthews & Power, 2002). In addition, for women, working long hours is less normative and may therefore be more stressful for example, in terms of work-family conflicts (Jansen, Kant, Kristensen, & Nijhuis, 2003). More women than men also work in monotonous jobs and have less control over the content and pace of work (Lundberg, 2002 ; Virtanen et al., 2007) as well as less control over work time (Ala-Mursula, Vahtera, Pentti, & Kivimaki, 2004).

There is also some evidence of increased myocardial infarction in women but not in men who work overtime (Alfredsson et al., 1985). Myocardial infarction is associated with depression (Blumenthal, 2008) although in an earlier report from the Whitehall II study no significant sex differences were observed in the association between long working hours and increased risk of coronary heart disease (Virtanen et al., 2010). Long working hours have been associated with elevated salivary cortisol levels particularly among women (Lundberg & Hellström, 2002), and other studies suggest that elevated cortisol levels may be related to the development of depression (Handwerger, 2009). However, our sex-specific findings may more simply reflect well-known sex differences in responses to external stressors; symptoms of depression and anxiety more common among women and alcohol use disorders more prevalent among men (Batty, Hunt, Emslie, Lewars, & Gale, 2009 ; Jenkins et al., 1997). Future studies should therefore extend the investigation of long working hours to include alcohol use disorders.

There is some discussion in the literature on whether the association between long working hours and mental ill health is due to selection; that is, employees with pre-existing mental disorders tend to work or have to work longer; or employees with mental disorders are forced to stay in unsatisfactory jobs, including those with longer working hours, because their potential for finding alternative employment is limited (Kleppa et al., 2008 ; Waghorn & Chant, 2005). Alternatively, employees with mental health problems may reduce their working hours in order to enable recovery (De Raeve et al., 2009). However, we did not find evidence of reverse causality in our analysis. We excluded part-time employees from our main analysis because people with health problems may choose part-time work and therefore be selected for poorer health (De Raeve et al., 2009 ; Ettner, Frank, & Kessler, 1997). However, future studies should examine whether working part-time has implications for employee mental health.

We found rather similar associations of long working hours with depressive and anxiety symptoms. As these mental health problems are highly co-morbid in the general population (Prince et al., 2007) and also exhibited a considerable degree of correlation in our sample ($r = .64$, $p < 0.001$) it is possible that there are common pathways, such as occupational burnout, explaining the association between work exposures and various forms of common mental disorders (Ahola & Hakanen, 2007 ; Ahola et al., 2005 ; Peterson et al., 2008).

Some limitations of the study are noteworthy. Cohorts like the Whitehall II study that follow the same individuals over an extended time period are subject to a “healthy survivor” effect as participants with severe illnesses are more prone to drop out of the study over time (Ferrie et al ., 2009). However, work exposures such as working hours cannot reliably be examined among participants who are no longer exposed to work. Thus in our study, the loss of unhealthy participants may result in an underestimation rather than an overestimation of the true effect. Our sensitivity analyses suggested similar results when the study samples were restricted to those who were employed over the whole follow-up period.

Another limitation relates to our measures of depressive and anxiety symptoms not being validated against clinical diagnoses. The present results should therefore be confirmed using standardised measures of depressive and anxiety disorders. Furthermore, we were not able to assess how long a person was exposed to long hours before the baseline and over the follow-up period. Finally, although our cohort of civil servants included several occupational grades it did not include blue collar workers. Thus, it remains unclear whether our findings are generalisable to blue-collar workers and employees in the private sector.

In conclusion, a follow-up of approximately 5 years suggests an association of long working hours with subsequent depressive and anxiety symptoms particularly among women. If these associations are causal, the findings of the present study suggest that long of working hours would be recognized as a potential risk factor for the development of anxiety and depression in women.

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Footnotes:

Declaration of interest: None.

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Table 1

Characteristics of the participants by working hours at baseline

Characteristic	Weekly working hours n (%)/Mean (SD)				
	All	**35–40**	**41–55**	**>55**	**p -value for trend**
Age (Mean, SD)	52.3 (4.3)	52.7 (4.5)	51.9 (4.0)	52.9 (4.4)	<0.001[a]
Sex					<0.001
Male	2248 (76)	824 (70)	1209 (79)	215 (81)	
Female	712 (24)	345 (30)	316 (21)	51 (19)	
Marital status					<0.001
Married/cohabiting	2323 (78)	860 (74)	1242 (81)	221 (83)	
Non-married/cohabiting	637 (22)	309 (26)	283 (19)	45 (17)	
Occupational grade					<0.001
1 (highest)	653(22)	103 (9)	424 (28)	126 (47)	
2	731 (25)	214(18)	451 (30)	66 (25)	
3	440 (15)	199 (17)	213 (14)	28 (11)	
4	515(17)	289 (25)	207 (14)	19 (7)	
5	330 (11)	179 (15)	134 (9)	17 (6)	
6 (lowest)	291 (10)	185 (16)	96 (6)	10 (4)	
Chronic disease					0.185
No	1549 (52)	596 (51)	807 (53)	146 (55)	
Yes	1411 (48)	573 (49)	718 (47)	120 (45)	
Alcohol use					<0.001
No	376 (13)	182 (16)	174 (11)	20 (8)	
>0–14 women; >0–21 men	1824 (62)	737 (63)	921 (60)	166 (62)	
Above recommended limits	760 (26)	250 (21)	430 (28)	80 (30)	
Smoking					0.014
No	2668 (90)	1036 (89)	1385 (91)	247 (93)	
Yes	292 (10)	133 (11)	140 (9)	19 (7)	

a Paired test of difference between 41–55 hours vs 35–40 and >55 hours significant (p <.001). Difference between 35–40 hours and >55 hours non-significant (p =0.508).

Table 2

Association between working hours at baseline and incident anxiety and depressive symptoms at follow-up in a cohort free from depressive symptoms (n=2549) and anxiety symptoms (n=2618) at baseline.

	Depressive symptoms					Anxiety symptoms				
Weekly working hours at baseline	**Events**	**Person-years (py)**	**Rate/100 py**	**HR (95% CI)[a]**	**HR (95% CI)[b]**	**Events**	**Person-years (py)**	**Rate/100 py**	**HR (95% CI)[a]**	**HR (95% CI)[b]**
All participants										
All	274	13429	2.0			313	13723	2.3		
35–40	105	5202	2.0	1.00	1.00	119	5399	2.2	1.00	1.00
41–55	141	7076	2.0	1.03 (0.79–1.35)	1.02 (0.78–1.34)	158	7119	2.2	1.01 (0.78–1.31)	1.02 (0.79–1.32)
>55	28	1152	2.4	1.65 (1.05–2.59)	1.66 (1.06–2.61)	36	1206	3.0	1.68 (1.12–2.52)	1.74 (1.15–2.61)
Per 10 hr increase				1.18 (1.02–1.36)	1.17 (1.01–1.35)				1.22 (1.08–1.38)	1.22 (1.08–1.39)
Women										
All	77	3102	2.5			88	3036	2.9		
35–40	27	1507	1.8	1.00	1.00	36	1546	2.3	1.00	1.00
41–55	43	1378	3.1	2.15 (1.28–3.59)	2.15 (1.28–3.60)	42	1303	3.2	1.63 (0.99–2.71)	1.69 (1.02–2.81)
>55	7	216	3.2	2.80 (1.13–6.96)	2.67 (1.07–6.68)	10	187	5.3	2.81 (1.28–6.17)	2.84 (1.27–6.34)
Per 10 hr increase				1.43 (1.16–1.77)	1.40 (1.14–1.73)				1.31 (1.03–1.67)	1.31 (1.03–1.67)
Men										
All	197	10328	1.9			225	10687	2.1		
35–40	78	3695	2.1	1.00	1.00	83	3852	2.2	1.00	1.00
41–55	98	5697	1.7	0.75 (0.55–1.02)	0.73 (0.53–1.00)	116	5816	2.0	0.87 (0.64–1.17)	0.86 (0.64–1.17)
>55	21	936	2.2	1.30 (0.77–2.20)	1.30 (0.77–2.19)	26	1019	2.6	1.39 (0.87–2.24)	1.43 (0.89–2.30)
Per 10 hr increase				1.03 (0.85–1.26)	1.02 (0.83–1.25)				1.19 (1.03–1.39)	1.19 (1.03–1.38)

a Adjusted for age, sex, occupational grade, and marital status at baseline, and employment status at follow-up.

b Additionally adjusted for chronic illness, smoking, and alcohol use at baseline.

HR, Hazard ratio; CI, Confidence interval.