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**Employment and earnings trajectories before and after sickness absence due to major depressive disorder: a nationwide case-control study**

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## SES TRAJECTORIES AND DEPRESSION

**Objectives:** To examine employment and earnings trajectories before and after the first sickness absence period due to major depressive disorder (MDD).

**Methods:** All individuals (n=158 813) in Finland who had a first sickness absence period (lasting longer than 9 days) due to MDD between 2005 and 2015 were matched with one randomly selected individual of the same age and gender with no history of MDD.

Employment status and earnings were measured using register-based data annually from 2005 to 2015. Generalized estimating equations were used to examine the trajectories of employment and earnings before and after MDD diagnosis in men and women separately.

**Results:** Sickness absence due to MDD was associated with increased probability of non-employment during and after the year of the first sickness absence period. In men, but not in women, the probability of being employed was lower five years before the sickness absence period due to MDD. When compared to the individuals in the control group, men had around 34% and women 15% lower earnings one year, and 40% and 23%, respectively, five years, after the first sickness absence period due to MDD. More severe MDD and longer duration of sickness absence period were associated with lower probability of being employed.

**Conclusions:** Sickness absence due to MDD is associated with considerable reduction in employment and earnings losses. For men and individuals with more severe MDD, this reduction was before the first sickness period. This supports a reciprocal association between employment and earnings with MDD.

**Keywords:** depression; sickness absence; socioeconomic position; trajectories; register-based research

### **What is already known about this subject?**

- Whereas reciprocal association between depression with employment and personal income have been found in previous studies, employment and income trajectories before and after the first sickness absence due to MDD have not been examined.

### **What are the new findings?**

- Sickness absence due to MDD is associated with considerable reduction in employment and personal income losses.
- Among men and in those with more severe depression, labour market and economic disadvantage was prevalent years before the first sickness absence due to MDD.

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

- The present findings highlight the need for effective clinical practices and policies to reduce the burden of depression in the working-age population.

## SES TRAJECTORIES AND DEPRESSION

Major depressive disorder (MDD), which we sometimes refer to as “depression”, is a leading cause of disability around the world, and it is associated with tremendous social and economic burden<sup>1</sup>. Cost-of-illness studies have documented that unemployment and reduced productivity due to depression constitute the largest financial costs of the total indirect costs associated with depression<sup>1-3</sup>. Consistent with this evidence, most prospective observational longitudinal cohort studies have shown that major depressive disorder, depression-related sickness absence, or high number of depressive symptoms are associated with socioeconomic outcomes in terms of unemployment and low income<sup>4-12</sup>. This suggests that depression could lead to a low socioeconomic position (SEP) over the life course (i.e., health selection), and to a reduced worklife expectancy<sup>13</sup>. On the other hand, low SEP has been associated with increased risk of depression<sup>14-20</sup>, also in studies where the history of depression or other mental disorders have been taken into account<sup>17</sup>, indicating that socioeconomic adversity is a likely cause of depression (i.e., social causation).

However, there is a lack of nationwide studies examining how MDD is related to trajectories of employment and personal income. This issue is of high policy importance as for a significant fraction of all affected individuals, depression seems to be a rather transient condition<sup>21,22</sup>. For example, half of the individuals with MDD have been found to recover within 6 months<sup>23</sup>, and most individuals diagnosed with MDD receive treatment only up to 2 years<sup>24</sup>. While depression and severe psychological distress have been associated with an increased risk of sickness absence<sup>25-27</sup>, a large-scale study of Finnish public-sector employees showed that over 85% of depression-related work absence episodes ended as the person returned to work<sup>28</sup>. In a recent study using data from a nationally representative panel survey from Australia<sup>29</sup>, severe self-reported depressive symptoms were associated with unemployment, but unemployment had only a marginal effect on severe depressive symptoms in women, but not in men. To summarize, whereas it is likely that MDD is associated with unemployment and reduced income, it remains unclear what is the quantitative magnitude of

## SES TRAJECTORIES AND DEPRESSION

the ‘scarring’ effect of MDD on socioeconomic outcomes and whether reduced levels of employment or income are present already before the depression diagnosis.

The aim of the present study was to examine employment and earnings trajectories before and after the first sickness absence period due to MDD using nationwide register-based data from Finland. We investigated: (a) the average reduction in the employment rate and earnings in individuals after the onset of first recorded sickness absence due to MDD, (b) whether individuals with sickness absence due to MDD have lower employment rate and earnings before the first MDD-related sickness absence, (c) whether the association between MDD and employment differs according to the severity of MDD and duration of sickness absence related to MDD, (d) whether associations were similar in all educational groups. The heterogeneity analysis is important because high education may protect individuals from loss of earnings<sup>30</sup>. Depression diagnoses and reporting of depressive symptoms are more common in women than in men<sup>31</sup>, although previous studies have provided mixed empirical findings whether the association between MDD and socioeconomic factors differs between men and women<sup>29,32,33</sup>. For this reason, the associations for men and women were analyzed separately.

## Methods

### *Study design and setting*

Using personal identity numbers, which have been assigned to all Finnish residents starting from 1969, the study population was constructed by linking the following nationwide registries: population registry of Statistics Finland, the Causes of Death Statistics of Statistics Finland, and the sickness allowance register of the Social Insurance Institution of Finland (Kela). The population registry of Statistics Finland contains information on general demographics and individuals’ labour market status, including salaries extracted from tax

## SES TRAJECTORIES AND DEPRESSION

registers. The Causes of Death Statistics of Statistics Finland contains the date and cause of death.

The sickness allowance register maintains administrative information on sickness absences that were granted due to MDD and that were longer than nine days. The cut-off at nine days is based on the institutional structure of the Finnish sickness insurance system<sup>34</sup>. After the 9-day waiting period the employee is eligible to receive an earnings-related sickness allowance from Kela that also keeps a record of the spells of sickness absence. Individuals who are aged between 16 to 67 years and cannot do regular work because of their illness are eligible for the sickness allowance. Persons who are not employed can also apply, and also persons who are on temporary or permanent pension if they have been working. The sickness allowance has no ceiling and on average 70% of the previous earnings are covered by the sickness allowance<sup>34</sup>. Information on sickness absences was available from 2004 to 2015. The length of sickness absence was measured in days.

### *Study population*

Individuals (n=158 813; 64% women) who were born between 1942 and 1997, who had their recorded sickness absence spell (lasting more than 9 days) due to MDD between 2005 and 2015, and who were alive and living in Finland during the year the first sickness absence due to MDD was given constituted the study population of cases. Individuals who received a sickness absence due to MDD in 2004 were excluded. Each case (i.e., an individual with the first recorded sickness absence spell due to MDD between 2005-2015) was matched to one randomly selected control individual of the same birth year, birth month, and gender, who did not have a sickness absence due to MDD before or during the year of the case.

### *Ethical permission*

## SES TRAJECTORIES AND DEPRESSION

The ethics committee of the Finnish Institute of Health and Welfare (THL/730/6.02.01/2018) approved the study. Data were linked with the permission of the Statistics Finland (TK-53-1696-16), the National Institute of Health and Welfare, and the Social Insurance Institution of Finland.

### *Assessment of MDD-related sickness absence*

MDD-related sickness absence was diagnosed by a physician (i.e., general physicians, occupational physicians and psychiatrists) using the ICD-10 code F32. Mild or moderate MDD (ICD-10 codes F320-F321) and severe MDD (ICD-10 codes F322-F323) were also defined.

### *Assessment of employment and earnings*

Annual employment status was measured as the employment status during the last week of each calendar year. Individuals who were wage and salary earners or self-employed were defined as employed. All others were classified as non-employed. The total level of earnings, which include wage and salary earnings and self-employment income, were measured annually, i.e., each year. To ensure the comparability of income measures over the observation period, earnings were deflated to the base year 2015 using the official consumer price index maintained by Statistics Finland.

### *Covariates*

Education was measured at the time when MDD was diagnosed in cases and during the corresponding year among individuals in the control group. Education was classified as follows: 0=primary education (i.e., only basic compulsory education); 1=secondary education (i.e., completed upper secondary education or similar); 2=higher education (i.e., completed at least bachelor's degree, master's degree, polytechnic degree or similar).



### **Statistical analyses**

The observation period started at the year of the first sickness absence due to MDD for cases (i.e., those individuals who received a MDD diagnosis) and at the matched year for the control individuals. Participants were then followed backward and forward for as many years they had data available up to the maximum of 10 years (i.e., years 2005 to 2015). Thus, participants who were diagnosed with MDD at the beginning of the study period (e.g., year 2005), contributed mostly to the data after the first sickness absence period due to MDD, and the participants who were diagnosed with MDD at the end of the study period (e.g., year 2015), contributed mostly to the data before the first sickness absence period due to MDD.

Generalized estimating equations (GEE) were used to examine the trajectories of employment and earnings before and after sickness absence due to MDD. GEE allowed to account for correlations among repeated observations (i.e., employment and earnings) contributed by a single participant. With employment, logic link-function and binomial family function were used, and with earnings, log link-function and poisson family function were used. Employment (1=employed vs. 0=not employed) and annual earnings in euros were used as outcomes. Case status (1=case; 0=control), time point, age-groups in five-year intervals, and interaction between case status and time point were used as predictors.

To examine whether the trajectories of employment and earnings varied by the severity of the MDD diagnosis (0=not specified; 1=mild or moderate; 2=severe) and the length of sickness absence, additional models were examined only among cases. The length of sickness absence was transformed from the number of days to quartiles (Q1=shortest; Q4=longest). In addition to reporting results using relative effect sizes, margins command in Stata was used to calculate covariate adjusted predictions. Stata 15.1 (Stata Corp, College Station, TX) was used in all analyses.

## Results

Descriptive statistics of the study participants are shown in **Table 1**. Between 2005 and 2015, 56 472 men and 102 341 women had their first recorded sickness absence period lasting more than 9 days due to MDD. In men, 67.4% of the cases were employed at the end of the year when they were diagnosed. In women, the corresponding figure was 75.3%. In comparison, from the control group 74.6% of men and 74.1% of women were employed at the end of the matched year.

The predicted probability and the corresponding 95% confidence intervals (CIs) of employment before and after the sickness absence due to MDD for men and women are shown in **Figure 1** (for the corresponding parameter estimates, see **Supplement Table 1**). The probability of employment dropped considerably after sickness absence due to MDD. Among men, cases had a lower likelihood of being employed before the sickness absence due to MDD. During the year when they had the first sickness absence due to MDD, and after, the probability dropped considerably from 0.7 to 0.5. In women, a similar result was not detected. On the contrary, the likelihood of employment was slightly higher among individuals with sickness absence due to MDD, and the probability of being employed did not drop until at the year when they had sickness absence due to MDD. After that the probability continued to drop significantly.

The estimated mean earnings (and the 95% confidence intervals) before and after the sickness absence due to MDD for men and women are reported in **Figure 2** (the estimates are presented in **Supplement Table 2**). When compared to individuals in the control group, men had around 20% lower earnings and women 2% lower earnings during the year of diagnosis. During the consecutive years, this difference increased among both men and women; one year after the diagnosis women earned 15% and men 34% less than individuals in the control groups, whereas five years after the diagnosis, the corresponding figures were 23% for women and 40% for men.

## SES TRAJECTORIES AND DEPRESSION

The probability of employment according to educational level before and after sickness absence due to MDD are shown in **Figure 3** (for the estimates see **Supplement Table 3**). Although there were significant differences on average in the probability of employment across educational levels, the sickness absence due to MDD was associated with a reduction in the probability of employment across all educational levels. This effect was slightly smaller for the individuals with a higher educational level.

Severe MDD was associated with a considerably lower probability of employment before and after the sickness absence due to MDD when compared to MDD diagnoses where severity was either mild, moderate or not specified (**Figure 4**; for the estimates see **Supplement Table 4-5**). Similarly, a longer sickness absence period during the first year was associated with a lower probability of employment before and after the MDD diagnosis. This effect was especially pronounced for sickness absences in the highest severity quartile.

## Discussion

This nationwide population-based case-control study examined employment and earnings trajectories before and after the first onset of sickness absence due to MDD in Finland. We showed that individuals who had a MDD related sickness absence experienced considerable reduction in employment levels and mean earnings after their first sickness absence period. In men and in those with more severe MDD, the reduction was apparent already several years before the diagnosis. In comparison to the control group, women earned 15% and men 34% less on average one year after the MDD related sick leave. Five years after the diagnosis, this figure was 23% for women and 40% for men. These findings show that sickness absence due to MDD leads to a substantial, long-term reduction in employment and earnings.

These findings are in accordance with prospective longitudinal studies, which have shown that MDD is associated with poor employment prospects<sup>10-12</sup>. To the best of our

## SES TRAJECTORIES AND DEPRESSION

knowledge, the present study is the first one to examine the trajectories of employment and earnings before and after sickness absence due to MDD using a nationally representative register-based data. Although half of the individuals with MDD leading to temporary work disability have been found to return to work within 6 months<sup>23</sup>, the present findings suggest that the effect of depression on work-related outcomes is much more long-standing and rather persistent at the population level. We also found that more severe MDD and longer duration of sickness absence were associated with an increased risk of lower employment and reduced earnings. These findings support the recent meta-analysis in which more severe MDD was associated with a lower rate of return to work<sup>35</sup>. Our results also add to previous evidence highlighting that other serious mental disorders, such as bipolar disorders and psychotic disorders, are associated with increased likelihood of being outside the labor market already years before the actual diagnosis is given<sup>36,37</sup>.

There were some notable gender differences in the present study; men, but not women, had lower levels of employment several years before their sickness absence period. Men also had higher prevalence of severe MDD and longer duration of sickness absence than women. Previous studies have provided mixed empirical findings whether the association between depression and socioeconomic factors differs between men and women<sup>29,32,33</sup>. The present findings are in principle in accordance with a recent longitudinal panel study in which unemployment was more strongly associated with severe depressive symptoms among men<sup>29</sup>. The specific mechanisms explaining this finding are not known. However, it could be related for example to treatment seeking, societal roles, or stigma<sup>33</sup>.

The association between depression and socioeconomic factors have traditionally explained with two theoretical pathways, i.e. social causation and health selection<sup>19</sup>. The social causation hypothesis suggests that adversity and perceived stress associated with having a lower socioeconomic status are major causes of mental health problems; the health selection hypothesis proposes that mental health problems may cause

## SES TRAJECTORIES AND DEPRESSION

downward social mobility across and within generations due to supposed environmental or biological factors<sup>19</sup>. The earlier studies have shown that the social causation hypothesis is a likely explanation for the association between depression and socioeconomic factors among adults<sup>14,19,38</sup>, although recently the role of health selection has been highlighted in two register-based studies where depression in early adulthood was associated with low SES over the middle adulthood<sup>10,11</sup>. Although the present study was not explicitly designed to examine the two theoretical pathways, our findings can be interpreted to support the health selection hypothesis as there was a considerable reduction in employment and personal income after the first MDD-related sickness absence. In more severe MDD, the reduced levels of employment and income were present already years before the first MDD-related sickness absence spell, which could be explained by the social causation hypothesis or could indicate that persons with more severe MDD have a longer history of mental disorders that leads to worse employment prospects.

### *Strengths and limitations*

The main strength of the current study is the use of comprehensive register-based data, which enabled us to conduct a nationwide study that contained all individuals with a new onset MDD diagnosis registered as short- or long-term sickness absence.

There are also at least three potential limitations that have to be considered when interpreting the present findings. First, individuals who did not seek treatment or whose depression did not lead to certified sickness absence were not included as cases in the present analyses. This implies that the present results are likely not applicable to all MDD cases and that our estimates are conservative as the control group could contain individuals who were diagnosed with MDD without sickness absence. Second, despite using a longitudinal research design, we were not able to control for all previous episodes of sickness absence due to MDD or previous diagnoses of other mental disorders over the life course. While most mental

## SES TRAJECTORIES AND DEPRESSION

disorders emerge before the age of 25, the average age of onset of sickness absence due to MDD in the present study was 41 years. Thus, it is likely that some of the participants with a MDD-related sickness absence had a history of MDD or other mental disorder before their first MDD-related sickness absence was registered. Third, as the current study was based solely on registry data, we could not take into account information on psychosocial characteristics such as perceived work-related stress, personality traits or social relationships, which are likely to partially explain the present findings.

The present findings are relevant for policies and clinical practices targeted to reduce the burden of depression in the working-age population. The substantial and long-term reduction in employment and earnings associated with MDD-related sickness absence indicates that the current clinical practices are not effective enough in terms of helping people to return to work after sickness absence due to MDD. Although there are clinical guidelines for the treatment of depression in Finland<sup>39</sup>, it is not known how well these guidelines are followed in practice and whether they are specific enough in helping people with depression to maintain employment. Workplace-level educational and psychological interventions targeted to prevent depression have been shown to have a moderate effect<sup>40</sup>, although the quality of evidence is still relatively low and based on small sample sizes.

## Conclusions

The direction of the association between sickness absence due to MDD and socioeconomic adversity seems to be primarily from MDD to a considerable reduction in employment and earnings rather than from long-term poor employment history or low earnings to MDD. However, in men and in more severe cases, labour market marginalization was present years before the first sickness absence spell due to MDD diagnosis, suggesting that working capacity is affected long before the first sickness absence period is officially recorded.

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**Author Contribution:** CH and PB contributed to the concept and design of the study. CH wrote the first draft of the manuscript and performed all data analyses. All authors contributed to the interpretation of the results, manuscript revision, and approved the final version of the manuscript. CH is responsible for the overall content as guarantor.

**Conflict of interests:** None.

**Data availability statement:** Data used in the current study may be obtained from the Statistics Finland and the Social Insurance Institution of Finland. Restrictions apply to the availability of these data, which were used under license for this study. For information on accessing the data see: [www.stat.fi](http://www.stat.fi) and [www.kela.fi](http://www.kela.fi).

**Conflicts of interest:** None declared.

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**Figure captions**

**Figure 1.** Predicted trajectories of employment in men and women with and without sickness absence due to MDD.

*Note.* Year 0 depicts the year of MDD diagnosis.

**Figure 2.** Predicted trajectories of personal earnings for men and women with and without sickness absence due to MDD.

*Note.* Year 0 depicts the year of MDD diagnosis.

**Figure 3.** Predicted trajectories of employment for men and women with and without sickness absence due to MDD according to educational level (primary, secondary, higher)

*Note.* Year 0 depicts the year of MDD diagnosis.

**Figure 4.** Predicted trajectories of employment according to the duration of sickness absence (Q1=shortest, Q4=longest) due to MDD (A-B) and severity of the MDD (C-D)

*Note.* Year 0 depicts the year of MDD diagnosis.

# SES TRAJECTORIES AND DEPRESSION

**Table 1.** Descriptive statistics of the study sample

	Men (n=56 472)		Women (n=102 341)	
	Not case	Case	Not case	Case
Age in years	40.9 (12)	40.9 (12)	40.9 (12.2)	40.9 (12.2)
Employed	74.6%	67.4%	74.1%	75.3%
Earnings in euros	36 800 (49 300)	31 700 (44 500)	26 800 (37 500)	26 700 (18 400)
Education				
Primary	21.7%	25.8%	16.7%	18.9%
Secondary	58.9%	59.8%	58.9%	62.3%
Higher	19.4%	14.4%	24.2%	18.8%
Severity of depression				
Not specified	-	69.3%	-	70.8%
Mild or moderate	-	21.6%	-	22.3%
Severe	-	9.2%	-	6.9%
Duration of sickness absence in days	-	65 (79)	-	54 (71)

*Note.* Values are means (and standard deviations) or percentages