



Research paper

Association between neighborhood socioeconomic status and healthcare utilization among individuals with a first diagnosis of major depressive disorder in primary care in the Stockholm region

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ARTICLE INFO

Keywords:

Major depressive disorder
Neighborhood
Socioeconomic status
Healthcare utilization
Antidepressant

ABSTRACT

Background: Population-based surveys suggest that low socioeconomic status (SES) is associated with higher prevalence of depressive symptoms, while their healthcare utilization is not necessarily higher.

Objective: To investigate the association between neighborhood socioeconomic status (NSES) and healthcare utilization among individuals diagnosed with major depressive disorder (MDD).

Method: This was a retrospective longitudinal study of all adults with a first MDD diagnosis within primary care during 2010–2018. NSES was defined by the household area of residence using the Mosaic™ classification. Outcomes were AD (antidepressants) (N06A) dispensation and psychiatric outpatient visit, both of which are outlined as options in depression guidelines. Cox multivariable regression was used for the time to event analyses.

Results: A total of 117,193 individuals were included, of which 87,499 (75 %) were dispensed an AD and 35,989 (31 %) had a recorded psychiatric outpatient visit. Low NSES was associated with lower rate of AD dispensation in the first-year post-diagnosis (HR: 0.95, 95 % CI: 0.93–0.96, $p < 0.001$) and higher rate of psychiatric visit (HR: 1.10, 95 % CI: 1.07–1.12, $p < 0.001$) compared with high NSES.

Limitations: Data sources have high coverage. A minority of psychiatric care provided by non-publicly financed providers was not included. It was not possible to adjust for depression severity.

Conclusion: Socioeconomic status as measured by the neighborhood of residency was associated with AD dispensation and psychiatric outpatient visit in MDD, also in a healthcare system with virtually free access. This is of relevance for clinical practice, considering the focus on equity of care and the increase in depression prevalence worldwide.

Research paper

1. Introduction

Depression is estimated to affect approximately 5 % of the adult population and is a leading cause of disability (WHO, 2023). In Sweden, depression is the most common psychiatric diagnosis, and 3.3 % of all adults reported that they had received a depression diagnosis in the previous year (Folkhälsomyndigheten, 2023). Similar to other countries,

depression is mainly diagnosed and treated in primary care (Tylee and Jones, 2005; Harman, 2006). Although, individuals can self-refer to specialist psychiatric care, the majority are referred by a general practitioner, as stipulated by guidelines, after a minimum of two failed treatments, or if other complicating factors are present (Region Stockholm, 2019). Antidepressants (AD), in particular, SSRIs are recommended as first line of treatment for moderate to severe depression within primary and specialist psychiatric care. In an EU-based study, Sweden reported close to the EU average of 7.2 % in the percentage of

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<https://doi.org/10.1016/j.jad.2024.06.074>

Received 1 February 2024; Received in revised form 19 April 2024; Accepted 19 June 2024

Available online 22 June 2024

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individuals who reported using AD in the last 12 months (Lewer et al., 2015).

Equity of care is the absence of unfair, avoidable or remediable differences among groups of people and has been a central component of Swedish healthcare for decades (WHO, 2010; Sveriges Riksdag, 1982). Social inequalities are associated with mental disorders globally, with poor and disadvantaged individuals being disproportionately affected (Allen et al., 2014). Recent reports from Sweden have highlighted increasing inequities based on social status as well as sex and age, affecting both general health levels and access or utilization of healthcare (Socialstyrelsen, 2011; Regeringskansliet, 2018; Folkhälsomyndigheten, 2019). Self-reported mental health issues, including depressive symptoms are prevalent, particularly among individuals with low socioeconomic status (SES) (Giebel et al., 2020; Butterworth et al., 2013; Freeman et al., 2016; Alegria et al., 2000). Mental health issues, including major depressive disorders (MDD) are often left undiagnosed and untreated and although this is of a particular issue within the developing countries also in other countries where healthcare access is higher, gaps between expected needs and utilization exist (Kohn et al., 2004).

A recent Swedish report highlighted that SES, based on the area of residence, can affect the likelihood of being diagnosed with depression (Åhlén et al., 2022). In areas with low SES, self-reported depressive symptoms were more common, but the proportion of individuals actually diagnosed with depression was the same as in wealthier areas (Åhlén et al., 2022).

However, there is still inconsistent evidence regarding low SES and whether it is associated with higher or lower rates of depression diagnoses and healthcare utilization. Two Swedish longitudinal population-based studies found that low SES was linked with higher risk of having a depression diagnosis as well as higher use of AD (Andersson, 2011; Crump et al., 2011). Another population-based study found that low SES among men was linked with lower rate of AD, while for women there was no association (Kivimäki et al., 2007).

In epidemiological studies, AD use is most commonly used as a proxy for utilization, while psychiatric outpatient visit is less frequently reported (Crump et al., 2011; Andersson, 2011; Annequin et al., 2015; Kivimäki et al., 2007; Halonen et al., 2018; Freeman et al., 2016). SES is most often operationalized by individual factors such as income or education, but neighborhood characteristics have also been shown to be associated with prevalence of depressive symptoms as well as the likelihood of being diagnosed and to receive AD treatment (Mair et al., 2008; Crump et al., 2011; Julien et al., 2012). Neighborhood characteristics are often collected by means of census or other types of surveys, where the population is split into smaller geographical units and classified by neighborhood socioeconomic status. Variables used in the classification include education, income, unemployment, welfare assistance, home ownership but also structural components of an area such as walkability or safety related issues for example level of crime or drug use (Crump et al., 2011; Mair et al., 2008; Julien et al., 2012).

MDD, which is commonly diagnosed and managed in primary care, is associated with higher healthcare utilization compared to healthy individuals, especially in patients who have not responded to previous treatments or have complicated symptoms (Lundberg et al., 2022; Lundberg et al., 2023).

Despite a continued focus on equity, there is limited data on how healthcare utilization specifically among individuals where MDD has been diagnosed by a medical professional, is impacted by their SES as well as sex and age.

Aligned with the aims of the present study, only one previous study was found, which analyzed healthcare utilization rates in individuals with a depression diagnosis recorded by a medical professional and categorized SES based on neighborhood characteristics. This study found that low SES was associated with a slightly higher rate of any AD treatment compared to high SES (Lauzier et al., 2018). However, there was no association when only first line AD was considered (Lauzier

et al., 2018). Another study found that unemployed individuals with depressive symptoms were more likely to be prescribed an AD by their general practitioner instead of being referred to a specialist, suggesting potential differences in treatment based on employment status (Comino et al., 2000).

In Sweden, healthcare is universally accessible to all residents with minimal co-payments covering prescribed treatments, healthcare visits, and hospitalizations. In this inclusive system, access and choice should not be primarily driven by financial barriers and as such it provides an ideal environment for studying the effects of SES on healthcare utilization.

1.1. Study aim

The aim of the present study was to analyze the association between neighborhood socioeconomic status (NSES), as measured by a neighborhood composite score based on area of residency, and healthcare utilization measured as the date of their first AD dispensation and their first specialist psychiatric outpatient care visit after the first MDD diagnosis recorded within primary care.

Specifically, this study aimed to answer: (1) How do rates of AD dispensation and specialist psychiatric outpatient visit among individuals diagnosed with MDD in primary care within low NSES areas, compare with those in high NSES areas? (2) How does sex and age at first MDD diagnosis modify the association between NSES, AD dispensation and specialist psychiatric outpatient visit?

2. Materials and methods

2.1. Data sources

The population and the dataset (Stockholm MDD Cohort, SMC) for this retrospective longitudinal study has been previously described (Lundberg et al., 2022). The data was obtained from the regional healthcare data warehouse (VAL database) and Electronic Health Records (EHRs) in the Region of Stockholm (Cars et al., 2013). The VAL database is the largest regional care database in Sweden and includes information from all residents in the Stockholm region, which is approximately 2.3 million people. However, visits made by patients to private practitioners without public funding were not included in the data, accounting for approximately 6 % of all outpatient physician visits. Individual data was collected using personal identity numbers unique to each Swedish citizen, and it was analyzed in a pseudonymized format (Ludvigsson et al., 2009) to protect the privacy. The study protocol was approved by the regional ethics committee, Stockholm (No: 2018/546–31).

2.2. Study population

The study population included all adults, aged 18 and above, residing in the Stockholm region with a first recording in primary care between January 1, 2010, and December 31, 2018 of unipolar major depressive disorder (MDD) identified by ICD-10 codes F32 (depressive episode) and F33 (recurrent depressive episode). The F33 code was included, despite the recurrent definition, since physicians are known to use F32 and F33 interchangeably.

Exclusion criteria were no valid Swedish Personal Identity Number (PIN), resident in Region Stockholm <12 months prior to diagnosis, first MDD diagnosis recorded within any other healthcare level than primary care, recording of psychosis (ICD-10: F20-F29), bipolar disorder (ICD-10: F31), manic episode (ICD10: F30), or dementia (ICD-10: F00-F03) in order to exclude more complex clinical aetiology (Fig. 1). Individuals with missing information of the main exposure variable (NSES) were excluded.

Individuals with AD and psychiatric outpatient visit (but where MDD was not recorded) prior to MDD diagnosis were included in the main

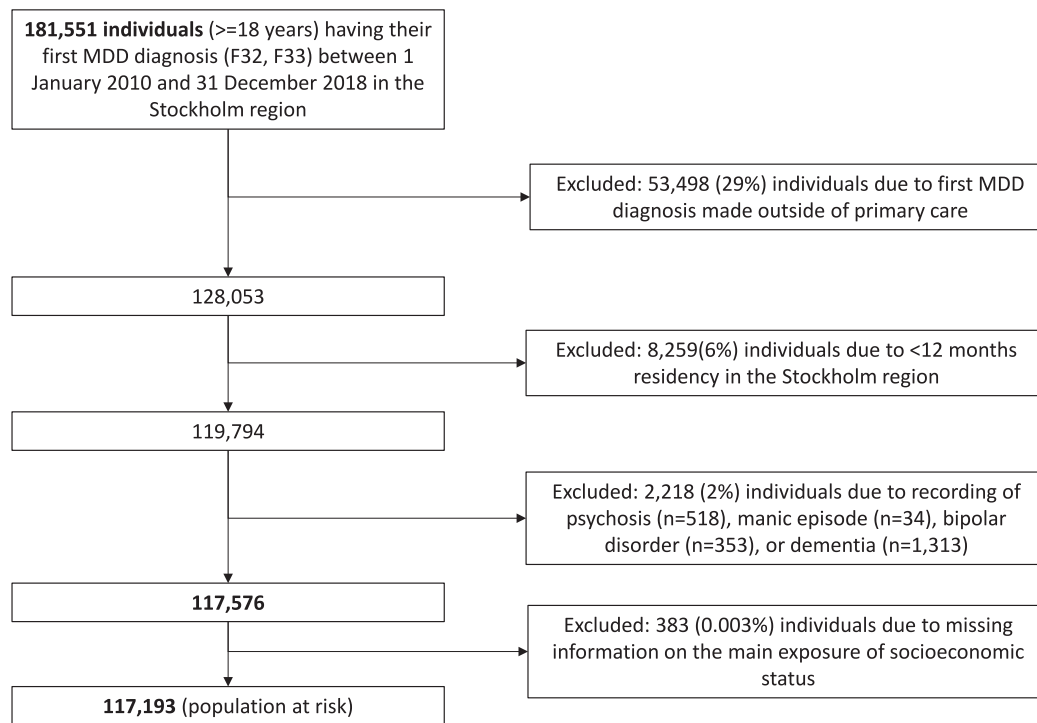


Fig. 1. Flowchart of the establishment of the study population.

analysis, which is motivated by the slow onset of depression and treatment of co-morbid conditions (Lundberg et al., 2022).

2.3. Outcome definitions

The outcome variables were: first AD dispensation of ATC-code N06A (antidepressants) and first recording of specialist psychiatric outpatient visit after the first diagnosis of MDD. These outcomes were chosen, as they represent two different options for MDD patients diagnosed in primary care, both recommended in the guidelines for depression (Socialstyrelsen, 2021; Region Stockholm, 2019).

2.4. Exposure and co-variables

The NSES variable was based on the Mosaic system, which was originally developed by a marketing company (Experian™ Mosaic), in order to categorize consumers for improving sales activities. It is a country-specific geodemographic classification system that utilizes 100 statistical variables related to the demographics of the neighborhood such as education and family composition, economic data (income and wealth), urbanity (population density) and dwelling data (Dahlén et al., 2019). In the Stockholm region, there were 1345 areas defined with each area covering on average 1700 inhabitants. These areas were classified into 3 distinct socioeconomic groups of low (highest deprivation), middle and high SE (lowest deprivation) (Dahlén et al., 2019). The Mosaic segmentation has been utilized in other epidemiological studies as a way to measure socioeconomic status (Sharma et al., 2010; Dahlén et al., 2019; Strang et al., 2020; Wändell et al., 2022).

Other exposure variables were sex, age at diagnosis, year of diagnosis, prior AD dispensation, prior psychiatric outpatient and inpatient visit. The following prior psychiatric co-morbidities, recorded by any healthcare level within the past 5 years before a first depression diagnosis, were included: anxiety (F41), stress disorders (F43, excl. Post-traumatic stress disorder), intentional self-harm (X60-X84), sleep disorders (G47, F51), mental and behavioral disorders due to psychoactive substance use (F10-F19).

3. Statistical analysis

Patient characteristics were presented per NSES group as mean (SD) for age at diagnosis and as percentages for all categorical variables. A complete case analysis was employed, which meant exclusion of individuals where NSES group was missing. Censoring was noted at any of the following events: death, emigration from the region, or the end of the study period (December 31st, 2018). Follow-up for each patient was computed as time in days from date of diagnosis to censoring or event. For individuals with the event on the same day as the first MDD diagnosis, one day was added to ensure that these individuals could be included in the time to event analyses.

The association between NSES and each outcome was investigated using Cox regression time to event analyses producing adjusted Hazard Ratios (HR). The high NSES group was used as a reference category in all analyses. 95 % confidence intervals (CI) and *p*-values were reported. Statistical analyses were performed using Stata version 16.

3.1. Confounding and interaction analyses

The age at which individuals were diagnosed with MDD was divided into two groups: those diagnosed before the age of 65 (pre-state pension age) and those diagnosed after. Age at diagnosis, together with the individuals' sex was considered in the analysis as potential confounders, and interactions between these factors and the outcomes were explored. Other variables, such as prior diagnoses of psychiatric co-morbidities and prior healthcare utilization, were included in the model based on previous research findings. The outcome of interest prior to the index date was not included in the model to avoid issues of multicollinearity. Interaction was considered in the final analysis if the direction of the effect was different in the stratified groups.

The assumption of proportional hazards was assessed for each outcome using Schoenfeld residuals and Nelson-Aalen plots. Sensitivity analyses were conducted by excluding individuals who had a record of the outcome of interest before their first diagnosis of MDD.

The final Cox regression models for AD dispensation and psychiatric outpatient visits were adjusted for all other variables of sex, age at

diagnosis, prior stress diagnosis, prior anxiety diagnosis, prior sleep disorder diagnosis, prior intentional self-harm diagnosis, prior psychoactive substance use diagnosis and prior inpatient visit. AD dispensation was additionally adjusted for prior outpatient visit while the outcome of psychiatric outpatient visit was adjusted for AD dispensation.

For the analysis of AD dispensation, only data from the first year post-diagnosis were included, due to a violation of the proportional hazard assumption. The majority of AD dispensations occurred during this period (69 %). For the analysis of psychiatric outpatient visit, two additional fully adjusted models were created, stratifying by age at diagnosis (below and above 65 years) since there was evidence of interaction.

4. Results

During the nine-year study period, a total of 117,576 individuals were diagnosed with MDD in primary care. Study exclusion, as shown in Fig. 1, was mainly due to having a first MDD diagnosis outside of primary care (29 %). These individuals had similar distribution of NSES compared to the overall study population. Additionally, 6 % were excluded because they had resided in Stockholm for <12 months. Another 2 % were excluded because they had pre-specified co-morbidities such as psychosis, manic episode, bipolar disorder, or dementia, in order to include only those individuals with unipolar MDD. Lastly, 383 individuals (0.003 %) had missing information on NSES and were excluded from all analyses. This resulted in a population at risk of 117,193 individuals (Fig. 1).

The baseline characteristics of the individuals in the study are summarized in Table 1. Among the study participants, 37 % were in the low NSES group, 20 % were in the middle NSES group, and 43 % were in the high NSES group. A majority were female (65 %), with a mean age of 45.5 years. The most common psychiatric co-morbidities were stress

Table 1
Characteristics of study population by NSES (at first MDD diagnosis, unless stated).

Characteristics	Total 117,193 (100 %)	Low NSES 43,650 (37 %)	Middle NSES 22,961 (20 %)	High NSES 50,582 (43 %)
Gender				
Male	40,901 (35)	15,206 (35)	7853 (34)	17,842 (35)
Female	76,292 (65)	28,444 (65)	15,108 (66)	32,740 (65)
Age				
Mean (SD)	45.5 (18.2)	45.8 (18.3)	44.6 (18.2)	45.6 (18.1)
18–64 years	97,424 (83)	36,171 (83)	19,290 (84)	41,963 (83)
≥65 years	19,769 (17)	7479 (17)	3671 (16)	8619 (17)
Year of first MDD diagnosis				
2010–2012	38,892 (33)	14,923 (34)	7523 (33)	16,466 (32)
2013–2015	40,297 (34)	14,806 (34)	7822 (34)	17,669 (35)
2016–2018	38,004 (32)	13,921 (32)	7616 (33)	16,467 (33)
Diagnosis of psychiatric co-morbidities (recorded within 5 years PRIOR to first MDD diagnosis)				
Stress disorders	26,616 (23)	10,026 (23)	5303 (23)	11,287 (22)
Anxiety disorders	25,085 (21)	9625 (22)	5174 (23)	10,286 (20)
Sleep disorder	18,547 (16)	7326 (17)	3569 (16)	7652 (15)
Intentional self-harm	442 (0.4)	206 (0.5)	87 (0.4)	149 (0.3)
Psychoactive substance use	5973 (5)	2555 (6)	1162 (5)	2256 (5)
Other events (recorded at any point during the study period)				
All-cause mortality	5919 (5.1)	2455 (5.6)	1198 (5.2)	2266 (4.5)
Emigration	9156 (7.8)	3523 (8.1)	1843 (8.0)	3790 (7.5)

NSES = neighborhood socioeconomic status, AD = antidepressant (N06A).

disorders (23 %) and anxiety (21 %) for both the total population and the subgroups based on NSES status. When comparing the low NSES group with the high NSES group, there were no differences in terms of sex, age distribution, or in the distribution of the year of their first MDD diagnosis. However, the low NSES group had higher proportions of prior psychiatric co-morbidities compared to the high NSES group across all diagnoses. Additionally, the low NSES group had higher rates of all-cause mortality (5.6 % vs. 4.5 %) and emigration (8.1 % vs. 7.5 %) compared to the high NSES group.

A total of 27 % had an AD dispensed prior to MDD diagnosis, while prior psychiatric outpatient visit was recorded by 9 % of the total population (Table 2). There were small differences between the NSES groups in the healthcare utilization both before and after their first MDD diagnosis.

4.1. Antidepressant dispensation

Table 2 presents the findings regarding AD dispensation in the study population. Out of the total population, 75 % (87,499 individuals) were prescribed at least 1 AD at some point after their MDD diagnosis. Within the first year, 69 % of the population received their first AD prescription. The overall rate of AD dispensation in the study population was 66.1 per 100 person-years.

When adjusting for all other variables (Fig. 2), the low NSES group had 5 % lower rate of AD dispensation compared with the high NSES group in the first year after diagnosis (HR: 0.95, 95 % CI: 0.93–0.96, $p < 0.001$). Females had a 7 % lower rate of AD compared to males (HR: 0.93, 95 % CI: 0.92–0.94, $p < 0.001$). On the other hand, older age was associated with a 54 % higher rate of AD dispensation compared to the younger age group (HR: 1.54, 95 % CI: 1.52–1.57, $p < 0.001$).

When excluding individuals with an AD dispensation (27 %) at any point prior to their first MDD diagnosis as part of a sensitivity analysis, the low NSES group maintained a lower rate of AD dispensation compared to the high NSES group (HR: 0.96, 95 % CI: 0.94–0.98, $p < 0.001$).

4.2. Psychiatric outpatient visit

In the study, approximately 31 % of the total study population

Table 2
Healthcare utilization of the study population.

Type of healthcare utilization	Total 117,193 (100 %)	Low NSES 43,650 (37 %)	Middle NSES 22,961 (20 %)	High NSES 50,582 (43 %)
Recorded PRIOR to first MDD diagnosis				
At least 1 AD (any point prior)	31,466 (27)	11,696 (27)	6004 (26)	13,766 (27)
At least 1 AD (any point prior), but no AD post diagnosis	3197 (2.73)	1323 (3.03)	621 (2.70)	1253 (2.48)
Psychiatric outpatient visit (within 12 months prior)	9965 (9)	3881 (9)	2066 (9)	4018 (8)
Psychiatric inpatient visit (within 12 months prior)	767 (0.65)	338 (0.77)	167 (0.73)	262 (0.52)
Recorded AFTER first MDD diagnosis				
At least 1 AD	87,499 (75)	32,463 (74)	16,994 (74)	38,042 (75)
Psychiatric outpatient visit	35,989 (31)	13,972 (32)	7315 (32)	14,702 (29)
Primary care visit, median (IQR)	4 (8)	5 (9)	4 (8)	4 (8)

NSES = neighborhood socioeconomic status, AD = antidepressant (N06A).

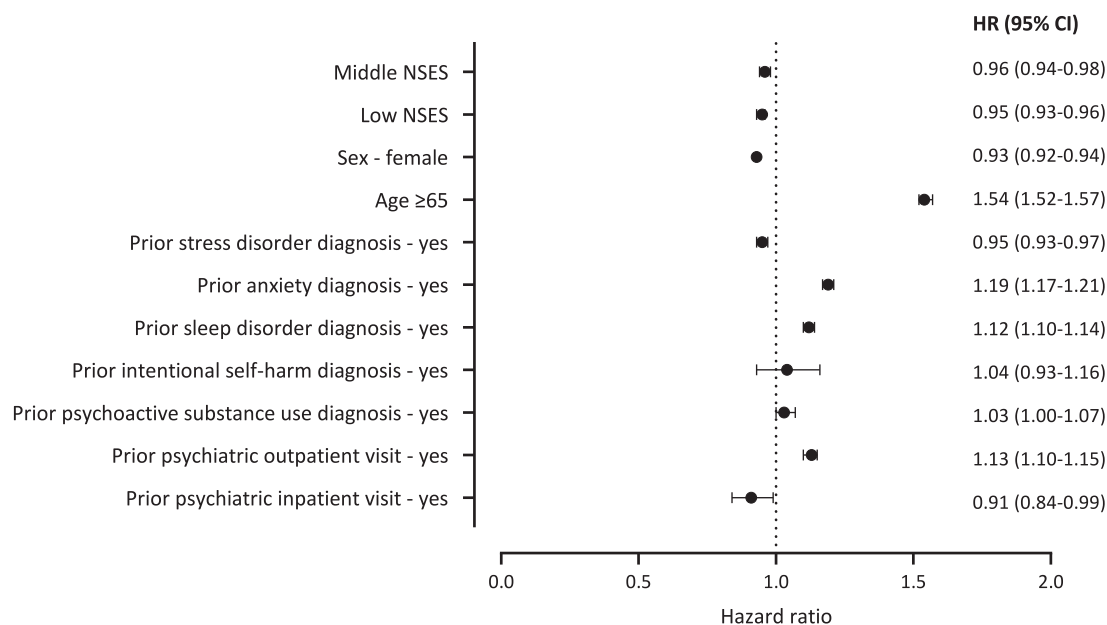


Fig. 2. Fully adjusted multivariable Cox regression: time to AD dispensation in the first year post-diagnosis for NSES adjusting for all other variables (hazard ratio, 95 % CI) (N = 117,193).

All variables listed have been adjusted for all the other variables. NSES = neighborhood socioeconomic status.

(35,989 individuals), had a specialist psychiatric outpatient visit at some point after their diagnosis. Within the first year, 20 % had their first outpatient visit. The overall rate of outpatient visits in the total population was 10.2 per 100 person-years.

In the total population (Fig. 3, full population A), when adjusting for all other factors, low NSES was associated with a 10 % higher rate of psychiatric outpatient visit compared to high NSES (HR: 1.10, 95 % CI: 1.07–1.12, $p < 0.001$). Being female and of older age was associated

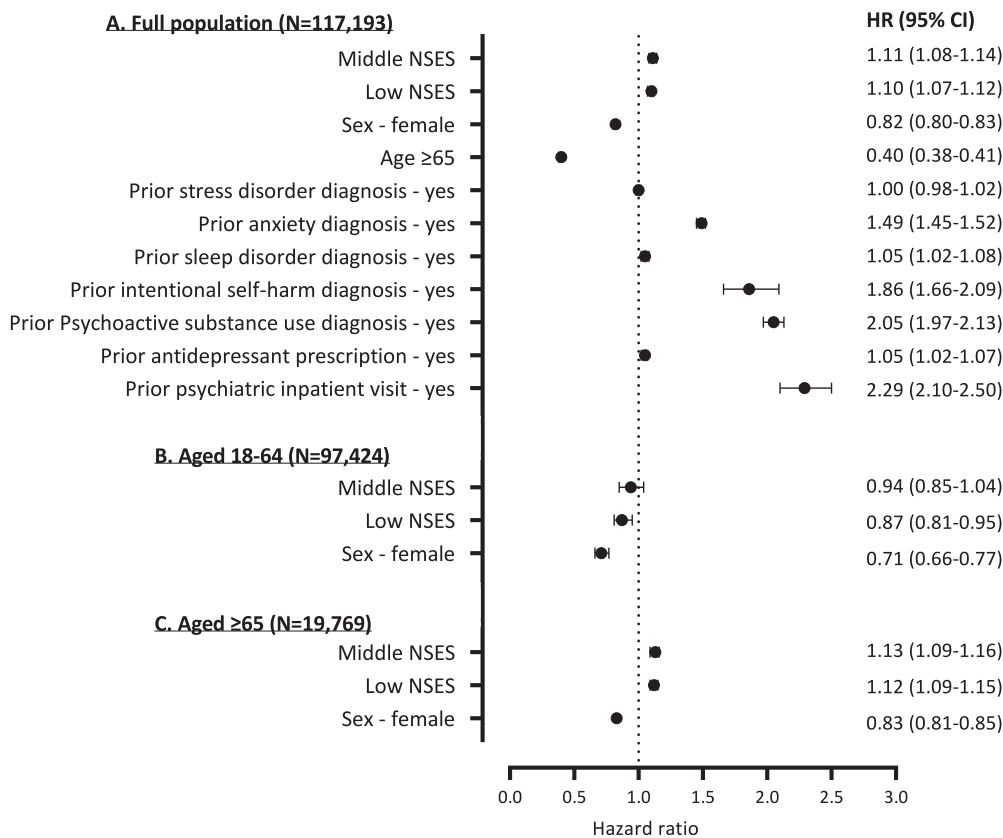


Fig. 3. Fully adjusted multivariable Cox regression: time to psychiatric outpatient visit for NSES adjusting for all other variables (hazard ratio, 95 % CI).

All variables listed in all 3 models have been adjusted for all the other variables (as listed in model A). A. full population B. Individuals aged 18–64C. Individuals aged ≥65. AD = antidepressant, NSES = neighborhood socioeconomic status.

with a 18 % (HR: 0.82, 95 % CI: 0.80–0.83, $p < 0.001$) and 60 % (HR: 0.40, 95 % CI: 0.38–0.41, $p < 0.001$) lower rate of psychiatric visit, respectively. Previous diagnosis of anxiety, intentional self-harm, psychoactive substance use, and prior inpatient care were all associated with higher rate of psychiatric outpatient visit.

Among younger individuals (Fig. 3, population B), those in the low NSES group had a 13 % lower rate of outpatient visit compared to those in the high NSES group (HR: 0.87, 95 % CI: 0.81–0.95, $p < 0.001$). However, in the older age group (Fig. 3, population C), the low NSES group had a 12 % higher rate of outpatient visits (HR: 1.12, 95 % CI: 1.09–1.15, $p < 0.001$). Both younger and older females had a lower rate of psychiatric outpatient visit compared to males, with a 29 % lower rate in younger individuals and a 17 % lower rate in older individuals.

In the sensitivity analysis excluding individuals (9 %) with a psychiatric outpatient visit within 12 months prior to diagnosis, the low NSES group maintained a higher rate of visit compared with the high NSES group (HR: 1.18; 95 % CI: 1.15–1.22, $p < 0.001$).

5. Discussion

The aim of this study was to examine how neighborhood socioeconomic status (NSES) is related to healthcare utilization among individuals diagnosed in primary care with major depressive disorder (MDD). We found that individuals living in low NSES areas were less likely to receive antidepressant (AD) within the first year after their MDD diagnosis compared to those in high NSES areas. However, individuals in low NSES areas were more likely to visit a specialist psychiatric outpatient clinic, regardless of their sex, age, and prior psychiatric co-morbidities.

There is prior evidence suggesting that depressed individuals from lower socioeconomic groups have worse prognosis and treatment outcomes, which could explain the higher rate of psychiatric care (Buckman et al., 2022). Additionally, higher mortality rates in low SES groups as seen in this study as well as other studies could indicate higher severity and complexity (Kivimäki et al., 2007). Added complexity could make general practitioner more inclined to refer a patient to psychiatric care.

This does not however explain the lower rate of AD for the low NSES group. Previous research, which in contrast to this study are mainly population-based studies with individuals who have not sought care, generally points towards a higher AD rate among low SES individuals, apart from one study where men with low SES were less likely to receive an AD (Crump et al., 2011; Lauzier et al., 2018; Kivimäki et al., 2007). There could be several explanations for the lower rate of AD in the low NSES group such as differential attitudes towards AD, differential access to other forms of healthcare or as hypothesized in an earlier publication, high socio-economic groups may demand mental health treatment and prescriptions to a different degree (Kivimäki et al., 2007).

The proportion of individuals with an AD dispensation in this study (75 %) was slightly lower compared to another study conducted in a different region in Sweden, where 80 % were prescribed an AD within the first year after diagnosis (Andersson, 2011).

In this study, 20 % of individuals had a psychiatric outpatient visit within the first year, which is the same percentage referred to in the Swedish national guidelines of patients receiving a referral to specialist care (Socialstyrelsen, 2021). A previous publication using the same data found a slightly lower percentage of referrals, but that analysis only considered visits where a depression diagnosis was formally recorded (Lundberg et al., 2022), indicating that psychiatric disorders other than MDD, may contribute to the morbidity of these patients. Despite Sweden, and Stockholm in particular, having a high number of psychiatrists per inhabitants, similar rates of first visit within the first year were found in other international studies ranging from 16 % to 58 % (Piek et al., 2011; Kravitz et al., 2006; Titzler et al., 2020). When looking at the two different age groups, we observed that individuals with low NSES in the below 65 years of age group had a lower rate of psychiatric outpatient visit compared to those with high NSES, i.e. the opposite to the full study

population. For the outcome of AD dispensation, there was no difference between the age groups and the full study population.

Our study found that women diagnosed with MDD were less likely than men to receive AD treatment and specialist psychiatric outpatient care. This finding is interesting since more women are diagnosed with depression and, on a group-level irrespective of their diagnosis, women use nearly twice as many AD treatments as men do (Lejtzén et al., 2014; Socialstyrelsen, 2023). Prior research shows that self-rated mental health is similar among men and women, but men seek care to a lesser extent than women (Åhlén et al., 2022). However, in this study since all individuals already had sought care for their depression, other factors may impact the difference in treatment patterns. A similar result was found in a previous Swedish study where the odds of being prescribed an AD was higher for men compared with women (Lytsy et al., 2019). Although previous research is scarce and inconsistent, there may be differences by gender in the preference for different treatment modalities where females have a stronger preference for psychotherapy (Houle et al., 2013). Psychotherapy was not investigated in this study due to low coverage in the existing databases.

We also observed that older age was associated with a higher use of AD but a lower rate of psychiatric outpatient care visit. This suggests that older individuals may not have the same level of access to specialist psychiatric care or that they utilize other healthcare options that were not considered in our study, such as geriatric specialist care, psychotherapy, or continued care from their general practitioner. Furthermore, individuals with previous diagnoses of psychiatric co-morbidities and a history of inpatient care had a higher rate of psychiatric outpatient visit, which aligns with regional guidelines recommending referral in the presence of complicating factors (Region Stockholm, 2019).

5.1. Strengths and limitations

A major strength of this study was the population-wide cohort created by linkages through personal identification numbers in a country with virtually free healthcare access, which meant low missingness. Another strength of the study is that it included individuals diagnosed with depression in primary care, which is where a majority of individuals in Stockholm receive their initial diagnosis (Lundberg et al., 2022). It is worth noting that the distribution of neighborhood socioeconomic status (NSES) among the excluded population, who were diagnosed outside of primary care, was similar to the total study population.

One limitation of the study was the inability to account for the severity of depression, since the codes and symptom rating scales used to indicate severity are rarely recorded in the data sources. This may bias the results, particularly if the severity differs by NSES status, since the use of AD and psychiatric care would likely increase with the severity of depression (Sun et al., 2018). The data sources used generally have a very high coverage (Wettermark et al., 2007), but approximately 6 % of all outpatient psychiatric visits, i.e. those provided by pure private caregivers would not be captured in this analysis. Individual-level data for dispensations was only available from July 1st 2010, which meant for a small proportion of individuals (<6 %) diagnosed prior to this, any dispensations made in their first 6 months would not be included in the analysis. The use of other drugs besides SSRI (N06A) is likely to be low, since this is the recommended and the most common first line treatment class (Socialstyrelsen, 2021). A second line AD treatment would only be relevant for those individuals with a dispensation prior to diagnosis and who stop their dispensation post-diagnosis, which was only found in 3 % of the individuals in this study.

The inclusion of any psychiatric outpatient visits post diagnosis, even if a depression diagnosis was not recorded, may have inflated the number of visits related to depression. However, it is unlikely that this would differ by socioeconomic status, age or sex.

The NSES exposure variable was only measured at the beginning of the study, hence any changes in NSES over time were not taken into

account. Using neighborhood demographics as a proxy for socioeconomic status may have limitations, as it assumes that all individuals in an area have the same characteristics, which may only be partially true. The Mosaic classification has the advantage of being based on a large number of variables, all of which were recorded in patient records. The regression analysis included individual-level variables such as age, gender, psychiatric co-morbidities, and time since diagnosis, to at least partly separate individual-level effects from neighborhood-level effects. However, there may still be some residual confounding due to a lack of additional individual-level data. Reverse causation could not be ruled out, where individuals with complex mental health issues move to low NSES areas due to economic constraints, which may inflate healthcare utilization levels related to mental health in those areas.

6. Conclusion

Based on the findings of this extensive study conducted in Sweden, it is suggested that access to healthcare for individuals diagnosed with major depressive disorder (MDD) may be influenced by socioeconomic factors, including the neighborhood in which they reside in addition to individual factors such as gender and age. This holds true even in publicly funded healthcare systems such as in Sweden. The study further suggests that special attention should be given to ensuring equitable care following their depression diagnosis for younger and middle-aged women living in low socioeconomic areas. However, the reasons behind these disparities in healthcare utilization cannot be determined based on this study, more specifically whether this is due to differences in individuals' healthcare-seeking behaviors, treatment preferences, or healthcare professionals' treatment approaches. Further research is needed to understand the underlying reasons and ensure that individuals in need of depression care receive treatment regardless of their socioeconomic background.

CRedit authorship contribution statement

Anna Gannedahl: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Conceptualization. **Carl Björkholm:** Writing – review & editing, Conceptualization. **Amy Leval:** Writing – review & editing, Methodology. **Thomas Cars:** Writing – review & editing, Methodology, Data curation. **Clara Hellner:** Writing – review & editing. **Johan Lundberg:** Writing – review & editing, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

During the final preparation of this work the author used ChatGPT3.5 in order to improve the fluency of the language. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Anna Gannedahl reports a relationship with Janssen Cilag AB that includes: employment. Amy Leval reports a relationship with Janssen Cilag AB that includes: employment and equity or stocks. Carl Björkholm reports a relationship with Janssen Cilag AB that includes: employment. Johan Lundberg reports a relationship with Janssen Cilag AB that includes: speaking and lecture fees. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

We would like to express our thanks to Karolinska University Hospital, Danderyds sjukhus AB, Södersjukhuset AB, TioHundra AB, Södertälje sjukhus, Stockholms läns sjukvårdsområde (SLSO), and to the public Health Care Services Administration for providing data for this study.

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