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Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories

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Abstract

Background: Long working hours and unpaid work are possible risk factors for depressive symptoms. However, little is known about how working hours influence the course of depressive symptoms. This study examined the influence of paid , unpaid working hours and total working hours on depressive symptoms trajectories.

Methods: The study was based on data from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH 2008-2014). We applied group-based trajectory modelling in order to identify trajectories of depressive symptoms and studied paid and unpaid working hours and total working hours as risk factors.

Results: Six trajectory groups were identified with symptoms: 'very low stable', 'low stable', 'doubtful increasing', 'high decreasing', 'mild decreasing', and 'high stable'. More time spent on paid- or unpaid work did not independently predict the symptom trajectories compared to being in the 'very low stable' symptom group. However, more total working hours was associated with a higher probability of having 'low stable' (Odds ratio (OR) 1.21, confidence interval (CI) 1.03-1.44) symptoms compared to having 'very low stable' symptoms, but especially 'mild decreasing' (OR 1.46, CI 1.22-1.74), and 'high stable' (OR 1.71, CI 1.35-2.16) symptoms, when adjusting for sex, age, civil status and socioeconomic status. Theses associations were similar between men and women.

Conclusions: This study supported heterogeneous individual patterns of depressive symptoms over time among the Swedish working population. The results also indicate that longer total working hours which indicate a double burden from paid and unpaid work may be associated with higher depressive symptom trajectories.

Strengths and Limitations of this Study

- This study was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years.
- In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder
- Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and identify heterogeneity in the sample
- A longer time series of measurement may have contributed to more power for identifying heterogeneity in symptoms over time

- The sample is probably characterized by relatively healthy individuals with high educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms.

INTRODUCTION

Mental health problems and especially depression are of major public health concern owing to the high prevalence and substantial negative consequences on personal functioning, but also work productivity [1]. It is well known that onset of depression may vary between individuals and that symptoms occasionally recur over the life course. Some long-term patterns of depressive symptoms may be associated with more functional limitations [2], and it has been suggested that different risk factors may be associated with different long-term patterns [3, 4]. However, little is known about the influence of work-related characteristics on different long-term patterns of depressive symptoms. Work stressors such as high work demands or high demands in combination with low control (job strain) have generally been implied as risk factors for depressive symptoms [7-9]. Long working hours has also been associated with depressive states [10]. In addition, non-work stressors may also be associated with poorer mental health [11]. Especially a "double burden" of work and non-work related responsibilities could have a negative health effect. A double burden or "high total workload" has been suggested to contribute to common physical and mental symptoms [12], but more knowledge is needed on both changes in stress from workload in paid and unpaid work, and the interplay between these stressors, over the life course, and how they influence health among men and women [13].

The aim of this study was to examine how time spent on paid and unpaid work as well total working hours are associated with different depressive symptoms trajectories among Swedish men and women.

METHODS

Study population

The study population consisted of participants from SLOSH (Swedish Longitudinal Occupational Survey of Health) study, a longitudinal cohort study with repeat self-reported measures every second year (starting in 2006) on an originally representative sample of the Swedish working population [14]. In SLOSH, all eligible participants in the Swedish Work Environment Survey (SWES) 2003 and 2005 have been followed up biennially up to 5 or 6 times. Four waves have been used in the present study: 2008, 2010, 2012, and 2014. The total

number of invited participants were 18639, 20298, 17434, and 38659, respectively, with overall response rates between 62% and 57%. The present study is based on those who responded to all SLOSH questionnaires between 2008 and 2014 (6300 participants) and with complete information on the main variables of interest (n=6291). The study has been approved by the Regional Research Ethics Board in Stockholm, and informed consent was obtained from all respondents. More information about the cohort can be found elsewhere [15].

Measures

Depressive symptoms were measured with a brief subscale from the Symptom Checklist (SCL-90), the SCL-CD_6 [16] which assesses perception of being troubled by: Feeling blue; Feeling no interest in things; Feeling lethargy or low in energy; Worrying too much about things; Blaming yourself for things; and Feeling everything is an effort, quantified on a five-category scale from 0=Not at all to 4=Extremely. The six items represent core symptoms, selected based on principals of clinical validity. The scale has validated and was found to have good psychometric properties making it suitable to add into a composite score indicative of depression severity [16].

Time use was also measured repeatedly 2008-2014 by a modified version of a measure developed and psychometrically evaluated by Mardberg et al. [17]. In addition to hours/week in paid employment and overtime at work, constituting a measure of paid working hours, the instrument covers unpaid work activities, such as household duties (mending, sewing, laundry, gardening), childcare (homework/teaching, care-taking, playing) and other unpaid duties (voluntary work in unions and organizations, care of sick or elderly relatives). Hours/week spent on household duties (shopping, cleaning, cooking, mending, sewing, laundry and gardening) and on childcare (homework/ teaching, care taking, playing) were added to a measure of unpaid working hours. In this study paid working hours was divided into 4 categories: <40, 40-49, 50-59, 60+ working hours/week. An exception was in SLOSH 2010 because of changes to the response options. Then the corresponding categories were <41, 41-50, 51-60, 61+. Unpaid working hours was also divided into 4 categories: <8, 8-11, 12-20, 21+ hours on average/week. The total number of hours spent on paid and unpaid work constituted the total working hours measure (reflecting "total workload"), and was divided into the following 4 categories: <58, 58–67, 68–80, and >80 h/week.

Statistical analysis

Group-based trajectory modelling (GBTM) was used in order to identify distinct groups of individual trajectories within the population, and examine whether working hours predicts the course of depressive symptoms over time. This is a semi-parametric model-based clustering technique that allows the identification of groups of individuals following a similar progression of an outcome over time in a flexible and easy way [18]. The trajectory model was fitted using maximum likelihood methods allowing for incomplete data and assuming missing at random data. We used calendar time rather than age as the underlying time scale, since sub-cohort effects could not be ruled out with a cohort-sequential design.

In order to select the best model we followed Nagins' recommended two-step procedure. Firstly the number of latent trajectories was selected. Models with one to eight groups were estimated starting with a single trajectory model described by a cubic polynomial equation to capture the relationship between time (waves) and depressive symptoms, and continuing with models with increasing number of groups. Estimation of depression trajectories was accomplished using the censored normal model (CNORM), which is appropriate for continuous data.

The Bayesian Information Criterion (BIC) was mainly used in order to determine the number of subgroups [19 18]. The magnitude of difference in BIC, the Bayes factor as well as the BIC-based probability approximation were used to choose between more complex and simpler models [19-21]. We further considered the significance of polynomial terms (at the confidence level alpha 0.05), the values of group membership probabilities and of average posterior probability (entropy) with recommended value greater than 0.7 [18 20 22] as complementary criterions for selecting the best model.

After selecting the optimal model in terms of number of groups we selected the shape for each of these groups. Then conditional on the best model, time-stable covariates (risk factors) were inserted in the model by assuming that these risk factors influence the probability of membership to a particular trajectory group. Paid and unpaid working hours were considered simultaneously relative to the defined trajectory groups as time-invariant covariates (risk factors) in the main analyses to allow for a temporal precedence of working hours. Also total working hours was modeled separately. Coefficients for risk factors indicate the increase in log odds of being in a trajectory (relative to the lowest group) per unit change in the risk factor [18]. Unadjusted models as well as models adjusted for sex (0 men, 1 women), age, civil status (0 not married, 1 married or cohabiting) and socioeconomic status [23] were presented. We further conducted the same analyses for men and women separately and among

participants working full time only. Working hours were, however, alternatively considered as time-varying covariates to account for the time-varying nature.

The GBTM analyses were conducted using the PROC TRAJ procedure developed by Jones and Nagin, which can be downloaded from http: //www.andrew.cmu.edu/user/bjones [21 24] in the SAS software (version 9.4; SAS Institute).

RESULTS

Table 1 shows some descriptive characteristics of the study sample. Most of the study participants were in middle age or in mature adulthood at wave 2 (2008). A high proportion were married or cohabiting and about 40 % had children living at home. Most were working full time with a day time work schedule. About 20 % of the population had long paid working hours i.e. worked more than 50/51 hours per week, and a relatively high proportion had long unpaid working hours i.e. were spending 21 hours or more on unpaid work per week. Almost 11 % had a long total working hours i.e. were spending over 80 hours per week on paid and/or unpaid work.

Table 1. Characteristics of the study sample in terms of demographic characteristics and workload from paid and unpaid work in 2008 (wave 2, SLOSH data)

Age (%)	Early adulthood (19-34)	8.9
	Middle life (35-49)	30.6
	Mature adulthood (50-70)	60.5
Sex (% females)		58.0
Civil status (% married or cohabiting)		79.7
Children at home (%)		40.9
SEI (%)	Unskilled manual workers	14.8
	Skilled manual workers	14.4
	Assistant non-manual employees	12.6
	Intermediate non-manual employees	31.5
	Higher non-manual employees	20.5
	Self-employed	6.2
Full time work (%)		77.4
Work schedule (%)	Day time	78.0

	Night work	6.2
	Shift work excl. nights	15.8
Paid working hours per week (%)	<40 or 41	30.0
	40/41-49/50	49.8
	50/51-59/60	12.6
	60/61+	7.6
Unpaid working hours per week (%)	<8	19.1
	8-11	40.6
	12-20	22.0
	21+	37.4
Total working hours per week (%)	<58	39.7
	58-67	28.5
	68-80	21.0
	>80	10.8

Our fit evaluation of the different models resulted in the selection of a model with six trajectories with a linear order for four groups suggesting a linearly decreasing or increasing trajectory, and a cubic order for two of the groups suggesting a trajectory where there are two turning points (inflections), a maximum and a minimum in depressive symptoms (BIC: -62598.42; Entropy: 0.8). Figure 1 depicts the shapes of the six trajectories as well as their class sizes. The pattern of symptoms over time could be described as either "very low stable", "low stable", "doubtful increasing", "high decreasing", "mild decreasing" and "high stable". The trajectories named 'very low stable', "low stable" and 'stable high' followed a slight downward linear trend over time, but remained either at a no depression level (<7 on the depression scale) or between moderate to severe level (>11 and >15, respectively, on the depression scale) [25]. The trajectory named 'mild decreasing' followed a slightly decreasing trend until year 2012 (wave 4) and slightly increasing afterwards. Symptoms varied from mild (>9 and < 11 on the depression scale) to doubtful (>6 and < 10 on the depression scale) depression. The trajectory named 'doubtful increasing' followed a slight increasing linear trend but remained either at doubtful or mild depression level. Finally the trajectory named 'high decreasing' followed a steep downward trend until year 2010 (wave 3) and a slightly decreasing trend thereafter. The symptoms varied from severe depression to no depression levels.

The majority of individuals were classified in either the 'very low stable' (49.1%) or 'low stable' (23.4%) group. The 'high decreasing' group represented the smallest group (1.3%) and the 'doubtful increasing' represented 8.4% of the sample. Both the 'high decreasing' group and the 'doubtful increasing' group followed a quadratic trend with two turning points. Altogether there were four favorable ('mild decreasing', 'high decreasing', 'low stable' and 'very low stable') and two unfavorable ('doubtful increasing', and 'high stable') trajectories.

A description of the demographic characteristics and the distribution of working hours in the year 2008 for the six trajectory groups are given in Table 2. The mean age was, for example, lowest in the 'high stable' trajectory (47.0 years), followed by the 'doubtful increasing' group (47.6 years). Overall there was a higher proportion of women in the unfavorable trajectories. Especially total working hours varied between the groups. A higher proportion of individuals with a long of total working hours were observed in the 'doubtful increasing' and the 'high stable' group.

Table 2. Characteristics of the trajectory groups in terms of demographic characteristics and workload from paid and unpaid working hours in 2008 (wave 2, SLOSH data)

		Very low stable (n=1447)	Low stable (n=3213)	Doubtful increasing (n=474)	High decreasing (n=74)	Mild decreasing (n=755)	High stable (n=328)
Mean Age (Years)		55.2	51.1	47.6	54.1	49.6	46.8
Sex (% females)		48.2	58.0	68.1	69.4	65.0	71.3
Civil status (% married)		82.5	80.6	76.3	71.6	77.2	71.8
Socioeconomic instatus (%)	Unskilled manual workers	15.3	13.9	16.0	13. 9	16.0	17.0
	Skilled manual workers	16.4	13.8	14.0	6.9	14.6	12.6
	Assistant non-manual employees	12.8	12.0	12.3	15.3	13.5	15.1
	Intermediate non-manual employees	17.9	32.3	32. 9	27.8	31.8	28.7
	Higher non-manual employees	8.0	22.3	18.6	22.2	19.2	20.8
	Self-employed	8.2	5.7	6.1	13.9	4.6	5.9
Paid working hours per week (%)	<40 or 41	30.1	30.9	30.2	41. 8	29.8	29.4
	40/41-49/50	51.0	49.9	51.7	41.8	52.1	50.2
	50/51-59/60	12.1	12.2	12.1	9.0	11.3	13.6
	60/61+	6.8	7.1	6.0	7.5	6.9	6.8
Unpaid working hours per week (%)	<8	17.7	19.4	21.0	15.3	20.4	18.3
	8-11	21.5	21.9	21.8	23.7	19.5	20.9
	12-20	22.9	21.5	22.7	23.7	21.6	22.6
	21+	37.9	37.3	34.5	37.3	38.5	38.3
Total working hours per week (%)	<58	48.7	41.0	29.1	55.3	37.3	28.6
	58-67	26.2	27.3	32.3	12.8	25.8	25.6
	68-80	17.7	20.5	21.8	17.0	23.2	27.6
	>80	7.5	11.3	16.8	14.9	13.5	18.1

Table 3 reports the results of the multinomial logistic regression in log-odds ratios (estimate), standard errors (SE) and odds ratios (OR), with the 'very low stable' group as reference group. The results showed that neither longer paid working hours nor unpaid working hours at the baseline measurement (2008) was independently associated with a significantly higher or lower likelihood of being in any of the trajectory groups as compared to being in the reference group. Longer total working hours was, on the other hand, associated with increased likelihood of being in the 'low stable', 'doubtful increasing', 'mild decreasing', and 'high

stable' group. Sex, age, and civil status and socioeconomic status were included in the adjusted models as additional risk factors for the trajectory group membership. Estimates from the adjusted model with respect to paid/unpaid working hours were relatively similar to those in the unadjusted model. However, individuals with longer unpaid working hours, had a statistically significantly lower likelihood [OR:0.90; CI:[0.82;0.99]] of being in the group with 'doubtful increasing' symptoms compared to the 'very low stable' group in this model. With respect to longer total working hours we also found similar results in the adjusted model. There was an increased likelihood of being in the 'low stable' [OR:1.21; CI:[1.03;1.44]], 'doubtful increasing' [OR:1.13; CI:[0.96;1.32]], 'mild decreasing' [OR:1.46; CI:[1.22;1.74]], and 'high stable' group [OR:1.71; CI:[1.35;2.16]]. Especially, a higher probability of being in the 'mild decreasing' and 'high stable' trajectory group was observed in the adjusted model.

Table 3. Results from the multinomial logistic regressions models estimating the probabilities of group membership according to a) paid working hours and unpaid working hours b) total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios; SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory groups	**Low Stable**		**Doubtful increasing**		**High decreasing**		**Mild decreasing**		**High stable**	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted models										
Paid working hours	0.01 (0.01)	1.01 [0.99;1.03]	0.00 (0.01)	1.00 [0.98;1.02]	0.01 (0.01)	1.01 [0.99;1.03]	0.00 (0.02)	1.00 [0.96;1.04]	0.01 (0.01)	1.01 [0.99;1.02]
Unpaid working hours	-0.01 (0.06)	0.99 [0.88;1.11]	-0.10 (0.06)	0.91 [0.81;1.02]	-0.02 (0.06)	0.98 [0.87;1.11]	-0.03 (0.12)	0.97 [0.77;1.23]	0.00 (0.09)	1.00 [0.84;1.19]
Total working hours	0.24 (0.05)*	1.27 [1.15;1.40]	0.39 (0.06)*	1.47 [1.31;1.65]	0.11 (0.14)	1.11 [0.85;1.46]	0.34 (0.12)*	1.40 [1.11;1.77]	0.53 (0.08)	1.70 [1.45;1.98]
Adjusted models including sex, age, civil status, and socioeconomic status										
Paid working hours	0.00 (0.01)	1.00 [0.98;1.02]	-0.01 (0.01)	0.99 [0.97;1.01]	0.00 (0.02)	1.00 [0.96;1.03]	0.01 (0.01)	1.01 [0.98;1.02]	0.00 (0.01)	1.00 [0.97;1.03]
Unpaid working hours	-0.02 (0.06)	0.98 [0.87;1.10]	-0.13 (0.06)*	0.88 [0.78;0.97]	-0.06 (0.12)	0.94 [0.75;1.19]	-0.05 (0.07)	0.95 [0.83;1.09]	-0.07 (0.09)	0.93 [0.77;1.12]
Total working hours	0.19 (0.08)*	1.21 [1.03 1.44]	0.12 (0.08)	1.13 [0.96 1.32]	0.06 (0.18)	1.06 [0.74 1.51]	0.38 (0.09)*	1.46 [1.22 1.74]	0.54 (0.12)*	1.71 [1.35 2.16]

*: significance at 5%.

These analyses were also stratified by sex. In general, both unpaid working hours and paid working hours was somewhat differently related to the various trajectory groups among men and women, compared to 'very low stable' group. However, the results were not statistically significant neither for men nor for women (results not shown). Results were also similar in a subsample of full-time employees only.

In analyses with working hours as time-varying covariate, adjusting for sex, age, civil status, and socioeconomic status, longer paid working hours increased the depressive symptom trajectory in the 'low stable', 'doubtful increasing', and high stable' group. Longer unpaid working hours also raised the trajectory in the 'doubtful increasing' group but decreased the depressive symptoms in the 'mild decreasing' group. Longer total working hours, however, significantly increased depressive symptoms in both the 'very low stable', 'low stable', 'doubtful increasing', and 'high stable' group, but not in the 'high or mild decreasing' groups (Supplementary Table 1).

DISCUSSION

The current study identified six distinct depressive symptoms trajectories. Previous population based studies have also shown that stable patterns are common such as stable low symptoms[5], which is in line our findings. A small group with stable high symptoms, as in the present study, have also commonly been found in other studies[2, 5]. Patterns with varying degree of symptoms over time are more seldom observed [5]. However, it has also been found that a considerable proportion of the general population experience a stable recovery after a depressive episode [2]. The patterns observed in this study are thus generally in line previous findings and expectations.

It has previously been indicated that factors such as problems with peers and parents, alcohol/tobacco/drug use, parental history of depression and negative cognitive styles could lead to worse depression trajectories over time among children/adolescents [5]. Among older people, poor self-rated health, past history of somatic illness, functional and cognitive impairment and low social support have been associated with negative course of symptoms. Stressful life events has also a found to be a predictor of poor depressive symptom trajectories [5]. This work suggest that also working hours is associated with different long-term trajectories of depressive symptoms. However, neither paid working hours nor unpaid working hours per se seemed to influence the depressive symptoms trajectories. The study on the other hand indicate that a longer total working hours (double burden) is associated with certain patterns of depressive symptoms over time. Some previous work have found that a higher total workload in terms of hours spent on paid/unpaid work is associated with work stress and with various physiological and psychological symptoms distress [27,28]. However, this is the first study to our knowledge on the relationship between total working hours and depressive symptom trajectories. The results indicated an association between working hours and both favorable ('low stable', 'mild decreasing') and unfavorable ('high stable') trajectories, but especially high stable symptoms. A higher risk of belonging to some of these groups such as the 'low stable' and 'mild decreasing' groups may be explained by a higher initial level of depressive symptoms than those in the 'very low stable' group. Total working hours was, on the other hand, not clearly associated with the 'high decreasing' group that started on a severe depression level but decreased to no depression.

Some previous work have concluded an association between long working hours and depression [10]. This was not confirmed in the present study. However, there are indications that only more extreme weekly working hours are associated with poorer health [29,30],

which may partly explain why we did not observe any association between time spent on paid work and depressive symptom trajectories in the present study. Complementary analyses further showed that the depressive symptoms increased further in some groups, especially in the unfavorable groups with doubtful increasing and stable high symptoms, with an increase in total working hours over the period.

Some strengths of the study are that it was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years. In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder [5]. Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and also introduce risk factors that may influence membership in trajectory groups and therefore identify heterogeneity in the sample [19,31]. We based the trajectories on four time points, which is above the minimum required for estimating quadratic trajectories[22]. A longer time series of measurement may, however, have contributed to more power for identifying heterogeneity in symptoms over time, study onset versus recovery etc, and potential determinants of different trajectories. Dropout from the study may also have restricted the possibility to detect heterogeneity. Given that the subjects were originally working and repeatedly in paid work for more than 30 % over the study period, the sample is probably characterized by relatively healthy individuals with high educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms. Data were also missing on family history of mental health problems and childhood/adolescent characteristics, which may be predictors of depressive symptoms trajectories and workload and may confound the relationships of interest. In the main models we chose to examine whether working hours at the start of the trajectory predicted the course of depressive symptoms in order to allow for temporal precedence of working hours, although working hours may also be changing or stable over the study period. This does not rule out that depressive symptoms at baseline may have biased reporting of working hours. However, later depressive symptoms is unlikely to influences the initial measurement of working hours.

All in all, the results indicate that working hours may increase the risk of higher depressive symptom trajectories. Since an unfavorable trajectory with stable or recurrent high depressive symptoms is associated with a poor prognosis [5], interventions with regard to working hours may contribute to limit the burden of depressive disorders in the population.

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COMPETING INTERESTS

Conflicts of interest: No author has reported a conflict of interest

DATA SHARING

SLOSH data are not publicly available due to legal restrictions. Requests for data or results can be addressed to the SLOSH data manager data@slosh.se. More information can be found on the SLOSH website www.slosh.se.

CONTRIBUTORSHIP STATEMENT

Author contributions: LMH conceived the study. PP performed the analyses and drafted the manuscript. LMH, PP and HW contributed to the design and interpretation of data, critical revision of the work, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Fig. 1: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)

Supplementary Table. Results from the multinomial logistic regressions models estimating a potential increase or decrease in the symptom trajectories according to a) paid working hours and unpaid working hours b) total working hours

Trajectory groups	**Ref Group**		**Low Stable**		**Doubtful increasing**		**High decreasing**		**Mild decreasing**		**High stable**	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted Models												
Model 1												
Workload paid work	0.02 (0.01)	1.02 [0.99; 1.05]	0.02 (0.01)*	1.03 [1.01;1.04]	0.04 (0.03)	1.04 [0.98;1.10]	-0.05 (0.05)	0.95 [0.86;1.05]	-0.01 (0.05)	0.98 [0.96;1.00]	0.08 (0.03)*	1.09 [1.03;1.15]
Workload unpaid work	0.37 (0.09)*	1.45 [1.19;1.76]	0.10 (0.05)*	1.11 [1.00;1.23]	0.60 (0.14)*	1.83 [1.37;2.43]	0.84 (0.28)*	2.32 [1.33; 4.04]	-0.57 (0.29)	0.56 [0.31;1.01]	0.12 (0.14)	1.13 [0.84;1.51]
Model 2												
Total work load	0.32 (0.10)*	1.37 [1.12;1.68]	0.33 (0.07)*	1.39 [1.21;1.59]	0.71 (0.15)*	2.04 [1.51;2.74]	-0.18 (0.30)	0.83 [0.46;1.51]	-0.04 (0.31)	0.96 [0.52;1.76]	0.43(0.17)*	1.53 [1.08;2.17]
Adjusted models including sex, age, civil status and socioeconomic status												
Model 3												
Workload paid work	0.01 (0.02)	1.01 [0.98;1.05]	0.02 (0.01)*	1.03 [1.01;1.04]	0.07 (0.02)*	1.07 [1.01;1.12]	-0.05 (0.05)	0.95 [0.86;1.05]	-0.06 (0.06)	0.94 [0.84;1.05]	0.08 (0.03)*	1.08 [1.03;1.14]
Workload unpaid work	0.34 (0.10)*	1.40 [1.15;1.72]	0.07 (0.05)	1.07 [0.97;1.18]	0.62 (0.15)*	1.86 [1.39;2.49]	0.82 (0.27)	2.28 [1.34;3.89]	-0.71 (0.25)*	0.49 [0.29;0.81]	0.08 (0.15)	1.09 [0.81;1.45]
Model 4												
Total work load	0.26 (0.12)*	1.30 [1.03;1.63]	0.29 (0.07)*	1.34 [1.17;1.53]	0.66 (0.15)*	1.93 [1.45;2.59]	-0.17 (0.30)	0.85 [0.46;1.54]	0.37 (0.38)*	1.45 [0.68;3.06]	0.54 (0.17)*	1.56 [1.10:2.20]

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Longitudinal study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	
Objectives	3	State specific objectives, including any prespecified hypotheses	3	
Methods				
Study design	4	Present key elements of study design early in the paper	3	Cohort, longitudinal survey
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3	Further details on data collections can be found in references
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	3	Further details on data collections can be found in references
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-5	Further details can be found in references
Bias	9	Describe any efforts to address potential sources of bias	5	
Study size	10	Explain how the study size was arrived at	3	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-5	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4-5	
		(*b*) Describe any methods used to examine subgroups and interactions	4-5	
		(*c*) Explain how missing data were addressed	4-5	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	3	
		(*e*) Describe any sensitivity analyses	5	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	3	
		(b) Give reasons for non-participation at each stage	4	Details in ref
		(c) Consider use of a flow diagram	4	Details in ref
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1	
		(b) Indicate number of participants with missing data for each variable of interest	NA	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Table 1	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3, Supplementary table 1	
		(*b*) Report category boundaries when continuous variables were categorized	Table 1	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories

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Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories

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Abstract

Background: Long working hours and unpaid work are possible risk factors for depressive symptoms. However, little is known about how working hours influence the course of depressive symptoms. This study examined the influence of paid, unpaid working hours and total working hours on depressive symptoms trajectories.

Methods: The study was based on data from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH 2008-2014). We applied group-based trajectory modelling in order to identify trajectories of depressive symptoms and studied paid and unpaid working hours and total working hours as risk factors.

Results: Six trajectory groups were identified with symptoms: 'very low stable', 'low stable', 'doubtful increasing', 'high decreasing', 'mild decreasing', and 'high stable'. More time spent on paid- or unpaid work did not independently predict the symptom trajectories compared to being in the 'very low stable' symptom group. However, more total working hours was associated with a higher probability of having 'low stable' (Odds ratio (OR) 1.21, confidence interval (CI) 1.03-1.44) symptoms compared to having 'very low stable' symptoms, but especially 'mild decreasing' (OR 1.46, CI 1.22-1.74), and 'high stable' (OR 1.71, CI 1.35-2.16) symptoms, when adjusting for sex, age, civil status and socioeconomic status. These associations were relatively similar between men and women.

Conclusions: This study supported heterogeneous individual patterns of depressive symptoms over time among the Swedish working population. The results also indicate that longer total working hours which indicate a double burden from paid and unpaid work may be associated with higher depressive symptom trajectories.

Strengths and Limitations of this Study

- This study was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years.
- In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder
- Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and identify heterogeneity in the sample
- A longer time series of measurement may have contributed to more power for identifying heterogeneity in symptoms over time

- The sample is probably characterized by relatively healthy individuals with high educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms.

INTRODUCTION

Mental health problems and especially depression are of major public health concern owing to the high prevalence and substantial negative consequences on personal functioning, but also work productivity[1]. It is well known that onset of depression may vary between individuals and that symptoms occasionally recur over the life course.

Some long-term patterns of depressive symptoms may also be associated with more functional limitations[2], and it has been suggested that different risk factors may be associated with different long-term patterns[3-4]. It has previously been indicated that factors such as problems with peers and parents, alcohol/tobacco/drug use, parental history of depression and negative cognitive styles could lead to worse depression trajectories over time among children/adolescents[5]. Among older people, poor self-rated health, past history of somatic illness, functional and cognitive impairment and low social support have been associated with negative course of symptoms. Stressful life events has also a found to be a predictor of poor depressive symptom trajectories[5-6]. However, little is known about the influence of work-related characteristics on different long-term patterns of depressive symptoms.

Work stressors such as high work demands or high demands in combination with low control (job strain) have generally been implied as risk factors for depressive symptoms[7-9]. Long working hours has also been associated with several serious health outcomes such as stroke and coronary heart disease[1-10], and diabetes among people with low socioeconomic status[2,11], as well as depressive states[4,7-8,12-15]. It has been suggested that work stress may be one of the reasons for negative health effects of long working hours. Long working hours may also be associated with limited time for recuperation and lead to poorer health behaviors[16]. In the modern working life there is an increased risk that working times are extended beyond the contracted hours, which could have serious implications for recovery and health. However, the potential health effects associated with long working hours may also depend on non-work responsibilities.

In general, women still spend far more time than men on unpaid work[17]. Especially women may therefore be at risk of "a double burden" of both paid and unpaid work, A double burden or "high total workload" in terms of hours spent on paid/unpaid work has been suggested to

be associated with work stress and to contribute to common physical and mental symptoms[18-20] but more knowledge is needed on both changes in stress from workload in paid and unpaid work, and the interplay between these stressors, over the life course, and how they influence health among men and women[21] .

A better understanding of the health risks associated with long working hours and total workload can allow for better scheduling, legislation, and prioritization of preventive measures.

The aim of this study was to examine how time spent on paid and unpaid work as well total working hours are associated with different depressive symptoms trajectories among Swedish men and women.

METHODS

Study population

The study population consisted of participants from SLOSH (Swedish Longitudinal Occupational Survey of Health) study, a nationally representative longitudinal cohort study with repeat self-reported measures every second year[22]. SLOSH started in 2006 as a follow-up of participants in the Swedish Work Environment Survey (SWES) 2003 (N=9214). SWES 2003 participants were asked to complete questionnaires again in 2008, 2010, 2012, 2014 and 2016. Respondents from SWES 2005 were also added to the cohort in the next SLOSH wave in 2008 (raising the number of cohort members to 18917) and asked to respond to follow-up questionnaires every second year. Postal self-completion follow-up questionnaire were sent out to all eligible SWES participants each wave, one for those that currently work at least 30% or full time and one for people working less or those who had left the labor force temporarily or permanently. Four waves have been used in the present study: 2008, 2010, 2012, and 2014. The total number of invited participants were 18639, 20298, 17434, and 38659, respectively, with overall response rates between 62% and 57%. To allow for analyses of trajectories of depressive symptoms and temporal changes in working times, the present study is based on those SWES 2003 and 2005 participants who responded in all four waves (2008-2014) in total 6300 individuals (Figure 1). Women, older, highly educated, and married people are generally overrepresented among the respondents to SLOSH. A comparison of demographic characteristics between all respondents 2008 (n=11441) and the study sample, further showed that the study sample consisted of a higher proportion of women, university educated and with higher mean age and children at home than those excluded from the sample

because of non-response 2010-2014. Depressive symptoms scores were, however, generally a bit lower among the study subjects, as was the proportion of long working hours and long hours of unpaid work. The study has been approved by the Regional Research Ethics Board in Stockholm, and informed consent was obtained from all respondents. More information about the cohort can be found elsewhere[23].

Measures

Depressive symptoms were measured with a brief subscale from the Symptom Checklist (SCL-90), the SCL-CD_6 [24] which assesses perception of being troubled by: Feeling blue; Feeling no interest in things; Feeling lethargy or low in energy; Worrying too much about things; Blaming yourself for things; and Feeling everything is an effort, quantified on a five-category scale from 0=Not at all to 4=Extremely. The six items represent core symptoms, selected based on principals of clinical validity. The scale has validated and was found to have good psychometric properties making it suitable to add into a composite score indicative of depression severity[24].

Time use was also measured repeatedly 2008-2014 by a modified version of a measure developed and psychometrically evaluated by Mardberg et al.[25]. In addition to hours/week in paid employment and overtime at work, constituting a measure of paid working hours, the instrument covers unpaid work activities, such as household duties (mending, sewing, laundry, gardening), childcare (homework/teaching, care-taking, playing) and other unpaid duties (voluntary work in unions and organizations, care of sick or elderly relatives). Hours/week spent on household duties (shopping, cleaning, cooking, mending, sewing, laundry and gardening) and on childcare (homework/ teaching, care taking, playing) were added to a measure of unpaid working hours. In this study paid working hours was divided into 4 categories: <40, 40-49, 50-59, 60+ working hours/week. An exception was in SLOSH 2010 because of changes to the response options. Then the corresponding categories were <41, 41-50, 51-60, 61+. Unpaid working hours was also divided into 4 categories: <8, 8-11, 12-20, 21+ hours on average/week. The total number of hours spent on paid and unpaid work constituted the total working hours measure (reflecting "total workload"), and was divided into the following 4 categories: <58, 58–67, 68–80, and >80 h/week.

Statistical analysis

Group-based trajectory modelling (GBTM) was used in order to identify distinct groups of individual trajectories within the population, and examine whether working hours predicts the

course of depressive symptoms over time. This is a semi-parametric model-based clustering technique that allows the identification of groups of individuals following a similar progression of an outcome over time in a flexible and easy way[26]. The trajectory model was fitted using maximum likelihood methods allowing for incomplete data and assuming missing at random data. We used calendar time rather than age as the underlying time scale, since sub-cohort effects could not be ruled out with a cohort-sequential design.

In order to select the best model we followed Nagins' recommended two-step procedure. Firstly the number of latent trajectories was selected. Models with one to eight groups were estimated starting with a single trajectory model described by a cubic polynomial equation to capture the relationship between time (waves) and depressive symptoms, and continuing with models with increasing number of groups. Estimation of depression trajectories was accomplished using the censored normal model (CNORM), which is appropriate for continuous data.

The Bayesian Information Criterion (BIC) was mainly used in order to determine the number of subgroups[26-27]. The magnitude of difference in BIC, the Bayes factor as well as the BIC-based probability approximation were used to choose between more complex and simpler models[27-29]. However, because BIC sometimes keeps improving when adding trajectory groups[26], we further considered the significance of polynomial terms (at the confidence level alpha 0.05), the values of group membership probabilities and of average posterior probability (entropy) with recommended value greater than 0.7[26,28-30], and when the model no longer captured new distinctive features of the data as complementary criterions for selecting the best model. Because of a relatively large sample we allowed for trajectory groups consisting of a minimum of 1 % of the sample.

After selecting the optimal model in terms of number of groups we selected the shape for each of these groups. Then conditional on the best model, time-stable covariates (risk factors) were inserted in the model by assuming that these risk factors influence the probability of membership to a particular trajectory group. Paid and unpaid working hours were considered simultaneously relative to the defined trajectory groups as time-invariant covariates (risk factors) in the main analyses to allow for a temporal precedence of working hours (labelled model 1). Also total working hours was modeled separately (labelled model 2). Coefficients for risk factors indicate the increase in log odds of being in a trajectory (relative to the lowest group) per unit change in the risk factor[26]. Unadjusted models as well as models adjusted for sex (0 men, 1 women), age, civil status (0 not married, 1 married or cohabiting) and

socioeconomic status[31] were presented. We further conducted the same analyses for men and women separately since a significant interaction effect was found for sex, and among participants working full time only. The latter was done to exclude those with part time from the reference group since part time work may be associated with poorer health. We also fitted models with working hours as categorical variables. Working hours were, however, alternatively considered as time-varying covariates to account for the time-varying nature. Since health effects of long working hours may be at least partly attributed to poor working conditions we also tested if there was an interaction between long working hours and job strain (the combination between high job demands and low control)[32-34].

The GBTM analyses were conducted using the PROC TRAJ procedure developed by Jones and Nagin, which can be downloaded from http: //www.andrew.cmu.edu/user/bjones[29,35] in the SAS software (version 9.4; SAS Institute).

RESULTS

Table 1 shows some descriptive characteristics of the study sample. Most of the study participants were in middle age or in mature adulthood at wave 2 (2008). A high proportion were married or cohabiting and about 40 % had children living at home. Most were working full time with a day time work schedule. About 20 % of the population had long paid working hours i.e. worked more than 50/51 hours per week, and a relatively high proportion had long unpaid working hours i.e. was spending 21 hours or more on unpaid work per week. Almost 11 % had a long total working hours i.e. were spending over 80 hours per week on paid and/or unpaid work. Women generally worked longer in total (mean hours of total work: 65.02) compared to men (mean hours of total work: 60.07), while men generally spent more time on paid work (mean hours of paid work for men: 45.59 hrs; mean hours of unpaid work: 14.3 hrs) and women more time on unpaid work (mean hours of paid work: 45.09 and mean hours of unpaid work; 20.07).

Table 1. Characteristics of the study sample in terms of demographic characteristics and workload from paid and unpaid work in 2008 (wave 2, SLOSH data)

		All	Women	Men
Age (%)	Early adulthood (19-34)	8.9	10.2	7.06
	Middle life (35-49)	30.6	32.1	28.69
	Mature adulthood (50-70)	60.5	51.3	64.25

Sex (% females)		58.0		
Civil status (% married or cohabiting)		79.7	78.4	81.56
Children at home (%)		40.9	41.9	39.6
SEI (%)	Unskilled manual workers	14.8	14.1	15.8
	Skilled manual workers	14.4	12.4	17.1
	Assistant non-manual employees	12.6	16.5	7.1
	Intermediate non-manual employees	31.5	34.0	27.9
	Higher non-manual employees	20.5	19.1	22.8
	Self-employed	6.2	3.8	9.5
Full time work (%)		77.4	67.6	90.7
Work schedule (%)	Day time	78.0	76.5	80.1
	Night work	6.2	3.1	1.9
	Shift work excl. nights	15.8	4.32	3.13
Paid working hours per week (%)	<40 or 41	30.0	38.6	20.0
	40/41-49/50	49.8	46.8	55.3
	50/51-59/60	12.6	9.7	15.2
	60/61+	7.6	4.7	9.5
Unpaid working hours per week (%)	<8	19.1	10.7	30.2
	8-11	40.6	19.1	24.5
	12-20	22.0	24.2	19.1
	21+	37.4	46.0	26.2
Total working hours per week (%)	<58	39.7	33.6	47.5
	58-67	28.5	31.8	24.4
	68-80	21.0	23.0	18.3
	>80	10.8	11.5	9.8

Evaluation of the different models resulted in the selection of a model with six trajectories with a linear order for four groups suggesting a linearly decreasing or increasing trajectory, and a cubic order for two of the groups suggesting a trajectory where there are two turning points (inflections), a maximum and a minimum in depressive symptoms (BIC: -62598.42; Entropy: 0.8). BIC continued to decrease for models with increasing number of groups (Supplementary Table I). However, visual examination of models with four five, six and seven groups indicated that the six group model identified distinctive features of the data (average posterior probabilities above 0.8). Figure 2 depicts the shapes of the six trajectories as well as their class sizes. The pattern of symptoms over time could be described as either "very low stable", "low stable", "doubtful increasing", "high decreasing", "mild decreasing" and "high stable". The trajectories named 'very low stable', "low stable" and 'stable high' followed a slight downward linear trend over time, but remained either at a no depression level (<7 on the depression scale) or between moderate to severe level (>11 and >15, respectively, on the depression scale) [25]. The trajectory named 'mild decreasing' followed a slightly decreasing trend until year 2012 (wave 4) and slightly increasing afterwards. Symptoms varied from mild (>9 and < 11 on the depression scale) to doubtful (>6 and < 10 on the depression scale) depression. The trajectory named 'doubtful increasing' followed a slight increasing linear trend but remained either at doubtful or mild depression level. Finally the trajectory named 'high decreasing' followed a steep downward trend until year 2010 (wave 3) and a slightly decreasing trend thereafter. The symptoms varied from severe depression to no depression levels.

The majority of individuals were classified in either the 'very low stable' (49.1%) or 'low stable' (23.4%) group. The 'high decreasing' group represented the smallest group (1.3%) and the 'doubtful increasing' represented 8.4% of the sample. Both the 'high decreasing' group and the 'doubtful increasing' group followed a quadratic trend with two turning points. Altogether there were four favorable ('mild decreasing', 'high decreasing', 'low stable' and 'very low stable') and two unfavorable ('doubtful increasing', and 'high stable') trajectories.

A description of the demographic characteristics and the distribution of working hours in the year 2008 for the six trajectory groups are given in Table 2. The mean age was, for example, lowest in the 'high stable' trajectory (47.0 years), followed by the 'doubtful increasing' group (47.6 years). Overall there was a higher proportion of women in the unfavorable trajectories. Especially total working hours varied between the groups. A higher proportion of individuals with a long of total working hours were observed in the 'doubtful increasing' and the 'high stable' group.

Table 2. Characteristics of the trajectory groups in terms of demographic characteristics and workload from paid and unpaid working hours in 2008 (wave 2, SLOSH data)

		Very low stable (n=1447)	Low stable (n=3213)	Doubtful increasing (n=474)	High decreasing (n=74)	Mild decreasing (n=755)	High stable (n=328)
Mean Age (Years)		55.2	51.1	47.6	54.1	49.6	46.8
Sex (% females)		48.2	58.0	68.1	69.4	65.0	71.3
Civil status (% married)		82.5	80.6	76.3	71.6	77.2	71.8
Socioeconomic instatus (%)	Unskilled manual workers	15.3	13.9	16.0	13. 9	16.0	17.0
	Skilled manual workers	16.4	13.8	14.0	6.9	14.6	12.6
	Assistant non-manual employees	12.8	12.0	12.3	15.3	13.5	15.1
	Intermediate non-manual employees	17.9	32.3	32. 9	27.8	31.8	28.7
	Higher non-manual employees	8.0	22.3	18.6	22.2	19.2	20.8
	Self-employed	8.2	5.7	6.1	13.9	4.6	5.9
Paid working hours per week (%)	<40 or 41	30.1	30.9	30.2	41. 8	29.8	29.4
	40/41-49/50	51.0	49.9	51.7	41.8	52.1	50.2
	50/51-59/60	12.1	12.2	12.1	9.0	11.3	13.6
	60/61+	6.8	7.1	6.0	7.5	6.9	6.8
Unpaid working hours per week (%)	<8	17.7	19.4	21.0	15.3	20.4	18.3
	8-11	21.5	21.9	21.8	23.7	19.5	20.9
	12-20	22.9	21.5	22.7	23.7	21.6	22.6
	21+	37.9	37.3	34.5	37.3	38.5	38.3
Total working hours per week (%)	<58	48.7	41.0	29.1	55.3	37.3	28.6
	58-67	26.2	27.3	32.3	12.8	25.8	25.6
	68-80	17.7	20.5	21.8	17.0	23.2	27.6
	>80	7.5	11.3	16.8	14.9	13.5	18.1

Table 3 reports the results of the multinomial logistic regression models in log-odds ratios (estimate), standard errors (SE) and odds ratios (OR), with the 'very low stable' group as reference group. Model 1 presents the results from a model including both paid and unpaid working hours, while model 2 presents the results of a model analyzing the influence of total

working hours separately. The results showed that neither longer paid working hours nor unpaid working hours at the baseline measurement (2008) was independently associated with a significantly higher or lower likelihood of being in any of the trajectory groups as compared to being in the reference group. Longer total working hours was, on the other hand, associated with increased likelihood of being in the 'low stable', 'doubtful increasing', 'mild decreasing', and 'high stable' group. Sex, age, and civil status and socioeconomic status were included in the adjusted models as additional risk factors for the trajectory group membership. Estimates from the adjusted model with respect to paid/unpaid working hours were relatively similar to those in the unadjusted model. However, individuals with longer unpaid working hours, had a statistically significantly lower likelihood [OR:0.90; CI:[0.82;0.99]] of being in the group with 'doubtful increasing' symptoms compared to the 'very low stable' group in this model. With respect to longer total working hours we also found similar results in the adjusted model. There was an increased likelihood of being in the 'low stable' [OR:1.21; CI:[1.03;1.44]], 'doubtful increasing' [OR:1.13; CI:[0.96;1.32]], 'mild decreasing' [OR:1.46; CI:[1.22;1.74]], and 'high stable' group [OR:1.71; CI:[1.35;2.16]]. Especially, a higher probability of being in the 'mild decreasing' and 'high stable' trajectory group was observed in the adjusted model. In supplementary analyses of longer paid working hours separately, no significant associations between paid working hours and the trajectory groups were observed. Results were also similar in a subsample of full-time employees only. No clear associations was on the other hand observed in analyses with working hours as categorical variables, but which may be due to lack of power. Moreover, the risk estimates for paid working hours were not significantly different among people with or without job strain (data not shown).

Table 3. Results from the multinomial logistic regressions models estimating the probabilities of group membership according to a) paid working hours and unpaid working hours b) total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios; SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory groups	Low Stable		Doubtful increasing		High decreasing		Mild decreasing		High stable	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted models										
Unadjusted Model 1										
Paid working hours	0.01 (0.01)	1.01 [0.99;	0.00 (0.01)	1.00 [0.98;	0.01 (0.01)	1.01 [0.99;	0.00 (0.02)	1.00 [0.96;	0.01 (0.01)	1.01 [0.99;

		1.03]		1.02]		1.03]		1.04]		1.02]
Unpaid working hours	-0.01 (0.06)	0.99 [0.88; 1.11]	-0.10 (0.06)	0.91 [0.81; 1.02]	-0.02 (0.06)	0.98 [0.87; 1.11]	-0.03 (0.12)	0.97 [0.77; 1.23]	0.00 (0.09)	1.00 [0.84; 1.19]
Unadjusted Model 2										
Total working hours	0.24 (0.05)*	1.27 [1.15; 1.40]	0.39 (0.06)*	1.47 [1.31; 1.65]	0.11 (0.14)	1.11 [0.85; 1.46]	0.34 (0.12)*	1.40 [1.11; 1.77]	0.53 (0.08)	1.70 [1.45; 1.98]
Adjusted models including sex, age, civil status, and socioeconomic status										
Adjusted Model 1										
Paid working hours	0.00 (0.01)	1.00 [0.98; 1.02]	-0.01 (0.01)	0.99 [0.97; 1.01]	0.00 (0.02)	1.00 [0.96; 1.03]	0.01 (0.01)	1.01 [0.98; 1.02]	0.00 (0.01)	1.00 [0.97; 1.03]
Unpaid working hours	-0.02 (0.06)	0.98 [0.87; 1.10]	-0.13 (0.06)*	0.88 [0.78; 0.97]	-0.06 (0.12)	0.94 [0.75; 1.19]	-0.05 (0.07)	0.95 [0.83; 1.09]	-0.07 (0.09)	0.93 [0.77; 1.12]
Adjusted Model 2										
Total working hours	0.19 (0.08)*	1.21 [1.03; 1.44]	0.12 (0.08)	1.13 [0.96; 1.32]	0.06 (0.18)	1.06 [0.74; 1.51]	0.38 (0.09)*	1.46 [1.22; 1.74]	0.54 (0.12)*	1.71 [1.35; 2.16]

*: significance at 5%.

An interaction between total working hours and sex was on the hand noted. The analyses were therefore also stratified by sex. The separate trajectory groups identified for men and women are shown in Supplementary Figure I and II. Among men, the best solution resulted in only 5 trajectory groups whereas 6 groups were identified among women (Supplementary Table I). The trajectories were relatively similar to the ones illustrated in Figure 2. In line with the results in the total sample, neither longer paid working nor unpaid working hours were independently associated with increased likelihood of any of the trajectories among men or women (Supplementary Table II-Supplementary Table III). For total working hours among men we found an increased likelihood of being in the 'doubtful stable' group while longer total working hours for women was associated with increased likelihood in the 'high decreasing' and 'high stable' groups compared to the very low stable group (Supplementary Table II-Supplementary Table III). Hence, the association between total workload and high stable depressive symptoms was only apparent among women.

In analyses with working hours as time-varying covariate, adjusting for sex, age, civil status, and socioeconomic status, longer paid working hours increased the depressive symptom trajectory in the 'low stable', 'doubtful increasing', and high stable' group. Longer unpaid working hours also raised the trajectory in the 'doubtful increasing' group but decreased the depressive symptoms in the 'mild decreasing' group. Longer total working hours, however, significantly increased depressive symptoms in both the 'very low stable', 'low stable', 'doubtful increasing', and 'high stable' group, but not in the 'high or mild decreasing' groups (Supplementary Table IV).

DISCUSSION

The current study identified six distinct depressive symptoms trajectories. Previous population based studies have also shown that stable patterns are common such as stable low symptoms[5], which is in line our findings. A small group with stable high symptoms, as in the present study, have also commonly been found in other studies[2,5]. Patterns with varying degree of symptoms over time are more seldom observed[5]. However, it has also been found that a considerable proportion of the general population experience a stable recovery after a depressive episode[2]. The patterns observed in this study are thus generally in line previous findings and expectations.

This work further suggested that working hours is associated with different long-term trajectories of depressive symptoms. However, neither paid working hours nor unpaid working hours per se seemed to influence the depressive symptoms trajectories. The present study thus conflict with an association between long working hours and depression as found in previous work[12]. However, there are indications that only more extreme weekly working hours are associated with poorer health[10,36], which may partly explain why we did not observe any association between time spent on paid work and depressive symptom trajectories in the present study. Also changes in the response options restricting the possibility to separate part time work from more standard hours (35-40 h per week) in this study may have played a role, although sensitivity analyses among full-time employees showed similar results. The study on the other hand indicate that a longer total working hours is associated with certain patterns of depressive symptoms over time. This is the first study to our knowledge on the relationship between total working hours and depressive symptom trajectories. The results indicated an association between total working hours and both favorable ('low stable', 'mild decreasing') and unfavorable ('high stable') trajectories, but especially high stable symptoms. A higher risk of belonging to some of these groups such as the 'low stable' and 'mild decreasing' groups may be explained by a higher initial level of depressive symptoms than those in the 'very low stable' group. Total working hours was, on the other hand, not clearly associated with the 'high decreasing' group that started on a severe depression level but decreased to no depression.

Complementary analyses showed that the depressive symptoms increased further in some groups, especially in the unfavorable groups with doubtful increasing and stable high symptoms, with an increase in total working hours over the period. This suggests that long working hours potentially due to a double burden of paid and unpaid work constitute a risk

and should be considered in policy and prevention. Increased gender equality in terms of work conditions and unpaid work share may also contribute to lessen the burden in the society at large. More research is however needed to confirm our findings. Although, we did observe that there was a stronger association between total working hours and stable high depressive symptoms among women than men, there were generally small differences men and women. This is in contrast to some earlier studies that have suggested that long working hours may be more detrimental to women's health[36-41] although the evidence is still scarce and inconclusive[42-44]. Another study on the other hand observed similar associations between long working hours and health among men and women from Nordic countries characterized by the so called "dual breadwinner external care model" (meaning participation of both parents on the labor market and outsourcing of care), while different associations were observed in other countries dominated by e.g. the male breadwinner model[45].

Some strengths of the study are that it was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years. In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder[5]. Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and also introduce risk factors that may influence membership in trajectory groups and therefore identify heterogeneity in the sample[27,46]. We based the trajectories on four time points, which is above the minimum required for estimating quadratic trajectories [30]. A longer time series of measurement may, however, have contributed to more power for identifying heterogeneity in symptoms over time, study onset versus recovery etc, and potential determinants of different trajectories. Dropout from the study may also have restricted the possibility to detect heterogeneity. Given that the subjects were originally working and repeatedly in paid work for more than 30 % over the study period, the sample is probably characterized by relatively healthy individuals with high educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms. Data were also missing on family history of mental health problems and childhood/adolescent characteristics, which may be predictors of depressive symptoms trajectories and workload and may confound the relationships of interest. In the main models we chose to examine whether working hours at the start of the trajectory predicted the course of depressive symptoms in order to allow for temporal precedence of working hours, although working hours may also be changing or stable over the study period. This does not rule out that depressive symptoms at baseline may have biased reporting of working hours. However,

later depressive symptoms is unlikely to influences the initial measurement of working hours. For power considerations we also treated the data on working hours as continuous rather than categorical, which probably not optimal given that only more extreme hours may be associated with health consequences, but sensitivity analyses did not support associations between any of the specific categories and depressive symptoms trajectories.

All in all, the results indicate that working hours may increase the risk of higher depressive symptom trajectories. Since an unfavorable trajectory with stable or recurrent high depressive symptoms is associated with a poor prognosis[5], interventions with regard to working hours may contribute to limit the burden of depressive disorders in the population.

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COMPETING INTERESTS

Conflicts of interest: No author has reported a conflict of interest

DATA SHARING

SLOSH data are not publicly available due to legal restrictions. Requests for data or results can be addressed to the SLOSH data manager data@slosh.se. More information can be found on the SLOSH website www.slosh.se.

CONTRIBUTORSHIP STATEMENT

Author contributions: LMH conceived the study. PP performed the analyses and drafted the manuscript. LMH, PP and HW contributed to the design and interpretation of data, critical revision of the work, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Fig.1. Total number of respondents/non-respondents to the Swedish Longitudinal Occupational Survey of Health (SLOSH) among the SLOSH sample originally participating in the Swedish Work Environment Surveys (SWES) 2003 and 2005, as well as number of individuals included in the analytic sample.

Fig. 2: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)

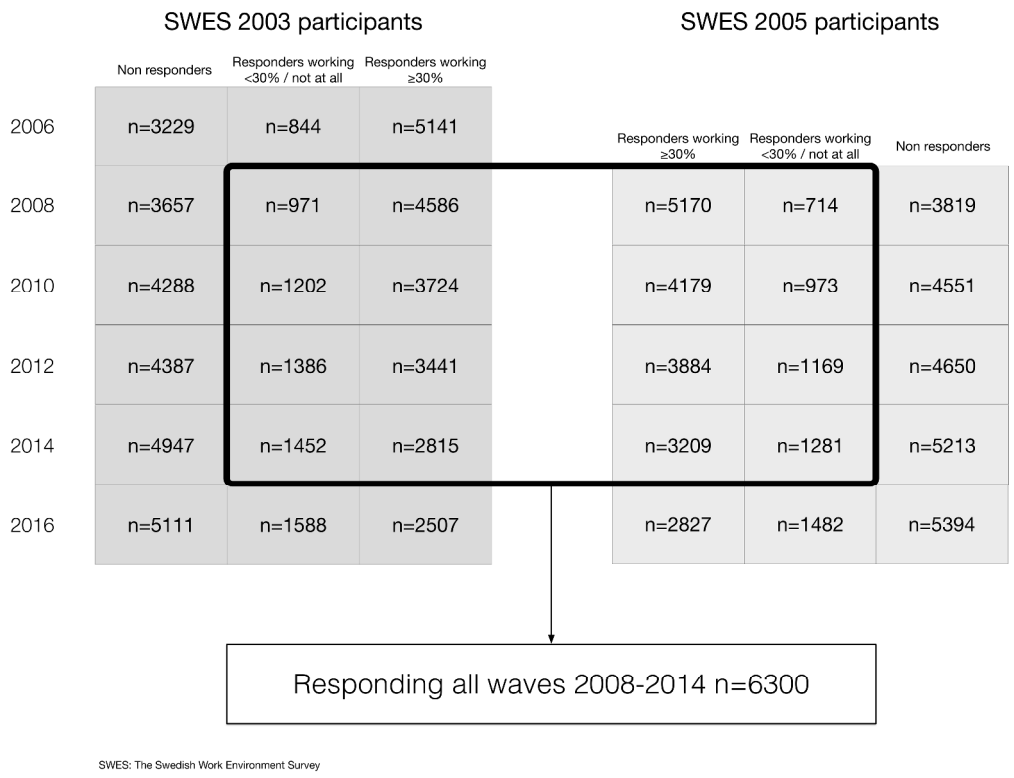

Fig.1. Total number of respondents/non-respondents to the Swedish Longitudinal Occupational Survey of Health (SLOSH) among the SLOSH sample originally participating in the Swedish Work Environment Surveys (SWES) 2003 and 2005, as well as number of individuals included in the analytic sample.

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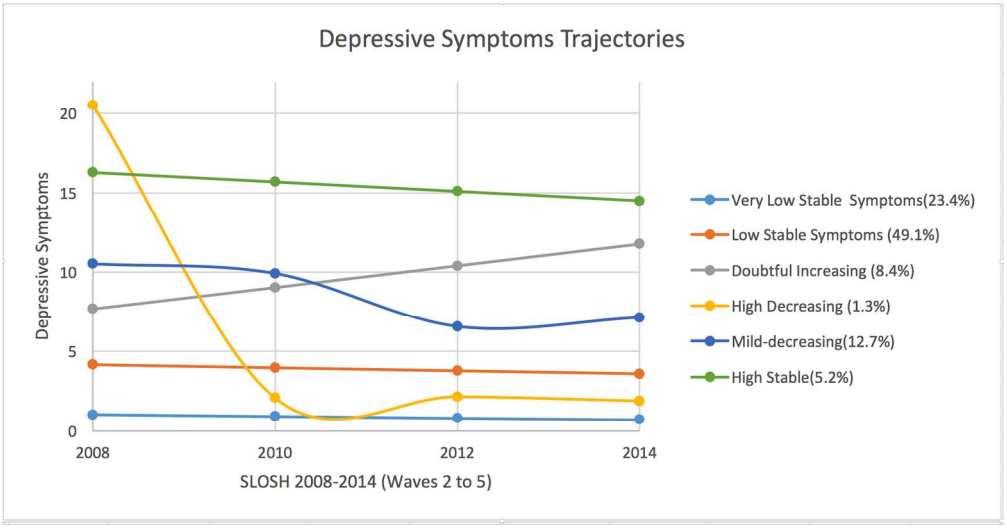


Fig. 2: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)

169x88mm (300 x 300 DPI)

Supplementary Table I: Fit Values for group-based trajectory models with different number of groups

	All	Males	Females
3 groups	BIC: -63381.45 AIC: -63330.85	BIC: -25232.18 AIC ; -25188.10	BIC=-38090.91 AIC=-38044.39
4 groups	BIC: -63075.15 AIC: -63007.68	BIC:-25080.06 AIC:-25021.28	BIC=-37961.41 AIC=-37899.39
5 groups	BIC: -62713.72 AIC: -62629.39	BIC:-24816.75 AIC:-24743.27	BIC=-37835.91 AIC=-37758.39
6 groups	BIC: -62627.43 AIC: -62526.23	BIC:-24836.44 AIC:-24748.27	BIC=-37800.26 AIC=-37707.23
7 groups	BIC: -62512.35 AIC: -62394.29		BIC=-37715.31 AIC=-37606.78
8 groups	BIC: -62398.45 AIC: -62263.52		BIC=-37635.37 AIC=-37511.33

Supplementary Table II: Results from the multinomial logistic regressions models for females estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and Adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (* significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

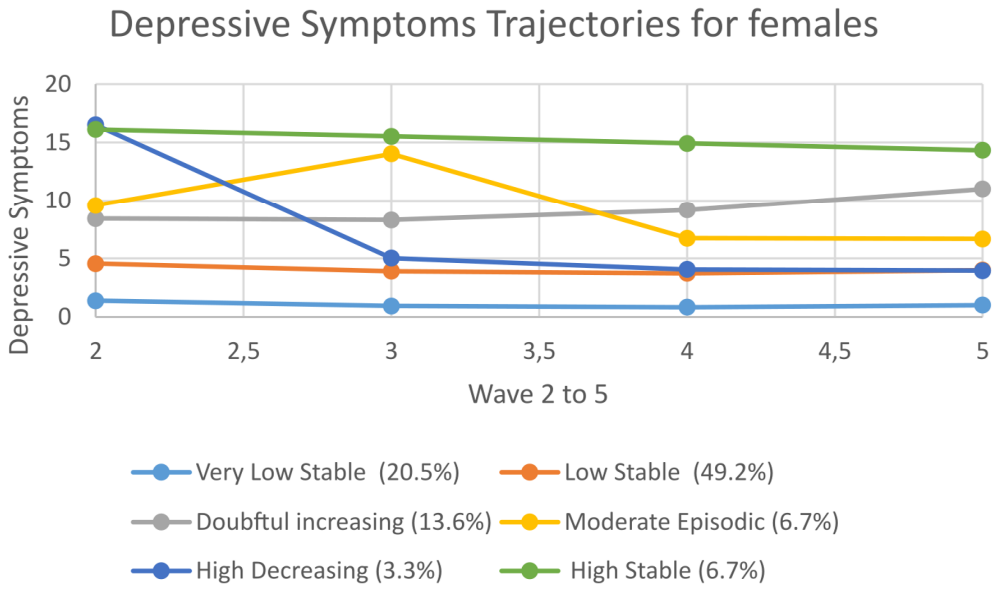
Trajectory groups	**Low Stable**		**Doubtful increasing**		**High decreasing**		**Moderate Episodic**		**High stable**	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted Models										
Unadjusted Model 1										
Workload paid work	0.01 (0.01)	1.01 [0.99; 1.02]	0.01 (0.01)	1.00 [0.98; 1.03]	0.01 (0.02)	1.01 [0.98; 1.04]	0.02 (0.02)	1.02 [0.98; 1.06]	-0.00 (0.01)	0.99 [0.97; 1.03]
Workload unpaid work	-0.07 (0.06)	0.93 [083; 105]	-0.05 (0.08)	0.95 [0.81; 1.11]	-0.21 (0.10)*	0.81 [0.66; 0.98]	001 (0.13)	1.00 [0.78; 1.29]	-0.03 (0.09)	0.97 [0.81; 1.15]
Unadjsuted Model 2										
Total work load	0.22 (0.08)*	1.25 [1.07; 1.46]	0.22 (0.10)*	1.25 [1.02; 1.51]	0.51 (0.14)*	1.66 [1.26; 2.19]	0.16 (0.15)	1.17 [0.87; 1.57]	0.50 (0.11)*	1.65 [1.33; 1.71]
Adjusted models including sex, age, civil status and socio-economic status										
Adjusted Model 1										
Workload paid work	-0.00 (0.02)	1.00 [0.96; 1.04]	0.00 (0.01)	1.00 [0.98; 1.02]	0.01 (0.01)	1.01 [0.98; 1.03]	0.02 (0.02)	1.02 [0.98; 1.06]	-0.00 (0.02)	0.99 [0.96; 1.23]
Workload unpaid work	-0.15 (0.12)	0.86 [0.69; 1.07]	-0.05 (0.07)	0.95 [0.81; 1.12]	-0.13 (0.07)	0.88 [0.76; 1.01]	-0.02 (0.14)	0.98 [0.74; 1.29]	0.09 (0.14)	1.09 [0.83; 1.43]
Adjusted Model 2										
Total work load	0.28 (0.17)	1.33 [0.95 ;1.5]	0.13 (0.09)	1.14 [0.95; 1.36]	0.22 (0.09)*	1.25 [1.05; 1.49]	0.09 (0.17)	1.10 [0.79; 1.54]	0.39 (0.12)*	1.48 [1.14; 1.91]

Supplementary Table III: Results from the multinomial logistic regressions models for males estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

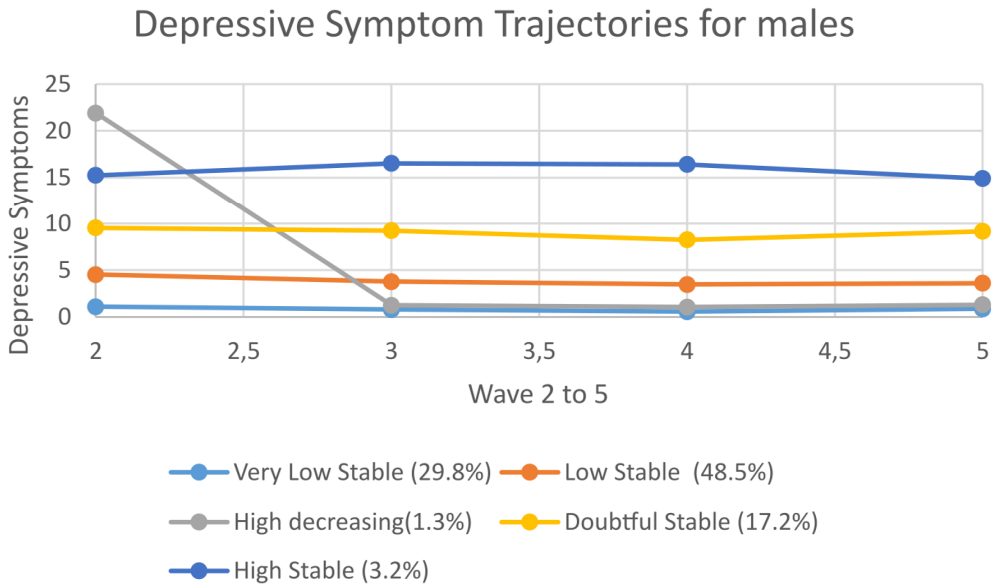
Trajectory groups	**Low Stable**		**High Decreasing**		**Doubtful Stable**		**High Stable**	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted models								
Unadjusted Model 1								
Paid working hours	0.00 (0.01)	1.00 [0.98;1.02]	-0.06 (0.04)	0.94 [0.87;1.01]	0.04 (0.07)	1.00 [0.98;1.02]	0.02 (0.02)	1.02 [0.98;1.06]
Unpaid working hours	0.06 (0.06)	1.07 [0.95;1.19]	-0.09 (0.18)	0.91 [0.64;1.29]	0.04 (0.07)	1.05 [0.91;1.19]	0.01 (0.15)	1.05 [0.75;1.35]
Unadjusted Model 2								
Total working hours	0.24 (0.05)*	1.19 [1.16;1.21	0.39 (0.06)*	0.66 [0.34;1.28]	0.11 (0.14)	1.39 [1.18;1.62]	0.34 (0.12)*	1.33 [0.91;1.25]
Adjusted models including, age, civil status, and socioeconomic status								
Adjusted Model 1								
Paid working hours	-0.01 (0.01)	0.99 [0.98;1.01]	-0.05 (0.04)	0.95 [0.88;1.02]	-0.00 (0.01)	1.00 [0.98;1.02]	0.02 (0.02)	1.02 [0.98;1.06]
Unpaid working hours	-0.09 (0.06)	0.92 [0.81;1.03]	-0.22 (0.19)	0.80 [0.55;1.16]	-0.03 (0. 07)	0.97 [0.65;1.11]	-0.09 (0.16)	0.91 [0.66;1.24]
Adjusted Model 2								
Total working hours	0.29 (0.18)	1.33 [0.94 1.89]	0.25 (0.09)*	1.29 [1.08 1.53]	-0.36 (0.36)	0.70 [0.34 1.41]	0.06 (0.08)	1.07 [0.91 1.25]

Supplementary Table IV. Results from the multinomial logistic regressions models estimating a potential increase or decrease in the symptom trajectories according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory groups	**Ref Group**		**Low Stable**		**Doubtful increasing**		**High decreasing**		**Mild decreasing**		**High stable**	
	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]	Estimate (SE)	OR [95 % CI]
Unadjusted Models												
Unadjusted Model 1												
Workload Paid work	0.02 (0.01)	1.02 [0.99; 1.05]	0.02 (0.01)*	1.03 [1.01; 1.04]	0.04 (0.03)	1.04 [0.98; 1.10]	-0.05 (0.05)	0.95 [0.86; 1.05]	-0.01 (0.05)	0.98 [0.96; 1.00]	0.08 (0.03)*	1.09 [1.03; 1.15]
Workload Unpaid work	0.37 (0.09)*	1.45 [1.19;1.76]	0.10 (0.05)*	1.11 [1.00; 1.23]	0.60 (0.14)*	1.83 [1.37; 2.43]	0.84 (0.28)*	2.32 [1.33; 4.04]	-0.57 (0.29)	0.56 [0.31; 1.01]	0.12 (0.14)	1.13 [0.84; 1.51]
Unadjusted Model 2												
Total work load	0.32 (0.10)*	1.37 [1.12; 1.68]	0.33 (0.07)*	1.39 [1.21 ;1.59]	0.71 (0.15)*	2.04 [1.51; 2.74]	-0.18 (0.30)	0.83 [0.46; 1.51]	-0.04 (0.31)	0.96 [0.52; 1.76]	0.43 (0.17)*	1.53 [1.08; 2.17]
Adjusted models including sex, age, civil status and socioeconomic status												
Adjusted Model 1												
Workload paid work	0.01 (0.02)	1.01 [0.98; 1.05]	0.02 (0.01)*	1.03 [1.01; 1.04]	0.07 (0.02)*	1.07 [1.01; 1.12]	-0.05 (0.05)	0.95 [0.86; 1.05]	-0.06 (0.06)	0.94 [0.84; 1.05]	0.08 (0.03)*	1.08 [1.03; 1.14]
Workload unpaid work	0.34 (0.10)*	1.40 [1.15; 1.72]	0.07 (0.05)	1.07 [0.97; 1.18]	0.62 (0.15)*	1.86 [1.39; 2.49]	0.82 (0.27)	2.28 [1.34; 3.89]	-0.71 (0.25)*	0.49 [0.29; 0.81]	0.08 (0.15)	1.09 [0.81; 1.45]
Adjusted Model 2												
Total work load	0.26 (0.12)*	1.30 [1.03; 1.63]	0.29 (0.07)*	1.34 [1.17; 1.53]	0.66 (0.15)*	1.93 [1.45; 2.59]	-0.17 (0.30)	0.85 [0.46; 1.54]	0.37 (0.38)*	1.45 [0.68; 3.06]	0.54 (0.17)*	1.56 [1.10; 2.20]



Supplementary Figure I: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms for females were identified: Very low stable (Group 1: 20.5% of the sample), Low stable (Group 2: 49.2% of the sample), Doubtful increasing (Group 3: 13.6% of the sample), Moderate Episodic (Group4: 6.7% of the sample), High decreasing (Group 5: 3.3% of the sample), High stable (Group 6: 6.7% of the sample)



Supplementary Figure II: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); five groups of depressive symptoms for males were identified: Very low stable (Group 1: 29.8% of the sample), Low stable (Group 2: 48.5% of the sample), High Decreasing (Group 3: 1.73% of the sample), Doubtful stable (Group 4: 17.2% of the sample), High stable (Group 5: 3.2% of the sample)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Longitudinal study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	
Objectives	3	State specific objectives, including any prespecified hypotheses	3	
Methods				
Study design	4	Present key elements of study design early in the paper	3	Cohort, longitudinal survey
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3	Further details on data collections can be found in references
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	3	Further details on data collections can be found in references
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-5	Further details can be found in references
Bias	9	Describe any efforts to address potential sources of bias	5	
Study size	10	Explain how the study size was arrived at	3	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-5	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4-5	
		(*b*) Describe any methods used to examine subgroups and interactions	4-5	
		(*c*) Explain how missing data were addressed	4-5	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	3	
		(*e*) Describe any sensitivity analyses	5	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	3	
		(b) Give reasons for non-participation at each stage	4	Details in ref
		(c) Consider use of a flow diagram	4	Details in ref
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1	
		(b) Indicate number of participants with missing data for each variable of interest	NA	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Table 1	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3, Supplementary table 1	
		(*b*) Report category boundaries when continuous variables were categorized	Table 1	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories: Results from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH)

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Keywords:	paid workload, unpaid workload, total workload, depressive symptoms, group-based trajectory modelling

Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories: Results from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH)

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The work was conducted at the Stress Research Institute, Stockholm University, Stockholm, Sweden

Keywords: paid workload, unpaid workload, total workload depressive symptoms, group-based trajectory modelling

Number of words: 3178

Abstract 283 words

Background: Long working hours and unpaid work are possible risk factors for depressive symptoms. However, little is known about how working hours influence the course of depressive symptoms. This

study examined the influence of paid, unpaid working hours and total working hours on depressive symptoms trajectories.

Methods: The study was based on data from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH 2008-2014). We applied group-based trajectory modelling in order to identify trajectories of depressive symptoms and studied paid and unpaid working hours and total working hours as risk factors.

Results: Six trajectory groups were identified with symptoms: 'very low stable', 'low stable', 'doubtful increasing', 'high decreasing', 'mild decreasing', and 'high stable'. More time spent on unpaid work was associated with the 'low stable' (Odds Ratio (OR) 1.16, confidence interval (CI) 1.04-1.30) and the 'high stable (OR 1.40, CI 1.18-1.65) symptom trajectories compared to being in the 'very low stable' symptom group. In addition more total working hours was associated with a higher probability of having ''high decreasing' (OR 1.30, CI 1.14-1.48), and 'high stable' (OR 1.22, CI 1.01-1.47) symptoms, when adjusting for sex, age, civil status and socioeconomic status. The results, however, differed somewhat for men and women. More unpaid working hours was more clearly associated with higher symptom trajectories among women. More total working hours was associated with 'high stable' symptoms among women only.

Conclusions: This study supported heterogeneous individual patterns of depressive symptoms over time among the Swedish working population. The results also indicate that a higher burden of unpaid work and longer total working hours, which indicate a double burden from paid and unpaid work, may be associated with higher depressive symptom trajectories, especially among women.

Strengths and Limitations of this Study

- This study was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years.
- In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder

- Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and identify heterogeneity in the sample
- A longer time series of measurement may have contributed to more power for identifying heterogeneity in symptoms over time
- The sample is probably characterized by relatively healthy individuals with high educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms.

INTRODUCTION

Mental health problems and especially depression are of major public health concern owing to the high prevalence and substantial negative consequences on personal functioning, but also work productivity[1] . It is well known that onset of depression may vary between individuals and that symptoms occasionally recur over the life course.

Some long-term patterns of depressive symptoms may also be associated with more functional limitations[2], and it has been suggested that different risk factors may be associated with different long-term patterns[3,4]. It has previously been indicated that factors such as problems with peers and parents, alcohol/tobacco/drug use, parental history of depression and negative cognitive styles could lead to worse depression trajectories over time among children/adolescents. Among older people, poor self-rated health, past history of somatic illness, functional and cognitive impairment and low social support have been associated with negative course of symptoms. Stressful life events has also a found to be a predictor of poor depressive symptom trajectories[5,6]. However, little is known about the influence of work-related characteristics on different long-term patterns of depressive symptoms.

Work stressors such as high work demands or high demands in combination with low control (job strain) have generally been implied as risk factors for depressive symptoms [7–9]. Long working hours has also been associated with several serious health outcomes such as stroke and coronary heart disease[1,10], and diabetes among people with low socioeconomic status[2,11], as well as depressive states[4,7–9,12–14]. It has been suggested that work stress may be one of the reasons for negative health effects of long working hours. Long working hours may also be associated with limited time for recuperation and lead to poorer health behaviors[15]. In the modern working life there is an increased risk that working times are extended beyond the contracted hours, which could have serious implications for recovery

and health. However, the potential health effects associated with long working hours may also depend on non-work responsibilities.

In general, women still spend far more time than men on unpaid work[16]. Especially women may therefore be at risk of "a double burden" of both paid and unpaid work, A double burden or "high total workload" in terms of hours spent on paid/unpaid work has been suggested to be associated with work stress and to contribute to common physical and mental symptoms[17–19] but more knowledge is needed on both changes in stress from workload in paid and unpaid work, and the interplay between these stressors, over the life course, and how they influence health among men and women[20].

A better understanding of the health risks associated with long working hours and total workload can allow for better scheduling, legislation, and prioritization of preventive measures.

The aim of this study was to examine how time spent on paid and unpaid work as well total working hours are associated with different depressive symptoms trajectories among Swedish men and women.

METHODS

Study population

The study population consisted of participants from SLOSH (Swedish Longitudinal Occupational Survey of Health) study, a nationally representative longitudinal cohort study with repeat self-reported measures every second year[21]. SLOSH started in 2006 as a follow-up of participants in the Swedish Work Environment Survey (SWES) 2003 (N=9214). SWES 2003 participants were asked to complete questionnaires again in 2008, 2010, 2012, 2014 and 2016. Respondents from SWES 2005 were also added to the cohort in the next SLOSH wave in 2008 (raising the number of cohort members to 18917) and asked to respond to follow-up questionnaires every second year. Postal self-completion follow-up questionnaire were sent out to all eligible SWES participants each wave, one for those that currently work at least 30% or full time and one for people working less or those who had left the labor force temporarily or permanently. Four waves have been used in the present study: 2008, 2010, 2012, and 2014. The total number of invited participants were 18639, 20298, 17434, and 38659, respectively, with overall response rates between 62% and 57%. To allow for analyses of trajectories of depressive symptoms and temporal changes in working times, the present study is based on those SWES 2003 and 2005 participants who responded in all four waves

(2008-2014) in total 6300 individuals (Figure 1). Women, older, highly educated, and married people are generally overrepresented among the respondents to SLOSH. A comparison of demographic characteristics between all respondents 2008 (n=11441) and the study sample, further showed that the study sample consisted of a higher proportion of women, university educated and with higher mean age and children at home than those excluded from the sample because of non-response 2010-2014. Depressive symptoms scores were, however, generally a bit lower among the study subjects, as was the proportion of long working hours and long hours of unpaid work. The study has been approved by the Regional Research Ethics Board in Stockholm, and informed consent was obtained from all respondents. More information about the cohort can be found elsewhere[22] .

Measures

Depressive symptoms were measured with a brief subscale from the Symptom Checklist (SCL-90), the SCL-CD_6 [23] which assesses perception of being troubled by: Feeling blue; Feeling no interest in things; Feeling lethargy or low in energy; Worrying too much about things; Blaming yourself for things; and Feeling everything is an effort, quantified on a five-category scale from 0=Not at all to 4=Extremely. The six items represent core symptoms, selected based on principals of clinical validity. The scale has validated and was found to have good psychometric properties making it suitable to add into a composite score indicative of depression severity[23].

Time use was also measured repeatedly 2008-2014 by a modified version of a measure developed and psychometrically evaluated by Mårdberg et al.[24]. In addition to hours/week in paid employment and overtime at work, constituting a measure of paid working hours, the instrument covers unpaid work activities, such as household duties (mending, sewing, laundry, gardening), childcare (homework/teaching, care-taking, playing) and other unpaid duties (voluntary work in unions and organizations, care of sick or elderly relatives). Hours/week spent on household duties (shopping, cleaning, cooking, mending, sewing, laundry and gardening) and on childcare (homework/ teaching, care taking, playing) were added to a measure of unpaid working hours. In this study paid working hours was divided into 5 categories based on pre-specified response options: <37, 37-40, 40-49, 50-59, 60+ working hours/week. Unpaid working hours was also divided into 5 categories: <8, 8-14, 15-20, 22-28, 29+ hours on average/week. The total number of hours spent on paid and unpaid work constituted the total working hours measure (reflecting “total workload”), and was divided into the following 5 categories: <41, 42-57, 58–67, 68–80, and >80 h/week.

Statistical analysis

Group-based trajectory modelling (GBTM) was used in order to identify distinct groups of individual trajectories within the population, and examine whether working hours predicts the course of depressive symptoms over time. This is a semi-parametric model-based clustering technique that allows the identification of groups of individuals following a similar progression of an outcome over time in a flexible and easy way[25]. The trajectory model was fitted using maximum likelihood methods allowing for incomplete data and assuming missing at random data. We used calendar time rather than age as the underlying time scale, since sub-cohort effects could not be ruled out with a cohort-sequential design.

In order to select the best model we followed Nagins' recommended two-step procedure. Firstly the number of latent trajectories was selected. Models with one to eight groups were estimated starting with a single trajectory model described by a cubic polynomial equation to capture the relationship between time (waves) and depressive symptoms, and continuing with models with increasing number of groups. Estimation of depression trajectories was accomplished using the censored normal model (CNORM), which is appropriate for continuous data.

The Bayesian Information Criterion (BIC) was mainly used in order to determine the number of subgroups[25,26]. The magnitude of difference in BIC, the Bayes factor as well as the BIC-based probability approximation were used to choose between more complex and simpler models[26–28]. However, because BIC sometimes keeps improving when adding trajectory groups[26], we further considered the significance of polynomial terms (at the confidence level alpha 0.05), the values of group membership probabilities and of average posterior probability (entropy) with recommended value greater than 0.7[25,27–29], and when the model no longer captured new distinctive features of the data as complementary criterions for selecting the best model. Because of a relatively large sample we allowed for trajectory groups consisting of a minimum of 1 % of the sample.

After selecting the optimal model in terms of number of groups we selected the shape for each of these groups. Then conditional on the best model, time-stable covariates (risk factors) were inserted in the model by assuming that these risk factors influence the probability of membership to a particular trajectory group. Paid and unpaid working hours were considered simultaneously relative to the defined trajectory groups as time-invariant covariates (risk factors) in the main analyses to allow for a temporal precedence of working hours (labelled

model 1). Also total working hours was modeled separately (labelled model 2). Coefficients for risk factors indicate the increase in log odds of being in a trajectory (relative to the lowest group) per unit change in the risk factor[25]. Unadjusted models as well as models adjusted for sex (0 men, 1 women), age, civil status (0 not married, 1 married or cohabiting) and socioeconomic status[30] were presented. We further conducted the same analyses for men and women separately since a significant interaction effect was found for sex, and among participants working full time only. The latter was done to exclude those with part time from the reference group in the analyses of paid working hours, since part time work may be attributed to poorer health. We also fitted models with working hours as categorical variables. Working hours were, however, alternatively considered as time-varying covariates to account for the time-varying nature. Since health effects of long working hours may be at least partly attributed to poor working conditions we also tested if there was an interaction between long working hours and job strain (the combination between high job demands and low control)[31–33].

The GBTM analyses were conducted using the PROC TRAJ procedure developed by Jones and Nagin, which can be downloaded from http: //www.andrew.cmu.edu/user/bjones[28,34] in the SAS software (version 9.4; SAS Institute).

RESULTS

Table 1 shows some descriptive characteristics of the study sample. Most of the study participants were in middle age or in mature adulthood at wave 2 (2008). A high proportion were married or cohabiting and about 40 % had children living at home. Most were working full time with a day time work schedule. About 20 % of the population had long paid working hours i.e. worked more than 50 hours per week, and a relatively high proportion had long unpaid working hours i.e. was spending 21 hours or more on unpaid work per week. Almost 10 % had a long total working hours i.e. was spending over 80 hours per week on paid and/or unpaid work. Women generally worked longer in total (mean hours of total work: 65.02) compared to men (mean hours of total work: 60.07), while men generally spent more time on paid work (mean hours of paid work for men: 45.59 hrs; mean hours of unpaid work: 14.3 hrs) and women more time on unpaid work (mean hours of paid work: 45.09 and mean hours of unpaid work; 20.07).

Table 1. Characteristics of the study sample in terms of demographic characteristics and workload from paid and unpaid work in 2008 (wave 2, SLOSH data)

		All	Women	Men
Age (%)	Early adulthood (19-34)	8.9	10.2	7.06
	Middle life (35-49)	30.6	32.1	28.69
	Mature adulthood (50-70)	60.5	51.3	64.25
Sex (% females)		58.0		
Civil status (% married or cohabiting)		79.7	78.4	81.56
Children at home (%)		40.9	41.9	39.6
SEI (%)	Unskilled manual workers	14.8	14.1	15.8
	Skilled manual workers	14.4	12.4	17.1
	Assistant non-manual employees	12.6	16.5	7.1
	Intermediate non-manual employees	31.5	34.0	27.9
	Higher non-manual employees	20.5	19.1	22.8
	Self-employed	6.2	3.8	9.5
Full time work (%)		77.4	67.6	90.7
Work schedule (%)	Day time	78.0	76.5	80.1
	Night work	6.2	3.1	1.9
	Shift work excl. nights	15.8	4.32	3.13
Paid working hours per week (%)	<37	25.2	32.2	16.1
	37-40	5.3	6.4	3.9
	40-49	50.4	46.8	55.3
	50-59	12.1	9.7	15.2
	60+	6.9	4.9	9.5
Unpaid working hours per week (%)	<8	19.1	10.7	30.2
	8-14	26.9	24.5	30.1
	15-21	22.4	26.6	17.1
	22-28	13.4	16.3	9.6
	29-	18.1	21.9	13.1
Total working hours per week (%)	<41	12.6	12.8	12.1
	42-57	34.2	31.3	37.9
	58-67	24.9	24.4	22.9
	68-80	18.6	19.3	17.6

>80	9.7	9.9	9.5

Evaluation of the different models resulted in the selection of a model with six trajectories with a linear order for four groups suggesting a linearly decreasing or increasing trajectory, and a cubic order for two of the groups suggesting a trajectory where there are two turning points (inflections), a maximum and a minimum in depressive symptoms (BIC: -62598.42; Entropy: 0.8). BIC continued to decrease for models with increasing number of groups (Supplementary Table I). However, visual examination of models with four five, six and seven groups indicated that the six group model identified distinctive features of the data (average posterior probabilities above 0.8). Figure 2 depicts the shapes of the six trajectories as well as their class sizes. The pattern of symptoms over time could be described as either "very low stable", "low stable", "doubtful increasing", "high decreasing", "mild decreasing" and "high stable". The trajectories named 'very low stable', "low stable" and 'stable high' followed a slight downward linear trend over time, but remained either at a no depression level (<7 on the depression scale) or between moderate to severe level (>11 and >15, respectively, on the depression scale) [25]. The trajectory named 'mild decreasing' followed a slightly decreasing trend until year 2012 (wave 4) and slightly increasing afterwards. Symptoms varied from mild (>9 and < 11 on the depression scale) to doubtful (>6 and < 10 on the depression scale) depression. The trajectory named 'doubtful increasing' followed a slight increasing linear trend but remained either at doubtful or mild depression level. Finally the trajectory named 'high decreasing' followed a steep downward trend until year 2010 (wave 3) and a slightly decreasing trend thereafter. The symptoms varied from severe depression to no depression levels.

The majority of individuals were classified in either the 'very low stable' (49.1%) or 'low stable' (23.4%) group. The 'high decreasing' group represented the smallest group (1.3%) and the 'doubtful increasing' represented 8.4% of the sample. Both the 'high decreasing' group and the 'doubtful increasing' group followed a quadratic trend with two turning points. Altogether there were four favorable ('mild decreasing', 'high decreasing', 'low stable' and 'very low stable') and two unfavorable ('doubtful increasing', and 'high stable') trajectories.

A description of the demographic characteristics and the distribution of working hours in the year 2008 for the six trajectory groups are given in Table 2. The mean age was, for example, lowest in the 'high stable' trajectory (47.0 years), followed by the 'doubtful increasing' group (47.6 years). Overall there was a higher proportion of women in the unfavorable trajectories. Especially unpaid working hours and total working hours varied between the groups. A higher proportion of individuals with unpaid- and long of total working hours were observed in the 'doubtful increasing' and the 'high stable' group.

Table 2. Characteristics of the trajectory groups in terms of demographic characteristics and workload from paid and unpaid working hours in 2008 (wave 2, SLOSH data)

		Very low stable (n=1447)	Low stable (n=3213)	Doubtful increasing (n=474)	High decreasing (n=74)	Mild decreasing (n=755)	High stable (n=328)
Mean Age (Years)		55.2	51.1	47.6	54.1	49.6	46.8
Sex (% females)		48.2	58.0	68.1	69.4	65.0	71.3
Civil status (% married)		82.5	80.6	76.3	71.6	77.2	71.8
Socioeconomic in status (%)	Unskilled manual workers	15.3	13.9	16.0	13. 9	16.0	17.0
	Skilled manual workers	16.4	13.8	14.0	6.9	14.6	12.6
	Assistant non-manual employees	12.8	12.0	12.3	15.3	13.5	15.1
	Intermediate non-manual employees	17.9	32.3	32. 9	27.8	31.8	28.7
	Higher non-manual employees	8.0	22.3	18.6	22.2	19.2	20.8
	Self-employed	8.2	5.7	6.1	13.9	4.6	5.9
Paid working hours per week (%)	<37	25.3	23.8	27.7	30.0	27.9	27.8
	37-40	5.8	5.4	6.3	8.3	4.4	2.9
	40/41-49/50	49.7	51.4	50.3	35.0	47.9	53.5
	50/51-59/60	11.3	12.8	10.8	18.3	11.3	10.6
	60/61+	7.8	6.6	5.2	8.3	8.4	5.1
Unpaid working hours per week (%)	<8	25.5	19.3	11.8	15.4	15.4	11.0
	8-14	28.9	27.9	20.3	26.9	25.4	22.4
	15-21	21,7	22.6	23.4	26.9	22.5	21.2
	22-28	12.6	12.8	14.9	17.3	14.2	17.1
	29+	11.3	17.3	29.6	13.5	22.5	28.2
Total working hours per week (%)	<42	15.9	11.8	11.0	10	12.3	9.5
	42-57	38.4	35.1	25.9	44.0	30.3	27.8
	58-67	21.5	25.8	28.2	18.0	24.6	26.9
	68-80	16.6	18.4	20.6	18.0	20.4	21.2
	>80	7.7	8.8	14.2	10.0	12.3	14.5

Table 3 reports the results of the multinomial logistic regression models in log-odds ratios (estimate), standard errors (SE) and odds ratios (OR), with the 'very low stable' group as reference group. Model 1 presents the results from a model including both paid and unpaid working hours, while model 2 presents the results of a model analyzing the influence of total working hours separately. The results showed unpaid working hours at the baseline measurement (2008) was associated with a significantly higher likelihood of being in all the trajectory groups as compared to being in the reference group but no significant associations were found for paid working hours. Longer total working hours was associated with increased likelihood of being in the 'low stable', 'doubtful increasing', 'mild decreasing', and 'high stable' group. Sex, age, and civil status and socioeconomic status were included in the adjusted models as additional risk factors for the trajectory group membership. Estimates from the adjusted model with respect to paid/unpaid working hours were relatively similar to those in the unadjusted model. However, longer unpaid working hours were now associated with a significantly higher likelihood of being in 'low stable' and 'high stable' as compared to the reference group. With respect to longer total working hours there was an increased likelihood of being in the 'high decreasing' [OR:1.30; CI:[1.14;1.48]], and 'high stable' group [OR:1.22; CI:[1.01;1.47]]. In supplementary analyses of longer paid working hours separately, no significant associations between paid working hours and the trajectory groups were observed. Results were also similar in a subsample of full-time employees only. No clear associations was on the other hand observed in analyses with working hours as categorical variables, but which may be due to lack of power. Moreover, the risk estimates for paid working hours were not significantly different among people with or without job strain (data not shown).

Table 3. Results from the multinomial logistic regressions models estimating the probabilities of group membership according to a) paid working hours and unpaid working hours b) total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios; SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory Groups	**Low Stable**		**Doubtful Increasing**		**High Decreasing**		**Mild Decreasing**		**High Stable**	
Unadjusted Models										
Model 1										
	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]
Paid Working	-0.01	0.99	0.00	1.00	-0.00	1.00	-0.01	0.99	-0.01	0.99

Hours	(0.01)	[0.98;1.01]	(0.00)	[0.99;1.01]	(0.01)	[0.97;1.02]	(0.01)	[0.98;1.00]	(0.01)	[0.97;1.01]
Unpaid Working Hours	0.26* (0.05)	1.29 [1.17;1.43]	0.28* (0.05)	1.32 [1.20;1.45]	0.25* (0.11)	1.28 [1.03;1.60]	0.54* (0.06)	1.72 [1.53;1.92]	0.53* (0.09)	1.31 [1.11;1.54]
Model 2										
	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]
Total Working Hours	0.17* (0.06)	1.18 [0.98;1.03]	0.22* (0.05)	1.25 [1.12;1.39]	0.13 (0.13)	1.15 [0.88;1.49]	0.39* (0.06)	1.47 [1.30;1.67]	0.34* (0.09)	1.40 [1.16;1.68]
Adjusted Models[!]										
Model 1										
	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]
Paid Working Hours	-0.01 (0.01)	0.99 [0.98;1.00]	0.00 (0.01)	1.00 [0.99;1.01]	0.37 (0.06)	1.01 [0.89;1.14]	0.13 (0.12)	1.14 [0.90;1.45]	0.33* (0.09)	1.40 [1.18;1.65]
Unpaid Working Hours	0.15* (0.06)	1.16 [1.04;130]	0.09 (0.05)	1.10 [0.99;1.23]	0.49* (0.10)	1.64 [1.34;2.02]	0.29* (0.12)	1.35 [1.05;1.71]	0.47* (0.11)	1.60 [1.29;1.982]
Model 2										
	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]	Estimate (SE)	OR [95%CI]
Total Working Hours	0.06 (0.06)	1.06 [0.94;1.19]	0.08 (0.06)	1.08 [0.96;1.21]	0.26* (0.07)	1.30 [1.14;1.48]	-0.03 (0.14)	0.97 [0.74;126]	0.19* (0.09)	1.22 [1.01;1.47]

An interaction between total working hours and sex was on the hand noted. The analyses were therefore also stratified by sex. The separate trajectory groups identified for men and women are shown in Supplementary Figures I and II. Among men, the best solution resulted in only 5 trajectory groups whereas 6 groups were identified among women. The trajectories were relatively similar to the ones illustrated in Figure 2. In the adjusted models, men with more unpaid working hours were more likely to be in 'Doubtful Stable' or 'High Stable' Groups, while no significant associations were found for paid working hours (Supplementary Table II). Unpaid working hours were also associated with an increased likelihood of higher symptom trajectories compared to the reference group for women while no significant associations were found for paid working hours (Supplementary Table III). For total working hours among men we found an increased likelihood of being in the 'doubtful stable' group while longer total working hours for women was associated with increased likelihood in the 'high decreasing' and 'high stable' groups compared to the very low stable group (Adjusted Models; Supplementary Table II-Supplementary Table III). Hence, the association between total workload and high stable depressive symptoms was only apparent among women.

In analyses with working hours as time-varying covariate, adjusting for sex, age, civil status, and socioeconomic status, longer paid working hours increased the depressive symptom trajectory in the 'low stable', 'doubtful increasing', and high stable' group. Longer unpaid working hours also raised the trajectory in the 'doubtful increasing' group but decreased the depressive symptoms in the 'mild decreasing' group. Longer total working hours, however, significantly increased depressive symptoms in both the 'very low stable', 'low stable', 'doubtful increasing', and 'high stable' group, but not in the 'high or mild decreasing' groups (Supplementary Table IV).

DISCUSSION

The current study identified six distinct depressive symptoms trajectories. Previous population based studies have also shown that stable patterns are common such as stable low symptoms[5], which is in line our findings. A small group with stable high symptoms, as in the present study, have also commonly been found in other studies[2,5]. Patterns with varying degree of symptoms over time are more seldom observed[5]. However, it has also been found that a considerable proportion of the general population experience a stable recovery after a depressive episode[2]. The patterns observed in this study are thus generally in line previous findings and expectations.

This work further suggested that total working hours and unpaid working hours is associated with different long-term trajectories of depressive symptoms but no association was noted for paid working hours. The present study thus conflict with an association between long working hours and depression as found in previous work[12]. However, there are indications that only more extreme weekly working hours are associated with poorer health[10,35], which may partly explain why we did not observe any association between time spent on paid work and depressive symptom trajectories in the present study. Also the inclusion of part time work in this study may have played a role may have played a role, although sensitivity analyses among full-time employees showed similar results. The study on the other hand indicate that a longer total working hours or unpaid working hours is associated with certain patterns of depressive symptoms over time. This is the first study to our knowledge on the relationship between unpaid working and total working hours and depressive symptom trajectories. The results indicated an association between unpaid- and total working hours and both favorable ('low stable', 'high decreasing') and unfavorable ('high stable') trajectories. A higher risk of

belonging to some of these groups such as the 'low stable' and 'high decreasing' groups may be explained by a higher initial level of depressive symptoms than those in the 'very low stable' group.

Complementary analyses showed that the depressive symptoms increased further in some groups, especially in the unfavorable groups with doubtful increasing and stable high symptoms, with an increase in total working hours over the period. This suggests that long working hours potentially due to a double burden of paid and unpaid work constitute a risk and should be considered in policy and prevention. Increased gender equality in terms of work conditions and unpaid work share may also contribute to lessen the burden in the society at large. More research is however needed to confirm our findings. Although, we did observe that there was a stronger association between unpaid- and total working hours and high decreasing as well as stable high depressive symptoms among women than men, there were generally small differences men and women. This is in contrast to some earlier studies that have suggested that long working hours may be more detrimental to women's health[35–40] although the evidence is still scarce and inconclusive[41–43]. Another study on the other hand observed similar associations between long working hours and health among men and women from Nordic countries characterized by the so called "dual breadwinner external care model" (meaning participation of both parents on the labor market and outsourcing of care), while different associations were observed in other countries dominated by e.g. the male breadwinner model[44].

Some strengths of the study are that it was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years. In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder[5]. Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and also introduce risk factors that may influence membership in trajectory groups and therefore identify heterogeneity in the sample[26,45]. We based the trajectories on four time points, which is above the minimum required for estimating quadratic trajectories [30]. A longer time series of measurement may, however, have contributed to more power for identifying heterogeneity in symptoms over time, study onset versus recovery etc, and potential determinants of different trajectories. Dropout from the study may also have restricted the possibility to detect heterogeneity. Given that the subjects were originally working and repeatedly in paid work for more than 30 % over the study period, the sample is probably characterized by relatively healthy individuals with high

educational level etc leading to potential underestimation of relationships between working hours and depressive symptoms. Longitudinal sampling weights to make the analyses more representative of the source population was not available. Data were also missing on family history of mental health problems and childhood/adolescent characteristics, which may be predictors of depressive symptoms trajectories and workload and may confound the relationships of interest. In the main models we chose to examine whether working hours at the start of the trajectory predicted the course of depressive symptoms in order to allow for temporal precedence of working hours, although working hours may also be changing or stable over the study period. This does not rule out that depressive symptoms at baseline may have biased reporting of working hours. However, later depressive symptoms is unlikely to influences the initial measurement of working hours. For power considerations we also treated the data on working hours as continuous rather than categorical, which probably not optimal given that only more extreme hours may be associated with health consequences, but sensitivity analyses did not support associations between any of the specific categories and depressive symptoms trajectories.

All in all, the results indicate longer total working hours may increase the risk of higher depressive symptom trajectories. Since an unfavorable trajectory with stable or recurrent high depressive symptoms is associated with a poor prognosis[5], interventions with regard to working hours may contribute to limit the burden of depressive disorders in the population.

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COMPETING INTERESTS

Conflicts of interest: No author has reported a conflict of interest

DATA SHARING

SLOSH data are not publicly available due to legal restrictions. Requests for data or results can be addressed to the SLOSH data manager data@slosh.se. More information can be found on the SLOSH website www.slosh.se.

CONTRIBUTORSHIP STATEMENT

Author contributions: LMH conceived the study. PP performed the analyses and drafted the manuscript. LMH, PP and HW contributed to the design and interpretation of data, critical revision of the work, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Fig.1. Total number of respondents/non-respondents to the Swedish Longitudinal Occupational Survey of Health (SLOSH) among the SLOSH sample originally participating in the Swedish Work Environment Surveys (SWES) 2003 and 2005, as well as number of individuals included in the analytic sample.

Fig. 2: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)

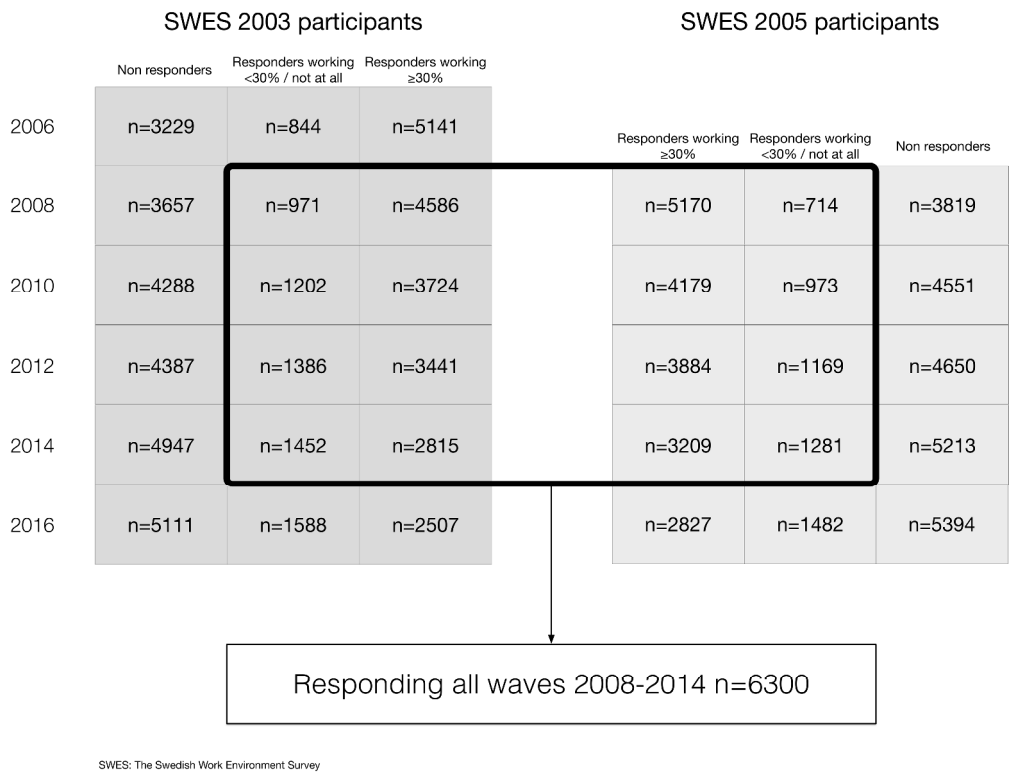

Fig.1. Total number of respondents/non-respondents to the Swedish Longitudinal Occupational Survey of Health (SLOSH) among the SLOSH sample originally participating in the Swedish Work Environment Surveys (SWES) 2003 and 2005, as well as number of individuals included in the analytic sample.

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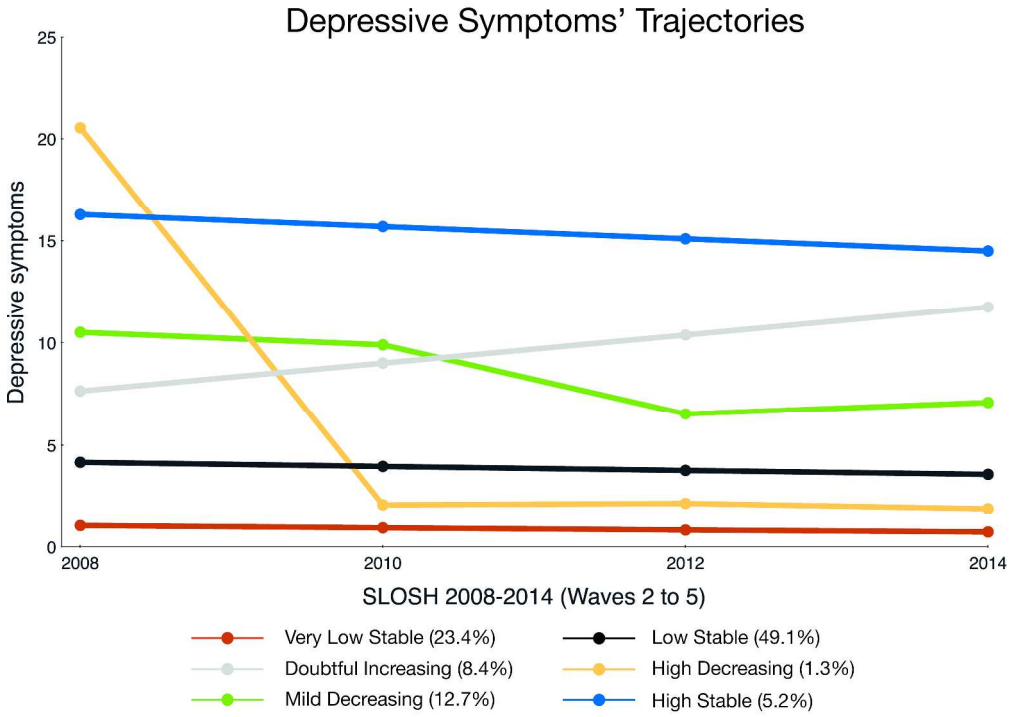


Fig. 2: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)

384x274mm (300 x 300 DPI)

Supplementary Table I: Fit Values for group-based trajectory models with different number of groups

	All	Males	Females
3 groups	BIC: -63381.45 AIC: -63330.85	BIC: -25232.18 AIC ; -25188.10	BIC=-38090.91 AIC=-38044.39
4 groups	BIC: -63075.15 AIC: -63007.68	BIC:-25080.06 AIC:-25021.28	BIC=-37961.41 AIC=-37899.39
5 groups	BIC: -62713.72 AIC: -62629.39	BIC:-24816.75 AIC:-24743.27	BIC=-37835.91 AIC=-37758.39
6 groups	BIC: -62627.43 AIC: -62526.23	BIC:-24836.44 AIC:-24748.27	BIC=-37800.26 AIC=-37707.23
7 groups	BIC: -62512.35 AIC: -62394.29		BIC=-37715.31 AIC=-37606.78
8 groups	BIC: -62398.45 AIC: -62263.52		BIC=-37635.37 AIC=-37511.33

Supplementary Table II: Results from the multinomial logistic regressions models for males estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory groups	**Low Stable**	**High Decreasing**	**Doubtful Stable**	**High Stable**
		Unadjusted Models		
Model 1				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Paid Working Hours	0.01 (0.01) 1.01 [0.99; 1.01]	0.01 (0.02) 1.01 [0.97; 1.05]	0.00 (0.01) 1.00 [0.99; 1.01]	-0.00 (0.01) 1.00 [0.97; 1.02]
Unpaid Working Hours	0.09* (0.05) 1.10 [1.00; 1.21]	0.01 (0.17) 1.01 [0.72; 1.43]	0.28* (0.06) 1.32 [1.18; 1.47]	026* (0.10) 1.30 [1.06; 1.59]
Model 2				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Total Working Hours	0.13* (0.05) 1.14 [1.03; 1.27]	-0.01 (0.20) 0.00 [0.667; 1.47]	0.28* (0.06) 1.32 [1.16; 1.50]	0.18 (0.13) 1.20 [0.93; 1.53]
		Adjusted Models[!]		
Model 1				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Paid Working Hours	0.00 (0.01) 1.00 [0.99; 1.01]	0.01 (0.02) 1.01 [0.97; 1.06]	0.00 (0.01) 1.00 [0.99; 1.01]	0.00 (0.01) 1.00 [0.97; 1.03]
Unpaid Working Hours	0.02 (0.05) 1.10 [0.92; 1.13]	-0.02 (0.21) 0.98 [0.65; 1.49]	0.20* (0.06) 1.22 [1.08; 1.38]	0.25* (0.11) 1.28 [1.02; 1.60]
Model 2				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Total working hours	-0.04 (0.06) 1.04 [0.92; 1.17]	-0.03 (0.23) 0.97 [0.62; 1.52]	0.21* (0.07) 1.24 [1.08; 1.42]	0.18 (0.13) 1.20 [0.92; 1.56]

! Adjusted Models for age, civil status, and socio-economic status

*significance at 5%

Supplementary Table III: Results from the multinomial logistic regressions models for females estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and Adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (* significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory Groups	**Low Stable**	**Doubtful Increasing**	**High Decreasing**	**Moderate Episodic**	**High Stable**
Unadjusted Models					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.00 1.00 (0.01) [0.98;1.01]	-0.00 1.00 (0.01) [0.98;1.01]	-0.00 1.00 (0.01) [0.98;1.02]	0.02 1.02 (0.01) [0.99;1.04]	0.00 1.00 (0.01) [0.98;1.02]
Unpaid Working Hours	0.28 1.33 (0.09)* [1.20;1.47]				
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.19* 1.21 (0.09) [1.01;1.43]	0.20* 1.23 (0.08) [1.04;1.45]	0.41* 1.51 (0.10) [1.24;1.84]	0.28* 1.32 (0.14) [1.01;1.73]	0.40* 1.50 (0.12) [1.19;1.88]
Adjusted Models!					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.01 0.99 (0.01) [0.98;1.03]	-0.01 0.99 (0.01) [0.97;1.01]	-0.01 0.99 (0.01) [0.97;1.01]	0.00 1.00 (0.01) [0.98;1.03]	-0.01 0.99 (0.01) [0.97;1.01]
Unpaid Working Hours	0.25* 1.28 (0.08) [1.09;1.52]	0.20* 1.22 (0.08) [1.04;1.45]	0.49* 1.64 (0.10) [1.34;2.02]	0.29* 1.35 (0.12) [1.05;1.71]	0.47* 1.60 (0.11) [1.29;1.982]
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.08 1.09 (0.08) [0.91;1.27]	0.05 1.05 (0.08) [0.89;1.24]	0.27* 1.32 (0.11) [1.07;1.63]	0.15 1.16 (0.13) [0.89;151]	0.26* 1.30 (0.11) [1.05;1.62]

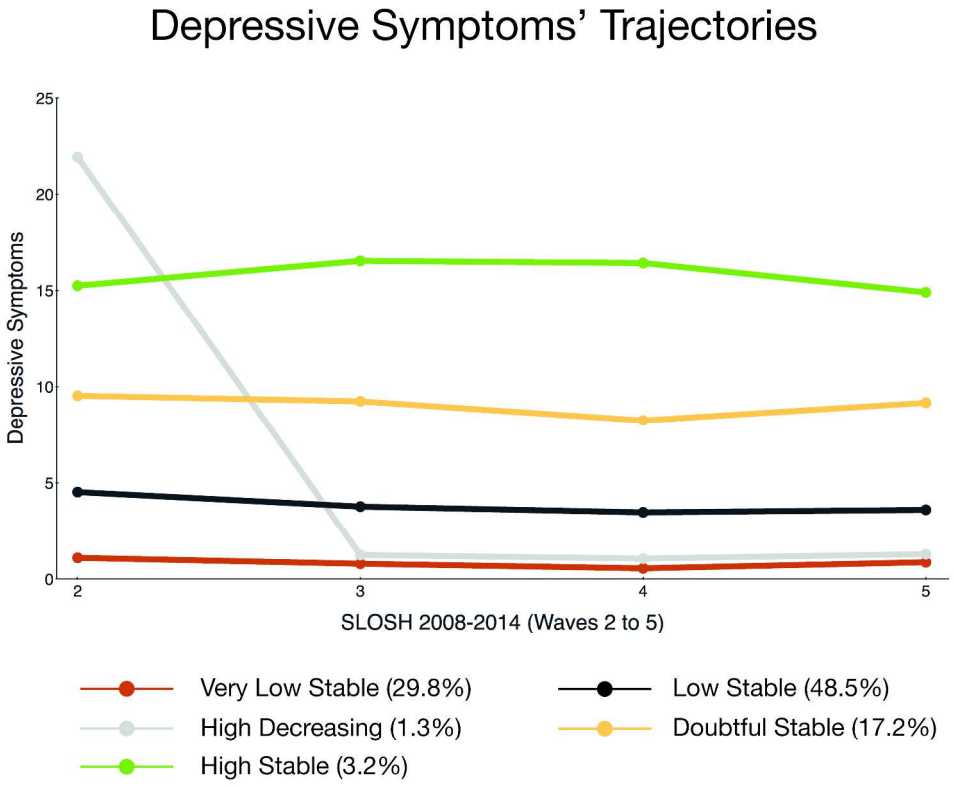
! Adjusted Models for age, civil status, and socio-economic status
*significance at 5%

Supplementary Table IV. Results from the multinomial logistic regressions models estimating a potential increase or decrease in the symptom trajectories according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory Groups	**Very Low Stable (Reference Group)**	**Low Stable**	**Doubtful Increasing**	**High Decreasing**	**Mild Decreasing**	**High Stable**
		Unadjusted	**Models**			
Model 1						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	0.02 1.02 (0.01) [0.99;1-05]	0.02* 1.03 (0.01) [1.01;1.04]	0.04 1.04 (0.03) [0.98;1.10]	-0.05 0.95 (0.05) [0.86;1.05]	-0.01 0.98 (0.05) [0.96;1.00]	0.08* 1.09 (0.03) [1.03;1.15]
Unpaid Working Hours	0.37* 1.45 (0.09) [1.19;1.76]	0.10* 1.11 (0.05) [1.00;1.23]	0.60* 1.83 (0.14) [1.37;2.43]	0.84* 2.32 (0.28) [1.33;4.34]	-0.57 0.56 (0.29) [0.31;1.01]	0.12 1.13 (0.14) [0.84;1.51]
Model 2						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.32* 1.37 (0.10) [1.12;1.68]	0.33* 1.39 (0.07) [1.21;1.59]	0.71* 2.04 (0.15) [1.51;2.74]	-0.18 0.83 (0.30) [0.46;1.51]	-0.04 0.96 (0.31) [0.52;1.76]	0.43* 1.53 (0.17) [1.08;2.17]
		Adjusted	**Models**[!]			
Model 1						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	0.01 1.01 (0.02) [0.98;1.05]	0.02* 1.03 (0.01) [1.01;1.04]	0.07* 1.07 (0.02) [1.01;1.12]	-0.05 0.95 (0.05) [0.86;1.05]	-0.06 1.03 (0.06) [1.01;1.04]	0.08* 1.08 (0.03) [1.03;1.14]
Unpaid Working Hours	0.34* 1.07 (0.10) [1.01;1.12]	0.07 1.07 (0.05) [0.97;1.18]	0.62* 1.86 (0.15) [1.39;2.49]	0.82 2.28 (0.27) [1.34;3.89]	-0.71* 0.49 (0.25) [0.29;0.81]	0.08 1.09 (0.15) [0.81;1.45]
Model 2						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours						
	0.26* 1.30 (0.12) [1.03;1.63]	0.29* 1.34 (0.07) [1.17;1.53]	0.66* 1.93 (0.15) [1.45;2.59]	-0.17 0.85 (0.30) [0.46;1.54]	0.37* 1.45 (0.38) [0.68;3.06]	0.54* 1.56 (0.17) [1.10;2.20]

! Adjusted Models for age, civil status, and socio-economic status

*significance at 5%



Supplementary Figure I: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); five groups of depressive symptoms for males were identified: Very low stable (Group 1: 29.8% of the sample), Low stable (Group 2: 48.5% of the sample), High Decreasing (Group 3: 1.73% of the sample), Doubtful stable (Group 4: 17.2% of the sample), High stable (Group 5: 3.2% of the sample)

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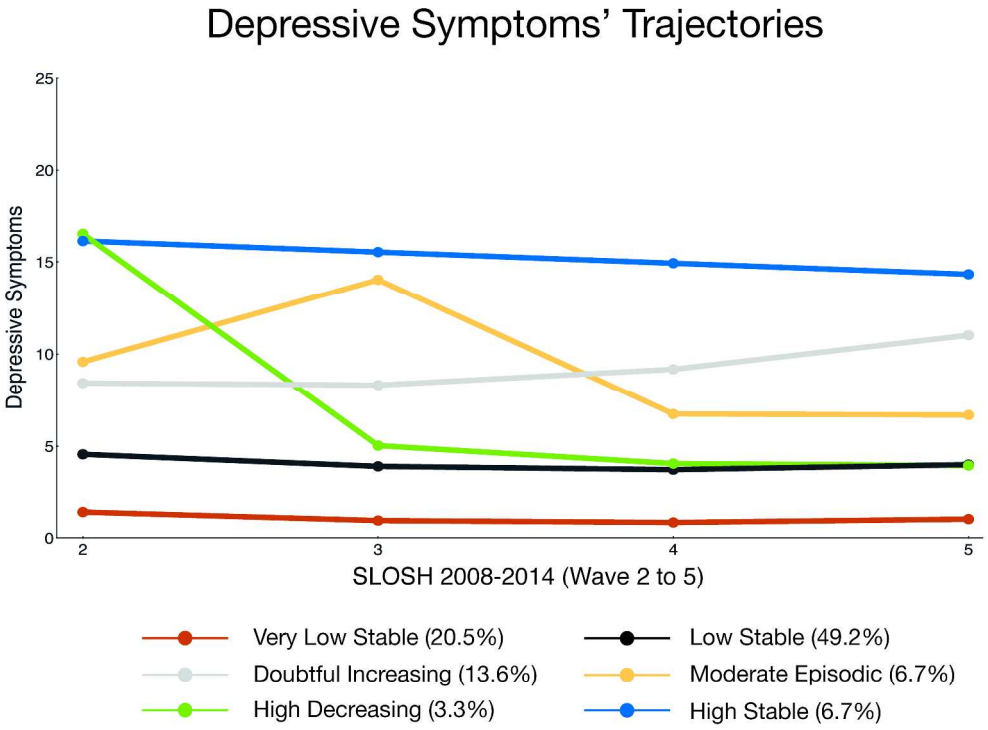

Supplementary Figure II: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms for females were identified: Very low stable (Group 1: 20.5% of the sample), Low stable (Group 2: 49.2% of the sample), Doubtful Increasing (Group 3: 13.63% of the sample), Moderate Episodic (Group 4: 6.7%% of the sample), High Decreasing (Group 5: 3.3% of the sample), High stable (Group 5: 6.7% of the sample)

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Longitudinal study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	
Objectives	3	State specific objectives, including any prespecified hypotheses	3	
Methods				
Study design	4	Present key elements of study design early in the paper	3	Cohort, longitudinal survey
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3	Further details on data collections can be found in references
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	3	Further details on data collections can be found in references
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-5	Further details can be found in references
Bias	9	Describe any efforts to address potential sources of bias	5	
Study size	10	Explain how the study size was arrived at	3	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-5	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4-5	
		(*b*) Describe any methods used to examine subgroups and interactions	4-5	
		(*c*) Explain how missing data were addressed	4-5	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	3	
		(*e*) Describe any sensitivity analyses	5	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	3	
		(b) Give reasons for non-participation at each stage	4	Details in ref
		(c) Consider use of a flow diagram	4	Details in ref
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1	
		(b) Indicate number of participants with missing data for each variable of interest	NA	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Table 1	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3, Supplementary table 1	
		(*b*) Report category boundaries when continuous variables were categorized	Table 1	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories: Results from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH)

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Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Research methods
Keywords:	paid workload, unpaid workload, total workload, depressive symptoms, group-based trajectory modelling

Paid and unpaid working hours among Swedish men and women in relation to depressive symptom trajectories: Results from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH)

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The work was conducted at the Stress Research Institute, Stockholm University, Stockholm, Sweden

Keywords: paid workload, unpaid workload, total workload depressive symptoms, group-based trajectory modelling

Number of words: 3178

Abstract 283 words

Background: Long working hours and unpaid work are possible risk factors for depressive symptoms. However, little is known about how working hours influence the course of depressive symptoms. This

study examined the influence of paid, unpaid working hours and total working hours on depressive symptoms trajectories.

Methods: The study was based on data from 4 waves of the Swedish Longitudinal Occupational Survey of Health (SLOSH 2008-2014). We applied group-based trajectory modelling in order to identify trajectories of depressive symptoms and studied paid and unpaid working hours and total working hours as risk factors.

Results: Six trajectory groups were identified with symptoms: 'very low stable', 'low stable', 'doubtful increasing', 'high decreasing', 'mild decreasing', and 'high stable'. More time spent on unpaid work was associated with the 'low stable' (Odds Ratio (OR) 1.16, confidence interval (CI) 1.04-1.30) and the 'high stable (OR 1.40, CI 1.18-1.65) symptom trajectories compared to being in the 'very low stable' symptom group. In addition more total working hours was associated with a higher probability of having ''high decreasing' (OR 1.30, CI 1.14-1.48), and 'high stable' (OR 1.22, CI 1.01-1.47) symptoms, when adjusting for sex, age, civil status and socioeconomic status. The results, however, differed somewhat for men and women. More unpaid working hours was more clearly associated with higher symptom trajectories among women. More total working hours was associated with 'high stable' symptoms among women only.

Conclusions: This study supported heterogeneous individual patterns of depressive symptoms over time among the Swedish working population. The results also indicate that a higher burden of unpaid work and longer total working hours, which indicate a double burden from paid and unpaid work, may be associated with higher depressive symptom trajectories, especially among women.

Strengths and Limitations of this Study

- This study was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years.
- In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder

- Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and identify heterogeneity in the sample
- A longer time series of measurement may have contributed to more power for identifying heterogeneity in symptoms over time
- The sample is probably characterized by relatively healthy individuals with high educational level etc. leading to potential underestimation of relationships between working hours and depressive symptoms.

INTRODUCTION

Mental health problems and especially depression are of major public health concern owing to the high prevalence and substantial negative consequences on personal functioning, but also work productivity[1] . It is well known that onset of depression may vary between individuals and that symptoms occasionally recur over the life course.

Some long-term patterns of depressive symptoms may also be associated with more functional limitations[2], and it has been suggested that different risk factors may be associated with different long-term patterns[3,4]. It has previously been indicated that factors such as problems with peers and parents, alcohol/tobacco/drug use, parental history of depression and negative cognitive styles could lead to worse depression trajectories over time among children/adolescents. Among older people, poor self-rated health, past history of somatic illness, functional and cognitive impairment and low social support have been associated with negative course of symptoms. Stressful life events has also a found to be a predictor of poor depressive symptom trajectories[5,6]. However, little is known about the influence of work-related characteristics on different long-term patterns of depressive symptoms.

Work stressors such as high work demands or high demands in combination with low control (job strain) have generally been implied as risk factors for depressive symptoms[7–9]. Long working hours has also been associated with several serious health outcomes such as stroke and coronary heart disease[1,10], and diabetes among people with low socioeconomic status[2,11], as well as depressive states[4,7–9,12–14]. It has been suggested that work stress may be one of the reasons for negative health effects of long working hours. Long working hours may also be associated with limited time for recuperation and lead to poorer health behaviors[15]. In the modern working life there is an increased risk that working times are

extended beyond the contracted hours, which could have serious implications for recovery and health. However, the potential health effects associated with long working hours may also depend on non-work responsibilities.

In general, women still spend far more time than men on unpaid work[16]. Especially women may therefore be at risk of "a double burden" of both paid and unpaid work. A double burden or "high total workload" in terms of hours spent on paid/unpaid work has been suggested to be associated with work stress and to contribute to common physical and mental symptoms[17–19] but more knowledge is needed on both changes in stress from workload in paid and unpaid work, and the interplay between these stressors, over the life course, and how they influence health among men and women[20].

A better understanding of the health risks associated with long working hours and total workload can allow for better scheduling, legislation, and prioritization of preventive measures.

The aim of this study was to examine how time spent on paid and unpaid work as well total working hours are associated with different depressive symptoms trajectories among Swedish men and women.

METHODS

Study population

The study population consisted of participants from SLOSH (Swedish Longitudinal Occupational Survey of Health) study, a nationally representative longitudinal cohort study with repeat self-reported measures every second year[21]. SLOSH started in 2006 as a follow-up of participants in the Swedish Work Environment Survey (SWES) 2003 (N=9214). SWES 2003 participants were asked to complete questionnaires again in 2008, 2010, 2012, 2014 and 2016. Respondents from SWES 2005 were also added to the cohort in the next SLOSH wave in 2008 (raising the number of cohort members to 18917) and asked to respond to follow-up questionnaires every second year. Postal self-completion follow-up questionnaire were sent out to all eligible SWES participants each wave, one for those that currently work at least 30% or full time and one for people working less or those who had left the labor force temporarily or permanently. Four waves have been used in the present study: 2008, 2010,

2012, and 2014. The total number of invited participants were 18639, 20298, 17434, and 38659, respectively, with overall response rates between 62% and 57%.

To allow for analyses of trajectories of depressive symptoms and temporal changes in working times, the present study is based on those SWES 2003 and 2005 participants who responded in all four waves (2008-2014) in total 6300 individuals (Figure 1). Women, older, highly educated, and married people are generally overrepresented among the respondents to SLOSH. A comparison of demographic characteristics between all respondents 2008 (n=11441) and the study sample, further showed that the study sample consisted of a higher proportion of women, university educated and with higher mean age and children at home than those excluded from the sample because of non-response 2010-2014. Depressive symptoms scores were, however, generally a bit lower among the study subjects, as was the proportion of long working hours and long hours of unpaid work. The study has been approved by the Regional Research Ethics Board in Stockholm, and informed consent was obtained from all respondents. More information about the cohort can be found elsewhere[22].

Measures

Depressive symptoms were measured with a brief subscale from the Symptom Checklist (SCL-90), the SCL-CD_6 [23] which assesses perception of being troubled by: Feeling blue; Feeling no interest in things; Feeling lethargy or low in energy; Worrying too much about things; Blaming yourself for things; and Feeling everything is an effort, quantified on a five-category scale from 0=Not at all to 4=Extremely. The six items represent core symptoms, selected based on principals of clinical validity. The scale was validated and was found to have good psychometric properties making it suitable to add into a composite score indicative of depression severity[23].

Time use was also measured repeatedly 2008-2014 by a modified version of a measure, developed and psychometrically evaluated by Mårdberg et al.[24]. In addition to hours/week in paid employment and overtime at work, constituting a measure of paid working hours, the instrument covers unpaid work activities, such as household duties (mending, sewing, laundry, gardening), childcare (homework/teaching, care-taking, playing) and other unpaid duties (voluntary work in unions and organizations, care of sick or elderly relatives). Hours/week spent on household duties (shopping, cleaning, cooking, mending, sewing, laundry and gardening) and on childcare (homework/ teaching, care taking, playing) were

added to a measure of unpaid working hours. The respondents were asked to indicate number of hours according to pre-specified categories in 2010-2014, which were used to divide working hours into 5 categories which were similar for all waves and comparable to some of the previous literature on long working hours[10,25] : <37, 37-39, 40-49, 50-59, 60+ working hours/week. Unpaid working hours was also divided into 5 categories: <8, 8-14, 15-21, 22-28, 29+ hours on average/week. The total number of hours spent on paid and unpaid work constituted the total working hours measure (reflecting "total workload"), and was divided into the following 5 categories: <42, 42-57, 58–67, 68–80, and >80 h/week. These categories were partly in line with previous literature[18].

Statistical analysis

Group-based trajectory modelling (GBTM) was used in order to identify distinct groups of individual trajectories within the population, and examine whether working hours predicts the course of depressive symptoms over time. This is a semi-parametric model-based clustering technique that allows the identification of groups of individuals following a similar progression of an outcome over time in a flexible and easy way[26]. The trajectory model was fitted using maximum likelihood methods allowing for incomplete data and assuming missing at random data. We used calendar time rather than age as the underlying time scale, since sub-cohort effects could not be ruled out with a cohort-sequential design.

In order to select the best model we followed Nagins' recommended two-step procedure. Firstly the number of latent trajectories was selected. Models with one to eight groups were estimated starting with a single trajectory model described by a cubic polynomial equation to capture the relationship between time (waves) and depressive symptoms, and continuing with models with increasing number of groups. Estimation of depression trajectories was accomplished using the censored normal model (CNORM), which is appropriate for continuous data.

The Bayesian Information Criterion (BIC) was mainly used in order to determine the number of subgroups[26,27]. The magnitude of difference in BIC, the Bayes factor as well as the BIC-based probability approximation were used to choose between more complex and simpler models[27–29]. However, because BIC sometimes keeps improving when adding trajectory groups[26], we further considered the significance of polynomial terms (at the confidence level alpha 0.05), the values of group membership probabilities and of average

posterior probability (entropy) with recommended value greater than 0.7[26,28–30], and when the model no longer captured new distinctive features of the data as complementary criterions for selecting the best model. Because of a relatively large sample we allowed for trajectory groups consisting of a minimum of 1 % of the sample.

After selecting the optimal model in terms of number of groups we selected the shape for each of these groups. Then conditional on the best model, time-stable covariates (risk factors) were inserted in the model by assuming that these risk factors influence the probability of membership to a particular trajectory group. Paid and unpaid working hours were considered simultaneously relative to the defined trajectory groups as time-invariant covariates (risk factors) in the main analyses to allow for a temporal precedence of working hours (labelled model 1). Also total working hours was modeled separately (labelled model 2). Coefficients for risk factors indicate the increase in log odds of being in a trajectory (relative to the lowest group) per unit change in the risk factor[26]. Unadjusted models as well as models adjusted for sex (0 men, 1 women), age, civil status (0 not married, 1 married or cohabiting) and socioeconomic status[31] were presented. We further conducted the same analyses for men and women separately since a significant interaction effect was found for sex, and among participants working full time only. The latter was done to exclude those with part time from the reference group in the analyses of paid working hours, since those with part time work may differ from full time workers with respect to e.g. health, caring responsibilities. We also fitted models with working hours as categorical variables. Working hours were, however, alternatively considered as time-varying covariates to account for the time-varying nature. Since health effects of long working hours may be at least partly attributed to poor working conditions we also tested if there was an interaction between long working hours and job strain (the combination between high job demands and low control)[32–34].

The GBTM analyses were conducted using the PROC TRAJ procedure developed by Jones and Nagin, which can be downloaded from http: //www.andrew.cmu.edu/user/bjones[29,35] in the SAS software (version 9.4; SAS Institute).

Patient and Public Involvement

The study was based on a sample of men and women from the general Swedish population, originally in paid work. The development of the research question, design of the study, recruitment and conduct of the study did not directly involve patients. The results of the study

have also been presented at scientific conferences, will be disseminated to study participants through the SLOSH website (www.slosh.se) and/or the Stress Research Institute website (www.stressforskning.su.se), and may be presented at seminars and communications with labor market representatives.

RESULTS

Table 1 shows some descriptive characteristics of the study sample. Most of the study participants were in middle age or in mature adulthood at wave 2 (2008). A high proportion were married or cohabiting and about 40 % had children living at home. Most were working full time with a day time work schedule. About 20 % of the population had long paid working hours i.e. worked more than 50 hours per week, and a relatively high proportion had long unpaid working hours i.e. was spending 21 hours or more on unpaid work per week. Almost 10 % had a long total working hours i.e. was spending over 80 hours per week on paid and/or unpaid work. Women generally worked longer in total (mean hours of total work: 65.02) compared to men (mean hours of total work: 60.07), while men generally spent more time on paid work (mean hours of paid work for men: 45.59 hrs; mean hours of unpaid work: 14.3 hrs) and women more time on unpaid work (mean hours of paid work: 45.09 and mean hours of unpaid work; 20.07).

Table 1. Characteristics of the study sample in terms of demographic characteristics and workload from paid and unpaid work in 2008 (wave 2, SLOSH data)

		All	Women	Men
Age (%)	Early adulthood (19-34)	8.9	10.2	7.06
	Middle life (35-49)	30.6	32.1	28.69
	Mature adulthood (50-70)	60.5	51.3	64.25
Sex (% females)		58.0		
Civil status (% married or cohabiting)		79.7	78.4	81.56
Children at home (%)		40.9	41.9	39.6
SEI (%)	Unskilled manual workers	14.8	14.1	15.8
	Skilled manual workers	14.4	12.4	17.1
	Assistant non-manual employees	12.6	16.5	7.1
	Intermediate non-manual employees	31.5	34.0	27.9
	Higher non-manual employees	20.5	19.1	22.8

	Self-employed	6.2	3.8	9.5
Full time work (%)		77.4	67.6	90.7
Work schedule (%)	Day time	78.0	76.5	80.1
	Night work	6.2	3.1	1.9
	Shift work excl. nights	15.8	4.32	3.13
Paid working hours per week (%)	<37	25.2	32.2	16.1
	37-39	5.3	6.4	3.9
	40-49	50.4	46.8	55.3
	50-59	12.1	9.7	15.2
	60+	6.9	4.9	9.5
Unpaid working hours per week (%)	<8	19.1	10.7	30.2
	8-14	26.9	24.5	30.1
	15-21	22.4	26.6	17.1
	22-28	13.4	16.3	9.6
	29+	18.1	21.9	13.1
Total working hours per week (%)	<42	12.6	12.8	12.1
	42-57	34.2	31.3	37.9
	58-67	24.9	24.4	22.9
	68-80	18.6	19.3	17.6
	>80	9.7	9.9	9.5

Evaluation of the different models resulted in the selection of a model with six trajectories with a linear order for four groups suggesting a linearly decreasing or increasing trajectory, and a cubic order for two of the groups suggesting a trajectory where there are two turning points (inflections), a maximum and a minimum in depressive symptoms (BIC: -62598.42; Entropy: 0.8). BIC continued to decrease for models with increasing number of groups (Supplementary Table I). However, visual examination of models with four five, six and seven groups indicated that the six group model identified distinctive features of the data (average posterior probabilities above 0.8). Figure 2 depicts the shapes of the six trajectories as well as their class sizes. The pattern of symptoms over time could be described as either "very low stable", "low stable", "doubtful increasing", "high decreasing", "mild decreasing" and "high stable". The trajectories named 'very low stable', "low stable" and 'stable high' followed a slight downward linear trend over time, but remained either at a no depression level (<7 on the depression scale) or between moderate to severe level (>11 and >15, respectively, on the depression scale)[25]. The trajectory named 'mild decreasing' followed a slightly decreasing trend until year 2012 (wave 4) and slightly increasing afterwards. Symptoms varied from mild (>9 and < 11 on the depression scale) to doubtful (>6 and < 10 on the depression scale) depression. The trajectory named 'doubtful increasing' followed a slight increasing linear trend but remained either at doubtful or mild depression level. Finally the trajectory named 'high decreasing' followed a steep downward trend until year 2010 (wave 3) and a slightly decreasing trend thereafter. The symptoms varied from severe depression to no depression levels.

The majority of individuals were classified in either the 'very low stable' (49.1%) or 'low stable' (23.4%) group. The 'high decreasing' group represented the smallest group (1.3%) and the 'doubtful increasing' represented 8.4% of the sample. Both the 'high decreasing' group and the 'doubtful increasing' group followed a quadratic trend with two turning points. Altogether there were four favorable ('mild decreasing', 'high decreasing', 'low stable' and 'very low stable') and two unfavorable ('doubtful increasing', and 'high stable') trajectories.

A description of the demographic characteristics and the distribution of working hours in the year 2008 for the six trajectory groups are given in Table 2. The mean age was, for example, lowest in the 'high stable' trajectory (47.0 years), followed by the 'doubtful increasing' group (47.6 years). Overall there was a higher proportion of women in the unfavorable trajectories. Especially unpaid working hours and total working hours varied between the groups. A higher proportion of individuals with unpaid- and long of total working hours were observed in the 'doubtful increasing' and the 'high stable' group.

Table 2. Characteristics of the trajectory groups in terms of demographic characteristics and workload from paid and unpaid working hours in 2008 (wave 2, SLOSH data)

		Very low stable (n=1447)	Low stable (n=3213)	Doubtful increasing (n=474)	High decreasing (n=74)	Mild decreasing (n=755)	High stable (n=328)
Mean Age (Years)		55.2	51.1	47.6	54.1	49.6	46.8
Sex (% females)		48.2	58.0	68.1	69.4	65.0	71.3
Civil status (% married)		82.5	80.6	76.3	71.6	77.2	71.8
Socioeconomic in status (%)	Unskilled manual workers	15.3	13.9	16.0	13. 9	16.0	17.0
	Skilled manual workers	16.4	13.8	14.0	6.9	14.6	12.6
	Assistant non-manual employees	12.8	12.0	12.3	15.3	13.5	15.1
	Intermediate non-manual employees	17.9	32.3	32. 9	27.8	31.8	28.7
	Higher non-manual employees	8.0	22.3	18.6	22.2	19.2	20.8
	Self-employed	8.2	5.7	6.1	13.9	4.6	5.9
Paid working hours per week (%)	<37	25.3	23.8	27.7	30.0	27.9	27.8
	37-39	5.8	5.4	6.3	8.3	4.4	2.9
	40-49	49.7	51.4	50.3	35.0	47.9	53.5
	50-59	11.3	12.8	10.8	18.3	11.3	10.6
	60/61+	7.8	6.6	5.2	8.3	8.4	5.1
Unpaid working hours per week (%)	<8	25.5	19.3	11.8	15.4	15.4	11.0
	8-14	28.9	27.9	20.3	26.9	25.4	22.4
	15-21	21,7	22.6	23.4	26.9	22.5	21.2
	22-28	12.6	12.8	14.9	17.3	14.2	17.1
	29+	11.3	17.3	29.6	13.5	22.5	28.2
Total working hours per week (%)	<42	15.9	11.8	11.0	10	12.3	9.5

42-57	38.4	35.1	25.9	44.0	30.3	27.8
58-67	21.5	25.8	28.2	18.0	24.6	26.9
68-80	16.6	18.4	20.6	18.0	20.4	21.2
>80	7.7	8.8	14.2	10.0	12.3	14.5

Table 3 reports the results of the multinomial logistic regression models in log-odds ratios (estimate), standard errors (SE) and odds ratios (OR), with the 'very low stable' group as reference group. Model 1 presents the results from a model including both paid and unpaid working hours, while model 2 presents the results of a model analyzing the influence of total working hours separately. The results showed unpaid working hours at the baseline measurement (2008) was associated with a significantly higher likelihood of being in all the trajectory groups as compared to being in the reference group but no significant associations were found for paid working hours. Longer total working hours was associated with increased likelihood of being in the 'low stable', 'doubtful increasing', 'mild decreasing', and 'high stable' group. Sex, age, and civil status and socioeconomic status were included in the adjusted models as additional risk factors for the trajectory group membership. Estimates from the adjusted model with respect to paid/unpaid working hours were relatively similar to those in the unadjusted model. However, longer unpaid working hours were now associated with a significantly higher likelihood of being in 'low stable' and 'high stable' as compared to the reference group. With respect to longer total working hours there was an increased likelihood of being in the 'high decreasing' [OR:1.30; CI:[1.14;1.48]], and 'high stable' group [OR:1.22; CI:[1.01;1.47]]. In supplementary analyses of longer paid working hours separately, no significant associations between paid working hours and the trajectory groups were observed. Results were also similar in a subsample of full-time employees only. No clear associations was on the other hand observed in analyses with working hours as categorical variables, but which may be due to lack of power. Moreover, the risk estimates for paid working hours were not significantly different among people with or without job strain (data not shown).

Table 3. Results from the multinomial logistic regressions models estimating the probabilities of group membership according to a) paid working hours and unpaid working hours b) total working hours. Reference group: Very low stable (Group 1). Estimates: log

odds ratios; SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory Groups	Low Stable	Doubtful Increasing	High Decreasing	Mild Decreasing	High Stable
Unadjusted Models					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.01 0.99 (0.01) [0.98;1.01]	0.00 1.00 (0.00) [0.99;1.01]	-0.00 1.00 (0.01) [0.97;1.02]	-0.01 0.99 (0.01) [0.98;1.00]	-0.01 0.99 (0.01) [0.97;1.01]
Unpaid Working Hours	0.26* 1.29 (0.05) [1.17;1.43]	0.28* 1.32 (0.05) [1.20;1.45]	0.25* 1.28 (0.11) [1.03;1.60]	0.54* 1.72 (0.06) [1.53;1.92]	0.53* 1.31 (0.09) [1.11;1.54]
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.17* 1.18 (0.06) [0.98;1.03]	0.22* 1.25 (0.05) [1.12;1.39]	0.13 1.15 (0.13) [0.88;1.49]	0.39* 1.47 (0.06) [1.30;1.67]	0.34* 1.40 (0.09) [1.16;1.68]
Adjusted Models					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.01 0.99 (0.01) [0.98;1.00]	0.00 1.00 (0.01) [0.99;1.01]	0.37 1.01 (0.06) [0.89;1.14]	0.13 1.14 (0.12) [0.90;1.45]	0.33* 1.40 (0.09) [1.18;1.65]
Unpaid Working Hours	0.15* 1.16 (0.06) [1.04;130]	0.09 1.10 (0.05) [0.99;1.23]	0.49* 1.64 (0.10) [1.34;2.02]	0.29* 1.35 (0.12) [1.05;1.71]	0.47* 1.60 (0.11) [1.29;1.982]
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.06 1.06 (0.06) [0.94;1.19]	0.08 1.08 (0.06) [0.96;1.21]	0.26* 1.30 (0.07) [1.14;1.48]	-0.03 0.97 (0.14) [0.74;126]	0.19* 1.22 (0.09) [1.01;1.47]

An interaction between total working hours and sex was on the hand noted. The analyses were therefore also stratified by sex. The separate trajectory groups identified for men and women are shown in Supplementary Figures I and II. Among men, the best solution resulted in only 5 trajectory groups whereas 6 groups were identified among women. The trajectories were relatively similar to the ones illustrated in Figure 2. In the adjusted models, men with more unpaid working hours were more likely to be in 'Doubtful Stable' or 'High Stable' Groups, while no significant associations were found for paid working hours (Supplementary Table II). Unpaid working hours were also associated with an increased likelihood of higher symptom trajectories compared to the reference group for women while no significant associations were found for paid working hours (Supplementary Table III). For total working hours among men we found an increased likelihood of being in the 'doubtful stable' group while longer total working hours for women was associated with increased likelihood in the 'high decreasing' and 'high stable' groups compared to the very low stable group (Adjusted Models; Supplementary Table II-Supplementary Table III). Hence, the association between total workload and high stable depressive symptoms was only apparent among women.

In analyses with working hours as time-varying covariate, adjusting for sex, age, civil status, and socioeconomic status, longer paid working hours increased the depressive symptom trajectory in the 'low stable', 'doubtful increasing', and high stable' group. Longer unpaid working hours also raised the trajectory in the 'doubtful increasing' group but decreased the depressive symptoms in the 'mild decreasing' group. Longer total working hours, however, significantly increased depressive symptoms in both the 'very low stable', 'low stable', 'doubtful increasing', and 'high stable' group, but not in the 'high or mild decreasing' groups (Supplementary Table IV).

DISCUSSION

The current study identified six distinct depressive symptoms trajectories. Previous population based studies have also shown that stable patterns are common such as stable low symptoms[5], which is in line our findings. A small group with stable high symptoms, as in the present study, have also commonly been found in other studies[2,5]. Patterns with varying degree of symptoms over time are more seldom observed[5]. However, it has also been found

that a considerable proportion of the general population experience a stable recovery after a depressive episode[2]. The patterns observed in this study are thus generally in line previous findings and expectations.

This work further suggested that total working hours and unpaid working hours is associated with different long-term trajectories of depressive symptoms but no association was noted for paid working hours. The present study thus conflict with an association between long working hours and depression as found in previous work[12]. However, there are indications that only more extreme weekly working hours are associated with poorer health[10,25], which may partly explain why we did not observe any association between time spent on paid work and depressive symptom trajectories in the present study. Also the inclusion of part time work in this study may have played a role, although sensitivity analyses among full-time employees showed similar results. The study on the other hand indicate that a longer total working hours or unpaid working hours is associated with certain patterns of depressive symptoms over time. This is the first study to our knowledge on the relationship between unpaid working and total working hours and depressive symptom trajectories. The results indicated an association between unpaid- and total working hours and both favorable ('low stable', 'high decreasing') and unfavorable ('high stable') trajectories. A higher risk of belonging to some of these groups such as the 'low stable' and 'high decreasing' groups may be explained by a higher initial level of depressive symptoms than those in the 'very low stable' group.

Complementary analyses showed that the depressive symptoms increased further in some groups, especially in the unfavorable groups with doubtful increasing and stable high symptoms, with an increase in total working hours over the period. This suggests that long working hours potentially due to a double burden of paid and unpaid work constitute a risk and should be considered in policy and prevention. Increased gender equality in terms of work conditions and unpaid work share may also contribute to lessen the burden in the society at large. More research is however needed to confirm our findings. Although, we did observe that there was a stronger association between unpaid- and total working hours and high decreasing as well as stable high depressive symptoms among women than men, there were generally small differences men and women. This is in contrast to some earlier studies that have suggested that long working hours may be more detrimental to women's health[36–41] although the evidence is still scarce and inconclusive[42–44]. Another study on the other hand observed similar associations between long working hours and health among men and women

from Nordic countries characterized by the so called "dual breadwinner external care model" (meaning participation of both parents on the labor market and outsourcing of care), while different associations were observed in other countries dominated by e.g. the male breadwinner model[45].

Some strengths of the study are that it was conducted in a sample from the general working population, and with measures of depressive symptom every second year over a period of 8 years. In contrast to studies of depression trajectories in clinical population, studies in the entire population may more accurately represent the true underlying continuum of the disorder[5]. Group-based trajectory modelling provides a flexible way to summarize data in an easy and understandable way and also introduce risk factors that may influence membership in trajectory groups and therefore identify heterogeneity in the sample[27,46]. We based the trajectories on four time points, which is above the minimum required for estimating quadratic trajectories[30]. A longer time series of measurement may, however, have contributed to more power for identifying heterogeneity in symptoms over time, study onset versus recovery etc., and potential determinants of different trajectories. Dropout from the study may also have restricted the possibility to detect heterogeneity. Given that the subjects were originally working and repeatedly in paid work for more than 30 % over the study period, the sample is probably characterized by relatively healthy individuals with high educational level etc. leading to potential underestimation of relationships between working hours and depressive symptoms. Longitudinal sampling weights to make the analyses more representative of the source population was not available. Data were also missing on family history of mental health problems and childhood/adolescent characteristics, which may be predictors of depressive symptoms trajectories and workload and may confound the relationships of interest. In the main models we chose to examine whether working hours at the start of the trajectory predicted the course of depressive symptoms in order to allow for temporal precedence of working hours, although working hours may also be changing or stable over the study period. This does not rule out that depressive symptoms at baseline may have biased reporting of working hours. However, later depressive symptoms is unlikely to influences the initial measurement of working hours. For power considerations we also treated the data on working hours as continuous rather than categorical, which probably not optimal given that only more extreme hours may be associated with health consequences, but sensitivity analyses did not support associations between any of the specific categories and depressive symptoms trajectories. Finally it would have been of interest to examine the

impact of part time work on depressive symptoms but this was not possible due to power limitations.

All in all, the results indicate longer total working hours may increase the risk of higher depressive symptom trajectories. Since an unfavorable trajectory with stable or recurrent high depressive symptoms is associated with a poor prognosis[5], interventions with regard to working hours may contribute to limit the burden of depressive disorders in the population.

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COMPETING INTERESTS

Conflicts of interest: No author has reported a conflict of interest

DATA SHARING

SLOSH data are not publicly available due to legal restrictions. Requests for data or results can be addressed to the SLOSH data manager data@slosh.se. More information can be found on the SLOSH website www.slosh.se.

CONTRIBUTORSHIP STATEMENT

Author contributions: LMH conceived the study. PP performed the analyses and drafted the manuscript. LMH, PP and HW contributed to the design and interpretation of data, critical revision of the work, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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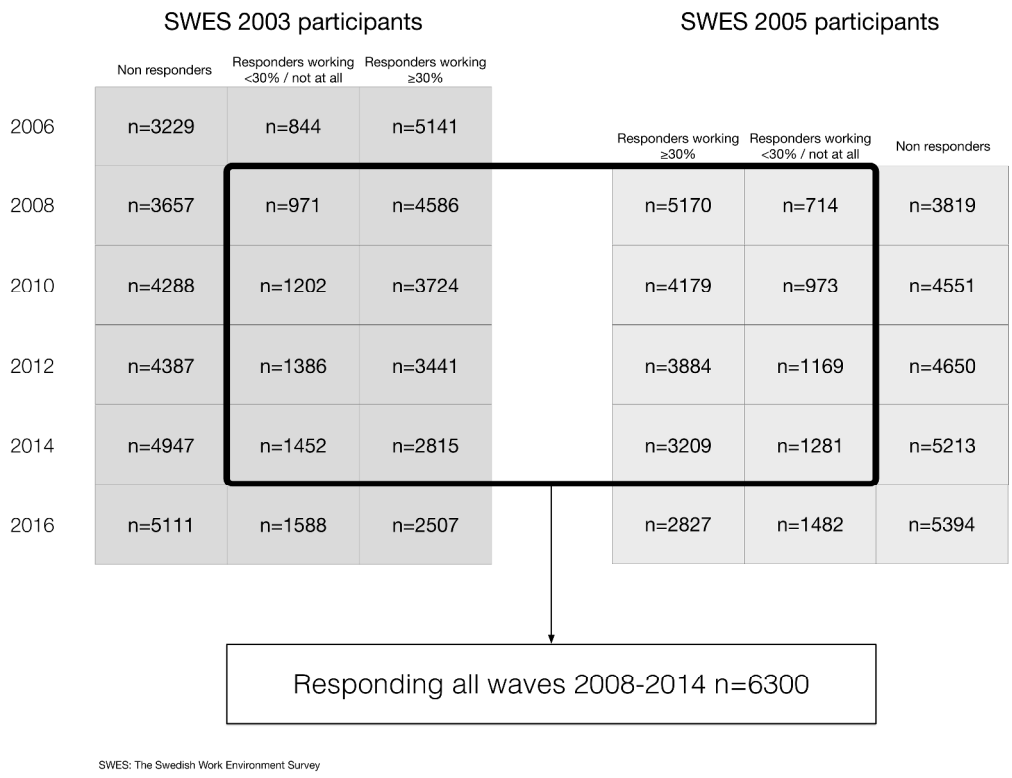
Fig.1. Total number of respondents/non-respondents to the Swedish Longitudinal Occupational Survey of Health (SLOSH) among the SLOSH sample originally participating in the Swedish Work Environment Surveys (SWES) 2003 and 2005, as well as number of individuals included in the analytic sample.

Fig. 2: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms were identified: Very low stable (Group 1: 23.4% of the sample), Low stable (Group 2: 49.1% of the sample), Doubtful increasing (Group 3: 8.4% of the sample), High decreasing (Group 4: 1.3% of the sample), Mild decreasing (Group 5: 12.7% of the sample), High stable (Group 6: 5.2% of the sample)



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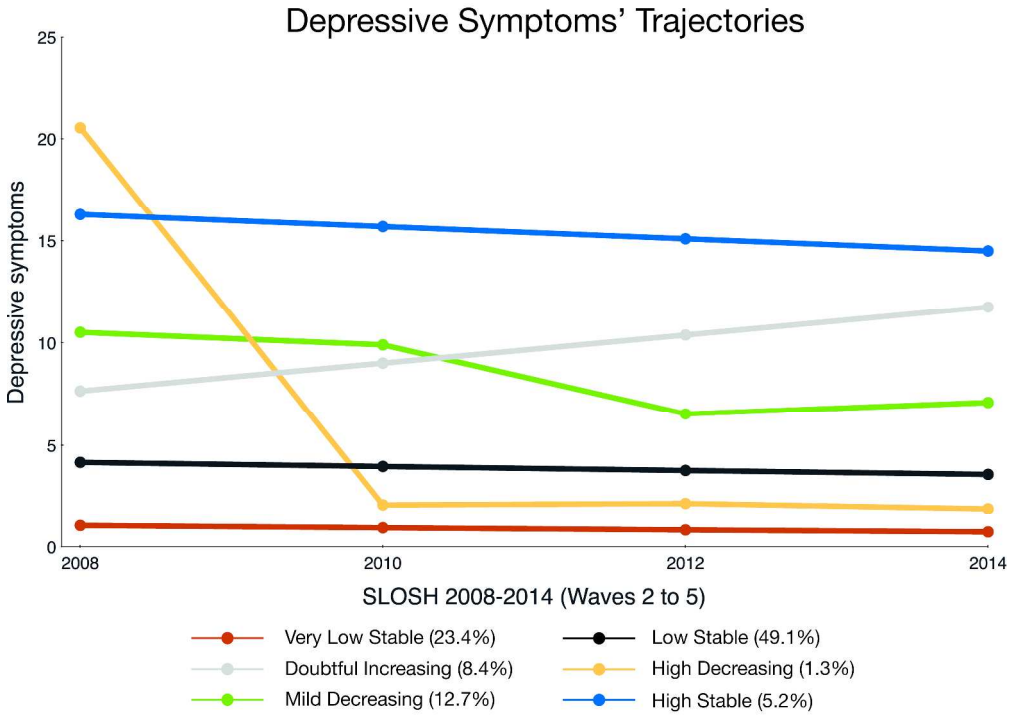
534x411mm (300 x 300 DPI)



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384x274mm (300 x 300 DPI)

Supplementary Table I: Fit Values for group-based trajectory models with different number of groups

	All	Males	Females
3 groups	BIC: -63381.45 AIC: -63330.85	BIC: -25232.18 AIC ; -25188.10	BIC=-38090.91 AIC=-38044.39
4 groups	BIC: -63075.15 AIC: -63007.68	BIC:-25080.06 AIC:-25021.28	BIC=-37961.41 AIC=-37899.39
5 groups	BIC: -62713.72 AIC: -62629.39	BIC:-24816.75 AIC:-24743.27	BIC=-37835.91 AIC=-37758.39
6 groups	BIC: -62627.43 AIC: -62526.23	BIC:-24836.44 AIC:-24748.27	BIC=-37800.26 AIC=-37707.23
7 groups	BIC: -62512.35 AIC: -62394.29		BIC=-37715.31 AIC=-37606.78
8 groups	BIC: -62398.45 AIC: -62263.52		BIC=-37635.37 AIC=-37511.33

Supplementary Table II: Results from the multinomial logistic regressions models for males estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory groups	**Low Stable**	**High Decreasing**	**Doubtful Stable**	**High Stable**
		Unadjusted Models		
Model 1				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Paid Working Hours	0.01 (0.01) 1.01 [0.99; 1.01]	0.01 (0.02) 1.01 [0.97; 1.05]	0.00 (0.01) 1.00 [0.99; 1.01]	-0.00 (0.01) 1.00 [0.97; 1.02]
Unpaid Working Hours	0.09* (0.05) 1.10 [1.00; 1.21]	0.01 (0.17) 1.01 [0.72; 1.43]	0.28* (0.06) 1.32 [1.18; 1.47]	026* (0.10) 1.30 [1.06; 1.59]
Model 2				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Total Working Hours	0.13* (0.05) 1.14 [1.03; 1.27]	-0.01 (0.20) 0.00 [0.667; 1.47]	0.28* (0.06) 1.32 [1.16; 1.50]	0.18 (0.13) 1.20 [0.93; 1.53]
		Adjusted Models[!]		
Model 1				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Paid Working Hours	0.00 (0.01) 1.00 [0.99; 1.01]	0.01 (0.02) 1.01 [0.97; 1.06]	0.00 (0.01) 1.00 [0.99; 1.01]	0.00 (0.01) 1.00 [0.97; 1.03]
Unpaid Working Hours	0.02 (0.05) 1.10 [0.92; 1.13]	-0.02 (0.21) 0.98 [0.65; 1.49]	0.20* (0.06) 1.22 [1.08; 1.38]	0.25* (0.11) 1.28 [1.02; 1.60]
Model 2				
	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]	Estimate (SE) OR [95%CI]
Total working hours	-0.04 (0.06) 1.04 [0.92; 1.17]	-0.03 (0.23) 0.97 [0.62; 1.52]	0.21* (0.07) 1.24 [1.08; 1.42]	0.18 (0.13) 1.20 [0.92; 1.56]

! Adjusted Models for age, civil status, and socio-economic status

*significance at 5%

Supplementary Table III: Results from the multinomial logistic regressions models for females estimating the probabilities of group membership according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and Adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (* significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

Trajectory Groups	**Low Stable**	**Doubtful Increasing**	**High Decreasing**	**Moderate Episodic**	**High Stable**
Unadjusted Models					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.00 1.00 (0.01) [0.98;1.01]	-0.00 1.00 (0.01) [0.98;1.01]	-0.00 1.00 (0.01) [0.98;1.02]	0.02 1.02 (0.01) [0.99;1.04]	0.00 1.00 (0.01) [0.98;1.02]
Unpaid Working Hours	0.28 1.33 (0.09)* [1.20;1.47]				
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.19* 1.21 (0.09) [1.01;1.43]	0.20* 1.23 (0.08) [1.04;1.45]	0.41* 1.51 (0.10) [1.24;1.84]	0.28* 1.32 (0.14) [1.01;1.73]	0.40* 1.50 (0.12) [1.19;1.88]
Adjusted Models[!]					
Model 1					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	-0.01 0.99 (0.01) [0.98;1.03]	-0.01 0.99 (0.01) [0.97;1.01]	-0.01 0.99 (0.01) [0.97;1.01]	0.00 1.00 (0.01) [0.98;1.03]	-0.01 0.99 (0.01) [0.97;1.01]
Unpaid Working Hours	0.25* 1.28 (0.08) [1.09;1.52]	0.20* 1.22 (0.08) [1.04;1.45]	0.49* 1.64 (0.10) [1.34;2.02]	0.29* 1.35 (0.12) [1.05;1.71]	0.47* 1.60 (0.11) [1.29;1.982]
Model 2					
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.08 1.09 (0.08) [0.91;1.27]	0.05 1.05 (0.08) [0.89;1.24]	0.27* 1.32 (0.11) [1.07;1.63]	0.15 1.16 (0.13) [0.89;151]	0.26* 1.30 (0.11) [1.05;1.62]

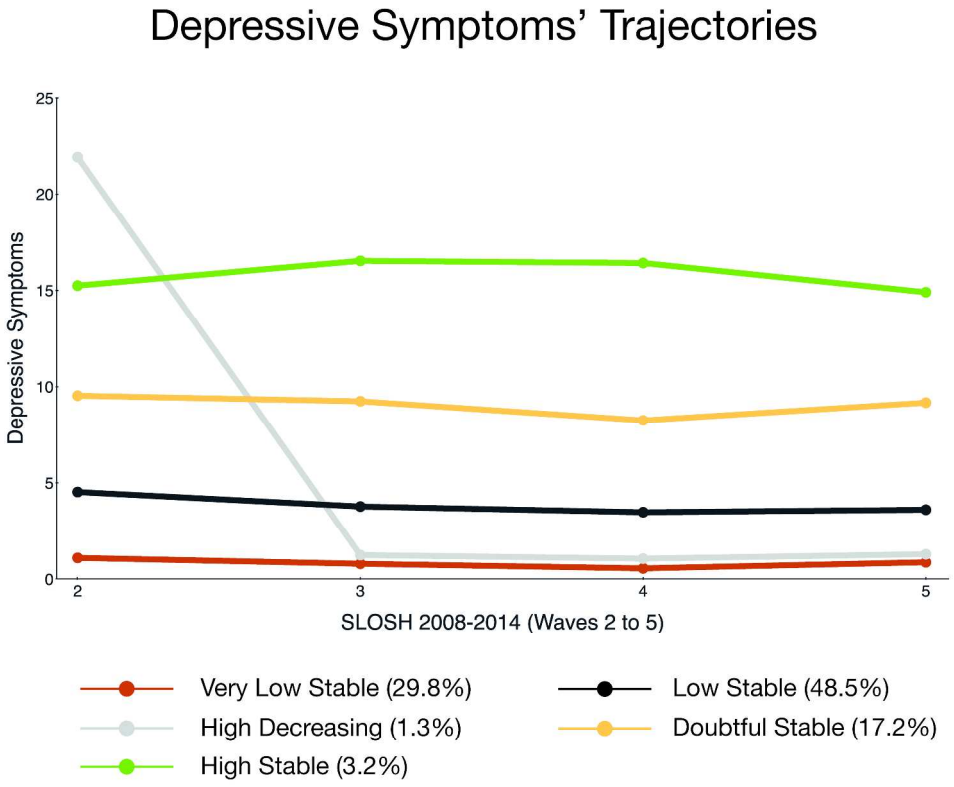
! Adjusted Models for age, civil status, and socio-economic status

*significance at 5%

Supplementary Table IV. Results from the multinomial logistic regressions models estimating a potential increase or decrease in the symptom trajectories according to Unadjusted and Adjusted Model 1: paid working hours and unpaid working hours; Unadjusted and adjusted Model 2: total working hours. Reference group: Very low stable (Group 1). Estimates: log odds ratios (*: significance at 5% level); SE: standard errors (in parentheses). OR: odds ratios: CI: 95% Confidence Intervals (in brackets).

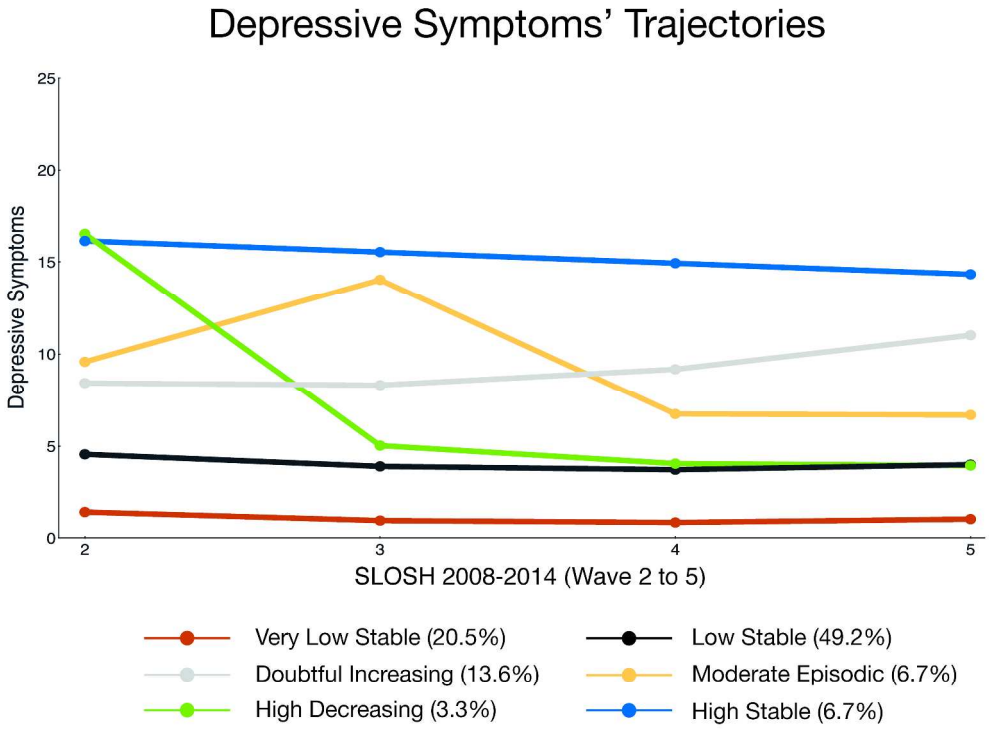
Trajectory Groups	**Very Low Stable (Reference Group)**	**Low Stable**	**Doubtful Increasing**	**High Decreasing**	**Mild Decreasing**	**High Stable**
		Unadjusted	**Models**			
Model 1						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	0.02 1.02 (0.01) [0.99;1-05]	0.02* 1.03 (0.01) [1.01;1.04]	0.04 1.04 (0.03) [0.98;1.10]	-0.05 0.95 (0.05) [0.86;1.05]	-0.01 0.98 (0.05) [0.96;1.00]	0.08* 1.09 (0.03) [1.03;1.15]
Unpaid Working Hours	0.37* 1.45 (0.09) [1.19;1.76]	0.10* 1.11 (0.05) [1.00;1.23]	0.60* 1.83 (0.14) [1.37;2.43]	0.84* 2.32 (0.28) [1.33;4.34]	-0.57 0.56 (0.29) [0.31;1.01]	0.12 1.13 (0.14) [0.84;1.51]
Model 2						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours	0.32* 1.37 (0.10) [1.12;1.68]	0.33* 1.39 (0.07) [1.21;1.59]	0.71* 2.04 (0.15) [1.51;2.74]	-0.18 0.83 (0.30) [0.46;1.51]	-0.04 0.96 (0.31) [0.52;1.76]	0.43* 1.53 (0.17) [1.08;2.17]
		Adjusted	**Models**[!]			
Model 1						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Paid Working Hours	0.01 1.01 (0.02) [0.98;1.05]	0.02* 1.03 (0.01) [1.01;1.04]	0.07* 1.07 (0.02) [1.01;1.12]	-0.05 0.95 (0.05) [0.86;1.05]	-0.06 1.03 (0.06) [1.01;1.04]	0.08* 1.08 (0.03) [1.03;1.14]
Unpaid Working Hours	0.34* 1.07 (0.10) [1.01;1.12]	0.07 1.07 (0.05) [0.97;1.18]	0.62* 1.86 (0.15) [1.39;2.49]	0.82 2.28 (0.27) [1.34;3.89]	-0.71* 0.49 (0.25) [0.29;0.81]	0.08 1.09 (0.15) [0.81;1.45]
Model 2						
	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]	Estimate OR (SE) [95%CI]
Total Working Hours						
	0.26* 1.30 (0.12) [1.03;1.63]	0.29* 1.34 (0.07) [1.17;1.53]	0.66* 1.93 (0.15) [1.45;2.59]	-0.17 0.85 (0.30) [0.46;1.54]	0.37* 1.45 (0.38) [0.68;3.06]	0.54* 1.56 (0.17) [1.10;2.20]

! Adjusted Models for age, civil status, and socio-economic status
*significance at 5%



Supplementary Figure I: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); five groups of depressive symptoms for males were identified: Very low stable (Group 1: 29.8% of the sample), Low stable (Group 2: 48.5% of the sample), High Decreasing (Group 3: 1.73% of the sample), Doubtful stable (Group 4: 17.2% of the sample), High stable (Group 5: 3.2% of the sample)

299x282mm (300 x 300 DPI)



Supplementary Figure II: Trajectories of depressive symptoms from 2008 to 2014 (waves 2 to 5 in SLOSH data); six groups of depressive symptoms for females were identified: Very low stable (Group 1: 20.5% of the sample), Low stable (Group 2: 49.2% of the sample), Doubtful Increasing (Group 3: 13.63% of the sample), Moderate Episodic (Group 4: 6.7%% of the sample), High Decreasing (Group 5: 3.3% of the sample), High stable (Group 5: 6.7% of the sample)

324x282mm (300 x 300 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	Longitudinal study
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3	
Objectives	3	State specific objectives, including any prespecified hypotheses	3	
Methods				
Study design	4	Present key elements of study design early in the paper	3	Cohort, longitudinal survey
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3	Further details on data collections can be found in references
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	3	Further details on data collections can be found in references
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	NA	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4	
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-5	Further details can be found in references
Bias	9	Describe any efforts to address potential sources of bias	5	
Study size	10	Explain how the study size was arrived at	3	

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-5	
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4-5	
		(*b*) Describe any methods used to examine subgroups and interactions	4-5	
		(*c*) Explain how missing data were addressed	4-5	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	3	
		(*e*) Describe any sensitivity analyses	5	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	3	
		(b) Give reasons for non-participation at each stage	4	Details in ref
		(c) Consider use of a flow diagram	4	Details in ref
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1	
		(b) Indicate number of participants with missing data for each variable of interest	NA	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	NA	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	Table 1	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3, Supplementary table 1	
		(*b*) Report category boundaries when continuous variables were categorized	Table 1	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-13
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.