



## Own depression, partner's depression, and childlessness: A nationwide register-based study

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### ABSTRACT

Depression and other mental health disorders are increasing while childlessness is increasing. However, this relationship has rarely been studied. We examine how depression, as measured by antidepressant use, is related to childlessness. We add to the previous research by examining both the role of current partnership status and having a partner with depression as a mechanism.

We use Finnish total population register data for cohorts born in 1977–1980. We estimate discrete time event history models for the likelihood of having a child with average marginal effects separately for men and women. Depression was measured annually with a time-varying indicator of having at least one purchase of antidepressants in the preceding year.

We find a positive association between depression and childlessness; the annual probability of having a child was 2.7 percentage points lower for women with depression and 1.6 percentage points for men with depression in age-controlled models. When controlling for all background variables such as education, the likelihood of having a child was 1.9 percentage points lower for women with depression and 0.3 percentage points lower for men with depression. In total, 41% of men and 26% of women who had used antidepressant medication between ages 18–38 remained childless at age 39, compared to 30% of men and 22% of women who had not used antidepressant medication. We also find that a partner's depression increases the probability of being childless, and the likelihood of being childless is even higher if both an individual and their partner had depression.

### 1. Introduction

Contemporary society is marked by a concurrent rise in depression and decline in fertility rates, presenting a compelling landscape for exploration. The rise in mental health problems (both self-rated and diagnosed) has been evident (Abbing-Karahagopian et al., 2014; Noordam et al., 2015), especially for young adults (Gyllenberg et al., 2018; Krokstad et al., 2022), but less so among older adults (Richter et al., 2019). Further, in the 1977–80 cohort, 36% of women and 26% of men have used antidepressant medication by the age of 39 (own calculations). The use of antidepressant medication has also increased over time. For example, in Finland, antidepressant medication use has increased from 70 to 90 daily doses per 1000 inhabitants from 2007 to

2022 (Fimea, 2020, 2022). Simultaneously, the sharp decline in Finland's total fertility rate from 1.80 in 2010 to 1.26 in 2023 signals transformative shifts in demographic patterns (Statistics Finland, 2024). Also, the level of childlessness has increased over this period; thus, exploring the link between depression and childlessness is particularly interesting (Miettinen and Jalovaara, 2024).

However, a substantial knowledge gap persists between these two phenomena. Some studies have found that depression is linked with childlessness (e.g., Golovina et al., 2023), but the mechanisms behind this association are not well known. For example, the role of partnership history is not well-examined yet. There are two studies that document the impact of ever having a co-residential partner on childlessness (Liu et al., 2024; Golovina et al., 2024). Both have found that the likelihood

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of co-residential partnership was lower among those with mental health diagnoses. However, these studies examine partnership broadly by looking at whether an individual has ever been in a co-residential relationship. Specifically, both studies lack information about each individual's full partnership history, including the characteristics of the partner, which may be an important pathway since depression may affect both initiating and maintaining partnerships (e.g., Leach and Butterworth, 2020; Metsä-Simola et al., 2018). This study seeks to fill this gap by first examining an individual's entire partnership history and, second, the partner's depression as mechanisms. As an indicator for depression, we use antidepressant medication. We use Finnish total population register data on the 1977–1980 cohorts and follow individual partnership and fertility histories from the age of 18 until the age of 39.

## 2. Background

The relationship between mental health and family dynamics has become a critical concern, particularly as mental health issues and childlessness are on the rise while fertility rates are declining. Over the years, the incidence of childlessness has surged. For instance, in 1987 in Finland, the childlessness rate at age 45 stood at 19% for men, but by 2020, it had risen to 29%. Similarly, for women, the figures rose from 14% to 20% (Miettinen and Jalovaara, 2024). At the same time, depression is one of the most prevalent mental health problems, with its incidence steadily increasing over time (Andersen et al., 2011; Krokstad et al., 2022; Gyllenberg et al., 2018). Notably, age at onset of depression often aligns with the typical age of parenthood (Golovina et al., 2023; Solmi et al., 2022), prompting exploration into its relationship with childlessness.

Previous studies have indicated that individuals with depression are less likely to have children and tend to have fewer offspring (e.g., Golovina et al., 2023; Vigod et al., 2014; Liu et al., 2024; Williams et al., 2007). A recent Finnish study demonstrated that an earlier onset of depression was more strongly linked to reduced fertility and delayed childbearing than later onset of depression (Golovina et al., 2023). Thus, we expect that.

### H1. Depression is positively related to childlessness (general hypothesis).

Various explanations exist regarding the link between depression and childlessness, and the most commonly examined of these is socioeconomic factors. It is well established that depression is associated with lower socioeconomic outcomes, such as lower education, income, and higher unemployment (Hakulinen et al. 2016, 2019; Ahola et al., 2011). Studies in the Nordic countries suggest that lower socioeconomic status is associated with reduced fertility and higher rates of childlessness, with individuals with higher education levels having more children and lower likelihoods of being childless. The association between lower education levels and childlessness is stronger for men (Jalovaara et al., 2019, 2022; Jalovaara and Miettinen, 2024).

Depression may also pose challenges in initiating and sustaining intimate relationships. Young adults with depression are less likely to be in partnerships (Liu et al., 2024; Golovina et al., 2024), and if they are, the quality of those partnerships tends to be poorer (Leach and Butterworth, 2020). Individuals with depression report lower satisfaction levels in their relationships (Downward et al., 2022). Additionally, social isolation is linked to depression (e.g., Hall-Lande et al., 2007), and social isolation may interfere with individuals' partnership formation – depression is linked with avoiding contact with friends and taking part in fewer social activities (NHS, 2023; Hirschfeld et al., 2000), which may lead to a lower likelihood of finding a partner. Previous studies have also found that individuals with mental health disorders are more likely to have never been in a co-residential partnership (Golovina et al., 2024; Liu et al., 2024). Individuals with depression also face higher risks of separation (Metsä-Simola et al., 2018). As there is evidence that short or non-cohabiting relationships are linked with higher odds of

childlessness (Jalovaara and Fasang, 2017), we propose.

### H2. The relationship between childlessness and depression (measured as antidepressant use) is mediated by individuals' partnership histories, because individuals with depression often have less stable partnership histories (partnership history hypothesis).

At the same time, due to assortative mating, it is possible that the partner of a person with depression also has depression. Assortative mating refers to the phenomenon wherein partners share common characteristics, such as educational attainment and social status (Kalucza et al., 2015; Mäenpää, 2015). However, assortative mating has been found to extend to various other domains, including mental health disorders (Mathews and Reus, 2001; Nordsletten et al., 2016). Assortative mating is not particularly strong in mood disorders as compared to conditions like schizophrenia and autism, but it is similar in size to occupational class and many other common mental health disorders (Nordsletten et al., 2016; Torvik et al., 2023; Schwartz et al., 2021). Additionally, assortative mating has been found to be stronger in mental health than somatic health (Torvik et al., 2023). Assortative mating regarding mental health disorders may exacerbate their accumulation within couples, potentially reducing the likelihood of parenthood. Additionally, the accumulation of depression within couples may result from the significant influence that partners exert on each other's mental and physical well-being (Kiecolt-Glaser and Wilson, 2017). However, past research on depression and childlessness has largely overlooked the role of partners' depression despite its possible significance. We anticipate.

### H3. Childlessness is notably high when both partners experience depression (measured by antidepressant use), albeit lower than in cases where an individual is without a partner (accumulation within couples hypothesis).

Lastly, according to previous literature, gender differences are evident, with men experiencing more pronounced effects of mental health challenges on family outcomes (Power et al., 2013; Kalucza et al., 2015; Golovina et al., 2023). Specifically, a recent Finnish study showed that depression reduced the odds of ever having a child by 33% for men and 15% for women, highlighting the gender-specific effects of depression on fertility (Golovina et al., 2023). Some Nordic studies also show that those with depression, both men and women, have lower fertility intentions (Carlsson and Kim, 2024). Since most previous research suggests that men are more strongly affected than women even though women receive more depression diagnoses and use antidepressant medication more often, we hypothesize.

### H4. Depression (measured as antidepressant use) is more strongly related to childlessness among men compared to women (gender hypothesis).

Our study aims to make several contributions toward clarifying the associations between depression, as measured by antidepressant use, and childlessness. First, we take into account individuals' entire relationship histories by following them from the age of 18 until the age of 39. This provides more information on how singleness and co-residential partnerships (measured annually) contribute to the higher rates of childlessness among those with depression. Second, we also examine how a potential partner's depression is related to childlessness. We add to the existing literature by assessing the role of full partnership histories and partner's depression using annual measures, whereas in previous studies partnership status was simply measured by ever having a co-residential partner (Liu et al., 2024; Golovina et al., 2024).

## 3. Data and methods

### 3.1. Data

We use the Finnish total population register data on the 1977–1980 cohorts and follow individuals from 18 to 39 years of age. The mean maternal age at first birth was 29.6 years in 2022 and the mean paternal

age at first birth was 32.1 years (Statistics Finland, 2022, 2023). The childlessness rates differ only slightly between ages 40 and 45 (Jalovaara and Miettinen, 2024; Nisén et al., 2014). It is also evident that the proportions of childlessness stabilise before the age of 40 (Nisen et al., 2014). Thus, our sample captures childlessness and having at least one child by the age of 39 well; however, we acknowledge that some individuals may have their first child after the age of 39, so our results should not be directly interpreted as lifetime childlessness. We restrict the sample to individuals who are born in Finland because for these persons, we were able to achieve a complete linkage of education, healthcare, and sociodemographic data in the study period. In order to avoid postpartum depression influencing our results, we also excluded individuals who had depression and a live birth in the same year (798 women and 801 men), thus arriving at a study design where antidepressant medication use is always measured before having a child. In the final analytical sample, we have 123,182 women and 128,468 men. As a sensitivity check, we conducted analysis without excluding individuals who had a child and depression in the same year, but the main results remained unchanged (Appendix Table A7).

The *outcome* variable is having the first child during a given year, coded as a time-varying dummy variable. The *main independent* variable is own depression, and it is measured with a fully time-varying indicator of having at least one annual purchase of antidepressants in the previous year. Thus, an individual can have several spells of depression and is considered to have recovered from depression if there are no antidepressant purchases in the preceding year. Antidepressant medication includes the N06A category of the ATC (Anatomical Therapeutic Chemical) classification system (Fimea, 2022). In Finland, antidepressant medication is obtained only from authorised pharmacies by prescription from a medical doctor after clinical assessment and diagnosis. While antidepressants can be used for other psychiatric and non-psychiatric disorders, they are most widely used for depression (Sihvo et al., 2008; Henriksson et al., 2003). Furthermore, non-psychiatric use is more common among older people and less of a concern in the young and working-age population (Moustgaard et al., 2013; Sihvo et al., 2008; Thielen et al., 2009) (see Robustness analyses and Discussion for more details on the strengths and limitations of our measure).

The time-varying control variables are age, partner order, own education, and current partnership status. Partnerships are defined as co-residential partnerships, including both marriages and cohabitations. Age is a categorical variable and has values from 18 to 39. Own highest education was categorised into basic, secondary (including vocational and general tracks), and tertiary education (including those with a bachelor's degree or higher). Partner order was the highest partner order at each observation point. The value of partner order stays constant when a partnership dissolves and increases when a new partnership is formed. For current partnership status, 1 refers to having a partner without depression, 2 refers to not having a partner, and 3 refers to having a partner with depression.

### 3.2. Methods

We use discrete-time event history models with a logistic link. The time variable in the analysis is the individual's age, and it is treated as a polynomial. We predict the time-varying binary variable 'birth of a first child' in time  $t$  by depression, as measured by antidepressant use, status in year  $t-1$ . We use similar lagging of covariates for all time-varying variables. All analyses are performed separately for both women and men.

Our analytical procedure consisted of two parts. First, we fitted discrete-time event history models with AME (average marginal effect) to examine the likelihood of being childless, and conducted separate analyses for men and women. AMEs enable us to compare the coefficients across nested models and they can be interpreted as percentages (Mood, 2010). Right-censoring occurred after emigration, death, or

age 39. We created nested models and started with the M1 model, where we only examined the association between own depression and the likelihood of having a child, controlling for age. In the ensuing models, we progressively adjusted for current partnership status (M2), partner order (M3), and highest education (M4). This stepwise adjustment helps us to determine how much different background characteristics such as partnership status explain the association.

Second, in order to examine the possible effects of the accumulation of depression within couples, we included an interaction term between own depression and current partnership status. The interaction results are presented as predicted probabilities to have a child in a given year. In addition, several robustness analyses are presented in the Robustness Analyses section.

The results in the tables are presented as average marginal effects (AME) and in the figures as predicted probabilities. Both AMEs and predicted probabilities can be interpreted as percentages. We argue that the use of average marginal effects is necessary because they are not as sensitive to unobserved heteroscedasticity across groups as the more widely used odds ratios. Using AMEs enables us to compare the coefficients across nested models, and they are also more intuitive to interpret (Mood, 2010).

## 4. Results

### 4.1. Main results

The descriptive statistics in Table 1 are presented from the end of the study period, i.e., age 39. Descriptive statistics presented as person-years can be found in the Appendix (Tables A1 and A2).

In our data, women use more often antidepressant medication more often than men. Not having a partner and being childless is more common among men than women, and women are more highly educated than men (Table 1). Those who have depression have less education and more often have a partner with depression. Notably, the average number of partners is higher for women than men, and even higher when individuals have depression.

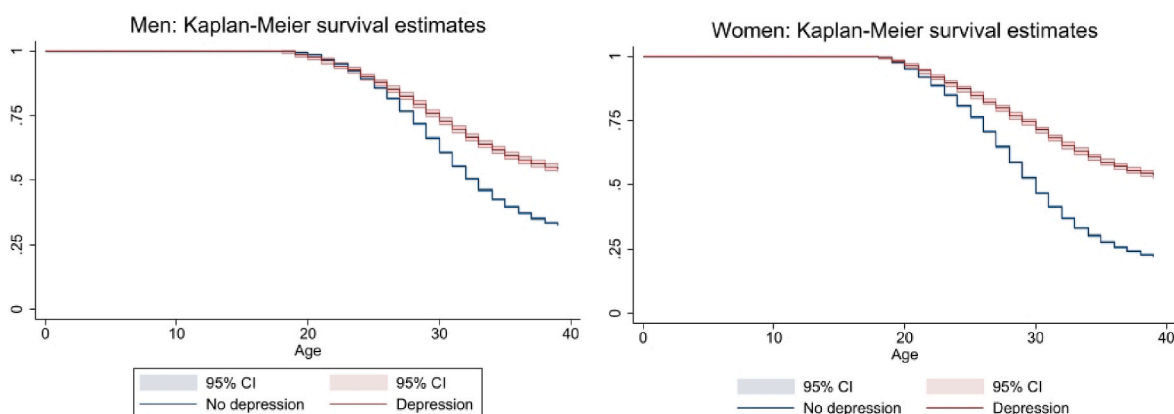
Fig. 1 shows Kaplan-Meier survival curves for the likelihood of having a child by own depression status. Individuals are followed from the age of 18 until age 39. The figure clearly shows that those who have depression are less likely to have a child, and the association seems to be stronger for women.

Our statistical analysis, as presented in Tables 2 and 3, shows a consistent positive relationship between an individual's depression, as measured by antidepressant use, and childlessness (Appendix Table A8 shows the full model as hazard ratios). The annual probability of having a child was 2.7% lower for women and 1.9% lower for men with depression in Model 1. In the fully controlled model, the probability was 1.9% lower for women and 0.3% lower for men. The association is stronger for women than men (model comparison,  $p < 0.001$ ). Taking into account the current partnership status reduces the estimates for women by 30% and for men by 85%. Including the rest of the background variables did not change the results. Interestingly, when comparing women's and men's estimates, it is apparent that women's depression is more strongly related to childlessness than men's depression.

We examined the interplay of depression and partnership status by using interaction models. The interaction results did not essentially change when we included partner order and education in the model; thus, we show the full model, corresponding to Model 4, in Fig. 2. The figure shows the yearly likelihood of having a child by depression and partnership status, and results are presented as predicted probabilities. The interaction analysis shows that the likelihood of having a child is lowest if the individual does not have a partner (Fig. 2). Moreover, if both partners have had depression, the likelihood of having a child is the second lowest. We can also conclude that women's depression is more decisive for the likelihood of having a child than men's depression; for

**Table 1**  
Descriptive statistics for women (123,182) and men (N = 128,468). Measured by the end of following period i.e., at the age of 39 or censoring.

	Women			Men		
	No depression (%)	Depression (%)	All (%)	No depression (%)	Depression (%)	All (%)
Ever own depression	0	100	36	0	100	26
Ever child	78	74	77	70	59	67
Ever partner	92	92	92	88	82	87
Ever partner with depression	14	25	18	23	33	26
Current partnership status						
Partner without depression	69	50	62	58	36	52
Partner with depression	9	13	10	15	17	16
No partner	23	37	28	27	47	32
Highest education						
Basic	3	7	5	9	18	12
Secondary	38	45	40	52	54	52
Tertiary	59	48	55	39	28	36
Average number of partners	1.40(0.84), 0/9	Mean(SD), min/max 1.62(1.02), 0/9	1.48(0.92), 0/9	1.35(0.88), 0/9	Mean(SD), min/max 1.42(1.05), 0/9	1.36(0.93), 0/9
N	79,572	43,610	123,182	95,335	33,133	128,468



**Fig. 1.** Kaplan-Meier survival curves of likelihood of having a child by own depression, as measured by antidepressant use, status. Individuals are followed from the age of 18 till age 39.

women who have depression, their partner's depression matters relatively little, whereas for men, a partner with depression is strongly associated with a lower likelihood of having a child.

**Table 2**  
Depression, as measured by antidepressant use, and likelihood of having a child among women. Discrete time event history analysis with AME.

	M1	M2	M3	M4
Own depression	-0.0272*** (0.0006)	-0.0193*** (0.0006)	-0.0199*** (0.0006)	-0.0187*** (0.0006)
Age-dummy	X	X	X	X
Current partnership status (ref. Partner without depression)				
No partner		-0.0494*** (0.0002)	-0.0443*** (0.0003)	-0.0429*** (0.0003)
Partner with depression		-0.0078*** (0.0010)	-0.0076*** (0.0009)	-0.0069*** (0.0009)
Partner order			0.0051*** (0.0002)	0.0061*** (0.0002)
Own education (ref. Basic)				
Secondary				-0.0083*** (0.0004)
Tertiary				0.0083*** (0.0005)
N (person-years)	2,628,9495	2,628,9495	2,628,9495	2,628,9495
pseudo R <sup>2</sup>	0.034	0.096	0.097	0.102
BIC	760730	711973	711230	707229

Note: All variables fully time-varying. \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

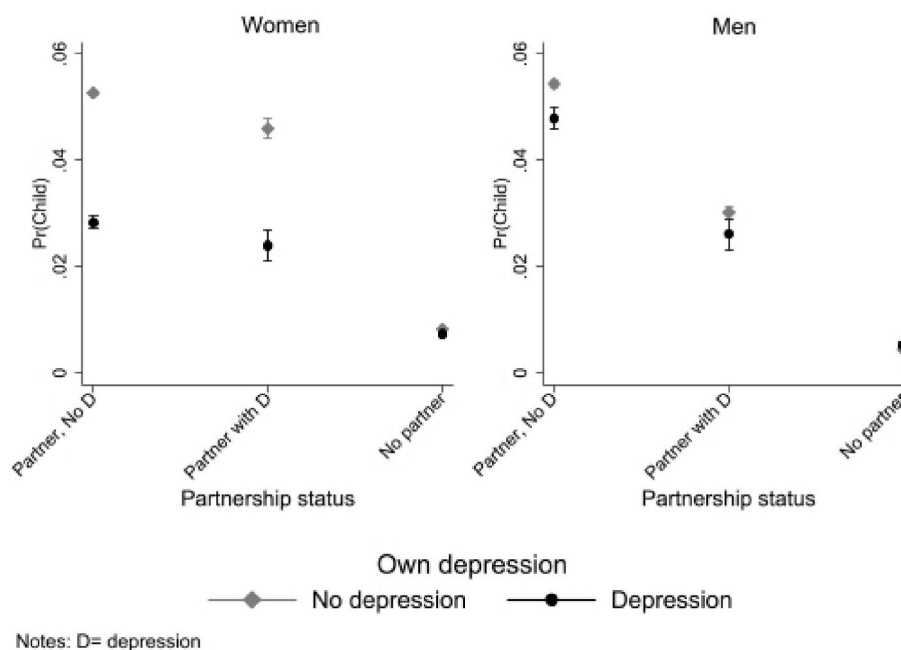
#### 4.2. Support for hypotheses

We found support for *hypothesis 1*, which stated that depression is positively linked with childlessness. We do not find support for *hypothesis 2*, which states that childlessness is more prevalent among

**Table 3**  
Depression, as measured by antidepressant use, and likelihood of having a child among men. Discrete time event history analysis with AME.

	M1	M2	M3	M4
Own depression	-0.0155*** (0.0006)	-0.0026*** (0.0005)	-0.0029*** (0.0005)	-0.0027*** (0.0005)
Age-dummy	X	X	X	X
Current partnership status (ref. Partner without depression)				
No partner		-0.0556*** (0.0003)	-0.0504*** (0.0003)	-0.0496*** (0.0003)
Partner with depression		-0.0266*** (0.0006)	-0.0247*** (0.0006)	-0.0242*** (0.0006)
Partner order			0.0042*** (0.0002)	0.0045*** (0.0002)
Own education (ref. Basic)				
Secondary				-0.0047*** (0.0003)
Tertiary				0.0033 (0.0004)
N (person-years)	2,740,198	2,740,198	2,740,198	2,740,198
pseudo R <sup>2</sup>	0.001	0.113	0.113	0.114
BIC	737341	654408	654403	653997

Note: All variables fully time-varying. \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.



**Fig. 2.** The interaction between own depression, as measured by antidepressant use, and partnership status on the likelihood of having a child. Discrete time event history models (highest education, age and partner order controlled). Presented as predicted probabilities. Note: all variables time-varying.

individuals with depression due to less stable partnership status, because controlling for partner order does not change the association (Tables 2 and 3). However, we find that having a partner is strongly related to the likelihood of having a child, especially for men.

We find support for *hypothesis 3*, which states that childlessness is notably high when both partners experience depression, even though it is lower than in cases where an individual is without a partner. Lastly, we did not find support for *hypothesis 4* because depression seems to be more strongly related to women's childlessness than men's, especially when partnership status is taken into account. The probability of having a child was 2.7 percentage points lower for women with depression and 1.6 percentage points lower for men with depression in age-controlled models (Tables 2 and 3). Controlling for partnership status reduced the percentages to 1.9% for women and 0.3% for men, thus partnership status seems to be more important for men than women. Thus, for men, the association between depression and childlessness is explained through partnership and partner's depression status (Fig. 2).

In summary, depression is positively related to childlessness, and partnership status, especially for men, partly explains the association. Moreover, depression is more strongly related to women's childlessness than men's, even though men are more often childless than women.

## 5. Robustness analyses

### 5.1. Different definition of depression: several depression spells and recovering from depression not possible

As a robustness check, we conducted models where depression was defined differently compared to the models presented in the main analysis. In the main analysis, an individual can have several episodes of depression (measured as antidepressant use) because depression is measured as fully time-varying. In the robustness analysis, when an individual has had an antidepressant purchase, the individual will be coded as having depression from that year onwards, i.e., one cannot recover from depression. The pattern of the results is similar to the main analysis, but the estimates are much weaker for women (Tables A3 & A4, Figures A1 & A2).

### 5.2. Different definition for depression: diagnoses from specialised health care

We conducted a robustness analysis using diagnostic data from specialised healthcare. In our primary analysis, we used antidepressant purchase data because it provides a larger sample of individuals with depression. This is because the antidepressant purchase data includes all individuals who have purchased antidepressants, whereas the diagnostic data from specialised healthcare excludes information from occupational health and primary care and is likely capturing more severe cases. Consequently, the populations with depression differ significantly in both size and composition. Only 11% of women and 7% of men are classified as ever having depression by age 39 in the diagnostic data, whereas similar numbers for antidepressant purchases are 36% and 26%. Additionally, individuals defined as having depression based on a diagnosis from specialised healthcare tend to have lower education levels and other disadvantageous factors more frequently than those defined by antidepressant purchases.

The robustness analysis using diagnostic data revealed slightly different results. The magnitude of the estimate for depression was lower, and men's depression was more strongly associated with the likelihood of having a child compared to women's depression (Tables A5 and A6). Further discussion about different measures of depression can be found in the Discussion section.

## 6. Discussion and conclusion

### 6.1. Discussion

Our study investigated the relationship between depression, as measured by antidepressant use, and childlessness, shedding light on contemporary societal trends marked by rising rates of both childlessness and depression alongside declining fertility in many Western countries. Despite these trends, the linkage between depression and childlessness has received relatively little attention in research literature. To our knowledge, our study represents one of the first efforts to examine how yearly partnership status and the presence of a partner's depression influence this association.

Our analysis draws upon comprehensive data sourced from Finnish total population registers and cohorts spanning from 1977 to 1980. Our findings can be summarised as follows. Firstly, we discerned a positive association between depression and childlessness, indicating that individuals with depression exhibit a heightened likelihood of remaining childless, aligning with prior research (e.g., Golovina et al., 2023, 2024). Secondly, we find that the association is stronger for women compared to men. The annual probability of having a child was 2.7 percentage points lower for women with depression and 1.6 percentage points lower for men with depression in age-controlled models. Thirdly, controlling for partnership status reduced these differences to 1.9 percentage points for women and 0.3 percentage points for men. Thus, partnership status seems to be more important for men. Other background characteristics, including partner order and education, had little further impact on the differences. Notably, at age 39, 41% of men and 26% of women who had ever used antidepressant medication remained childless, compared to 30% of men and 22% of women without antidepressant medication.

We find that the prevalence of childlessness was notably high even when both partners had depression. Thus, the accumulation of depression within couples appears to be an important factor in the likelihood of having a child. However, women's depression is more decisive in the couple's likelihood of having a child than men's. In all models, women's depression is more strongly related to the likelihood of having a child.

As above shortly mentioned, we observed that the association was more pronounced among women than men, contrary to previous findings which suggested a stronger link between depression and the likelihood of men having children (Power et al., 2013; Kalucza et al., 2015; Golovina et al., 2023). This discrepancy may stem from our study design, which accounts for yearly partnership status, incorporates yearly data on antidepressant purchases allowing for multiple episodes and recoveries, and includes less severe cases of depression. This differs from studies such as Golovina et al. (2023, 2024), where diagnoses from specialised healthcare and public primary health care were used, excluding diagnoses in occupational health care and private clinics. However, when we used diagnostic data from specialised healthcare, we found that men's depression is more strongly related to childlessness, indicating that both the study design and the study population affect results. Individuals whose depression is identified through specialised healthcare diagnosis data were more disadvantaged than those identified through the use of antidepressant medication. In essence, we find that a woman's depression plays a more decisive role in couples' childbearing decisions, possibly because societal expectations place a heavier caregiving burden on women, hindering their choices regarding childbearing more profoundly. A Swedish study supports this explanation, as it found that women's intentions of childbearing are a stronger predictor of fertility than men's intentions (Duvander et al., 2018). Another possible explanation is a gender difference in help-seeking behaviour: women may be more likely to seek help for their mental health issues than men, and this might explain the difference between diagnostic data from specialist health-care providers and antidepressant medication data, as less severe cases are more likely to be included in the antidepressant medication data. The gender differences in help-seeking also likely lead to differences in underdiagnoses by gender (e.g., Cabezas-Rodríguez et al., 2020). Recent studies have also indicated that the gender difference both in diagnoses and consumption of antidepressant medication increases by age and is greater in more disadvantaged social groups (Cabezas-Rodríguez et al., 2020; Faisal-Cury et al., 2022; Magaard et al., 2017).

Finally, we observed that individuals without partners were most

commonly childless irrespective of their own depression. We also find that partnership status is more important for men than for women, because men's likelihood of having a child is lower than women's if they do not have a partner. This is also in line with previous research that finds that short or non-cohabiting relationships are linked with higher odds of childlessness, and the association is stronger for men (Jalovaara and Fasang, 2017).

However, it is crucial to acknowledge that challenges related to childlessness can also impact mental health. Previous studies indicate that individuals facing infertility challenges, particularly childless women, exhibit an increased risk for dysthymia and anxiety disorders (Klemetti et al., 2010). Similarly, childless men undergoing infertility experiences tend to report significantly poorer quality of life. Moreover, Baldur-Felskov et al. (2013) found that women who did not give birth after infertility evaluations faced an elevated risk of hospitalisation for various mental disorders. Thus, it is clear that involuntary childlessness can contribute to mental health disorders as well.

Similarly, lack of a partner or stable partnership may also influence mental health. Social isolation and loneliness are linked with depression (Matthews et al., 2016). Moreover, those without a partner are often lonelier, especially if they are young (Böger and Huxhold, 2018). We minimised the effects of such 'reverse causation' in our analyses by lagging the depression information by one year.

## 6.2. Methodological considerations and future research

Looking across studies, one key observation is that different data sources for depression lead to slightly different findings regarding gender differences in the association between depression and childlessness. It appears that studies utilising diagnostic data to identify depression tend to find a stronger impact on men (e.g., Golovina et al., 2023; Golovina et al., 2024). Interestingly, the medication data (used in our main analysis) suggests the opposite. This is likely due to different representations of individuals across all socioeconomic groups in medical data and the specialised healthcare data (see Tables 2 and 3, and A3 & A4). In Golovina et al. (2024), the authors also use diagnostic data from the primary health care providers, but this dataset did not include diagnoses from occupational health care and private clinics. The inclusion of occupational health care may be important since, in Finland, most employees have access to it, and employees are more likely to use occupational health care services than other health care services (Ikonen et al., 2013). On the other hand, antidepressant data contained no information on diagnoses, so we could not ascertain with certainty that the antidepressants were prescribed for depression. Antidepressants can be used for other mental health disorders besides depression, although depression is the most common indication (e.g., Sihvo et al., 2008; Gardarsdottir et al., 2007). Furthermore, in working-age individuals, non-psychiatric indications are less common (Gardarsdottir et al., 2007; Thielen et al., 2009; Moustgaard, 2015; Sihvo et al., 2008).

Future research should examine the role of partnership history and potential partners' mental health disorders in more detail, encompassing a broader spectrum of mental health disorders beyond depression. Additionally, a thorough examination of factors that create vulnerability to the effects of mental health disorders on family formation, alongside the identification of protective and compensating factors that foster resilience, is warranted. It would also be important to examine whether there are common structural or medical causes for the rise of both depression and childlessness.

A key strength of our study lies in its use of Finnish total population registers, enabling analyses with minimal selection bias, loss to follow-

up, or reporting bias. Furthermore, our study complements previous research by incorporating information on antidepressant medication from the registers, thereby also capturing individuals treated solely in occupational health care and private clinics. We believe that our indicator for depression is accurate concerning childbearing, as terminating antidepressant medication when planning pregnancy is generally not recommended. However, in Finland taking depression medication during pregnancy is typically discouraged unless deemed essential (Käypähoito suositus, 2024).

Nonetheless, certain limitations should be acknowledged, such as the lack of information on individuals' desires to have children and the quality of their partnerships. Depression and other mental health disorders may affect individuals' desire to have children (e.g., Carlsson and Kim, 2024). According to representative Finnish survey data (Family Barometer), slightly more than 22% of participants who wished to have at least one child said that having a child was not currently feasible because of their own or their spouses' health problems (Sorsa et al., 2023). Another limitation is that we cannot differentiate between voluntary and involuntary childlessness in the study. In the Finnish Family Barometer (2023), about 17% percent of participants answered that their ideal number of children was 0 in 2022 and 15% correspondingly in 2015. Interestingly, there are almost no gender differences under the age of 35 (Sorsa et al., 2023). While some voluntary childlessness is likely due to depression and other mental health issues, the increase in childlessness is probably more attributable to increasing involuntary childlessness, as the ideal number of children has not changed significantly over the years and both the number of children and proportion of childless individuals has increased (Jalovaara and Miettinen, 2024; Sorsa et al., 2023). Future studies should investigate how strongly voluntary childlessness is associated with an individual's mental health status. A better understanding of these relationships can guide targeted interventions to address mental health issues and facilitate individuals in achieving desired family outcomes. The severity of depression was not studied here because antidepressant purchase data does not allow it. Additionally, further research should consider the co-morbidity of depression with other mental and somatic health conditions. Lastly, research suggests that depression can impact fecundity, with gender-specific effects on pregnancy rates and outcomes in couples (Evans-Hoeker et al., 2018; Wu et al., 2019).

### 6.3. Conclusions

In terms of broader societal implications, our findings are relevant for policymakers and healthcare professionals. The observed link between depression and childlessness highlights the need for improved support systems for individuals with depression. Our study shows that the consequences of depression should be examined from a broader view by including the individual's partnership history and possible partner's characteristics. When supporting individuals to have their desired number of children, professionals should have a wider focus on individuals' lives and not focus only on single aspects, as this study clearly

## Appendix

### *Calculation method for the variation in total population childlessness if depression were to decrease or increase*

We used life-table techniques to calculate the hypothetical impact of increasing or decreasing depression on childlessness. We first calculated the

shows. Using the estimated association between depression and the probability of having a child, combined with information on the prevalence of depression by age, we estimated what would happen to total population childlessness if depression were to decrease or increase strongly (More about method, see Appendix). These crude calculations suggest that if depression were to halve, then women's childlessness would decrease by 1.3 percentage points (pp) and men's by 0.8 pp. On the other hand, if depression were to double, then women's childlessness would increase by 2.6 pp and men's by 1.5 pp. Thus, the level of depression in society is directly linked to the level of childlessness.

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## Ethics approval

Statistics Finland's Board of Statistical Ethics (K/23/07.03.00/2024, U0256\_C.22) and Findata permission (THL/6303/14.06.00/2023) have approved the use of the register data underlying this study. All methods were carried out in accordance with relevant guidelines and regulations. When participants are not contacted, informed consent is not required for register-based studies in Finland.

## CRedit authorship contribution statement

**Sanna Kailaheimo-Lönnqvist:** Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Heta Moustgaard:** Writing – original draft, Methodology, Conceptualization. **Pekka Martikainen:** Writing – original draft, Funding acquisition, Conceptualization. **Mikko Myrskylä:** Writing – original draft, Methodology, Funding acquisition, Conceptualization.

## Data availability

The data that has been used is confidential.

probability of first birth by age in each one-year age group, separately for those without ( $p_{wo}$ ) and with depression ( $p_w$ ), with depression lagged by one year. The prevalence of depression ( $d$ ) weighted average  $p_t = d * p_w + (1-d) * p_{wo}$  is the total population age-specific probability of first birth. Based on these age-specific probabilities, the total population childlessness is calculated as the product of the terms “not having first birth” ( $1-p_t$ ) from youngest to the oldest age. In this set-up, we can then increase or decrease the prevalence of depression  $d$  to explore the impact on total population childlessness. In our simulation, we multiplied each age-specific  $d$  to explore the impact of doubling of depression, and conversely halved age-specific  $d$  to explore the impact of halving of depression.

**Table A1**  
Descriptive statistics for women (N = 123,182). Descriptive statistics presented as person-years.

	No depression	Depression	All
Own depression			18
Child	4	3	3
Current partnership status			
Partner without depression	54	48	52
No partner	43	43	43
Partner with depression	4	9	5
Highest Education			
Basic	13	13	13
Secondary	51	54	53
Tertiary	36	33	34
		<i>Mean(SD), min/max</i>	
Partner order	0.76(0.81), 0/9	0.93(1.02), 0/9	0.79(0.85), 0/9

Note: All variables time-varying.

**Table A2**  
Descriptive statistics for men (N = 128,468). Descriptive statistics presented as person-years.

	No depression	Depression	All
Own depression			12
Child	3	2	3
Current partnership status			
Partner without depression	42	31	41
No partner	52	56	52
Partner with depression	6	13	7
Highest education			
Basic	13	13	13
Secondary	51	54	53
Tertiary	36	33	34
		<i>Mean(SD), min/max</i>	
Partner order	0.64(0.79), 0/9	0.70(0.95), 0/8	0.65(0.81), 0/9

Note: All variables time-varying.

**Table A3**  
Depression and likelihood of having a child among women. Discrete time event history analysis with AME.

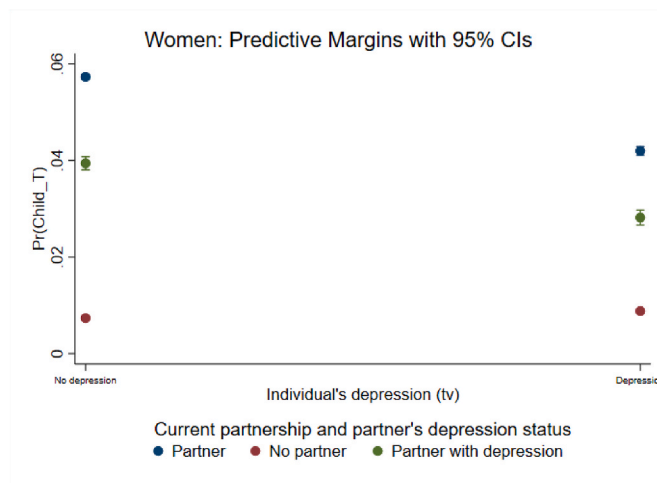
	M1	M2	M3	M4
Depression	-0.0094*** (0.0003)	-0.0084*** (0.0003)	-0.0087*** (0.0003)	-0.0088*** (0.0003)
Current partnership status (ref. Partner without depression)				
No partner		-0.0487*** (0.0002)	-0.0476*** (0.0003)	-0.0471*** (0.0003)
Partner with depression		-0.0177*** (0.0006)	-0.0175*** (0.0006)	-0.0176*** (0.0006)
Partner order			0.0010*** (0.0002)	0.0010*** (0.0002)
Highest education (ref. Basic)				
Secondary				-0.0092*** (0.0004)
Tertiary				-0.0014** (0.0005)
<i>N (person-years)</i>	2628495	2628495	2628495	2628495
<i>pseudo R<sup>2</sup></i>	0.001	0.068	0.068	0.070
<i>BIC</i>	786176.1885	733523.3800	733508.0962	732250.4107

Note: All variables (except depression) fully time-varying. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

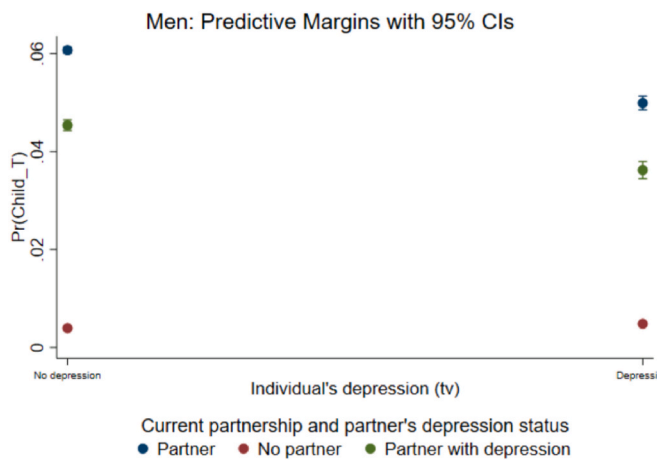
**Table A4**  
Depression and likelihood of having a child among men. Discrete time event history analysis with AME.

	M1	M2	M3	M4
Depression	-0.0079*** (0.0003)	-0.0045*** (0.0003)	-0.0047*** (0.0003)	-0.0049*** (0.0003)
Current partnership status (ref. Partner without depression)				
No partner		-0.0570*** (0.0002)	-0.0556*** (0.0003)	-0.0555*** (0.0003)
Partner with depression		-0.0156*** (0.0005)	-0.0153*** (0.0005)	-0.0154*** (0.0005)
Partner order			0.0009*** (0.0002)	0.0009*** (0.0002)
Highest education (ref. Basic)				
Secondary				-0.0049*** (0.0003)
Tertiary				-0.0007 (0.0004)
<i>N</i> (person-years)	2757474	2757474	2757474	2757474
pseudo <i>R</i> <sup>2</sup>	0.001	0.112	0.112	0.112
<i>BIC</i>	743931.9737	661292.5075	661275.2907	660845.9830

Note: All variables (except depression) fully time-varying. \**p* < 0.05, \*\**p* < 0.01, \*\*\**p* < 0.001.



**Fig. A1.** Depression and likelihood of having a child by partnership status. Women. Discrete time event history models with AME (highest education and partner order controlled).



**Fig. A2.** Depression and likelihood of having a child by partnership status. Men. Discrete time event history models with AME (highest education and partner order controlled).

**Table A5**

The association between depression (diagnose data from the specialised health care) and likelihood of having a child. Discrete event history models and AME. Men.

	M1	M2	M3	M4
Own depression	-0.0070*** (0.0004)	-0.0029*** (0.0004)	-0.0028*** (0.0004)	-0.0016*** (0.0004)
Age-dummy	X	X	X	X
Current partnership status (ref. Partner without depression)				
No partner		-0.0132*** (0.0012)	-0.0098*** (0.0013)	-0.0096*** (0.0013)
Partner with Depression		-0.0328*** (0.0001)	-0.0293*** (0.0002)	-0.0291*** (0.0002)
Partner order			0.0183*** (0.0001)	0.0186*** (0.0001)
Own education (ref. Basic)				
Secondary				-0.0021*** (0.0003)
Tertiary				0.0098*** (0.0004)
<i>N (person-years)</i>	2,757,474	2,757,474	2,757,474	2,757,474
pseudo R <sup>2</sup>	0.040	0.065	0.098	0.101
BIC	715109	696199	671906	669776

**Table A6**

The association between depression (diagnose data from the specialised health care) and likelihood of having a child. Discrete event history models and AME. Women.

	M1	M2	M3	M4
Own depression	-0.0037*** (0.0003)	-0.0023*** (0.0004)	-0.0030*** (0.0004)	-0.0009*** (0.0004)
Age-dummy	X	X	X	X
Current partnership status (ref. Partner without depression)				
No partner		-0.0065*** (0.0010)	-0.0046*** (0.0010)	-0.0037*** (0.0011)
Partner with Depression		-0.0309*** (0.0002)	-0.0253*** (0.0003)	-0.0247*** (0.0003)
Partner order			0.0189*** (0.0001)	0.0195*** (0.0001)
Own education (ref. Basic)				
Secondary				-0.0061*** (0.0004)
Tertiary				0.0147*** (0.0005)
<i>N (person-years)</i>	2,628,495	2,628,495	2,628,495	2,628,495
pseudo R <sup>2</sup>	0.031	0.041	0.068	0.075
BIC	763369	755330	734027	728197

**Table A7**

Depression and likelihood of having a child. Discrete time event history analysis with AME and *without* excluding individuals who had depression and gave birth in the same year.

	Women	Men
Own depression	-0.0187*** (0.0006)	-0.0027*** (0.0005)
Age-dummy	X	X
Current partnership status (ref. Partner without depression)		
No partner	-0.0429*** (0.0003)	-0.0496*** (0.0003)
Partner with depression	-0.0069*** (0.0009)	-0.0242*** (0.0006)
Partner order	0.0061*** (0.0002)	0.0045*** (0.0002)
Own education (ref. Basic)		
Secondary	-0.0083*** (0.0004)	-0.0047*** (0.0003)
Tertiary	0.0083*** (0.0005)	0.0033 (0.0004)
<i>N</i>	123,980	129,269

Note: All variables fully time-varying. \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

**Table A8**  
Depression and likelihood of having a child. Results presented as hazard ratios.

	Women	Men
Own depression	0.5214 [0.5035,0.5399]	0.9810 [0.8392,0.9039]
Current partnership status (ref. Partner without depression)		
No partner	0.0893 [0.0869,0.0918]	0.0458 [0.0443,0.0472]
Partner with depression	0.8560 [0.8124,0.8881]	0.5248 [0.5058,0.5444]
Partner order	1.0174 [1.0066,1.0284]	1.0086 [0.9971,1.0202]
Own education (ref. Basic)		
Secondary	0.5873 [0.5731,0.6018]	0.7607 [0.7451,0.7767]
Tertiary	0.6956 [0.6779,0.7138]	0.8349 [0.8160,0.8542]
N	123,980	129,269

95% confidence intervals in brackets.

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