<https://helda.helsinki.fi>

Bipolar disorder and depression in early adulthood and
long-term employment, income, and educational attainment : A
nationwide cohort study of 2,390,127 individuals

Hakulinen, Christian

2019-11

Hakulinen , C , Musliner , K L & Agerbo , E 2019 , ' Bipolar disorder and depression in early adulthood and long-term employment, income, and educational attainment : A nationwide cohort study of 2,390,127 individuals ' , Depression and Anxiety , vol. 36 , no. 11 , pp. 1080-1088 . <https://doi.org/10.1002/da.22956>

<http://hdl.handle.net/10138/324859>

<https://doi.org/10.1002/da.22956>

unspecified

acceptedVersion

Downloaded from Helda, University of Helsinki institutional repository.

This is an electronic reprint of the original article.

This reprint may differ from the original in pagination and typographic detail.

Please cite the original version.

Bipolar disorder and depression in early adulthood and long-term employment, income and educational attainment: A nationwide cohort study of 2 390 127 individuals

Christian Hakulinen^{1,2,3,4}, Katherine Louise Musliner^{2,3,4}, and Esben Agerbo^{2,3,4}

¹Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Finland

²iPSYCH, The Lundbeck Foundation Initiative for Integrative Psychiatric Research, Aarhus University, Denmark

³NCRR - National Centre for Register-Based Research, Department of Economics and Business Economics, Aarhus University, Denmark

⁴CIRRAU - Centre for Integrated Register-Based Research, Aarhus University, Aarhus, Denmark

Corresponding author: Christian Hakulinen, University of Helsinki, P.O. Box 21, 00014, Helsinki, Finland. Tel: +358 50 448 2041 Email: christian.hakulinen@helsinki.fi

Word count: 3704 words in the main text; 250 in the abstract; 1 table; 4 figures; online supplementary appendix (4 tables and 7 figures)

Published: Hakulinen, C., Musliner, K. L., & Agerbo, E. (2019). Bipolar disorder and depression in early adulthood and long-term employment, income, and educational attainment: A nationwide cohort study of 2,390,127 individuals. *Depression and anxiety*, 36(11), 1080-1088.

<https://doi.org/10.1002/da.22956>

Acknowledgements

Funding: This study was funded by the Academy of Finland (310591 to CH), the Stanley Medical Research Institute (EA) and Lundbeck Foundation, Denmark (EA).

Conflict of Interest: None declared.

Abstract

Background: Mood disorders are known to be associated with poor socioeconomic outcomes, but no study has examined these associations across the entire work-life course. Our goal was to estimate the associations between bipolar disorder and depression in early adulthood and subsequent employment, income and educational attainment.

Methods: We conducted a nationwide prospective cohort study including all individuals (n=2390 127, 49% female) born in Denmark between 1955-1990. Hospital-based diagnoses of depression and bipolar disorder before age 25 were obtained from the Danish psychiatric register. Yearly employment, earnings, and education status from ages 25-61 were obtained from Danish labour market and education registers. We estimated both absolute and relative proportions.

Results: Population rates of hospital-diagnosed depression and bipolar between ages 15-25 were 1% and .12%, respectively. Compared to individuals without mood disorders, those with depression and particularly bipolar disorder had consistently poor socioeconomic outcomes across the entire work-life span. For example, at age 30, 62% of bipolar and 53% of depression cases were outside the workforce compared to 19% of the general population, and 52% of bipolar and 42% of depression cases had no higher education compared to 27% of the general population. Overall, individuals with bipolar disorder or depression earned around 36% and 51%, respectively, of the income earned by individuals without mood disorders. All associations were smaller for individuals not rehospitalized after age 25.

Conclusions: Severe mood disorders with onset prior to age 25, particularly bipolar disorder, are associated with persistent poor socioeconomic outcomes across the entire work-life course.

Keywords: mood disorders; socio-economic outcomes; depression; bipolar disorder; register based study

Mood disorders such as depression and bipolar disorder are prevalent mental disorders associated with high disability and disease burden (Mokdad et al., 2018; Whiteford et al., 2013). Economic evaluations have estimated that the total costs of mood disorders are enormous (Cloutier, Greene, Guerin, Touya, & Wu, 2018; Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015; Kessler et al., 2008; Luppá, Heinrich, Angermeyer, König, & Riedel-Heller, 2007), with unemployment and other indirect costs typically being the largest components of the total economic costs (Cloutier et al., 2018; Greenberg et al., 2015). A number of prospective observational cohort studies have shown that mood disorders are associated with poor socioeconomic outcomes in terms of occupational status and income (Ahola et al., 2011; Hakulinen et al., 2016; Marwaha, Durrani, & Singh, 2013; Sampson et al., 2015; Whooley et al., 2002; Zimmerman & Katon, 2005); however the findings regarding mood disorders and subsequent educational attainment are mixed (Mojtabai et al., 2015; Tempelaar, Termorshuizen, MacCabe, Boks, & Kahn, 2017).

There is a lack of large scale population based studies on the topic, and it also remains unclear whether the associations between mood disorders and socioeconomic outcomes persist over the whole work life-course, or whether these associations diminish over time. Mood disorders, particularly bipolar disorder, often manifest early in life before or during the period in which most young adults complete their educational degrees and establish their careers (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012; Pedersen et al., 2014). Because of this, it is important to quantify the effects of mood disorders with an onset in early adulthood on long-term income, education and workforce participation in order to better understand how these disorders effect quality of life and the fulfillment of human potential (Chetty et al., 2016).

To address these questions, the present study examined the associations between hospital-based contacts for bipolar disorder and depression in early adulthood with subsequent employment, income, and educational attainment using a comprehensive nationwide cohort design. By using data that combines longitudinal register-based information on mental disorders with

administrative data on long-term socioeconomic outcomes, we aimed to examine whether mood disorders with an onset between the ages of 15 and 25 are associated with poor socioeconomic prospects over the whole working life course, and to estimate the total income losses associated with these disorders.

Materials and methods

Study population

Since 1968, all residents in Denmark have been given a unique personal identification number allowing data to be linked at an individual level across population registers. We used the Danish Civil Registration System dataset which includes demographic details and links to parents as well as continuous updates on place of residence and vital status (Pedersen, 2011). Our study population included all individuals born in Denmark between January 1, 1955, though December 31, 1990, who were alive on their 25th birthday. This study was approved by the Danish Protection Agency and did not require ethical approval according to Danish laws.

Assessment of mood disorders

Using the personal identification number (CPR number), which is allocated to all legal residents in Denmark, we linked individuals in the study population and their parents to the Danish Psychiatric Central Research Register, which covers all psychiatric in-patient admissions starting from 1969 and from 1995 all out-patient and emergency unit visits (Mors, Perto, & Mortensen, 2011).

Individuals were defined as having a mood disorder (bipolar disorder: ICD-10 codes F30-F31; ICD-8 codes 296.19, 296.39, 298.19; depression: ICD-10 codes F32-F33; ICD-8 codes 296.09, 296.29, 298.09, 300.49) if they were admitted to a psychiatric hospital, received outpatient psychiatric care or visited a psychiatric emergency unit. Date of onset was defined as the day of first contact with a

mood disorder diagnosis. For depression, severity of the first diagnosis (mild, moderate, severe, severe with psychotic symptoms, and unspecified) was defined based on the ICD-10 diagnostic code.

Socioeconomic outcomes

Socioeconomic outcomes were acquired from the Integrated Database for Labour Market Research (Petersson, Baadsgaard, & Thygesen, 2011). Employment status was measured annually at the end of November. Individuals who were outside the workforce (i.e. receiving governmental pensions (including early retirement and disability pension) or otherwise not working) were categorized as unemployed. Annual wage or self-employment earnings were ascertained for all individuals with residence in Denmark on the 31th of December. Earnings were deflated using consumer price index (base year 2015). Highest completed education was acquired from the Danish education registry (Jensen & Rasmussen, 2011), which is updated annually. Individuals with only primary school education were categorized as having no secondary education.

Covariates

To control for possible sources of confounding, the analyses were adjusted for parental socioeconomic status and parental mental disorders, which have been linked with an increased risk of mood disorders (Dean et al., 2010; Gilman, Kawachi, Fitzmaurice, & Buka, 2002). Information on parental employment, income, and highest completed education was obtained for the year the participants turned 25. The same definitions as previously described were used, except that low parental wage income was defined as annual earnings less than 30 000 DKK (4500 US Dollars) (Westergaard-Nielsen, Agerbo, Eriksson, & Mortensen, 2004). Parental socioeconomic variables were operationalized as a score ranging from 0 to 3, with one point given each for unemployment, low wage income or no secondary education. History of parental mental disorders was obtained

from the Danish Psychiatric Central Research Register (Mors et al., 2011), and parental mental disorders were categorized into two groups: 0=no mental disorders; 1=any mental disorder, as in prior research (Pedersen et al., 2014). Hospitalization for any mental disorder (Pedersen et al., 2014) after age 25 was defined for all participants.

Statistical analyses

Logistic regression analysis was used as the main analytical method. First, we conducted analyses with a diagnosis of bipolar disorder or depression between ages 15 and 25 as the exposure, and employment status, income, and education attainment at specific ages (e.g. age 26, age 27 ... age 61) as outcomes. Second, we repeated these analyses adjusting for parental history of mental disorders and parental socioeconomic status. Third, we examined the associations separately by re-hospitalization status where the variable indicating rehospitalization for any psychiatric disorder (yes/no) was included as a covariate. Fourth, we conducted sensitivity analyses to examine whether age at initial diagnosis (15-19 vs. 20-25 years) and the severity of the depression diagnosis (mild, moderate, severe without psychosis, severe with psychosis) modified the previously described associations. Fifth, we examined whether there were any period effects for the associations between mood disorders and employment status. All logistic regression analyses were adjusted for sex and birth year. Lastly, we calculated unadjusted mean income levels for individuals with mood disorders, including those who were and were not re-hospitalized after age 25, and also for individuals without mood disorders in early adulthood. Stata 15.1 was used for all analyses. Both absolute proportions and odds ratios were reported, as absolute proportions are more informative for prevention and intervention planning.

Results

In total, 2 390 127 individuals (48.8% women) were included. Between ages 15 to 25 years, 2851 individuals (0.12%) were diagnosed in a psychiatric hospital with bipolar disorder and 22 812 (0.95%) with depression. Of the individuals diagnosed with bipolar disorder before age 25, 1 971 (69.1%) had subsequent hospital contacts with a mental disorder after age 25. Of the individuals diagnosed with depression, 10 212 (44.8%) had subsequent psychiatric hospital contacts after age 25. **Appendix Table 1** displays descriptive statistics for the individuals diagnosed with bipolar disorder, depression and the full sample (for the number of participants at each age, see **Appendix Table 2**. For descriptive statistics for the subgroup of individuals not rehospitalized after age 25, see **Appendix Table 3**).

Figure 1 shows (a) odd ratios for the associations between mood disorders and unemployment, and (b) the absolute proportions of unemployment for individuals with bipolar disorder, depression, and the total population across the work-life course. At age 30, bipolar disorder was associated with a seven-fold increase in the odds of unemployment (odds ratio [OR] 7.21, 95% confidence interval [CI] 6.54 – 7.96). Depression was associated with a four-fold increase in the odds of unemployment (OR 4.06, 95% CI 3.92 - 4.22). For bipolar disorder, the strength of these associations increased over follow-up (unemployed at age 40: [OR 9.63, 95% CI 8.48 – 10.92]). A similar trend was evident for depression (unemployed at age 40: [OR 5.10, 95% CI 4.74 – 5.48]). In absolute proportions, whereas 19% of the total study was population was unemployed at age 30, 62% of bipolar case and 53% of depression cases were unemployed. For individuals with bipolar disorder, the rate of unemployment increased over time and was 69% at the age of 55. A similar trend was not found for individuals with depression.

Figure 2 shows these same associations when rehospitalization after age 25 was included as a covariate. At age 30, bipolar disorder was associated with a 2.5-fold increase in the odds of unemployment (OR 2.51, 95% CI 2.25 – 2.79), which remained constant over follow-up (unemployed at age 50: [OR 2.25, 95% CI 1.87 – 2.03]. Similarly, depression was associated with a

2-fold increase in the odds of unemployment (odds ratio [OR] 2.09, 95% confidence interval [CI] 2.01 – 2.17), which then fluctuated, but remained stable over follow-up (unemployed at age 50: [OR 2.27, 95% CI 1.99 – 2.58]. In absolute proportions, 24% and 26% of individuals with bipolar disorder and depression, respectively, were unemployed at age 40 compared to 41% of bipolar and 38% of depression cases at age 30.

Figure 3 shows the mean income levels for the study sample without mood disorders and for the individuals with mood disorders, including those who were and those who were not re-hospitalized after age 25. Between ages 25 to 61, average cumulative earnings for the total study population were \$1.64 million (11.04 million DKK). On average, individuals with bipolar disorder earned \$0.59 million (3.98 million DKK) and individuals with depression earned \$0.84 million (5.66 million DKK), or around 36% and 51%, respectively, of the amount earned by individuals without mood disorders. Individuals with a mood disorder diagnosed before age 25 who were not re-hospitalized after age 25 fared considerably better – cumulative earnings among bipolar and depression patients who were not rehospitalized were 1.12 million (8.11 million DKK) and 1.20 million (8.03 million DKK), respectively, which is 73% of the amount earned by individuals without mood disorders.

Figure 4 shows (a) the associations between mood disorders and secondary and post-secondary education and (b) the absolute proportions. Both bipolar disorder and depression were associated with higher odds of no secondary education (at the age of 30, bipolar disorder: OR 3.21, 95% CI 2.92 - 3.54; depression: OR 2.81, 95% CI 2.71 – 2.91). There was a clear, slightly decreasing trend such that at age 50, bipolar disorder was associated with 2.36-fold odds (95% CI 2.00 – 2.77) and depression with 2.04-fold odds (95% CI, 1.81 - 2.29) of having no secondary education – indicating that the impact of mood disorders on educational attainment may be to delay, rather than prevent, completion of higher education. In absolute numbers, at the age of 30, between 42% and 52% of the individuals diagnosed with mood disorders had not completed secondary

education, compared to 27% of the full study population. When rehospitalization was included as a covariate, associations were considerably weaker and decreased slightly over time; at the age of 30, bipolar disorder was associated with 1.61-fold odds (95% CI 1.46 – 1.78) and depression with 1.79-fold odds (95% CI, 1.72 - 1.86) of having no secondary education (**Appendix Figure 1**). At age 50, these same odds were 1.38 (95% CI 1.17 – 1.63) and 1.43 (95% CI 1.27 – 1.62), respectively.

Table 1 shows the associations between (a) bipolar disorder and (b) depression with employment status and educational attainment at ages 30, 40 and 50, after additional adjustments for parental socioeconomic factors and parental history of mental disorders. Adjusting for parental socioeconomic measures (model 2 and model 3) had little, if any, effect on the associations between bipolar disorder and depression and unemployment or educational attainment. Adjusting for parental history of mental disorders slightly diluted the associations – for example, the association between bipolar disorder with unemployment was 7% lower when parental socioeconomic measures and history of mental disorders were taken into account. Similar patterns were found when the associations between bipolar disorder and depression for individuals not rehospitalized after age 25 (**Appendix Table 4**).

Age, Severity at Diagnosis, and Period Effects

Age at diagnosis (15-19 vs. 20-25) had little impact on the associations with employment (**Appendix Figure 2**), but earlier age at bipolar diagnosis was associated with higher odds of no secondary education at all ages (**Appendix Figure 3**). This same trend was not seen in depression (**Appendix Figure 3**). When compared to individuals with mild, moderate, or severe depression without psychosis, individuals with psychotic depression had twice the odds of unemployment at the age 25 and 30 (**Appendix Figure 4**). This same trend was not present for employment at ages 35 or 40. Psychotic depression was also associated with increased odds of no secondary education at age 30, but not at other ages (**Appendix Figure 5**). Lastly, analyses of potential periods effects

indicated that neither bipolar disorder nor depression were systematically associated with increased unemployment at certain calendar periods (**Appendix Figures 6-7**).

Discussion

Using nationwide comprehensive Danish register data, we found that hospital-diagnosed mood disorders in early adulthood were associated with consistently, and in some cases increasingly, poorer socioeconomic outcomes over time compared to the general population. Individuals with bipolar disorder faced a particularly bleak socioeconomic outlook. Compared to the general population, individuals with bipolar disorder or depression were 6-9 times and 4-5 times as likely to be unemployed, respectively, and they were 2-3 times less likely to complete secondary education. While the unemployment rate within the general population was 15% at the age of 40, the rates were 39% and 24% among individuals with bipolar disorder and depression. Individuals with bipolar disorder or depression earned only 36% or 51%, respectively, of the cumulative income earned by the general population. These findings indicate that, on average, mood disorders in early adulthood lead to a substantial loss of earnings over the life course. However, these associations were considerably smaller for those individuals who were never re-hospitalized after age 25, indicating that individuals who are able to recover from mood disorders have considerably better socioeconomic prospects.

Comparison with previous findings

Present findings are in line with a number of prior prospective observational cohort studies where mood disorders have been associated with unemployment (Marwaha et al., 2013; Sampson et al., 2015) and work disability (Ahola et al., 2011). Many of these studies are, however, hampered by non-participation, selective attrition and low numbers of participants with mood disorders. In absolute proportions, between 45% to 60% of individuals with bipolar disorder in our sample were

outside the work force, which is in line with previous estimates based on mostly small-scale survey studies (Marwaha et al., 2013). Regarding depression, to the best of our knowledge, absolute proportions have not been previously summarized, thus our finding that over a third of individuals with depression are unemployed over the work life course is novel. Our findings related to lost earnings are also in accordance with previous economic evaluations (Cloutier et al., 2018; Greenberg et al., 2015).

Our findings related to employment and income can be partly explained by our finding that bipolar disorder and depression are also associated with lower educational attainment across the whole work life course. This is in keeping with previous studies where higher educational attainment has been associated with lower risk of future mood disorders (Erickson et al., 2016). Whereas we did not find any notable differences between depression or bipolar, earlier age at bipolar diagnosis was associated with higher risk of having no secondary or post-secondary education. In absolute proportions, whereas around 25% of the participants who were not diagnosed with mood disorder before age 25 did not complete secondary education, that number was 45% among individuals diagnosed with bipolar disorder or depression. Only a few previous longitudinal studies have examined this question, producing mixed findings (Mojtabai et al., 2015; Tempelaar et al., 2017). Lastly, lower number of psychiatric hospitalizations has been associated with an increased likelihood of being employed among individuals with bipolar disorder (Tse, Chan, Ng, & Yatham, 2014), which is in line with our finding that those individuals who are not repeatedly in the hospitals or outpatient clinics for mood disorders have improved rates of employment.

Although parental socioeconomic position and parental mental disorders are established risk factors for mood disorders (Dean et al., 2010; Gilman et al., 2002; Muntaner, Eaton, Miech, & O'Campo, 2004), these variables had little – if any – effect on our findings. Earlier age of onset, especially for bipolar disorder, appears to be associated with poorer educational outcomes over the whole work-life course. This is understandable as an onset before the age of 20 is likely to

disturb the process of moving from primary to secondary or higher education. We also found that diagnosis of severe depression with psychotic symptoms had twice the effect on unemployment at age 25 or 30 as other depression diagnoses. It has been shown that psychotic depression is a separate subtype of depression (Nelson et al., 2018), and it has been also associated with higher risk of converting from depression to bipolar disorder (Musliner & Østergaard, 2018). Thus, it makes intuitive sense that the results would be similar for bipolar disorders and psychotic depression.

Mechanisms and policy implications

Two general hypotheses – social causation vs. social selection – have been proposed to explain the association between mental disorders and socioeconomic factors (Dohrenwend et al., 1992; Hollingshead & Redlich, 1958). Whereas the social causation hypothesis proposes that adversity and stress associated with having a lower socioeconomic status cause mental health problems, the social selection hypothesis suggests that mental disorders may cause both inter- and intra-generational downward social mobility due to putative biological or environmental factors. Previous studies have shown that the social causation hypothesis is a likely explanation for the association between depression and socioeconomic factors among adults (Dohrenwend et al., 1992; Johnson, Cohen, Dohrenwend, Link, & Brook, 1999; Miech, Caspi, Moffitt, Wright, & Silva, 1999; Ritsher, Warner, Johnson, & Dohrenwend, 2001), but not necessary among children (Costello, Compton, Keeler, & Angold, 2003). Taken together, although the present findings are clearly in line with the social selection hypothesis, they don't rule out the social causation hypothesis.

To the best of our knowledge, this study is one of the largest to examine the associations of mood disorders with socioeconomic outcomes, and thus it provides a comprehensive overview for policy decisions. Although Denmark has a universal welfare policy intended to provide economic security during unemployment and periods of illness, the present findings indicate that individuals with mood disorders nevertheless maintain lower employment rates.

Whereas the employment rate of the population improved between the ages of 25 to 45, the employment rates for individuals with mood disorders deteriorated. Similarly, where the mean income of the population increased by more than a third between ages 25 and 45, among individuals with mood disorders, increases were modest. Beyond the obvious first-order economic incentives, our findings suggest it is beneficial to introduce policies that increase workforce participation and income among individuals with early onset mood disorders. After mood disorder onset, early and rapid intervention should be a top priority in order to prevent the progression of the disease (Post, 2018), and to help individuals with mood disorders regain their capacity to work or to study.

Strengths and Limitations

This is the first large scale population based study to examine the associations between mood disorders with onset before age 25 and subsequent socio-economic outcomes over the full work life course. Danish national registers provide rich, longitudinal information for the entire population, which is a significant strength of the current study. In addition, Danish psychiatric hospitals and outpatient facilities are public, and all admissions and discharges are recorded in the registers. All treatment is also free of charge. Thus, the current study does not suffer from selective non-response, which has likely biased survey studies conducted previously on this topic.

A number of limitations needs to be taken into account when interpreting the current findings. First, our data is limited to cases and diagnoses given at psychiatric hospitals and outpatients clinics between the age of 15 and 25. Although the validity of mood disorder diagnoses in the Danish Psychiatric Central Register in general is high (Kessing, 1998), many individuals with mood disorders, particularly with mild or moderate depression, remain undiagnosed, or receive treatment solely from primary care doctors. A recent study showed that among individuals aged 15-25 years, around 70% of medical treatment for depression in Denmark takes place outside hospital settings (Musliner et al., 2019). Thus, our data likely contain more severe cases and the current

results may not be generalizable to milder cases or to cases with an onset before the age of 15. Second, as mood disorders are associated with risk of early mortality including suicide (Chesney, Goodwin, & Fazel, 2014; Laursen, Musliner, Benros, Vestergaard, & Munk-Olsen, 2016; Walker, McGee, & Druss, 2015), selective survival could potentially skew our results towards the null – i.e., those individuals with mood disorders who survive are healthier than those who do not. Third, although socioeconomic registers have high validity and coverage (Petersson et al., 2011), they include some degree of measurement error and for example individuals with short-term and part-time jobs could be misclassified as unemployed. This could bias the results. Fourth, it is worth noting that the current study examined only the association between mood disorders and select socioeconomic measures and thus did not capture the whole individual costs associated with mood disorders. For example, previous studies have indicated that costs of presenteeism – i.e., working while sick – are also substantial (Marwaha et al., 2013; Stewart, Ricci, Chee, Hahn, & Morganstein, 2003). Thus, the current results should be seen as conservative estimates of the effect of mood disorders on lost earnings. Last, there may be additional confounding factors that were not measured, which cannot be ruled out in observational studies such as this one.

Conclusion

Mood disorders with onset in early adulthood are associated with poor socioeconomic outcomes across the entire work-life course. Those individuals who are able to recover from mood disorders, however, have considerably better socioeconomic prospects.

Data availability statement: The data that support the findings of this study are available from Statistics Denmark. Restrictions apply to the availability of these data, which were used under license for this study. For information on accessing the data see www.dst.dk.

REFERENCES

- Ahola, K., Virtanen, M., Honkonen, T., Isometsä, E., Aromaa, A., & Lönnqvist, J. (2011). Common mental disorders and subsequent work disability: A population-based Health 2000 Study. *Journal of Affective Disorders, 134*, 365–372.
- Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: A meta-review. *World Psychiatry, 13*, 153–160.
- Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., ... Cutler, D. (2016). The Association Between Income and Life Expectancy in the United States, 2001-2014. *JAMA, 315*, 1750–66.
- Cloutier, M., Greene, M., Guerin, A., Touya, M., & Wu, E. (2018). The economic burden of bipolar I disorder in the United States in 2015. *Journal of Affective Disorders, 226*, 45–51.
- Costello, E. J., Compton, S. N., Keeler, G., & Angold, A. (2003). Relationships Between Poverty and Psychopathology: A natural experiment. *JAMA, 290*, 2023–2029.
- Dean, K., Stevens, H., Mortensen, P. B., Murray, R. M., Walsh, E., & Pedersen, C. B. (2010). Full spectrum of psychiatric outcomes among offspring with parental history of mental disorder. *Archives of General Psychiatry, 67*, 822–829.
- Dohrenwend, B. P., Levav, I., Shrout, P. E., Schwartz, S., Naveh, G., Link, B. G., ... Stueve, A. (1992). Socioeconomic status and psychiatric disorders: The causation-selection issue. *Science, 255*, 946–52.
- Erickson, J., El-Gabalawy, R., Palitsky, D., Patten, S., Mackenzie, C. S., Stein, M. B., & Sareen, J. (2016). Educational Attainment As a Protective Factor for Psychiatric Disorders: Findings From a Nationally Representative Longitudinal Study. *Depression and Anxiety, 33*, 1013–1022.
- Gilman, S. E., Kawachi, I., Fitzmaurice, G. M., & Buka, S. L. (2002). Socioeconomic status in childhood and the lifetime risk of major depression. *International Journal of Epidemiology,*

31, 359–67.

- Greenberg, P. E., Fournier, A.-A., Sisitsky, T., Pike, C. T., & Kessler, R. C. (2015). The Economic Burden of Adults With Major Depressive Disorder in the United States (2005 and 2010). *The Journal of Clinical Psychiatry*, 2010, 155–162.
- Hakulinen, C., Elovainio, M., Pulkki-Råback, L., Böckerman, P., Viinikainen, J., Pehkonen, J., ... Hintsanen, M. (2016). Depressive symptoms and long-term income: The Young Finns Study. *Journal of Affective Disorders*, 204, 120–123.
- Hollingshead, A. B., & Redlich, F. C. (1958). *Social class and mental illness: Community study*. Hoboken, NJ, US: John Wiley & Sons Inc.
- Jensen, V. M., & Rasmussen, A. W. (2011). Danish education registers. *Scandinavian Journal of Public Health*, 39, 91–94.
- Johnson, J. G., Cohen, P., Dohrenwend, B. P., Link, B. G., & Brook, J. S. (1999). A longitudinal investigation of social causation and social selection processes involved in the association between socioeconomic status and psychiatric disorders. *Journal of Abnormal Psychology*, 108, 490–499.
- Kessing, L. (1998). Validity of diagnoses and other clinical register data in patients with affective disorder. *European Psychiatry*, 13, 392–398.
- Kessler, R. C., Heeringa, S., Lakoma, M., Petukhova, M., Rupp, A., Schoenbaum, M., ... Zaslavsky, A. (2008). Individual and societal effects of mental disorders on earnings in the United States: results from the National Comorbidity Survey Replication. *American Journal of Psychiatry*, 165, 703–711.
- Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. (2012). Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research*, 21, 169–184.
- Laursen, T. M., Musliner, K. L., Benros, M. E., Vestergaard, M., & Munk-Olsen, T. (2016).

- Mortality and life expectancy in persons with severe unipolar depression. *Journal of Affective Disorders*, 193, 203–207.
- Luppa, M., Heinrich, S., Angermeyer, M. C., König, H. H., & Riedel-Heller, S. G. (2007). Cost-of-illness studies of depression. A systematic review. *Journal of Affective Disorders*, 98, 29–43.
- Marwaha, S., Durrani, A., & Singh, S. (2013). Employment outcomes in people with bipolar disorder: A systematic review. *Acta Psychiatrica Scandinavica*, 128, 179–193.
- Miech, R. a., Caspi, A., Moffitt, T. E., Wright, B. R. E., & Silva, P. a. (1999). Low Socioeconomic Status and Mental Disorders: A Longitudinal Study of Selection and Causation during Young Adulthood. *American Journal of Sociology*, 104, 1096–1131.
- Mojtabai, R., Sampson, N., Hwang, I., Eaton, W. W., Kessler, R. C., & Stuart, E. A. (2015). Long-term effects of mental disorders on educational attainment in the National Comorbidity Survey ten-year follow-up. *Social Psychiatry and Psychiatric Epidemiology*, 50, 1577–1591.
- Mokdad, A., Ballestros, K., Echko, M., Glenn, S., Olsen, H., Mullany, E., & Lee, A. (2018). The State of US Health, 1990-2016: Burden of Diseases, Injuries, and Risk Factors Among US States. *JAMA*, 319, 1444.
- Mors, O., Perto, G. P., & Mortensen, P. B. (2011). The Danish psychiatric central research register. *Scandinavian Journal of Public Health*, 39, 54–57.
- Muntaner, C., Eaton, W. W., Miech, R., & O'Campo, P. (2004). Socioeconomic position and major mental disorders. *Epidemiologic Reviews*, 26, 53–62.
- Musliner, K. L., Liu, X., Gasse, C., Christensen, K. S., Wimberley, T., & Munk-Olsen, T. (2019). Incidence of medically treated depression in Denmark among individuals 15-44 years old: A comprehensive overview based on population registers. *Acta Psychiatrica Scandinavica*, 1–10.
- Musliner, K. L., & Østergaard, S. D. (2018). Patterns and predictors of conversion to bipolar disorder in 91 587 individuals diagnosed with unipolar depression. *Acta Psychiatrica Scandinavica*, 137, 422–432.

- Nelson, J. C., Bickford, D., Delucchi, K., Ph, D., Fiedorowicz, J. G., Ph, D., & Coryell, W. H. (2018). Risk of Psychosis in Recurrent Episodes of Psychotic and Nonpsychotic Major Depressive Disorder: A Systematic Review and Meta-Analysis. *American Journal of Psychiatry*, 175, 897–904.
- Pedersen, C. B. (2011). The Danish civil registration system. *Scandinavian Journal of Public Health*, 39, 22–25.
- Pedersen, C. B., Mors, O., Bertelsen, A., Waltoft, B. L., Agerbo, E., McGrath, J. J., ... Eaton, W. W. (2014). A comprehensive nationwide study of the incidence rate and lifetime risk for treated mental disorders. *JAMA Psychiatry*, 71, 573–581.
- Petersson, F., Baadsgaard, M., & Thygesen, L. C. (2011). Danish registers on personal labour market affiliation. *Scandinavian Journal of Public Health*, 39, 95–98.
- Post, R. M. (2018). Preventing the malignant transformation of bipolar disorder. *JAMA*, 319, 1197–1198.
- Ritsher, J. E. B., Warner, V., Johnson, J. G., & Dohrenwend, B. P. (2001). Inter-generational longitudinal study of social class and depression: A test of social causation and social selection models. *British Journal of Psychiatry*, 178, 4–10.
- Sampson, N., Kessler, R. C., Susukida, R., Hwang, I., Mojtabai, R., Stuart, E. A., & Eaton, W. W. (2015). Long-term effects of mental disorders on employment in the National Comorbidity Survey ten-year follow-up. *Social Psychiatry and Psychiatric Epidemiology*, 50, 1657–1668.
- Stewart, W. F., Ricci, J. A., Chee, E., Hahn, S. R., & Morganstein, D. (2003). Cost of Lost Productive Work Time Among US Workers With Depression. *JAMA*, 289, 3135–3144.
- Tempelaar, W. M., Termorshuizen, F., MacCabe, J. H., Boks, M. P. M., & Kahn, R. S. (2017). Educational achievement in psychiatric patients and their siblings: A register-based study in 30 000 individuals in the Netherlands. *Psychological Medicine*, 47, 776–784.
- Tse, S., Chan, S., Ng, K. L., & Yatham, L. N. (2014). Meta-analysis of predictors of favorable

employment outcomes among individuals with bipolar disorder. *Bipolar Disorders*, 16, 217–229.

Walker, E. R., McGee, R. E., & Druss, B. G. (2015). Mortality in mental disorders and global disease burden implications a systematic review and meta-analysis. *JAMA Psychiatry*, 72, 334–341.

Westergaard-Nielsen, N., Agerbo, E., Eriksson, T., & Mortensen, P. B. (2004). Mental Illness: Gender Differences With Respect To Marital Status and Labour Market Outcomes. In D. E. Marcotte & V. Wilcox-Gök (Eds.), *The Economics of Gender and Mental Illness* (Vol. 15, pp. 73–94). Elsevier Ltd.

Whiteford, H., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., ... Vos, T. (2013). Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *The Lancet*, 382, 1575–1586.

Whooley, M., Kiefe, C., Chesney, M., Markovitz, J., Matthews, K., & Hulley, S. (2002). Depressive Symptoms, Unemployment, and Loss of Income. *Archives of Internal Medicine*, 162, 2614–2620.

Zimmerman, F. J., & Katon, W. (2005). Socioeconomic status, depression disparities, and financial strain: What lies behind the income-depression relationship? *Health Economics*, 14, 1197–1215.

Figure 1. On the left, odds ratios for the association between (a) bipolar disorder and (b) depression between ages 15 to 25 with unemployment from 25 to 61 years. On the right, percentages of individuals unemployment. Associations are adjusted for sex and birthyear.

Figure 2. On the left, odds ratios for the association between (a) bipolar disorder and (b) depression between ages 15 to 25 with unemployment from 25 to 61 years for a subgroup of individuals who were not rehospitalized after age 25. On the right, percentages of individuals unemployment in three groups. Associations are adjusted for sex and birthyear.

Figure 3. Mean income for individuals with (a) bipolar disorder, (b) depression, and (c) population, and subgroups of individuals with (e) bipolar disorder and (f) depression who were not rehospitalized after age 25.

Figure 4. On the left, odds ratios for the association between (a) bipolar disorder and (b) depression between ages 15 to 25 with not having completed any secondary or higher education between ages of 25 to 61 years. On the right, percentages of individuals not having completed any secondary or higher education. Associations are adjusted for sex and birthyear.

Table 1. Associations between bipolar and depression with unemployment and having no secondary or higher education at the age of 30, 40 and 50

Age 30 (N=1606691)								
	Unemployment				No secondary or higher education			
	Bipolar disorder		Depression		Bipolar disorder		Depression	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1	7.01	6.25-7.87	4.23	4.06-4.40	3.26	2.91-3.64	3.01	2.89-3.14
Model 2	6.95	6.19-7.81	4.18	4.01-4.35	3.26	2.91-3.65	2.96	2.84-3.09
Model 3	6.89	6.13-7.73	4.12	3.96-4.29	3.26	2.91-3.65	2.91	2.79-3.03
Model 4	6.45	5.74-7.25	3.95	3.79-4.12	3.08	2.75-3.46	2.78	2.67-2.90
Age 40 (N=1142861)								
	Unemployment				No secondary or higher education			
	Bipolar disorder		Depression		Bipolar disorder		Depression	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1	10.09	8.65-11.76	5.45	4.98-5.96	2.87	2.46-3.35	2.57	2.34-2.83
Model 2	10.03	8.60-11.70	5.41	4.94-5.92	2.86	2.44-3.34	2.53	2.30-2.79
Model 3	10.07	8.63-11.76	5.38	4.92-5.89	2.88	2.46-3.37	2.53	2.29-2.79
Model 4	9.31	7.97-10.89	5.08	4.64-5.57	2.76	2.36-3.24	2.43	2.20-2.68
Age 50 (N=565007)								
	Unemployment				No secondary or higher education			
	Bipolar disorder		Depression		Bipolar disorder		Depression	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1	10.12	8.19-12.51	6.16	5.27-7.20	2.47	2.00-3.05	2.19	1.86-2.58
Model 2	10.17	8.22-12.59	6.07	5.19-7.10	2.47	2.00-3.06	2.13	1.81-2.51
Model 3	10.22	8.25-12.66	6.07	5.18-7.11	2.48	2.00-3.08	2.13	1.80-2.51
Model 4	9.43	7.61-11.70	5.74	4.90-6.73	2.40	1.93-2.97	2.07	1.75-2.44

Model 1: sex and birthyear adjusted

Model 2: Model 1 + father's SES score

Model 3: Model 2 + mother's SES score

Model 4: Model 3 + parental history of mental disorders

ONLINE SUPPLEMENT APPENDIX

Table S1. Descriptive statistics of the participants.

Table S2. Number of participants.

Table S3. Number of participants and descriptive statistics of those individuals with bipolar disorder or depression who had not been rehospitalized after the age of 25.

Table S4. Associations between bipolar disorder and depression with unemployment, having low income and having no secondary or higher education at the age of 30, 40 and 50 among those individuals who were not hospitalized after the age of 25

Figure S1. On the left, odds ratios for the association between (a) bipolar disorder and (b) depression between ages 15 to 25 with not having completed any secondary or higher education between ages of 25 to 61 years for a subgroup of individuals who were not rehospitalized after the age of 25. On the right, percentages of individuals not having completed any secondary or higher education for a subgroup of individuals who were not rehospitalized after the age of 25

Figure S2. The association between bipolar disorder and depression with unemployment (at the age of 25, 30, 35 and 40) at different age of onset

Figure S3. The association between bipolar disorder and depression with having no secondary or higher education (at the age of 25, 30, 35 and 40) at different age of onset

Figure S4. Severity of the first depression diagnosis and status of unemployment at the age of 25, 30, 35 and 40

Figure S5. Severity of the first depression diagnosis (mild, moderate, severe, severe with psychotic symptoms or unspecified) and status of having no secondary or higher education at the age of 25, 30, 35 and 40

Figure S6. The association between bipolar disorder with unemployment at the age of 25 and 30 at over seven different periods.

Figure S7. The association between depression with unemployment at the age of 25 and 30 at over seven different periods.

Table S1. Descriptive statistics of the study participants.

Age	Unemployed, %	Income (mean)	No secondary or higher education, %
	Bipolar / Depression / Population	Bipolar / Depression / Population	Bipolar / Depression / Population
25	70 / 66 / 31	62600 / 83500 / 180300	
26	69 / 65 / 29	68500 / 91400 / 195500	64 / 57 / 39
27	67 / 61 / 25	76500 / 102400 / 212100	61 / 52 / 34
28	65 / 58 / 23	82500 / 114200 / 227500	58 / 48 / 31
29	63 / 55 / 20	90500 / 123500 / 240600	55 / 45 / 29
30	62 / 53 / 19	98600 / 132500 / 251800	52 / 42 / 27
31	61 / 52 / 18	103100 / 139000 / 261500	51 / 40 / 26
32	61 / 51 / 17	105200 / 143200 / 270100	49 / 39 / 25
33	62 / 50 / 17	109100 / 148800 / 277900	48 / 38 / 25
34	61 / 49 / 16	109400 / 155300 / 284900	46 / 37 / 24
35	63 / 49 / 16	108900 / 159000 / 291900	46 / 37 / 24
36	63 / 48 / 16	113700 / 163100 / 298300	46 / 37 / 24
37	63 / 48 / 16	114700 / 165200 / 304200	45 / 36 / 24
38	63 / 48 / 15	118500 / 166800 / 309700	45 / 37 / 24
39	63 / 49 / 15	119600 / 167200 / 315300	46 / 38 / 24
40	63 / 48 / 15	122300 / 167900 / 320300	46 / 39 / 24
41	64 / 51 / 15	118200 / 165300 / 325000	46 / 40 / 24
42	64 / 49 / 14	117500 / 168300 / 329300	46 / 41 / 24
43	63 / 48 / 14	121300 / 172200 / 332700	46 / 42 / 24
44	63 / 48 / 15	121900 / 174600 / 335300	46 / 43 / 24
45	64 / 48 / 15	123800 / 174200 / 336800	46 / 43 / 24
46	65 / 50 / 15	122600 / 170300 / 337900	46 / 44 / 24
47	66 / 51 / 15	120100 / 166500 / 338300	46 / 44 / 25
48	64 / 51 / 16	128600 / 166500 / 338700	46 / 44 / 25
49	65 / 52 / 16	123400 / 168300 / 338200	46 / 43 / 25
50	65 / 52 / 16	120600 / 167700 / 337100	45 / 43 / 25
51	67 / 52 / 17	110800 / 166800 / 334900	45 / 43 / 26
52	69 / 52 / 17	107300 / 165400 / 331800	46 / 43 / 26
53	68 / 51 / 18	105800 / 165500 / 328000	45 / 42 / 27
54	69 / 53 / 19	102000 / 159100 / 323300	44 / 43 / 27
55	69 / 53 / 19	105700 / 160600 / 319200	45 / 43 / 28
56	70 / 53 / 20	99800 / 161800 / 314100	47 / 43 / 28
57	70 / 54 / 21	103300 / 154700 / 310000	48 / 43 / 29
58	70 / 55 / 21	101700 / 150500 / 306200	48 / 44 / 29
59	66 / 53 / 22	111500 / 153300 / 303000	47 / 45 / 30
60	68 / 54 / 23	105300 / 146700 / 297400	50 / 48 / 32
61	71 / 51 / 24	100300 / 160600 / 285600	43 / 47 / 32

Note. Values with a slash represent individuals with bipolar disorder, depression, and total study sample, respectively.

Table S2. Number of participants.

Age	Unemployed Bipolar / Depression / Population	No secondary or higher education Bipolar / Depression / Population
25	2851 / 22812 / 2365291	
26	2589 / 20508 / 2304423	2539 / 20223 / 2271207
27	2340 / 18380 / 2242057	2291 / 18059 / 2198917
28	2133 / 16340 / 2181115	2090 / 16024 / 2134142
29	1943 / 14465 / 2122657	1904 / 14171 / 2073728
30	1790 / 12737 / 2067094	1755 / 12472 / 2017168
31	1662 / 11166 / 2011876	1623 / 10918 / 1962583
32	1568 / 9806 / 1958652	1530 / 9572 / 1910173
33	1471 / 8507 / 1907637	1429 / 8308 / 1859997
34	1394 / 7431 / 1857019	1359 / 7246 / 1811292
35	1318 / 6448 / 1805360	1282 / 6290 / 1761696
36	1259 / 5546 / 1753436	1222 / 5415 / 1711830
37	1201 / 4743 / 1698242	1168 / 4635 / 1658450
38	1137 / 4012 / 1641178	1108 / 3918 / 1603173
39	1098 / 3392 / 1581946	1065 / 3320 / 1545931
40	1043 / 2884 / 1522965	1017 / 2817 / 1488478
41	984 / 2442 / 1460683	963 / 2389 / 1427707
42	935 / 2116 / 1392333	910 / 2063 / 1360954
43	883 / 1873 / 1325040	860 / 1825 / 1295335
44	830 / 1695 / 1257407	806 / 1650 / 1229098
45	792 / 1533 / 1186522	773 / 1490 / 1159698
46	760 / 1424 / 1115850	741 / 1383 / 1090470
47	714 / 1364 / 1049280	695 / 1324 / 1025099
48	673 / 1311 / 982893	657 / 1271 / 959864
49	644 / 1263 / 913623	624 / 1220 / 891793
50	617 / 1205 / 838672	597 / 1163 / 818066
51	566 / 1145 / 757828	549 / 1107 / 738585
52	518 / 1077 / 679933	501 / 1035 / 661952
53	465 / 987 / 603944	448 / 949 / 587482
54	427 / 910 / 529368	407 / 874 / 514318
55	368 / 838 / 458925	352 / 808 / 445609
56	317 / 737 / 390379	301 / 706 / 378670
57	263 / 651 / 322584	251 / 625 / 312412
58	216 / 555 / 257443	207 / 532 / 248767
59	156 / 447 / 192306	150 / 429 / 186109
60	101 / 313 / 127859	100 / 312 / 125646
61	52 / 168 / 63174	51 / 167 / 62381

Note. Values with a slash represent individuals with bipolar disorder, depression, and total study sample, respectively

Table S3. Number of participants and descriptive statistics of those individuals with bipolar disorder or depression who had not been rehospitalized after the age of 25.

Age	N, Unemployed	N, No secondary Education	Unemployed, %	Income (mean)	No secondary Education, %
25	2215 / 19914		67 / 64	69900 / 89600	
26	1472 / 15244	1441 / 15039	61 / 59	90300 / 107900	62 / 55
27	1126 / 12307	1095 / 12083	55 / 52	111800 / 127900	60 / 49
28	911 / 10105	884 / 9899	49 / 47	127400 / 146500	55 / 44
29	753 / 8402	736 / 8219	44 / 42	141800 / 162500	52 / 39
30	647 / 7045	630 / 6889	41 / 38	158000 / 178000	47 / 35
31	559 / 5940	542 / 5795	40 / 36	168100 / 188600	43 / 33
32	494 / 5035	477 / 4900	37 / 34	174100 / 196200	39 / 31
33	424 / 4243	408 / 4139	37 / 32	186200 / 205100	36 / 30
34	378 / 3614	368 / 3515	34 / 30	187500 / 216000	35 / 29
35	342 / 3080	330 / 2995	35 / 29	203300 / 223500	34 / 28
36	304 / 2580	295 / 2514	33 / 27	214600 / 230800	35 / 28
37	278 / 2151	270 / 2097	30 / 28	226600 / 235200	33 / 29
38	252 / 1809	245 / 1768	28 / 27	241300 / 236700	32 / 30
39	232 / 1472	225 / 1446	26 / 27	251900 / 241800	31 / 32
40	213 / 1229	209 / 1201	24 / 26	257000 / 243800	32 / 32
41	201 / 1047	199 / 1029	26 / 28	245400 / 242700	31 / 33
42	187 / 913	185 / 895	23 / 25	256900 / 248800	31 / 35
43	175 / 830	172 / 813	21 / 24	266300 / 251300	30 / 35
44	163 / 763	160 / 746	21 / 24	271900 / 258100	29 / 36
45	153 / 685	151 / 668	22 / 25	277800 / 257500	27 / 36
46	149 / 639	147 / 619	25 / 26	272700 / 254000	27 / 36
47	138 / 605	136 / 586	27 / 28	270200 / 252500	26 / 36
48	129 / 582	127 / 562	27 / 28	260200 / 251200	25 / 35
49	120 / 563	116 / 543	28 / 30	256900 / 250800	25 / 34
50	113 / 533	110 / 511	27 / 29	261300 / 252600	25 / 35
51	97 / 508	95 / 487	27 / 30	257200 / 247200	23 / 35
52	87 / 480	84 / 457	29 / 32	253000 / 243400	21 / 36
53	74 / 440	71 / 423	22 / 30	275000 / 238900	20 / 36
54	66 / 410	63 / 393	26 / 32	270000 / 230700	16 / 38
55	59 / 377	57 / 361	25 / 34	278400 / 232200	16 / 37
56	53 / 332	51 / 317	28 / 33	257900 / 230400	18 / 39
57	45 / 299	43 / 289	33 / 34	249300 / 222500	21 / 40
58	37 / 256	36 / 244	35 / 38	222100 / 217200	17 / 42
59	27 / 213	27 / 203	30 / 40	223000 / 203700	22 / 44
60	16 / 149	16 / 148	44 / 39	211100 / 201400	25 / 47
61	7 / 80	7 / 79	57 / 36	161100 / 217800	29 / 52

Note. Values with a slash represent individuals with bipolar disorder and depression, respectively.

Table S4. Associations between bipolar disorder and depression with unemployment, having low income and having no secondary or higher education at the age of 30, 40 and 50 among those individuals who were not hospitalized after the age of 25

	Unemployment				No secondary or higher education			
	Bipolar disorder		Depression		Bipolar disorder		Depression	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age 30 (N = 1462802)								
Model 1	2.49	2.19-2.82	2.18	2.08-2.28	1.60	1.43-1.80	1.89	1.81-1.98
Model 2	2.49	2.19-2.82	2.17	2.07-2.27	1.63	1.45-1.84	1.88	1.80-1.97
Model 3	2.49	2.19-2.82	2.15	2.06-2.25	1.66	1.47-1.86	1.87	1.79-1.95
Model 4	2.40	2.11-2.72	2.10	2.01-2.20	1.62	1.44-1.82	1.82	1.74-1.90
Age 40 (N = 969169)								
Model 1	2.35	1.99-2.78	1.91	1.72-2.11	1.46	1.25-1.71	1.59	1.44-1.75
Model 2	2.35	1.99-2.78	1.91	1.73-2.11	1.48	1.26-1.73	1.59	1.44-1.75
Model 3	2.38	2.02-2.82	1.91	1.73-2.12	1.52	1.29-1.78	1.60	1.45-1.77
Model 4	2.30	1.95-2.72	1.86	1.68-2.06	1.50	1.28-1.76	1.57	1.42-1.74
Age 50 (N = 375406)								
Model 1	2.36	1.87-2.98	2.36	1.97-2.82	1.45	1.17-1.79	1.52	1.29-1.80
Model 2	2.38	1.89-3.00	2.33	1.95-2.79	1.47	1.19-1.82	1.49	1.26-1.77
Model 3	2.40	1.90-3.03	2.33	1.95-2.79	1.49	1.20-1.85	1.50	1.27-1.78
Model 4	2.31	1.83-2.92	2.28	1.90-2.73	1.47	1.19-1.83	1.48	1.25-1.75

Note: Model 1: sex and birthyear adjusted

Model 2: Model 1 + father's SES score

Model 3: Model 2 + mother's SES score

Model 4: Model 3 + parental history of mental disorders

Figure S1. On the left, odds ratios for the association between (a) bipolar disorder and (b) depression between ages 15 to 25 with not having completed any secondary or higher education between ages of 25 to 61 years for a subgroup of individuals who were not rehospitalized after the age of 25. On the right, percentages of individuals not having completed any secondary or higher education for a subgroup of individuals who were not rehospitalized after the age of 25

Figure S2. The association between bipolar disorder and depression with unemployment (at the age of 25, 30, 35 and 40) at different age of onset

Figure S3. The association between bipolar disorder and depression with having no secondary or higher education (at the age of 25, 30, 35 and 40) at different age of onset

Figure S4. Severity of the first depression diagnosis (mild, moderate, severe, severe with psychotic symptoms or unspecified) and status of unemployment at the age of 25, 30, 35 and 40

Figure S5. Severity of the first depression diagnosis (mild, moderate, severe, severe with psychotic symptoms or unspecified) and status of having no secondary or higher education at the age of 25, 30, 35 and 40

Figure S6. The association between bipolar disorder with unemployment at the age of 25 and 30 at over seven different periods.

Figure S7. The association between depression with unemployment at the age of 25 and 30 at over seven different periods.