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Impact of socioeconomic position on symptoms of depression and subsequent mental health care treatment: a Danish six-month register-based follow-up study on a population survey.

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Impact of socioeconomic position on symptoms of depression and subsequent mental health care treatment: a Danish six-month register-based follow-up study on a population survey.

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Transparency declaration
Aake Packness affirms that this manuscript is an honest, accurate, and transparent account of the study being reported, that no important aspects of the study have been omitted, and that any discrepancies from the study as planned have been explained.

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Abstract

Objective: The objective was to examine whether the severity of symptoms of depression was determining the type of mental health care treatment received, and if this relationship was influenced by socioeconomic position (SEP).

Design: Register-based follow-up study on participants from the Danish General Suburban Population Study (GESUS) 2010 - 2013, who had scored the Major Depression Inventory (MDI).

Participants: Of the 21,253 respondents in GESUS, 19,011 were included.

Interventions: Mental health care treatment of the participants was tracked in national registers for four months prior and six months after their MDI-score. Health care treatment was graduated in levels. SEP was defined by years of formal education: none; short; medium/long. Data was analysed using logistic and Poisson regression analyses.

Outcomes: Mental health treatment included number of contacts to: general practitioner (GP), Mental Health Counselling by GP, prescriptions of antidepressants, psychologist, psychiatrist, emergency contacts and admissions to mental hospital.

Results: 988 (5.2%) had symptoms of depression, whereof those in health care contact there was no difference across the educational groups in use of services. However, of the 547 respondents with symptoms of moderate/severe depression, 10% had no treatment contacts at all, and 47% had no treatment beyond GP consultation in the study period. Among respondents with no/few symptoms of depression, longer education was associated with having more contact to specialized services (odds ratio OR 1.92; 95% confidence interval CI 1.18 – 3.13) and fewer prescriptions of antidepressants (OR 0.69; CI 0.50 – 0.95) compared to those without education.

Conclusion: We found no indication of inequity in treatment of participants with symptoms of depression, but inequity in treatment of respondents with no/few symptoms of depression: high SEP was referred to specialist services, whereas low SEP more likely was treated with antidepressants. Half the participants with moderate/severe symptoms had no treatment beyond GP consultation.

The study was approved by The Danish Data Protection Agency J. nr. 2015-41-3984.
Accessible at: https://www.datatilsynet.dk/fortegnelsen/soeg-i-fortegnelsen/

Strengths and limitations of this study:

- The design of this study, combining data from a population survey on symptom-score with prospective register data on health care use and medication, is unique in health service research on treatment of people with symptoms of depression.
- The study design made it possible to reduce the inherent problem of recall bias in these types of studies.
- The limited number of health care contacts beyond GP forced us to group symptom-categories and treatment types in order to gain power in the analysis, whereby some accuracy could have been lost.
- The actual reasons for treatment contacts or for prescription of antidepressants were not known and could potentially have been caused by other disorders than depression.

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Title:

Impact of socioeconomic position on symptoms of depression and subsequent mental health care treatment: a Danish six-month register-based follow-up study on a population survey.

Introduction

The principles of equal access to health care based on need and reduction of inequalities in health are major policy objectives in most OECD countries[1]. Similarly, the World Health Organization states that addressing social inequalities contributes significantly to health and well-being[2].

Sustained economic hardship leads to poorer physical, psychological, and cognitive functioning[3], and social deprivation is associated with more prevalent mental health problems[4]. Specifically, depressive disorders are more prevalent among people in low socioeconomic position (SEP)[5] and enhanced by worsening socioeconomic circumstances[6]. In addition to this, depression is a major health problem, globally ranked as the single largest contributor to non-fatal health loss by 7.5% of all *Years Lived with Disability*[7]. It is estimated that life expectancy is reduced by 14 years for men and 10 years for women treated for severe depression[8].

Equity in access to health care is commonly defined as equal access for equal need. However, both *access* and *need* are ambiguous concepts[9]. It has been documented that patients in high SEP use more specialized health care services[10;11], also within mental health care[12], and far from all in need of mental health care receive it[13-15]. Additionally, not all users of mental health care are in clinical need[16].

The fact that depressive disorders are widespread and more common among persons in lower SEP makes these disorders well suited for evaluating the capability of health care systems to address the need of deprived citizens. At the same time, being a serious disorder with extensive personal, social and economic consequences makes treatment of depression an important issue.

Objectives

We aimed to evaluate whether the Danish health care system delivers equal treatment to patients with symptoms of depression. We defined *mental health care treatment* by specific health care services related to the treatment of depressive disorders as well as treatment with antidepressants.

The objective was to examine if the severity of symptoms of depression (need) was determining the mental health care treatment received, independently of SEP, in both type and frequencies of treatments within six months following a symptom score received in a survey study.

Method

Setting – Danish health care system

Health care is tax-funded in Denmark and free at delivery, except dental care and psychologists for adults, which are partly subsidized[17]. The general practitioner (GP) acts as a gatekeeper to more specialized care. Treatment by a psychologist is subsidized for patients with specific conditions, such as reaction to specific traumatic events, moderate depression and, specifically for citizens between 18 and 38 years old, also moderate anxiety disorders. In 2014, the down payment was equivalent to 44€ for each session[18]. The psychologist needs a special authorization by the Danish Supervisory Board of Psychological Practice in order to be subsidized.

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Study population and data sources

The study was conducted as a follow-up study on mental health care utilization and use of antidepressants by the participants who scored high on symptoms of depression in the Danish General Suburban Population Study (GESUS)[19] in the municipality of Næstved, Denmark. The municipality is positioned 90 km south of the capital Copenhagen. It has a total population of 81,000 and a socioeconomic index score 4% lower than the national average in 2013[20]. The GESUS data were collected from January 2010 until October 2013. All citizens above the age of 30 were invited, as were a random selection of ¼ of citizens between 20 and 30 years of age. The study consists of 21,253 participants, equivalent to 43% of the invited citizens.

Persons with permanent residence in Denmark are registered in the Danish Civil Registration System (CRS)[21] and are assigned a unique 10 digit identification number, Central Personal Register Number (CPR). The CPR number was registered in the survey data and thus gave information on age and gender and also made it is possible to identify the individual in all public registers in Denmark.

Data concerning vital status and migration were gathered from the CRS.

Linking by CPR, the use of healthcare and antidepressants was tracked in registers for four months (120 days) before and six months (180 days) after the respondents entered GESUS, or until their death or migration if that occurred before; thus, the sample consists of respondents entering the GESUS study from May 2010.

Independent variables

Data on all variables came from GESUS, except for outcome data and data on treatment at entry date.

Measure of need

Depression was chosen as an expression of need, with the Major Depression Inventory (MDI) as measurement tool. The MDI is based on the 12-item Likert scale and found to have an adequate internal and external validity for defining different stages of depression[22]. The MDI is based on the ICD-10 diagnostic criteria for depressive disorder[23], with scores ranging from 0 to 50. Mild depression is covered by scores from 21 – 25, moderate depression from 26 – 30 and severe depression by scores from 31 – 50[24]. In the study, we reduced the categories to three in order to gain statistical power: no/few symptoms (MDI 0 – 20), mild symptoms (MDI 21-25), and moderate/severe symptoms (MDI 26+). The grouping of symptoms of depression in two groups was supported by the recommended therapeutic approach at the time; patients with mild symptoms were recommended watchful waiting and maybe supportive consultations, whereas the recommended treatment of patients with moderate to severe depression was antidepressants and therapy by a psychologist or a psychiatrist[25]. If more than two items were missing in the MDI, the score was categorized as missing[26].

Socioeconomic position - Years of education

SEP is commonly measured by income, occupation, housing tenure, or education, where education is said to gain high response rates in questionnaires[27]. Education was chosen as a measure of SEP in this study, even though older age groups tend to have lower education, they also have lower incomes. Education was determined as: *None:* if the respondent did not study or fulfil any formal education after primary or upper secondary school; *Short*: for *Vocational* 1 – 3 years and *Academy Profession Graduate* 1 – 3 years; *Medium/long*: for Diploma Graduate 3 – 4 years; Academic Graduate ≥ 5 years. Students were categorized at the same level as the study would end up in, e.g. academic students would be categorized as academics.

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***Extrinsic variables*:**
Sociodemographic data covered, age, gender, marital status, cohabitation status.

Information on somatic comorbidity included: previous acute myocardial infarction (AMI), arteriosclerosis, angina pectoris, stroke, cancer, diabetes mellitus, hyper- or hypo-thyreosis. The somatic disorders were all grouped into one. Previous depressive episodes were registered separately.

Present medication covered self-reported use of antidepressants. Respondents defined as being *In treatment* included both participants who reported use of antidepressants and participants identified in registers, as described below, who had redeemed a prescription for antidepressants and/or had contact to a psychiatrist and/or a psychologist within four months prior to the date of returning the questionnaire with the depression score; in the following named as the *index date*.

Dependent variables
The outcome variables relate to the pathway to treatment of depression as recommended in the national guidelines at the time[25]. They are initiated by counselling and therapy by the GP, followed by a prescription of antidepressants, followed by referral to therapy at a psychologist, then followed by referral to treatment at a psychiatrist and, finally, by referral to outpatient or eventually to inpatient treatment at a psychiatric hospital. (defined by codes in Supplement table 1). Emergency visits to a mental hospital were included in the hospital contacts. The more severe or non-respondent the depression is, the higher the patient is supposed to reach in the recommended treatment hierarchy. Due to few observations in the separate levels, treatments by psychologists or psychiatrists, whether private or public, were pooled into one group for analysis.

Data on the utilization of private psychiatrists, psychologists, and general practitioners (GPs) were drawn from the Danish National Health Service Register for Primary Care[28]. For psychologists only the subsidized services are in the register. Respondents covered by private insurance and treated for depression or anxiety are included in the data as insurance agencies require referral from GPs to compensate for the patients extra expenses. Talk therapy by a GP consists of at least two talks within the first six months and up to seven talks within one year. Talk therapy is registered and paid as additional reimbursement to the GP. In the study, this service was termed as mental health counselling by a GP (MHC by GP). Topics for ordinary consultations by GP are not registered in the national registers.

Data on prescriptions for antidepressants (Anatomical Therapeutic Chemical (ATC) classification system N06A) were extracted from the Danish National Prescription Registry[29;30]. Bupropion (ATC N06AX12) was not included since it is only prescribed for smoking cessation in Denmark.

Information concerning public in- and outpatient psychiatric treatment was drawn from the Danish National Patient Register[31] (ICD-10 coded F00 – F99).

Statistical analyses
First, we estimated the association between SEP and the different binary outcome variables (that is, five different types of health care contact: *No health care contact*, *GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*) in separate logistic regression models, both uni- and multivariable. Each model was stratified into three MDI categories: no/few symptoms (MDI < 21), symptoms of mild depression (MDI 21 – 25), and symptoms of moderate to severe depression (MDI > 26)).

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The SEP category *No education* was used as reference category. To examine a possible interaction between SEP and MDI category, we employed logistic regression models for each outcome with patients having *No education* and no/*few depression symptoms* as key reference.

Second, in order to evaluate differences in visit and prescription rates, we estimated incidence rate ratios (IRR) by Poisson regression models for each type of contact (*GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*). For each type of contact, analyses were restricted to those patients who had at least one contact. For exposure, death and emigration within 180 days after index date were taken into consideration. As above, analyses were stratified into MDI category, and the SEP category *No education* was used as reference category.

Finally, we performed a linear regression analysis for the effect of combined SEP and MDI category on the highest reached treatment level (see Table 1 above). The treatment level was categorized as shown in table 1, (0: no treatment/contact; 1: GP consultation; 2: MHC by GP; 3: antidepressants; 4: psychologist; 5: private psychiatrist; 6: public psychiatrist; 7: psychiatric hospital). Patients having *No education* and *no/few depression symptoms* were the key reference groups.

All multivariable regression models included age (*20-59* versus *60+*), gender and present treatment with antidepressants, psychologist or psychiatrist (*yes/no*) in addition to the variable studied in the univariate (crude) analysis.

The significance level was 5% throughout, and all reported confidence intervals were 95% confidence intervals. All statistical analyses were performed using Stata 14[32].

Ethics

Access to data from the GESUS was approved by the board of the GESUS in December 2015. The data were stored at a server at Statistics Denmark. The collection and handling of the data has been approved by the Danish Data Protection Agency, Journal number: 2015-41-3984. Approval by an ethics committee is not required for register studies in Denmark.

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Results

The study included 19,011 respondents from the GESUS study, after being reduced by 1,627 respondents to fit the register timeframe for the present treatment and by 615 respondents who did not have a valid MDI score. In all, 988 (5.2%) had symptoms of depression. Of these, 441 had symptoms of mild depression and 547 symptoms of moderate and severe depression, whereof 271 were grouped severe. 29 deaths and four persons emigrating were included in the analysis until death or migration (flowchart in Supplement).

In the GESUS sample, respondents with no education were underrepresented by one third when compared to the population they were sampled from; those with a short education had a little higher representation and the proportion with longer education had an almost 30 percent higher representation, compared to the population in Næstved[33]. The educational status of respondents aged 70+ was almost similar to the status of the study population under 70 years.

The baseline characteristics show respondents with symptoms from mild to severe depression to be: younger, more singles, living without a partner, and without formal education (Table 1). More respondents had a prior history of depression and more had a comorbid somatic disorder.

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Table 1. Baseline characteristics of the study population by MDI grade

MDI score	All	MDI < 21	MDI 21 - 25	MDI 26+	MDI missing
Symptoms of depression	n (pct.)	None/few	Mild	Moder./severe§	NA
All	19626 (100)	18023 (100)	441 (100)	547 (100)	615 (100)
In treatment*					
No	18076 (92.1)	16860 (93.5)	334 (75.7)	335 (61.2)	547 (88.9)
Yes	1550 (7.9)	1163 (6.5)	107 (24.3)	212 (38.8)	68 (11.1)
Gender					
Male	8927 (45.5)	8349 (46.3)	162 (36.7)	168 (30.7)	
Female	10699 (54.5)	9674 (53.7)	279 (63.3)	379 (69.3)	
age group					
20-29	294 (1.5)	266 (1.5)	10 (2.3)	17 (3.1)	
30-39	2382 (12.1)	2206 (12.2)	79 (17.9)	86 (15.7)	
40-49	4186 (21.3)	3891 (21.6)	106 (24)	146 (26.7)	
50-59	4417 (22.5)	4100 (22.7)	115 (26.1)	144 (26.3)	
60-69	5123 (26.1)	4771 (26.5)	74 (16.8)	93 (17)	
70+	3224 (16.4)	2789 (15.5)	57 (12.9)	61 (11.2)	
Marital status					
Married	13398 (68.3)	12519 (69.5)	234 (53.1)	259 (47.3)	
Separated/divorced	2174 (11.1)	1936 (10.7)	71 (16.1)	117 (21.4)	
Widow/er	1385 (7.1)	1172 (6.5)	37 (8.4)	45 (8.2)	
Nothing of above	2669 (13.6)	2396 (13.3)	99 (22.4)	126 (23)	
Cohabitating					
No	4342 (22.1)	3745 (20.8)	147 (33.3)	217 (39.7)	
Yes (incl missing)	15284 (77.9)	14278 (79.2)	294 (66.7)	330 (60.3)	
Education					
None	2988 (15.2)	2502 (13.9)	93 (21.1)	136 (24.9)	
Vocational/1-3yrs (Short)	8227 (41.9)	7645 (42.4)	169 (38.3)	199 (36.4)	
Short/<3yrs (Short)	2156 (11)	2005 (11.1)	56 (12.7)	58 (10.6)	
Medium/3-4yrs (Medium-long)	5024 (25.6)	4706 (26.1)	104 (23.6)	137 (25)	
Academic/5+yrs (Medium-long)	1231 (6.3)	1165 (6.5)	19 (4.3)	17 (3.1)	
Comorb. former depression					
No	16755 (85.4)	15826 (87.8)	255 (57.8)	210 (38.4)	
Yes	2484 (12.7)	1917 (10.6)	173 (39.2)	319 (58.3)	
Missing	387 (2)	280 (1.6)	13 (2.9)	18 (3.3)	
Comorbidity somatic, all ¤					
No	13791 (70.3)	13109 (72.7)	195 (44.2)	168 (30.7)	
Yes	5835 (29.7)	4914 (27.3)	246 (55.8)	379 (69.3)	
Medication antidepressants #					
No	18537 (94.5)	17213 (95.5)	363 (82.3)	385 (70.4)	576 (93.7)
Yes	1089 (5.5)	810 (4.5)	78 (17.7)	162 (29.6)	39 (6.3)

§ Moderate or severe

* In treatment at index date or 120 days before by psychologist, psychiatrist, or with antidepressiva according to GESUS or register data

¤ Somatic comorbidities: Ischemic heart disease, diabetes, cancer, metabolic diseases

replied in questionnaire

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The crude number of contacts and mean number of visits shows overall more frequent visits by the group with symptoms of depression; though, of all 1,677 visits to specialized services, two thirds (65%) of the visits were by respondents with no/few symptoms of depression. (Supplement table 2)

Table 2 shows odds ratios for mental health care treatment contacts. Among respondents with symptoms of depression, there was no statistically significant difference across educational groups in odds for contacts and prescriptions in the adjusted analyses, except that those with short education and mild symptoms had a lower use of mental health counselling by GP (adjusted odds ratio (aOR) 0.30, confidence interval (CI) 0.10 – 0.91), compared to respondents without education. Among respondents with no/few symptoms, the group with longer education were 30% more likely to have no contact at all compared to the group without education (aOR 1.32, CI 1.18 – 1.49). They also had fewer consultations by GP (aOR 0.77, CI 0.68 – 0.86) and fewer prescriptions of antidepressants (aOR 0.69, CI 0.50 – 0.95), compared to those without education. However, they more often had contact to specialized services (aOR 1.92, CI 1.18 – 3.13), alongside those with short education (aOR 1.81, CI 1.13 – 2.88).

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Table 2: Odds ratios for type of *Mental health care treatment* by educational level stratified by MDI grade

Symptoms of depression	**No/Few** (N=18023 pts.)		**Mild** (N = 441 pts.)		**Moderate/severe** (N = 547 pts.)	
No health care contact	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	**1.26 (1.13–1.40)**	1.10 (0.98–1.23)	1.96 (0.91–4.22)	1.62 (0.71–3.67)	1.73 (0.79–3.77)	1.62 (0.72–3.65)
Medium/Long education	**1.54 (1.38–1.72)**	**1.32 (1.18–1.49)**	**2.38 (1.05–5.38)**	2.01 (0.84–4.83)	1.99 (0.87–4.55)	1.79 (0.76–4.23)
GP consultation						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	**0.80 (0.72–0.89)**	0.92 (0.82–1.02)	0.52 (0.26–1.06)	0.64 (0.31–1.35)	0.68 (0.35–1.31)	0.70 (0.36–1.37)
Medium/Long education	**0.66 (0.59–0.74)**	**0.77 (0.68–0.86)**	**0.46 (0.21–0.97)**	0.54 (0.24–1.19)	0.69 (0.34–1.41)	0.74 (0.36–1.53)
GP Mental health counseling						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	1.20 (0.84–1.71)	1.09 (0.76–1.57)	**0.34 (0.12–0.97)**	**0.30 (0.10–0.91)**	1.20 (0.61–2.33)	1.27 (0.65–2.50)
Medium/Long education	1.31 (0.90–1.89)	1.21 (0.83–1.76)	1.26 (0.50–3.17)	1.03 (0.38–2.81)	1.23 (0.59–2.55)	1.30 (0.62–2.73)
Antidepressants						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	0.85 (0.71–1.01)	0.75 (0.55–1.01)	0.96 (0.52–1.77)	1.11 (0.47–2.65)	0.72 (0.47–1.10)	0.82 (0.43–1.56)
Medium/Long education	**0.69 (0.57–0.83)**	**0.69 (0.50–0.95)**	1.17 (0.60–2.29)	1.40 (0.54–3.63)	0.65 (0.40–1.05)	0.86 (0.42–1.77)
Specialized services¤						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	**1.94 (1.24–3.03)**	**1.81 (1.13–2.88)**	1.34 (0.52–3.46)	0.79 (0.27–2.36)	1.30 (0.70–2.43)	1.73 (0.87–3.41)
Medium/Long education	**1.91 (1.20–3.05)**	**1.92 (1.18–3.13)**	2.01 (0.75–5.41)	1.41 (0.45–4.36)	1.25 (0.63–2.49)	1.67 (0.78–3.57)

* Adjusted for age-group 60 +/-, gender, present treatment of antidepressiva, psychologist or psychiatrist
¤ Psychologist or psychiatrist public or private
Results significant within a 95% confidence interval are marked in bold

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Table 3: Incidence rate ratios for *Mental health care treatments* by educational level stratified by MDI grade

Symptoms of depression	No/few		Mild		Moderate/severe	
GP consultation	IRR (crude)	IRR (Adjusted)*	IRR (crude)	IRR (Adjusted)*	IRR (crude)	IRR (Adjusted)*
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	**0.82** (0.80–0.84)	**0.87** (0.85–0.89)	**0.79** (0.69–0.89)	**0.88** (0.77–0.99)	**0.81** (0.73–0.89)	**0.81** (0.74–0.89)
Medium/Long education	**0.77** (0.75–0.80)	**0.84** (0.81–0.86)	**0.74** (0.64–0.86)	**0.83** (0.72–0.97)	**0.76** (0.68–0.85)	**0.77** (0.69–0.86)
GP Mental health counseling						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	0.93 (0.73–1.20)	0.93 (0.72–1.20)	1.36 (0.70–2.64)	1.22 (0.58–2.56)	1.08 (0.74–1.58)	1.13 (0.77–1.65)
Medium/Long education	0.93 (0.72–1.22)	0.93 (0.71–1.21)	0.85 (0.44–1.61)	0.82 (0.40–1.69)	0.76 (0.48–1.18)	0.79 (0.50–1.24)
Antidepressants#						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	0.95 (0.85–1.05)	0.93 (0.84–1.03)	1.03 (0.73–1.46)	1.05 (0.73–1.50)	1.07 (0.89–1.28)	1.06 (0.88–1.27)
Medium/Long education	1.00 (0.89–1.12)	1.01 (0.90–1.13)	1.10 (0.76–1.59)	1.11 (0.77–1.62)	1.12 (0.91–1.37)	1.08 (0.88–1.33)
Specialized services¤						
No education	Ref	Ref	Ref	Ref	Ref	Ref
Short education	0.97 (0.77–1.22)	0.94 (0.75–1.19)	1.11 (0.71–1.71)	0.93 (0.58–1.48)	0.93 (0.72–1.21)	0.94 (0.72–1.22)
Medium/Long education	1.06 (0.84–1.34)	1.02 (0.80–1.29)	1.32 (0.85–2.05)	1.02 (0.63–1.66)	1.09 (0.82–1.43)	1.10 (0.83–1.46)

*adjusted for age-group 60 +/-, gender, present treatment of antidepressiva, psychologist or psychiatrist
¤ Psychologist or psychiatrist, public or private
Number reimbursed prescriptions
Results significant within a 95% confidence interval are marked in bold

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Table 3 shows that the incidence rate ratios of visits to a GP were higher for the group with no education compared to the others independent of depression score. For all other outcomes, there were no significant differences between educational groups in visit rates, when adjusted for age, gender, and present treatment among those using the services.

Table 4 shows the highest gained treatment level within the 180 days in crude numbers. More severe symptoms were more often met with a higher level of treatment, though 10% of the respondents with symptoms of moderate to severe depression had no contact at all. 47% of the 547 with symptoms of moderate to severe depression had no treatment or contacts beyond a GP consultation. This proportion was the same in all educational groups (not shown).

Table 4. Highest gained treatment level by MDI grade

Final treatment level\MDI grade	No/few	Mild	Mod./severe
No contacts	4540 (25.2)	73 (16.6)	56 (10.2)
GP consultation	12084 (67)	257 (58.3)	259 (47.3)
GP MHC	160 (.9)	5 (1.1)	20 (3.7)
Antidepressants#	931 (5.2)	64 (14.5)	125 (22.9)
Psychologists	162 (.9)	17 (3.9)	27 (4.9)
Priv psychiatrist	96 (.5)	18 (4.1)	39 (7.1)
Out-pat. Psychiatry	17 (.1)	3 (.7)	7 (1.3)
Admission MH & EA **	33 (.2)	4 (.9)	14 (2.6)
Sum	18.023 (100)	441 (100)	547 (100)

Percent's in brackets
Reimbursed prescriptions
* Contact to either psychologist or psychiatrist, public or private
** MH: Mental hospital; EA: Emergency access psychiatric ward

Table 5 shows that respondents with symptoms of depression gained a significantly higher treatment level, increasing with higher symptom score, compared to those with no/few symptoms and no education. For the group with no/few symptoms, respondents with longer education reached all in all a lower level. We found no statistically significant differences between educational groups stratified by grade of symptoms, but a significant increase in treatment level within each educational group, when depression score increased from no/few symptoms to symptoms of mild depression, and again when it changed to symptoms of moderate/severe depression (results not shown).

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Table 5. Mean level of *Mental health care treatment* by educational level and MDI grade

	.97 (N=19011)	
No/few symptoms of depression		β*
No education	0.98 (N=2502)	(Ref)
Short education	0.94 (N=9650)	-0.01 (-0.04; 0.02)
Medium/Long education	0.87 (N=5871)	**-0.05 (-0.08; -0.02)**
Mild symptoms of depression		
No education	1.49 (N=93)	**0.15 (0.01; 0.29)**
Short education	1.47 (N=225)	**0.14 (0.05; 0.24)**
Medium/Long education	1.58 (N=123)	**0.22 (0.10; 0.35)**
Moderate/severe symptoms of depression		
No education	2.18 (N=136)	**0.37 (0.26; 0.49)**
Short education	1.99 (N=257)	**0.35 (0.26; 0.44)**
Medium/Long education	2.01 (N=154)	**0.45 (0.33; 0.56)**

* adjusted for agegr 60 +/-, gender, present treatment of antidepressiva, psychologist or psychiatrist

Treatment levels: 0: no contact; 1: GP consultation; 2: GP MHC; 3: Antidepressants; 4: psychologist; 5: priv. psychiatrist; 6: publ. psychiatrist; 7: psychiatric hospital & emergency visits

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Discussion

We combined results from a symptom score of depression (MDI) at baseline from GESUS with subsequent mental health care treatment within the following six months. Symptoms of depression were associated with higher treatment level, increasing with severity of symptoms independently of educational level as a measure of SEP.

However, not all in need received treatment for depression. Ten percent of the respondents with symptoms of moderate to severe depression had no contact at all during the six months following the index date. Another 47% of this group, independent of SEP, settled for a consultation by a GP only.

Additionally, not all of the respondents treated were in need. Two thirds of the visits to specialized services, mostly psychologists, were made by respondents with no/few symptoms of depression, and those with short and longer education used specialized mental health services almost twice as often compared to respondents with no education.

A strength of this study was that we were able to obtain reliable data on need from a large sample of people in the GESUS as well as high quality data on healthcare contacts and prescriptions of antidepressants from Danish registers, challenges common in studies of equality in health care[9]. To our knowledge, this is the first study combining survey data reporting depression score with register data on mental health care treatment. Thus we managed to avoid the inherent problem of recall bias, which is a common problem in these types of studies[34].

The sample size forced us to group depression into two instead of three categories and the specialized services into one, whereby some accuracy could be lost.

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We used education as indicator of SEP. The span of respondents: from a few students to a high proportion of older and retired persons, as seen in the sample, makes income and employment status less potent to differentiate the resources that the respondents could be expected to have. For that reason, education was chosen, even though older age is associated with lower educational attainment[27]. Additionally, education comes out as a particularly important factor when evaluating the use of health care specialists[10]. The sample had a lower proportion without education compared to the population of Næstved in the age group less than 70, but we did not consider this to be relevant in the inter-educational comparisons where we adjusted for age over 60.

The study related to use of services based on an indication of need stretching up to six prior months. Need will change over time, but such change would not be expected to differ within the educational groups and, if so, would be expected to change towards higher need for those with no education.

The actual reasons for treatment contacts were not known, nor were the reasons for prescriptions of antidepressants. Both could have been for other disorders than depression. The variety of possible reasons is not expected to differ between the socioeconomic groups, which is why it should not have an impact on our conclusions.

Not all services used are included in the registers. If the patient is not referred from a GP and pays the full expense out of own pocket, there will be no reimbursement and subsequently no registration of the service in the registers. This would usually require a high income, which is often associated with a longer education. We have no information for this study, but we do not expect it to be common.

Need & use

Respondents in need and in contact with health care providers were treated according to their needs. No association between education, type of treatment, or rates of contacts to GP-MHC and specialized services was found for the group with symptoms of depression, and treatment levels were associated with severity of symptoms. Such a finding might be due to lack of statistical power to detect existing differences, however, the finding is in accordance with other studies on the treatment of respondents with symptoms of depression[35] that likewise, found no independent impact of SEP on type of treatment[36-38] or intensity of treatment[37;39]. Yet, some studies have found that higher education was associated with more use of specialized mental health care, even when adjusted for needs[40-42]. All prior studies rely on recalled service use. It is a strength of the present study that it relies on register data, which minimizes the risk of recall bias.

Need & no use

Firstly, we found that 10 percent of 547 respondents with moderate to severe symptoms of depression had no contacts at all. A Swedish follow-up study on more than 2,000 respondents with symptoms of depression (MDI>20) or anxiety likewise found that one third did not seek care at all. People with a higher education were less likely to seek care at all, and if they did, they more often sought help by a psychologist[43]. Other studies report that 35 – 52% of respondents with symptoms of severe common mental disorders have no treatment contacts[36;44]. As in the Swedish study, we found that respondents with a longer education were less likely to have contacts at all, compared to respondents without education, but not in the group with symptoms of depression.

This finding could be explained by no actual need despite the symptom scores, or it could be due to the patient's choice.

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It has been argued that the instruments used, most commonly the *Composite International Diagnostic Interview* (CIDI), generate inflated prevalence estimates of depression due to a high number of false positives and are thus overestimating unmet needs[45]. A recent publication from the Netherlands Mental Health Survey and Incidence Study (NEMESIS-1) found most respondents who met the criteria for a common mental disorder to remit without treatment, and it supports the argument that the diagnostic criteria in large epidemiological samples do not necessarily indicate a need for mental health treatment[46].

Whether or not unmet needs are overestimated in these studies, they would not have an impact on the socioeconomic comparisons within the studies, though.

A French mixed method study found the patients' reasons for not consulting a GP during a depressive episode to be the negative perception of treatment, the negative perception of the disease, the importance of the social environment, and the doctor-patient relationship. The negative perception of depression was the dominant reason for not consulting the GP and covered feelings of low self-worth and stigmatization, whereas social support was a reason for not feeling a need to consult a GP[47].

Secondly, 47% of the 547 respondents with symptoms of moderate to severe depression had consultation by GP and no additional treatment. GPs' ability to detect depression could be questioned. When compared to ratings by semi-structured interviews, the detection rates for depression in primary health care are relatively low with a sensitivity rate of 50% and a specificity rate of 81%[48], and more recently, a sensitivity rate of 51% and a specificity rate of 87%, when compared to the Patient Health Questionnaire-9[49]. The use of depression scoring tools validated for primary care could improve detection rates; if self-administered, it will be a less time-consuming and a more realistic approach[49]. It is noteworthy that the proportion having the highest treatment level at a GP was the same across educational groups.

No need & use

The group treated, but not in need, may indicate an overuse of services. "No-need" reflects a low symptom score on the MDI. The actual need was not known within the six months, and the term should be taken with this reservation. However, we consider a comparison across educational groups relevant in this group, as in the other symptoms groups.

Firstly, we found no/ few symptoms of depression associated with more use of specialized mental health services for respondents with short and longer education compared to those with no education, when adjusted for age, gender and present treatment. Whereas the treatment of respondents with symptoms of depression seems to indicate needs met, this finding could indicate the so-called "met un-need"[50]. For patients with longer education and no/few symptoms, the GPs prescribed less antidepressants and more often referred to a psychologist. Two thirds of the specialized services were used by the group with no/few symptoms.

An Australian study found that only a small proportion (4%) of individuals without any disorders or need indicators did receive mental health care. Though this group comprised a fair proportion of service users, the vast majority only sought brief primary care or counselling treatment rather than consultations with psychiatrists, where they constituted 7% of all patients[51]. This study did not relate the use of services to SEP. However, a Canadian study did find individuals using mental health care and having no symptom of mental disorders to be better educated, compared to those with mental disorders using the services [16].

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Secondly, we found that prescription of antidepressants was more common in the group with no/few symptoms and no education. Similar findings were shown in another Australian study, where low SEP was associated with higher prescription rates not attributable to higher rates of depression[52]. It could be due to maintenance treatment that it is more common among persons in low SEP, which is plausible as depressive disorders are more prevalent in this group too. Alternatively, it could be due to prescription of antidepressants instead of referral to a psychologist, because of the expenses associated with the treatment. It could be due to the GP's assessment of the patient's capacity to engage in that type of treatment. A combination of all is also possible.

Implications

For clinicians and policy makers it is of particular interest to know that this study showed that GPs treated patients with no/few symptoms of depression differently. Patients in higher SEP were more likely to be referred to specialist services, primary psychologists, while patients in lower SEP were more likely to be treated with antidepressants. This difference was most likely due to the expenses associated with the use of psychologists in Denmark[53] and is in consistence with other studies[54;55]. If, or to what extent, the capacity to engage in e.g. cognitive therapy is related to educational groups in general, or among survey responders in particular, is not known.

Future research could explore why relatively many patients with symptoms of moderate to severe symptoms of depression do not consult their GP. It would also be of interest to know to what extent the GP prescribes antidepressant treatment when a psychologist might have been the first choice, given the access was free.

We found equal treatment for patients in equal need, but unequal treatment of patients in seemingly no need. It would be interesting to explore in future research if this differentiation in use of specialist services is also found in somatic health care, which means that mild symptoms are treated differently depending on SEP, but severe symptoms are not.

Conclusion

We found no socioeconomic differentiation in the treatment of respondents with symptoms of depression. However, GPs treated patients with no/few symptoms of depression differently. Patients in higher SEP were more likely to receive specialist services by primary psychologists, whereas patients in a lower SEP were more likely to be treated with antidepressants, which is most likely due to the difference in the associated expenses for the patient.

Author contributions.

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The statistical analyses were performed by statistician SW. AP conceived the research and wrote the first draft of the manuscript assisted by FBW. FBW contributed substantially to the study design and choice of analysis. AH, ES, and LH contributed to the data analysis, interpretation of results and critical revision of the manuscript.

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Data sharing: no additional data available.

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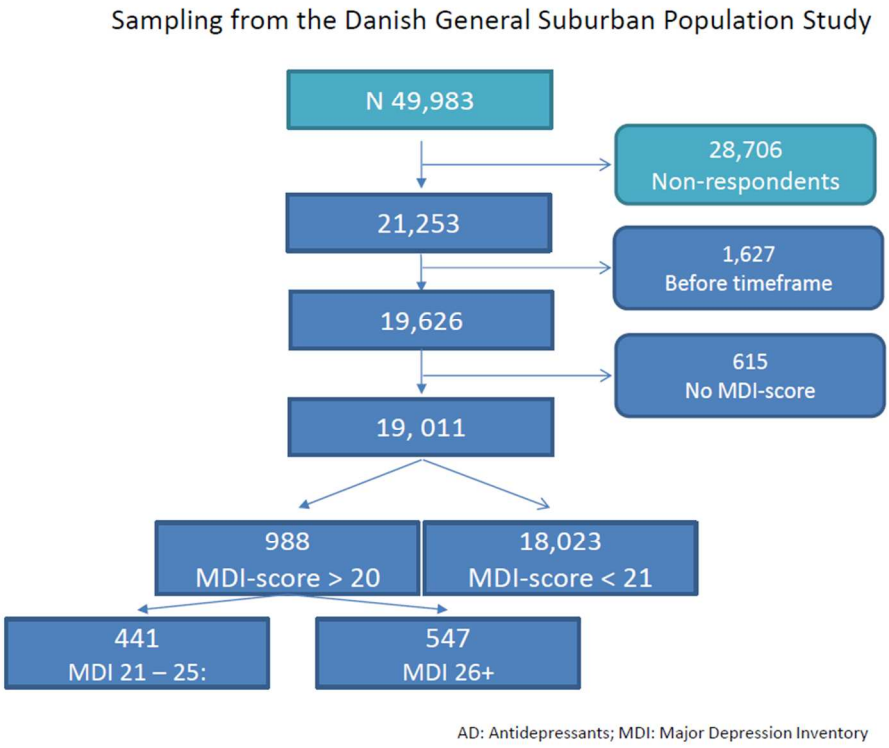
Impact of socioeconomic position on symptoms of depression and subsequent mental health care treatment: a Danish six-month register-based follow-up study on a population survey.

Supplementary figure and tables

Figure 1



AD: Antidepressants; MDI: Major Depression Inventory

Supplement Table1. Definition of treatment levels:

Level	*Primary health care*	Additional health care supply	Defined by source and code:
0	*No contact*		Not in NPR, NHSR, NPrR
1	*GP*	Consultation	+ NHSR GP (800101 + 800120 +(800411 – 800491) + 804001)
2	*GP*	Mental health counselling by GP	+ NHSR GP & contact concerning mental health (806101)
3	*GP*	Antidepressants	+ NPrR by ATC: NO6A – excl N06AX12
4	*GP*	Private psychologist	+NHSR (630110 – 630211) + (630214 – 630340)
5	*GP*	Private psychiatrist	+NHSR (240110 – 240140) + (240210 – 240236) + 241401
6	*GP*	Out-patient psychiatry	+NPR by ICD-10: F 00–– F99.99
7	*GP*	Mental hospital & Emergency visits	+NPR by ICD-10: F 00–– F99.99

NPR: The National Patient Register; NHSR: The National Health Service Register; NPrR: The National Prescription Registry; ATC: Anatomical Therapeutic Chemical classification.

Supplement Table 2. Number and mean number of *Mental health care treatments* by MDI grade

Symptoms of depression		No/few	Mild	Moderate/severe	Total
	Persons n (Pct.)	18023 (100)	441 (100)	547 (100)	19011 (100)
No contact					
	Persons n (Pct.)	4540 (25.2)	73 (16.6)	56 (10.2)	4669 (24.6)
GP consultation					
	Persons n (Pct.)	13329 (74.0)	356 (80.7)	474 (86.7)	14159 (74.5)
	Visits n	45044	1433	2252	48729
	Visit rates¤	3.38	4.03	4.75	3.44
GP MHC					
	Persons n (Pct.)	329 (1.8)	28 (6.3)	64 (11.7)	421 (2.2)
	Visits n	611	57	168	836
	Visit rates¤	1.86	2.04	2.63	1.99
Antidepressants#					
	Persons n (Pct.)	1056 (5.9)	87 (29.7)	186 (34.0)	1329 (7.0)
	Prescriptions n	2769	227	670	3666
	Prescrip rates¤	2.62	2.61	3.60	2.76
Psychologists					
	Persons n (Pct.)	167 (0.9)	19 (4.3)	31 (5.7)	217 (1.1)
	Visits n	706	112	144	962
	Visit rates¤	4.23	5.89	4.65	4.43
Private psychiatrist					
	Persons n (Pct.)	100 (0.6)	20 (4.5)	42 (7.7)	162 (0.9)
	Visits n	274	57	201	532
	Visit rates¤	2.74	2.85	4.79	3.28
Out-patient Psychiatry					
	Persons n (Pct.)	22 (0.1)	4 (0.9)	9 (1.6)	35 (0.2)
	Visits n	103	34	46	183
	Visit rates¤	4.68	8.50	5.11	5.23
Specialized services*					
	Persons n (Pct.)	283 (1.6)	40 (9.1)	76 (13.9)	399 (2.1)
	Visits n	1083	203	391	1677
	Visit rates¤	3.83	5.07	5.14	4.20
Admission MH & EA **					
	Persons n (Pct.)	33 (0.2)	4 (0.9)	14 (2.6)	51 (0.3)
	Visits n	49	11	37	97
	Visit rates¤	1.48	2.75	2.64	1.90

¤ Mean number of visits by respondents using the service/prescriptions

Reimbursed prescriptions

* Contact to either psychologist or psychiatrist, public or private

** MH: Mental hospital; EA: Emergency access psychiatric ward

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STROBE Statement for the study: **Impact of socioeconomic position on symptoms of depression and subsequent health care utilization and treatment: a Danish six-month register-based follow-up on a survey study.**

	Item No	Recommendation	Addressed on page:
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4 - 5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4 – 5 Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4 – 5 Table 1*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	4 + 7 & Figure 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5 - 6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5 – 6
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, explain how loss to follow-up was addressed	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 2
		(b) Indicate number of participants with missing data for each variable of interest	Table 2
		(c) Summarise follow-up time (eg, average and total amount)	

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Outcome data	15*	Report numbers of outcome events or summary measures over time	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3 Table 4 + 5
		(*b*) Report category boundaries when continuous variables were categorized	4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8 - 10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

*Give information separately for exposed and unexposed groups.

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

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BMJ Open

Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

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Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

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Transparency declaration
Aake Packness affirms that this manuscript is an honest, accurate, and transparent account of the study being reported, that no important aspects of the study have been omitted, and that any discrepancies from the study as planned have been explained.

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Abstract

Objective: Examine whether the severity of symptoms of depression were associated with the type of mental health care treatment (MHCT) received, independent of socioeconomic position (SEP).
Design: Register-based six-month follow-up study on participants from the Danish General Suburban Population Study (GESUS) 2010-2013, who scored the Major Depression Inventory (MDI).
Participants: 19,011 respondents from GESUS.
Interventions: MHCT of the participants was tracked in national registers four months prior and six months after their MDI score. MHCT was graduated in levels. SEP was defined by years of formal postsecondary education and income categorised in three levels. Data was analysed using logistic and Poisson regression analyses.
Outcomes: MHCT included number of contacts to: general practitioner (GP), GP mental health counselling, psychologist, psychiatrist, emergency contacts, admissions to mental hospital, and prescriptions of antidepressants.
Results: For 547 respondents with moderate to severe symptoms of depression there was no difference across SEP in use of services, contact (y/n), frequency of contact, or level of treatment, except respondents with low SEP had more frequent contact with their GP. However, of the 547, 10% had no treatment contacts at all, and 47% had no treatment beyond GP consultation. Among respondents with no/few symptoms of depression, postsecondary education ≥ 3 years was associated with more contact with specialized services (adjusted odds ratio aOR 1.92; 95% confidence interval (CI) 1.18-3.13); however, this difference did not apply for income; additionally, high SEP was associated with fewer prescriptions of antidepressants (education aOR 0.69; CI 0.50-0.95; income aOR 0.56, CI 0.39-0.80) compared to low SEP.
Conclusion: Participants with symptoms of depression were treated according to the severity of their symptoms, independent of SEP; however, more than half with moderate to severe symptoms received no treatment beyond GP consultation. People with low SEP and no/few symptoms of depression were more often treated with antidepressants.

The study was approved by The Danish Data Protection Agency Journal number 2015-41-3984.
Accessible at: https://www.datatilsynet.dk/fortegnelsen/soeg-i-fortegnelsen/

Strengths and limitations of this study

- The design of this study, combining data from a population survey on depression symptom-scores with prospective register data on health care use and medication, is unique in health service research on treatment of people with symptoms of depression.
- The study design made it possible to reduce the inherent problem of recall bias in these types of studies.
- The actual reasons for treatment contacts or for prescription of antidepressants were not known, they could have been caused by other disorders than depression.
- The study sample was generally better educated than the population they were sampled from

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Title:

Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Introduction

Equal access to health care based on need and the reduction of health inequalities are major policy objectives in most OECD countries[1]. Similarly, the World Health Organization states that addressing social inequalities contributes significantly to health and well-being of individuals and countries[2].

Sustained economic hardship can lead to poorer physical, psychological, and cognitive functioning[3], and is furthermore associated with a higher prevalence of mental health problems[4]. Specifically, depressive disorders are more prevalent among people with a low socioeconomic position (SEP)[5] and enhanced by worsening socioeconomic circumstances[6]. In addition to this, depression is a major health problem, globally ranked as the single largest contributor to non-fatal health loss, accounting for 7.5% overall in years lived with disability[7]. It is estimated that life expectancy is reduced by 14 years for men and 10 years for women treated for severe depression[8].

Equity in access to health care is commonly defined as equal access for equal need. However, both *access* and *need* are ambiguous concepts[9]. It has been documented that patients with a high SEP use more specialized health care services[10 11], also within mental health care[12]; yet there remains a gap between those in need of mental health care and those who receive it[13-15]. Additionally, not all users of mental health care are in clinical need[16]. As for depression and anxiety disorders, some studies have found access to specialist care to be reflective of clinical need, with little inequity in SEP[17 18], whereas others report specialized mental health services are not provided to persons with low SEP according to need[19 20], or that higher SEP is associated with more use of specialized mental health services[21 22]. This uncertainty and the fact that depressive disorders are widespread and more common among persons with lower SEP makes these disorders both relevant and well suited to evaluate the capability of health care systems to address the needs of economically deprived citizens. Depression is a serious disorder with extensive personal, social and economic consequences, which makes its treatment an important issue and health equality an urgent cause.

Objectives

We aimed to evaluate whether the Danish health care system delivers equal treatment to patients with symptoms of depression. We defined *mental health care treatment* (MCHT) as the use of specific health care services related to the treatment of depressive disorders, as well as treatment with antidepressants.

The objective was to examine if the severity of symptoms of depression (need) was associated with the mental health care treatment received, independent of SEP in both type and frequency of treatments, and highest gained treatment level within six months following a symptom score in a survey study.

Method

Design

A six-month follow-up study on respondents with symptoms of depression, combining survey data with register data on mental health care treatment.

Setting: Danish health care system

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Health care is tax-funded in Denmark and free at delivery, except for dental care and visits to psychologists for adults, which are both partly subsidized[23]. The general practitioner (GP) acts as a gatekeeper to more specialized care. Treatment by a psychologist is subsidized for patients with specific conditions, such as reaction to specific traumatic events, moderate depression, and, specifically for citizens between 18 and 38 years, also moderate anxiety disorders. In 2014, the co-payment for a psychologist appointment was equivalent to 44€ per session[24]. Each psychologist is obliged to obtain a special authorization from the Danish Supervisory Board of Psychological Practice in order to be subsidized.

Study population and data sources

The study was conducted as a follow-up study on mental health care utilization and use of antidepressants, examining participants who scored high on symptoms of depression in the Danish General Suburban Population Study (GESUS)[25] in the municipality of Næstved, Denmark. The municipality of Næstved is located 90 kilometres south of the capital Copenhagen. It has a total population of 81,000 and a socioeconomic index score 4% lower than the 2013 national average[26]. The GESUS data was collected from January 2010 through October 2013. All citizens over the age of 30 were invited, as were a random selection of one-quarter of citizens between 20 and 30 years of age. The study consists of 21,253 participants, equivalent to 43% of the invited citizens, the median age of participants were 56 years and 52 years for the non-participants. Data from the self-administered GESUS questionnaire was used in the present study.

Persons with permanent residence in Denmark are registered in the Danish Civil Registration System (CRS)[27] and are assigned a unique 10-digit identification number, the Central Personal Register Number (CPR). The CPR number was registered in the survey data and thus provided a way to match respondents with information on their age and gender, and also made it is possible to identify the individuals in all public data registers in Denmark. In addition to the data sources already mentioned, data concerning vital status and dates of migration were gathered from the CRS as well.

Using the CPRs from GESUS, we linked to national registers and tracked the use of healthcare services and antidepressants for four months (120 days) prior and six months (180 days) after the respondents entered the GESUS study, or until their death or migration, if that occurred before. Data from national registers covered the years 2010-2014 in order to fit a timeframe of four months prior to index date; however, the sample was reduced to include only respondents entering the GESUS study from May 2010, due to lack of data availability from 2009. The period of four months prior to the study was chosen assuming active treatment would include a treatment appointment or renewed prescription at least every three to four months.

Independent variables

Data on independent variables came from GESUS.

Measure of need

Depression was chosen as an expression of need, with the Major Depression Inventory (MDI) as a measurement tool, extracted from the GESUS questionnaire. The MDI is based on the 12-item Likert scale and has been found to have an adequate internal and external validity for defining different stages of depression[28]. The MDI is also based on the ICD-10 diagnostic criteria for depressive disorder[29], with scores ranging from 0 to 50: scores ≤20 do not indicate depression; mild depression is defined as a score from 21-25; moderate depression from 26-30; and severe depression from 31-50[30]. In the study, we collapsed moderate and severe depression into the same category, reducing the categories to three in order to gain statistical power: *no/few symptoms* (summed MDI 0 –

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20), *mild symptoms* (summed MDI 21-25), and *moderate/severe symptoms* (summed MDI 26+). This splitting of symptomatic individuals into only two groups (mild or moderate/severe) was supported by the recommended therapeutic approach at the time: patients with mild symptoms were recommended "watchful waiting" and perhaps supportive consultations, whereas patients with moderate to severe depression were recommended antidepressants and therapy by a psychologist or a psychiatrist[31]. If more than two items were missing in the MDI, the score was categorized as missing[32].

Socioeconomic position

SEP is commonly measured by income, occupation, housing tenure, or education; higher education in particular is known to predict higher response rates in questionnaires[33]. Education and income were chosen as measures of SEP in this study due to the respondents' age distribution skewing older than the general population; older age groups tend to have lower education, and they also have lower incomes, but occupation is not a useful SEP measurement for retired individuals. Education was classified as, *No postsecondary education:* if the respondent did not complete any postsecondary education; *1-3 years postsecondary education:* for vocational education of 1 - 3 years; *or* for academy/professional graduates of 1 - 3 years; *3+ postsecondary education:* for baccalaureate who completed 3 - 4 years, and *Academic* for those who completed graduate study of ≥ 5 years. Students were categorized at the level that their studies would end in, e.g. students in doctoral programs would be categorized as Academics even though they had not yet completed 5 years of graduate study.

Information on income was also extracted from the GESUS questionnaire, where it was reported in Danish Kroner (DDK). 100 DDK equals 13.42€, a fixed exchange rate for many years. Income was grouped into three equal groups: *Less than 300,000 DDK; 300,000-599,999 DDK;* and *600,000+ DDK* and reported as: *<40,250€*; *≥40,250< 80,499€*; or *≥ 80,500€.*

When both income and education show the same association to an outcome, it will be addressed as an association to SEP; otherwise the association will be addressed to the variable in question (income/education).

Extrinsic variables

Sociodemographic data included age, gender, marital status, and cohabitation status.

Information on *somatic comorbidity* included: previous acute myocardial infarction (AMI), arteriosclerosis, angina pectoris, stroke, cancer, diabetes mellitus, hyper- or hypo-thyroidism. The somatic disorders were all grouped into one variable. Previous depressive episodes were registered separately.

Present medication covered self-reported use of antidepressants. Respondents defined as being in *present treatment* included both participants who reported use of antidepressants and participants identified in registers, as described below, who had redeemed a prescription for antidepressants and/or had contact with a psychiatrist and/or a psychologist within four months prior to the date of returning the questionnaire (in the following termed the *index date*) with the depression score.

Dependent variables

Data on dependable variables was drawn from national registers.

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The outcome variables were graded according to the stepwise treatment of increasing intensity for depression as was recommended in the Danish national guidelines at the time[25]. The guidelines start with #1) counselling and # 2) therapy provided by the GP, followed by # 3) prescription of antidepressants, followed by # 4) referral to therapy with a psychologist, then # 5) referral to treatment by a psychiatrist, and finally referral to # 6) outpatient public psychiatrist or eventually #7) inpatient treatment at a psychiatric hospital (see code definitions in Supplement Table 1; an additional #0 refer to no treatment contact). Emergency visits to a mental hospital were included in the category of hospital contacts. The more severe or non-respondent the depression is to the proscribed treatment, the higher the patient is supposed to move in the recommended treatment hierarchy. Treatment by psychologists (#step 4) or psychiatrists (#steps 5 # and #6), whether private or public, were pooled into one group in some analyses due to low numbers of observations. Data on the utilization of private psychiatrists, psychologists, and general practitioners (GPs) was drawn from the Danish National Health Service Register for Primary Care[34]. For psychologists, only subsidized services are in the register. Respondents covered by private insurance and treated for depression or anxiety are included in the data, as insurance agencies require referral from GPs to compensate the patient.

Mental health counselling provided by a GP consists of at least two talks within the first six months and up to seven talks within one year. This type of therapeutic counselling is registered and paid as additional reimbursement to the GP. In the study, this service was termed mental health counselling by a GP (MHC by GP). Topics for ordinary consultations by GP are not registered in the national registers.

Data on prescriptions for antidepressants (Anatomical Therapeutic Chemical (ATC) classification system N06A) were extracted from the Danish National Prescription Registry[35 36]. However, bupropion (ATC N06AX12), which is approved for the treatment of depression in some countries, was excluded from this study since it is only prescribed for smoking cessation in Denmark.

Information concerning public in- and outpatient psychiatric treatment was drawn from the Danish National Patient Register[37] (ICD-10 coded F00 – F99).

Statistical analyses

First, we estimated the association between SEP and the different binary outcome variables (that is, the five different types of health care contact: *No health care contact*, *GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*) in separate logistic regression models, both uni- and multivariable. Each model was stratified into three MDI categories: no/few symptoms (MDI < 21), symptoms of mild depression (MDI 21-25), and symptoms of moderate to severe depression (MDI ≥ 26). The SEP category '*No postsecondary education* and income *<40,250€*' was used as the reference category. To examine a possible interaction between SEP and MDI category, we employed logistic regression models for each outcome, with patients having *No postsecondary education* / *<40,250€* and *no/few depression symptoms* as key reference.

Second, in order to evaluate differences in visits and prescription rates, we estimated incidence rate ratios (IRR) by Poisson regression models for each type of contact (*GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*). For each type of contact, analyses were restricted to those patients who had at least one contact. For exposure, death and emigration within 180 days after index date were taken into consideration. As above, analyses were stratified into MDI category, and the SEP category '*No education* and *< 40,250€*' was used as a reference category.

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Finally, we performed a linear regression analysis for the effect of combined SEP and MDI category on the highest reached treatment level (see treatment progression described above). The treatment levels were categorized as shown in Supplementary Table 1 (0: no treatment/contact; 1: GP consultation; 2: MHC by GP; 3: antidepressants; 4: psychologist; 5: private psychiatrist; 6: public psychiatrist; 7: psychiatric hospital). Patients having *No postsecondary education* / *< 40,250€* and *no/few depression symptoms* were the key reference groups.

All multivariable regression models included age (*20-59* versus *60+*), gender, present treatment with antidepressants, and psychologist or psychiatrist (*yes/no*), in addition to the variable studied in the univariate (crude) analysis. In analyses including income, cohabitation was also included.

The significance level was 5% throughout, and all reported confidence intervals were 95%. All statistical analyses were performed using Stata 14[38].

Patient and Public Involvement

The study did not involve patients or public in planning or execution.

Ethics

Access to data from the GESUS was approved by the GESUS board in December 2015. The data were stored at a server at Statistics Denmark. The collection and handling of the data has been approved by the Danish Data Protection Agency, Journal number: 2015-41-3984. Approval by an ethics committee is not required for register studies in Denmark.

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Results

The study included 19,011 respondents from the GESUS study; the original 21,253 were reduced by 1,627 respondents who entered before May 2010 due to data unavailability for 2009. The respondents were further reduced by an additional 615 who did not have a valid MDI score (see flowchart, Supplement Figure 1). 29 deaths and four persons emigrating were included in the analysis only until death or migration. In all, 988 (5.2%) had symptoms of depression. Of these, 441 had symptoms of mild depression and 547 had symptoms of moderate and severe depression, and of the latter group 271 were rated severe.

Respondents with no education beyond the secondary level were underrepresented by one-third when compared to the total sample population, according to Statistics Denmark; those with only 1-3 years of postsecondary education had a little higher representation, and the proportion with more than 3 years of postsecondary education had an almost 30 percent higher representation compared to the population in Næstved[39].

Table 1. Baseline characteristics of the study sample by MDI grade

MDI score	All	MDI < 21	MDI 21 - 25	MDI 26+	MDI missing
Symptoms of depression	n (pct.)	None/few	Mild	Moder./sev§	NA
All	19626 (100)	18023 (100)	441 (100)	547 (100)	615 (100)
In treatment*					
No	18076 (92.1)	16860 (93.5)	334 (75.7)	335 (61.2)	547 (88.9)
Yes	1550 (7.9)	1163 (6.5)	107 (24.3)	212 (38.8)	68 (11.1)
Gender					
Male	8927 (45.5)	8349 (46.3)	162 (36.7)	168 (30.7)	
Female	10699 (54.5)	9674 (53.7)	279 (63.3)	379 (69.3)	
Age group					
20-29	294 (1.5)	266 (1.5)	10 (2.3)	17 (3.1)	
30-39	2382 (12.1)	2206 (12.2)	79 (17.9)	86 (15.7)	
40-49	4186 (21.3)	3891 (21.6)	106 (24)	146 (26.7)	
50-59	4417 (22.5)	4100 (22.7)	115 (26.1)	144 (26.3)	
60-69	5123 (26.1)	4771 (26.5)	74 (16.8)	93 (17)	
70+	3224 (16.4)	2789 (15.5)	57 (12.9)	61 (11.2)	
Marital status					
Married	13398 (68.3)	12519 (69.5)	234 (53.1)	259 (47.3)	
Separated/divorced	2174 (11.1)	1936 (10.7)	71 (16.1)	117 (21.4)	
Widow/er	1385 (7.1)	1172 (6.5)	37 (8.4)	45 (8.2)	
None of the above	2669 (13.6)	2396 (13.3)	99 (22.4)	126 (23)	
Cohabitating					
No	4342 (22.1)	3745 (20.8)	147 (33.3)	217 (39.7)	
Yes (incl missing)	15284 (77.9)	14278 (79.2)	294 (66.7)	330 (60.3)	
Education					
None (No postsecundary)	2988 (15.2)	2502 (13.9)	93 (21.1)	136 (24.9)	
Vocational/1-3yrs (1-3 years postsecundary)	8227 (41.9)	7645 (42.4)	169 (38.3)	199 (36.4)	
Academy/professional <3yrs (1-3 yrs postsecund.)	2156 (11)	2005 (11.1)	56 (12.7)	58 (10.6)	
Baccalaureate /3-4yrs (3+ years postsecundary)	5024 (25.6)	4706 (26.1)	104 (23.6)	137 (25)	
Academic/5+yrs (3+ years postsecundary)	1231 (6.3)	1165 (6.5)	19 (4.3)	17 (3.1)	
Income					
less than 150.000DDK (< 40,250€)	1063 (5.4)	847 (4.7)	38 (8.6)	69 (12.6)	
150,000 - 299,999DDK (<40,250€)	3406 (17,4)	3003 (16.7)	100 (22.7)	139 (25.4)	
300,000 - 449,999 DDK (≥40,250 <80,500€)	3601 (18.3)	3344 (18.6)	73 (16.6)	98 (17.9)	
450,000 - 599,000DDK (≥40,250 <80,500€)	3025 (15.4)	2863 (15.9)	64 (14.5)	66 (12.1)	
600,000 - 749,999DDK (≥80,500€)	3245 (16.5)	3086 (17.1)	74 (16.8)	64 (11.7)	
750,000 - 899,999DDK (≥80,500€)	1856 (9.5)	1794 (10)	22 (5)	29 (5.3)	
900,000 - 1,049,999DDK (≥80,500€)	693 (3.5)	667 (3.7)	12 (2.7)	9 (1.6)	
1,050,000DKR + (≥80,500€)	706 (3.6)	691 (3.8)	8 (1.8)	5 (.9)	
Missing	2031 (10.3)	1728 (9.6)	50 (11.3)	68 812.4)	
Comorb. former depression					
No	16755 (85.4)	15826 (87.8)	255 (57.8)	210 (38.4)	
Yes	2484 (12.7)	1917 (10.6)	173 (39.2)	319 (58.3)	
Missing	387 (2)	280 (1.6)	13 (2.9)	18 (3.3)	
Comorbidity somatic, all ¤					
No	13791 (70.3)	13109 (72.7)	195 (44.2)	168 (30.7)	
Yes	5835 (29.7)	4914 (27.3)	246 (55.8)	379 (69.3)	
Medication antidepressants #					
No	18537 (94.5)	17213 (95.5)	363 (82.3)	385 (70.4)	576 (93.7)
Yes	1089 (5.5)	810 (4.5)	78 (17.7)	162 (29.6)	39 (6.3)

§ Moderate or servere
* In treatment at index date or 120 days before by psychologist, psychiatrist, or antidepressant prescription, according to GESUS or registers
¤ Somatic comorbidities: Ischemic heart disease, diabetes, cancer, metabolic diseases
replied in questionnaire

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The baseline characteristics of the study sample are shown in table 1, in total, and stratified by severity of symptoms of depression. Respondents with symptoms of mild to severe depression tended to be: younger, more singles, living without a partner, and without formal education, compared to those with no/few symptoms.

Table 2 shows odds ratios for mental health care treatment contacts. Respondents in low SEP more often established contact with their GP than those in high SEP, whereas respondents in high SEP more often had no health care contacts at all; however, these differences disappeared in the group with symptoms of depression.

Among respondents with symptoms of depression, there was no statistically significant difference across educational groups or income groups in odds for contacts and prescriptions in the adjusted analyses, except those with 1-3 years of postsecondary education and mild symptoms had a lower use of mental health counselling by GP (adjusted odds ratio (aOR) 0.30, confidence interval (CI) 0.10 - 0.91) compared to respondents without any postsecondary education.

Among respondents with no/few symptoms, the group with three or more years of postsecondary education were 30% more likely to have no healthcare contacts at all when compared to the group without postsecondary education (aOR 1.32, CI 1.18 - 1.49); likewise, respondents in the highest income group were 66% more likely to have no healthcare contacts at all when compared to the lowest income group (aOR 1.66, CI 1.46-1.89). Higher education (3+ years) as well as high income was associated with fewer consultations with a GP and fewer prescriptions of antidepressants, compared to those without postsecondary education or with low income. However, increased educational level was associated with more contact with specialized services (aOR 1.81, CI 1.13 - 2.88; aOR 1.92, CI 1.18 - 3.13); however, this difference was not seen between the income groups.

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Table 2: Odds ratios for type of *Mental health care treatment* by educational- and income level stratified by MDI grade

Symptoms, depression	No/Few (MDI <21)		Mild (MDI 21-25)		Moderate/severe (MDI >25)	
No contact at all	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*
Education	(N=18023 pts.)		(N = 441 pts.)		(N = 547 pts.)	
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**1.26 (1.13–1.40)**	1.10 (0.98–1.23)	1.96 (0.91–4.22)	1.62 (0.71–3.67)	1.73 (0.79–3.77)	1.62 (0.72–3.65)
3+ years postsec. educ.	**1.54 (1.38–1.72)**	**1.32 (1.18–1.49)**	**2.38 (1.05–5.38)**	2.01 (0.84–4.83)	1.99 (0.87–4.55)	1.79 (0.76–4.23)
Income	(N=16295)		(N=391)		(N=479)	
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**1.69 (1.53-1.87)**	**1.39 (1.24-1.56)**	1.20 (0.62-2.33)	0.79 (0.36-1.76)	1.74 (0.89–3.40)	1.59 (0.72-3.52)
Income ≥80,500€	**2.27 (2.06-2.51)**	**1.66 (1.46-1.89)**	1.90 (0.99-3.63)	1.35 (0.55-3.33)	1.16 (0.51–2.63)	1.04 (0.38-2.82)
GP consultation						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.80 (0.72–0.89)	0.92 (0.82–1.02)	0.52 (0.26–1.06)	0.64 (0.31–1.35)	0.68 (0.35–1.31)	0.70 (0.36–1.37)
3+ years postsec. educ.	0.66 (0.59–0.74)	**0.77 (0.68–0.86)**	**0.46 (0.21–0.97)**	0.54 (0.24–1.19)	0.69 (0.34–1.41)	0.74 (0.36–1.53)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**0.60 (0.54-0.66)**	**0.72 (0.64-0.80)**	0.90 (0.48-1.67)	1.25 (0.60-2.61)	0.55 (0.30-1.00)	0.53 (0.27-1.07)
Income ≥80,500€	**0.45 (0.41-0.50)**	**0.60 (0.53-0.68)**	0.63 (0.34-1.84)	0.79 (0.34-1.84)	0.94 (0.44-1.97)	0.81 (0.33-2.01)
GP Mental health counseling						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	1.20 (0.84–1.71)	1.09 (0.76–1.57)	**0.34 (0.12–0.97)**	**0.30 (0.10–0.91)**	1.20 (0.61–2.33)	1.27 (0.65–2.50)
3+ years postsec. educ.	1.31 (0.90–1.89)	1.21 (0.83–1.76)	1.26 (0.50–3.17)	1.03 (0.38–2.81)	1.23 (0.59–2.55)	1.30 (0.62–2.73)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	1.07 (0.80-1.43)	1.09 (0.78-1.53)	1.14 (0.43-3.05)	1.40 (0.44-4.47)	**2.06 (1.05-4.02)**	1.79 (0.81-3.97)
Income ≥80,500€	0.84 (0.62-1.14)	0.85 (0.57-1.28)	1.20 (0.44-3.31)	1.33 (0.34-3.96)	1.66 (0.77-3.59)	1.35 (0.52-3.53)
Antidepressants						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.85 (0.71–1.01)	0.75 (0.55–1.01)	0.96 (0.52–1.77)	1.11 (0.47–2.65)	0.72 (0.47–1.10)	0.82 (0.43–1.56)
3+ years postsec. educ.	**0.69 (0.57–0.83)**	**0.69 (0.50–0.95)**	1.17 (0.60–2.29)	1.40 (0.54–3.63)	0.65 (0.40–1.05)	0.86 (0.42–1.77)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**0.67 (0.57-0.78)**	**0.71 (0.52-0.95)**	0.77 (0.43-1.39)	1.29 (0.51-3.25)	0.67 (0.43-1.03)	0.53 (0.25-1.11)
Income ≥80,500€	**0.44 (0.37-0.52)**	**0.56 (0.39-0.80)**	0.63 (0.33-1.20)	1.25 (0.39-3.96)	**0.53 (0.32-0.89)**	0.53 (0.20-1.36)
Specialized services¤						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**1.94 (1.24–3.03)**	**1.81 (1.13–2.88)**	1.34 (0.52–3.46)	0.79 (0.27–2.36)	1.30 (0.70–2.43)	1.73 (0.87–3.41)
3+ years postsec. educ.	**1.91 (1.20–3.05)**	**1.92 (1.18–3.13)**	2.01 (0.75–5.41)	1.41 (0.45–4.36)	1.25 (0.63–2.49)	1.67 (0.78–3.57)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	1.03 (0.75-1.42)	1.11 (0.76-1.64)	0.67 (0.30-1.49)	0.79 (0.36-1.76)	1.32 (0.73-2.37)	1.47 (0.69-3.14)
Income ≥80,500€	0.89 (0.64-1.23)	0.99 (0.63-1.55)	0.96 (0.44-2.09)	1.35 (0.55-3.33)	1.05 (0.53-2.11)	1.36 (0.52-3.56)

* Adjusted for age- group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
** Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
¤ Psychologist or psychiatrist public or private
Results significant within a 95% confidence interval are marked in bold

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Table 3 Incidence rate ratios for *Mental health care treatments* by education- and income level stratified by MDI grade

Symptoms of depression	No/few (MDI <21)		Mild (MDI 21-25)		Moderate/severe (MDI >25)	
GP consultation	**IRR (crude)**	**IRR (Adjusted)***	**IRR (crude)**	**IRR (Adjusted)***	**IRR (crude)**	**IRR (Adjusted)***
Education	(N=18023)		(N=441)		(N=547)	
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**0.82 (0.80–0.84)**	**0.87 (0.85–0.89)**	**0.79 (0.69–0.89)**	**0.88 (0.77–0.99)**	**0.81 (0.73–0.89)**	**0.81 (0.74–0.89)**
3+ years postsec. educ.	**0.77 (0.75–0.80)**	**0.84 (0.81–0.86)**	**0.74 (0.64–0.86)**	**0.83 (0.72–0.97)**	**0.76 (0.68–0.85)**	**0.77 (0.69–0.86)**
Income	(N=16295)		(N=391)		(N=479)	
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥40,250 <80,500€	**0.81 (0,80-0.83)**	**0.88 (0.85-0.90)**	**0.75 (0.66–0.85)**	0.88 (0.76–1.02)	**0.74 (0.67-0.82)**	**0.81 (0.72-0.91)**
Income ≥80,500€	**0.67 (0.66-0.69)**	**0.78 (0.76-0.81)**	**0.63 (0.55–0.73)**	**0.78 (0.65–0.94)**	**0.66 (0.59-0.75)**	**0.75 (0.65-0.86)**
GP Mental health counseling						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.93 (0.73–1.20)	0.93 (0.72–1.20)	1.36 (0.70–2.64)	1.22 (0.58–2.56)	1.08 (0.74–1.58)	1.13 (0.77–1.65)
3+ years postsec. educ.	0.93 (0.72–1.22)	0.93 (0.71–1.21) **	0.85 (0.44–1.61)	0.82 (0.40–1.69) **	0.76 (0.48–1.18)	0.79 (0.50–1.24) **
Income < 40,250€	Ref	Ref	Ref	Ref	Ref	Ref
Income ≥40,250 <80,500€	0.98 (0.79-1.22)	0.93 (0.74-1.18)	0.73 (0.39–1.36)	0.97 (0.49-1.91))	0.83 (0.56-1.23)	0.69 (0.42-1.14)
Income ≥80,500€	1.00 (0.80-1.25)	0.94 (0.71-1.24)	**0.45** (0.22–0.96)	**0.39** (0.18-0.88)	1.07 (0.69-1.64)	0.86 (0.50-1.48)
Antidepressants#						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.95 (0.85–1.05)	0.93 (0.84–1.03)	1.03 (0.73–1.46)	1.05 (0.73–1.50)	1.07 (0.89–1.28)	1.06 (0.88–1.27)
3+ years postsec. educ.	1.00 (0.89–1.12)	1.01 (0.90–1.13) **	1.10 (0.76–1.59)	1.11 (0.77–1.62)	1.12 (0.91–1.37)	1.08 (0.88–1.33)
Income < 40,250€	Ref	Ref **	Ref	Ref **	Ref	Ref**
Income ≥40,250 <80,500€	0.98 (0.90–1.08)	1.00 (0.90–1.11)	1.09 (0.79–1.49)	1.29 (0.90–1.84)	0.97 (0.80-1.18)	0.92 (0.73-1.16)
Income ≥80,500€	0.92 (0.83-1.02)	0.95 (0.84-1.09)	1.02 (0.71–1.46)	1.18 (0.74–1.88)	1.18 (0.94-1.47)	1.11 (0.84-1.46)
Specialized services¤						
No postsecundary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.97 (0.77–1.22)	0.94 (0.75–1.19)	1.11 (0.71–1.71)	0.93 (0.58–1.48)	0.93 (0.72–1.21)	0.94 (0.72–1.22)
3+ years postsec. educ.	1.06 (0.84–1.34)	1.02 (0.80–1.29)	1.32 (0.85–2.05)	1.02 (0.63–1.66)	1.09 (0.82–1.43)	1.10 (0.83–1.46)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥40,250 <80,500€	1.09 (0.92-1.28)	1.20 (0.99-1.45)	1.30 (0.91–1.85)	1.30 (0.88-1.94)	1.01 (0.78-1.30)	0.77 (0.57-1.06)
Income ≥80,500€	1.18 (1.00-1.39)	**1.35 (1.09-1.68)**	**1.58 (1.14–2.19)**	1.21 (0.79-1.86)	1.46 (1.12-1.92)	1.00 (0.69-1.45)

* Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
** Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
¤ Psychologist or psychiatrist, public or private
Number reimbursed prescriptions
Results significant within a 95% confidence interval are marked in bold

Table 3 shows that the rate (incidence rate ratios (IRR)) of visits to a GP were higher for the group with no postsecondary education compared to the others, independent of depression score. For all other outcomes, there were no significant differences between educational groups in visit rates when adjusted for age, gender, and present treatment among those using services. SEP measured by income showed the same results, except participants with mild symptoms of depression and high income had a lower visit rate for GP-MHC than the low-income group (aIRR 0.39, CI 0.18-0.88). Additionally, among participants with no/few symptoms of depression, high income was associated with more frequent visits to a specialist, compared to the low income group (aIRR 1.35, CI 1.09-1.68).

Table 4 shows the highest gained treatment level within the 180 day window in crude numbers. (Supplementary table 2 shows Number and mean number of mental health care treatment by MDI grade). More severe symptoms were met with a higher level of treatment, though 10% of the respondents with symptoms of moderate to severe depression had no contact at all. 47% of the 547 with symptoms of moderate to severe depression had no treatment or contacts beyond a GP consultation.

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Table 4. Highest gained treatment level by MDI grade

Final treatment level\MDI grade	No/few	Mild	Mod./severe
No contacts	4540 (25.2)	73 (16.6)	56 (10.2)
GP consultation	12084 (67)	257 (58.3)	259 (47.3)
GP MHC	160 (.9)	5 (1.1)	20 (3.7)
Antidepressants#	931 (5.2)	64 (14.5)	125 (22.9)
Psychologists	162 (.9)	17 (3.9)	27 (4.9)
Priv psychiatrist	96 (.5)	18 (4.1)	39 (7.1)
Out-pat. Psychiatry	17 (.1)	3 (.7)	7 (1.3)
Admission MH & EA **	33 (.2)	4 (.9)	14 (2.6)
Sum	18.023 (100)	441 (100)	547 (100)

Percent's in brackets
Reimbursed prescriptions
* Contact to either psychologist or psychiatrist, public or private
** MH: Mental hospital; EA: Emergency access psychiatric ward

Table 5 shows that respondents with symptoms of depression gained a significantly higher treatment level, increasing with higher symptom score, compared to those with no/few symptoms and no postsecondary education or low income (Supplementary table 3 shows highest treatment level gained within six months by education, income and severity of symptoms, in crude numbers and percentage). For the group with no/few symptoms, respondents with 3+ years of postsecondary education or higher income reached a lower level overall. We found no statistically significant differences between educational groups stratified by grade of symptoms, but a significant increase in treatment level within each educational group when depression score increased from no/few symptoms to symptoms of mild depression, and again when it changed to symptoms of moderate/severe depression (results not shown). SEP measured by income had similar outcomes, but differed in the group with mild symptoms of depression, where only respondents with high income gained a higher treatment level compared to the low income group with no/few symptoms.

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Table 5. Mean level of *Mental health care treatment* by educational and income level and MDI grade

		β*
No/few symptoms of depression		
Education	.97 (N=19011)	
No postsecondary education	0.98 (N=2502)	(Ref)
1-3 years postsecondary education	0.94 (N=9650)	**-0.06 (-0.09; -0.03)**
3+ years postsecondary education	0.87 (N=5871)	**-0.05 (-0.08; -0.02)**
Income	.96 (N=17165)	
Income < 40,250€	1.07 (N=3850)	(Ref)**
Income ≥40,250 <80,500€	0.93 (N=6207)	-0.01 (-0.04; 0.02)
Income ≥80,500€	0.81 (N=6238)	**-0.12 (-0.15; -0.09)**
Mild symptoms of depression		
No postsecondary education	1.49 (N=93)	**0.15 (0.01; 0.29)**
1-3 years postsecondary education	1.47 (N=225)	**0.14 (0.05; 0.24)**
3+ years postsecondary education	1.58 (N=123)	**0.22 (0.10; 0.35)**
Income < 40,250€	1.62 (N=138)	0.05 (-0.06; 0.17)
Income ≥40,250 <80,500€	1.46 (N=137)	0.11 (-0.01; 0.23)
Income ≥80,500€	1.47 (N=116)	**0.22 (0.09; 0.34)**
Moderate/severe symptoms of depression		
No postsecondary education	2.18 (N=136)	**0.37 (0.26; 0.49)**
1-3 years postsecondary education	1.99 (N=257)	**0.35 (0.26; 0.44)**
3+ years postsecondary education	2.01 (N=154)	**0.45 (0.33; 0.56)**
Income < 40,250€	2.10 (N=208)	**0.28 (0.18; 0.37)**
Income ≥40,250 <80,500€	2.06 (N=164)	**0.40 (0.29; 0.51)**
Income ≥80,500€	1.80 (N=107)	**0.34 (0.21; 0.47)**

* Adjusted for agegr 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
* *Adjusted for agegr 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
Treatment levels: 0; no contact; 1: GP consultation; 2: GP MHC; 3: Antidepressants; 4: psychologist; 5: priv. psychiatrist; 6: publ. psychiatrist; 7: psychiatric hospital & emergency visits

Discussion

Participants with symptoms of depression were treated according to the severity of the symptoms, independent of SEP; however, more than half with moderate to severe symptoms received no treatment beyond GP consultation. People in low SEP and with no/few symptoms of depression were more often treated with antidepressants.

Symptoms of depression & use of services

Respondents in need and in contact with health care providers were treated according to their needs. This finding aligns with other studies on treatment of depression[40] that likewise found SEP had no independent impact on the type of treatment[17 41 42] or intensity of treatment[37;43] . Yet some studies have found that higher education was associated with more use of specialized mental health care, even when adjusted for needs[44-46]. All these prior studies rely on recalled service use only, however, and thus may be subject to recall bias.

Symptoms of depression & no use

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A Swedish follow-up study of more than 2,000 respondents with symptoms of depression (MDI>20) or anxiety likewise found that one-third did not seek care at all. People with a higher education were less likely to seek care at all, and if they did, they more often sought help from a psychologist[47]. Other studies report that 35-52% of respondents with symptoms of severe common mental disorders have no treatment contacts[36;48]. As in the Swedish study, we found respondents with 3+ years of postsecondary education or high income were less likely to have contacts at all, compared to respondents without postsecondary education or low income, but these differences were not significant in the groups with symptoms of depression.

GPs' ability to detect depression could be questioned, since only half the respondents with moderate to severe symptoms of depression are treated. When compared to ratings determined through semi-structured interviews, the detection rates for depression in primary health care are relatively low, with a sensitivity rate of 50% and a specificity rate of 81%[49] in 2009, and more recently in 2014, a sensitivity rate of 51% and a specificity rate of 87%, when compared to a standardised instrument as the Patient Health Questionnaire-9[50]. The use of depression scoring tools validated for primary care could improve detection rates; if self-administered, it would be less time-consuming for GPs and perhaps a more realistic approach[49]. It is noteworthy that the proportion receiving the highest treatment level from a GP was the same across educational groups.

A German study on trends in non-help-seeking for mental disorders found a downward trend, finding that 57% of the citizens with present symptoms of a mental disorder had never sought help for a mental problem in the years 2009-2012[51]; this result is very similar to the findings of our study.

No/few symptoms of depression & use of services

The group that was treated, but scored with no/few symptoms of depression, may indicate emerging needs or an overuse of services. Since respondents did not each undergo additional screening by a professional, there is a lack of verification for the level of need beyond the self-reported symptoms on the inventory. However, we consider a comparison across socioeconomic groups relevant in this group, as in the other symptoms groups.

Firstly, we found no/few symptoms of depression was associated with more use of specialized mental health services for respondents with postsecondary education when compared to those with no postsecondary education, adjusting for age, gender, and present treatment. Notably, when income was used as an indicator of SEP, no difference in use of specialist services was found. Other researchers have found higher education is associated with more use of specialized services and suggest it could be due to the fact that higher-educated individuals might recognize and accept psychiatric needs more than lower-educated individuals[44]; or that mental health treatment makes heavy demands on a client's cognitive capacities and this presents a greater obstacle for people with less education[45]. What is seen in the group with no/few symptoms could be the treatment of emerging mental health problems, and a result of specialized services being requested more by patients with postsecondary education, or that specialized services are a more evident first choice by the GP for some patients. We had also expected the expenses associated with the use of psychologists in Denmark[52] would have an impact, but it did not.

An Australian study found that only a small proportion (4%) of individuals without any disorders or need indicators were among those receiving mental health care. Though this group comprised a fair proportion of service users, the vast majority only sought brief primary care or counselling treatment rather than consultations with psychiatrists, where they constituted only 7% of psychiatry patients[53]. That study did not relate the use of services

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to SEP. However, a Canadian study did find that individuals using mental health care and having no symptoms of mental disorders were better educated compared to those with mental disorders using the services[16].

Secondly, we found that prescription of antidepressants was more common in the group with no/few symptoms and in low SEP. Similar findings were shown in another Australian study, where low SEP was associated with higher prescription rates not attributable to higher rates of depression[54]. The most plausible reason for this association is that depressive disorders are more prevalent in this group and antidepressants are the first choice of treatment, or that antidepressants are more commonly used as analgesic medications in this group, as chronic pain is more common for persons with low SEP[55] .

Strengths and limitations

A major strength of this study was that we were able to obtain reliable data on need from a large sample of people in the GESUS as well as high-quality data on healthcare contacts and prescriptions of antidepressants from national registers, addressing challenges common in studies of equality in health care[9]. To our knowledge, this is the first study combining survey data of depression scores with register data on mental health care treatment. Thus we managed to avoid the inherent problem of recall bias, which is a common problem in these types of studies[56].

SEP may be defined in different several ways[33], but in the present study we used education and income as indicators of SEP. The span of respondents seen in the sample, from a few students to a high proportion of older and retired persons, indicated that income and employment status would be less potent to differentiate the resources that respondents could be expected to have. For that reason, education was the first choice, paired with income, even though older age is associated with lower educational attainment[27]. Additionally, education seems a particularly important factor when evaluating the use of health care specialists[10].

The study related respondents' use of services based on an indication of need (MDI score) that might not capture the fluctuations in all six months afterwards, which is a potential limitation. Even though need will change over time, such change would not be expected to differ among the socioeconomic groups; however, if it did, it would be expected to trend towards higher need for those in low SEP.

The actual reasons for treatment contacts were not known, nor were the reasons for prescriptions of antidepressants known; both could have been for disorders other than depression, indicating a potential limitation of the study design. The variety of other possible disorders would tend to be more common for people in low SEP, and may explain the generally higher use of GP by respondents in low SEP.

Another potential limitation is that not all services used are included in the registers. If a patient is not referred by a GP and pays the full expense for a treatment out of pocket, there is no state reimbursement and subsequently no registration of the treatment in the registers. This would usually indicate high-income individuals, which is often associated with more years of postsecondary education. We do not expect this to be a common scenario, though we have no data to support this.

Implications

For clinicians and policy makers it is of particular interest to know that the treatment of patients with symptoms of depression matched the severity of symptoms and was independent of the SEP of the patient.

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A high proportion with symptoms of depression was not treated. Initiatives to improve mental health literacy might help people with symptoms of depression to address mental health problems when consulting their GP and thereby increase treatment rates. Better attention to mental health by the GP is also necessary, and probably a more systematic approach in evaluating patients' mental health should be implemented.

An interesting disparity between education and income on use of specialized services was found in the group with no/few symptoms. Are specialized services – most likely psychologists – the first choice for the GP when the patient has more years of postsecondary education? Is the initial treatment of patients with depressive symptoms different depending on their education, and why are the prescription rates of antidepressants much higher for persons in low SEP compared to those in high SEP? These issues deserve in-depth exploration in order to more fully address issues of health inequity.

Conclusion

We found no differentiation between socioeconomic groups in the treatment of respondents with symptoms of moderate to severe depression when looking at treatment contact, frequency of contacts, or level of treatment. However, more than half the respondents with moderate to severe symptoms had no treatment beyond GP consultation. Respondents with no/few symptoms of depression used services differently; people with low SEP were more often treated with antidepressants than people with high SEP, whereas people with postsecondary education were more likely to receive specialist services compared to those without postsecondary education, though this association was not found for income.

Author contributions

The statistical analyses were performed by statistician SW. AP conceived the research and wrote the first draft of the manuscript assisted by FBW. FBW contributed substantially to the study design and choice of analysis. AH, ES, and LH contributed to the data analysis, interpretation of results and critical revision of the manuscript.

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Data sharing: no additional data available.

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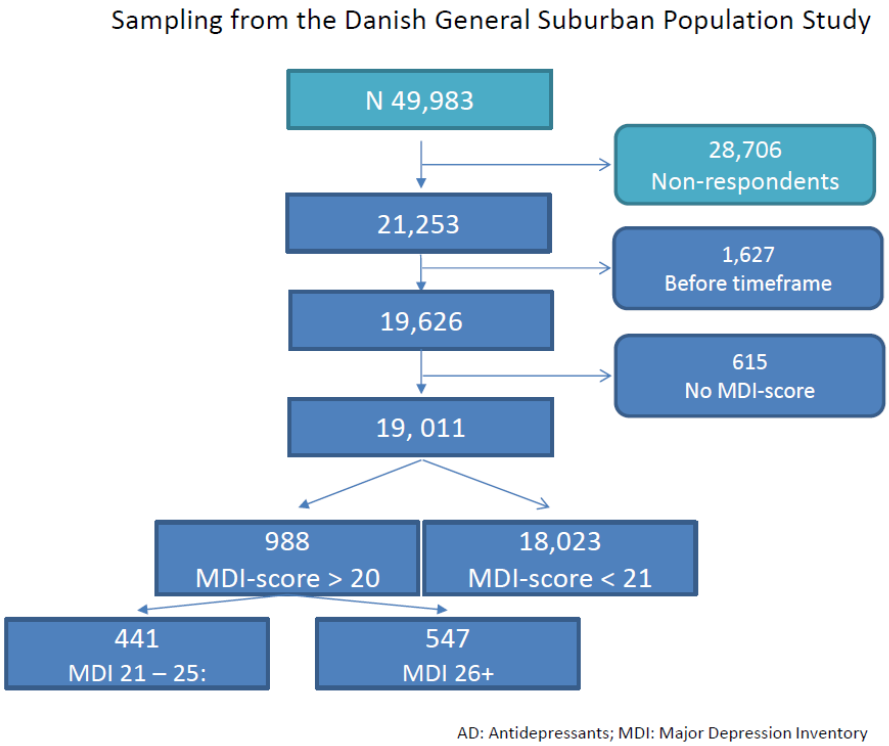
Socioeconomic position, symptoms of depression and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Supplementary figure and tables

Figure 1



Supplement Table 1. Definition of treatment levels

Level	Primary health care	Additional health care	Defined by source and code
0	*No contact*		Not in NPR, NHSR, NPrR
1	*GP*	Consultation	+ NHSR GP (800101 + 800120 +(800411 – 800491) + 804001)
2	*GP*	Mental health counselling by GP	+ NHSR GP & contact concerning mental health (806101)
3	*GP*	Antidepressants	+ NPrR by ATC: NO6A – excluding N06AX12
4	*GP*	Private psychologist	+NHSR (630110 – 630211) + (630214 – 630340)
5	*GP*	Private psychiatrist	+NHSR (240110 – 240140) + (240210 – 240236) + 241401
6	*GP*	Out-patient psychiatry	+NPR by ICD-10: F 00–– F99.99
7	*GP*	Mental hospital & Emergency visits	+NPR by ICD-10: F 00–– F99.99

NPR: The National Patient Register; NHSR: The National Health Service Register; NPrR: The National Prescription Registry; ATC: Anatomical Therapeutic Chemical classification.

Socioeconomic position, symptoms of depression and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Supplement Table 2. Number and mean number of *Mental health care treatments* by MDI grade

Symptoms of depression		No/few	Mild	Moderate/severe	Total
	Persons n (Pct.)	18023 (100)	441 (100)	547 (100)	19011 (100)
No contact					
	Persons n (Pct.)	4540 (25.2)	73 (16.6)	56 (10.2)	4669 (24.6)
GP consultation					
	Persons n (Pct.)	13329 (74.0)	356 (80.7)	474 (86.7)	14159 (74.5)
	Visits n	45044	1433	2252	48729
	Visit rates¤	3.38	4.03	4.75	3.44
GP MHC					
	Persons n (Pct.)	329 (1.8)	28 (6.3)	64 (11.7)	421 (2.2)
	Visits n	611	57	168	836
	Visit rates¤	1.86	2.04	2.63	1.99
Antidepressants#					
	Persons n (Pct.)	1056 (5.9)	87 (29.7)	186 (34.0)	1329 (7.0)
	Prescriptions n	2769	227	670	3666
	Prescrip rates¤	2.62	2.61	3.60	2.76
Psychologists					
	Persons n (Pct.)	167 (0.9)	19 (4.3)	31 (5.7)	217 (1.1)
	Visits n	706	112	144	962
	Visit rates¤	4.23	5.89	4.65	4.43
Private psychiatrist					
	Persons n (Pct.)	100 (0.6)	20 (4.5)	42 (7.7)	162 (0.9)
	Visits n	274	57	201	532
	Visit rates¤	2.74	2.85	4.79	3.28
Out-patient Psychiatry					
	Persons n (Pct.)	22 (0.1)	4 (0.9)	9 (1.6)	35 (0.2)
	Visits n	103	34	46	183
	Visit rates¤	4.68	8.50	5.11	5.23
Specialized services*					
	Persons n (Pct.)	283 (1.6)	40 (9.1)	76 (13.9)	399 (2.1)
	Visits n	1083	203	391	1677
	Visit rates¤	3.83	5.07	5.14	4.20
Admission MH & EA **					
	Persons n (Pct.)	33 (0.2)	4 (0.9)	14 (2.6)	51 (0.3)
	Visits n	49	11	37	97
	Visit rates¤	1.48	2.75	2.64	1.90

¤ Mean number of visits by respondents using the service/prescriptions

Reimbursed prescriptions

* Contact to either psychologist or psychiatrist, public or private

** MH: Mental hospital; EA: Emergency access psychiatric ward

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Supplement Table 3. Highest treatment level gained within six months by education, income, and severity of symptoms, in crude numbers and percentage

Crude	Highest gained treatment level*								
No postsec education	0	1	2	3	4	5	6	7	
MDI < 21	512	1783	17	162	5	11	6	6	2502
MDI 21 - 25	9	62	2	13	3	3	0	1	93
MDI >25	9	63	5	39	3	11	2	4	136
Missing	15	208	2	27	2	0	1	2	257
1-3 years postsecondary education									
MDI < 21	2361	6512	84	515	93	54	10	21	9650
MDI 21 - 25	39	134	1	31	6	9	3	2	225
MDI >25	28	122	8	59	14	20	2	4	257
Missing	42	177	5	22	2	3	0	0	251
3+ years postsecundary education									
MDI < 21	1667	3789	59	254	64	31	1	6	5871
MDI 21 - 25	25	61	2	20	8	6	0	1	123
MDI >25	19	74	7	27	10	8	3	6	154
Missing	25	68	0	12	1	1	0	0	107

Crude	Highest gained treatment level*								
Income < 40,250€	0	1	2	3	4	5	6	7	
MDI < 21	649	2809	28	292	26	27	7	12	3850
MDI 21 - 25	19	80	2	20	9	6	1	1	138
MDI >25	17	99	4	58	7	16	1	6	208
Missing	33	204	3	26	2	3	1	1	273
Income ≥ 40,250 <80,500€									
MDI < 21	1586	4113	74	318	62	34	6	14	6207
MDI 21 - 25	22	83	1	19	4	7	0	1	137
MDI >25	22	73	7	32	8	13	5	4	164
Missing	20	81	2	13	1	1	0	0	118
Income ≥80,500€									
MDI < 21	1969	3923	44	209	63	26	0	4	6238
MDI 21 - 25	27	62	2	12	4	5	2	2	116
MDI >25	10	61	5	15	7	7	0	2	107
Missing	13	24	0	1	1	0	0	0	39

Pct										Spec#
No postsec education	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**		
MDI < 21	20	71	0,7	6,5	0,2	0,4	0,2	0,2		0,9
MDI 21 - 25	10	67	2,2	14,0	3,2	3,2	0,0	1,1	100	6,5
MDI >25	7	46	3,7	28,7	2,2	8,1	1,5	2,9	100	11,8
1-3 years postsecundary education										
MDI < 21	24	67	0,9	5,3	1,0	0,6	0,1	0,2	100	1,6
MDI 21 - 25	17	60	0,4	13,8	2,7	4,0	1,3	0,9	100	8,0
MDI >25	11	47	3,1	23,0	5,4	7,8	0,8	1,6	100	14,0
3+ years postsecundary education										
MDI < 21	28	65	1,0	4,3	1,1	0,5	0,0	0,1	100	1,6
MDI 21 - 25	20	50	1,6	16,3	6,5	4,9	0,0	0,8	100	11,4
MDI >25	12	48	4,5	17,5	6,5	5,2	1,9	3,9	100	13,6

Pct										Spec#
Income < 40,250€	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**		
MDI < 21	17	73	1	8	1	1	0	0	100	1,6
MDI 21 - 25	14	58	1	14	7	4	1	1	100	11,6
MDI >25	8	48	2	28	3	8	0	3	100	11,5
Income ≥ 40,250 <80,500€										
MDI < 21	26	66	1	5	1	1	0	0	100	1,6
MDI 21 - 25	16	61	1	14	3	5	0	1	100	8,0
MDI >25	13	45	4	20	5	8	3	2	100	15,9
Income ≥80,500€										
MDI < 21	32	63	1	3	1	0	0	0	100	1,4
MDI 21 - 25	23	53	2	10	3	4	2	2		9,5
MDI >25	9	57	5	14	7	7	0	2		13,1

Treatment level: 0: none; 1: GP (general practitioner); 2: GP-mental health consultations; 3: antidepressants; 4: psychologist; 5: private psychiatrist; 6: public psychiatrist; 7: mental hospital

#Spec: Specialized services includes 4+5+6

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STROBE Statement for the study: **Socioeconomic position, symptoms of depression, and subsequent health care utilization and treatment: a Danish register-based six-month follow-up on a survey study.**

	Item No	Recommendation	Addressed on page:
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4 - 5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4 – 5 Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4 – 5 Table 1*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	4 + 8 & Suppl Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4 - 6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6 – 7
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, explain how loss to follow-up was addressed	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8 Suppl fig 1
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
		(c) Summarise follow-up time (eg, average and total amount)	

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Outcome data	15*	Report numbers of outcome events or summary measures over time	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 4 Supp tab 2+3
		(*b*) Report category boundaries when continuous variables were categorized	4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13 - 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

*Give information separately for exposed and unexposed groups.

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

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Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

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Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

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Aake Packness affirms that this manuscript is an honest, accurate, and transparent account of the study being reported, that no important aspects of the study have been omitted, and that any discrepancies from the study as planned have been explained.

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Abstract

Objective: Examine whether the severity of symptoms of depression were associated with the type of mental health care treatment (MHCT) received, independent of socioeconomic position (SEP).
Design: Register-based six-month follow-up study on participants from the Danish General Suburban Population Study (GESUS) 2010-2013, who scored the Major Depression Inventory (MDI).
Participants: 19,011 respondents from GESUS.
Interventions: MHCT of the participants was tracked in national registers four months prior and six months after their MDI score. MHCT was graduated in levels. SEP was defined by years of formal postsecondary education and income categorised in three levels. Data was analysed using logistic and Poisson regression analyses.
Outcomes: MHCT included number of contacts to: general practitioner (GP), GP mental health counselling, psychologist, psychiatrist, emergency contacts, admissions to mental hospital, and prescriptions of antidepressants.
Results: For 547 respondents with moderate to severe symptoms of depression there was no difference across SEP in use of services, contact (y/n), frequency of contact, or level of treatment, except respondents with low SEP had more frequent contact with their GP. However, of the 547, 10% had no treatment contacts at all, and 47% had no treatment beyond GP consultation. Among respondents with no/few symptoms of depression, postsecondary education ≥ 3 years was associated with more contact with specialized services (adjusted odds ratio aOR 1.92; 95% confidence interval (CI) 1.18-3.13); however, this difference did not apply for income; additionally, high SEP was associated with fewer prescriptions of antidepressants (education aOR 0.69; CI 0.50-0.95; income aOR 0.56, CI 0.39-0.80) compared to low SEP.
Conclusion: Participants with symptoms of depression were treated according to the severity of their symptoms, independent of SEP; however, more than half with moderate to severe symptoms received no treatment beyond GP consultation. People with low SEP and no/few symptoms of depression were more often treated with antidepressants.

The study was approved by The Danish Data Protection Agency Journal number 2015-41-3984.
Accessible at: https://www.datatilsynet.dk/fortegnelsen/soeg-i-fortegnelsen/

Strengths and limitations of this study

- The design of this study, combining data from a population survey on depression symptom-scores with prospective register data on health care use and medication, is unique in health service research on treatment of people with symptoms of depression.
- The study design made it possible to reduce the inherent problem of recall bias in these types of studies.
- The actual reasons for treatment contacts or for prescription of antidepressants were not known, they could have been caused by other disorders than depression.
- The study sample was generally better educated than the population they were sampled from

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Title:

Socioeconomic position, symptoms of depression, and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Introduction

Equal access to health care based on need and the reduction of health inequalities are major policy objectives in most OECD countries[1]. Similarly, the World Health Organization states that addressing social inequalities contributes significantly to health and well-being of individuals and countries[2].

Sustained economic hardship can lead to poorer physical, psychological, and cognitive functioning[3], and is furthermore associated with a higher prevalence of mental health problems[4]. Specifically, depressive disorders are more prevalent among people with a low socioeconomic position (SEP)[5] and enhanced by worsening socioeconomic circumstances[6]. Whereas low SEP is an outcome of schizophrenia low SEP is a determinant for depression[7 8]. Additionally, depression is a major health problem, globally ranked as the single largest contributor to non-fatal health loss, accounting for 7.5% overall in years lived with disability[9]. It is estimated that life expectancy is reduced by 14 years for men and 10 years for women treated for severe depression[10].

Equity in access to health care is commonly defined as equal access for equal need. However, both *access* and *need* are ambiguous concepts[11]. It has been documented that patients with a high SEP use more specialized health care services[12 13], also within mental health care[14]; yet there remains a gap between those in need of mental health care and those who receive it[15-17]. Additionally, not all users of mental health care are in clinical need[18]. As for depression and anxiety disorders, some studies have found access to specialist care to be reflective of clinical need, with little inequity in SEP[19 20], whereas others report specialized mental health services are not provided to persons with low SEP according to need[21 22], or that higher SEP is associated with more use of specialized mental health services[23 24]. This uncertainty and the fact that depressive disorders are widespread and more common among persons with lower SEP makes these disorders both relevant and well suited to evaluate the capability of health care systems to address the needs of economically deprived citizens. Depression is a serious disorder with extensive personal, social and economic consequences, which makes its treatment an important issue and health equality an urgent cause.

Objectives

We aimed to evaluate whether the Danish health care system delivers equal treatment to patients with symptoms of depression. We defined *mental health care treatment* (MCHT) as the use of specific health care services related to the treatment of depressive disorders, as well as treatment with antidepressants.

The objective was to examine if the severity of symptoms of depression (need) was associated with the mental health care treatment received, independent of SEP in both type and frequency of treatments, and highest gained treatment level within six months following a symptom score in a survey study.

Method

Design

A six-month follow-up study on respondents with symptoms of depression, combining survey data with register data on mental health care treatment.

Setting: Danish health care system

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Health care is tax-funded in Denmark and free at delivery, except for dental care and visits to psychologists for adults, which are both partly subsidized[25]. The general practitioner (GP) acts as a gatekeeper to more specialized care. Treatment by a psychologist is subsidized for patients with specific conditions, such as reaction to specific traumatic events, moderate depression, and, specifically for citizens between 18 and 38 years, also moderate anxiety disorders. In 2014, the co-payment for a psychologist appointment was equivalent to 44€ per session[26]. Each psychologist is obliged to obtain a special authorization from the Danish Supervisory Board of Psychological Practice in order to be subsidized.

Study population and data sources

The study was conducted as a follow-up study on mental health care utilization and use of antidepressants, examining participants who scored high on symptoms of depression in the Danish General Suburban Population Study (GESUS)[27] in the municipality of Næstved, Denmark. The municipality of Næstved is located 90 kilometres south of the capital Copenhagen. It has a total population of 81,000 and a socioeconomic index score 4% lower than the 2013 national average[28]. The GESUS data was collected from January 2010 through October 2013. The aim of GESUS was facilitate epidemiologic and genetic research by using information from questionnaires, health examinations, biochemical measurements, genetic variants and public registers to analyze the occurrence of co-morbidities (e.g. diabetes, cardiovascular disease, pulmonary disease and cancer) and mortality. All citizens over the age of 30 were invited, as were a random selection of one-quarter of citizens between 20 and 30 years of age. The study consists of 21,253 participants, equivalent to 43% of the invited citizens, the median age of participants were 56 years and 52 years for the non-participants. Data from the self-administered GESUS questionnaire was used in the present study.

Persons with permanent residence in Denmark are registered in the Danish Civil Registration System (CRS)[29] and are assigned a unique 10-digit identification number, the Central Personal Register Number (CPR). The CPR number was registered in the survey data and thus provided a way to match respondents with information on their age and gender, and also made it is possible to identify the individuals in all public data registers in Denmark. In addition to the data sources already mentioned, data concerning vital status and dates of migration were gathered from the CRS as well.

Using the CPRs from GESUS, we linked to national registers and tracked the use of healthcare services and antidepressants for four months (120 days) prior and six months (180 days) after the respondents entered the GESUS study, or until their death or migration, if that occurred before. Data from national registers covered the years 2010-2014 in order to fit a timeframe of four months prior to index date; however, the sample was reduced to include only respondents entering the GESUS study from May 2010, due to lack of data availability from 2009. The period of four months prior to the study was chosen assuming active treatment would include a treatment appointment or renewed prescription at least every three to four months.

Independent variables

Data on independent variables came from GESUS.

Measure of need

Depression was chosen as an expression of need, with the Major Depression Inventory (MDI) as a measurement tool, extracted from the GESUS questionnaire. The MDI is based on the 12-item Likert scale and has been found to have an adequate internal and external validity for defining different stages of depression[30]. The MDI is also based on the ICD-10 diagnostic criteria for depressive disorder[31], with scores ranging from 0 to 50: scores ≤20 do not

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indicate depression; mild depression is defined as a score from 21-25; moderate depression from 26-30; and severe depression from 31-50[32]. In the study, we collapsed moderate and severe depression into the same category, reducing the categories to three in order to gain statistical power: *no/few symptoms* (summed MDI 0 – 20), *mild symptoms* (summed MDI 21-25), and *moderate/severe symptoms* (summed MDI 26+). This splitting of symptomatic individuals into only two groups (mild or moderate/severe) was supported by the recommended therapeutic approach at the time: patients with mild symptoms were recommended "watchful waiting" and perhaps supportive consultations, whereas patients with moderate to severe depression were recommended antidepressants and therapy by a psychologist or a psychiatrist[33]. If more than two items were missing in the MDI, the score was categorized as missing[34].

Socioeconomic position

SEP is commonly measured by income, occupation, housing tenure, or education; higher education in particular is known to predict higher response rates in questionnaires[35]. Education and income were chosen as measures of SEP in this study due to the respondents' age distribution skewing older than the general population; older age groups tend to have lower education, and they also have lower incomes, but occupation is not a useful SEP measurement for retired individuals. Education was classified as, *No postsecondary education:* if the respondent did not complete any postsecondary education; *1-3 years postsecondary education:* for vocational education of 1 - 3 years; *or* for academy/professional graduates of 1 - 3 years; *3+ postsecondary education:* for baccalaureate who completed 3 - 4 years, and *Academic* for those who completed graduate study of ≥ 5 years. Students were categorized at the level that their studies would end in, e.g. students in doctoral programs would be categorized as Academics even though they had not yet completed 5 years of graduate study.

Information on income was also extracted from the GESUS questionnaire, where it was reported in Danish Kroner (DDK). 100 DDK equals 13.42€, a fixed exchange rate for many years. Income was grouped into three equal groups: *Less than 300,000 DDK; 300,000-599,999 DDK;* and *600,000+ DDK* and reported as: *<40,250€*; *≥40,250< 80,499€*; or *≥ 80,500€.*

When both income and education show the same association to an outcome, it will be addressed as an association to SEP; otherwise the association will be addressed to the variable in question (income/education).

Extrinsic variables

Sociodemographic data included age, gender, marital status, and cohabitation status.

Information on *somatic comorbidity* included: previous acute myocardial infarction (AMI), arteriosclerosis, angina pectoris, stroke, cancer, diabetes mellitus, hyper- or hypo-thyroidism. The somatic disorders were all grouped into one variable. Previous depressive episodes were registered separately.

Present medication covered self-reported use of antidepressants. Respondents defined as being in *present treatment* included both participants who reported use of antidepressants and participants identified in registers, as described below, who had redeemed a prescription for antidepressants and/or had contact with a psychiatrist and/or a psychologist within four months prior to the date of returning the questionnaire (in the following termed the *index date*) with the depression score.

Dependent variables

Data on dependable variables was drawn from national registers.

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The outcome variables were graded according to the stepwise treatment of increasing intensity for depression as was recommended in the Danish national guidelines at the time[25]. The guidelines start with #1) counselling and # 2) therapy provided by the GP, followed by # 3) prescription of antidepressants, followed by # 4) referral to therapy with a psychologist, then # 5) referral to treatment by a psychiatrist, and finally referral to # 6) outpatient public psychiatrist or eventually #7) inpatient treatment at a psychiatric hospital (see code definitions in Supplement Table 1; an additional #0 refer to no treatment contact). Emergency visits to a mental hospital were included in the category of hospital contacts. The more severe or non-respondent the depression is to the proscribed treatment, the higher the patient is supposed to move in the recommended treatment hierarchy. Treatment by psychologists (#step 4) or psychiatrists (#steps 5 # and #6), whether private or public, were pooled into one group in some analyses due to low numbers of observations. Data on the utilization of private psychiatrists, psychologists, and general practitioners (GPs) was drawn from the Danish National Health Service Register for Primary Care[36]. For psychologists, only subsidized services are in the register. Respondents covered by private insurance and treated for depression or anxiety are included in the data, as insurance agencies require referral from GPs to compensate the patient.

Mental health counselling provided by a GP consists of at least two talks within the first six months and up to seven talks within one year. This type of therapeutic counselling is registered and paid as additional reimbursement to the GP. In the study, this service was termed mental health counselling by a GP (MHC by GP). Topics for ordinary consultations by GP are not registered in the national registers.

Data on prescriptions for antidepressants (Anatomical Therapeutic Chemical (ATC) classification system N06A) were extracted from the Danish National Prescription Registry[37 38]. However, bupropion (ATC N06AX12), which is approved for the treatment of depression in some countries, was excluded from this study since it is only prescribed for smoking cessation in Denmark.

Information concerning public in- and outpatient psychiatric treatment was drawn from the Danish National Patient Register[39] (ICD-10 coded F00 – F99).

Statistical analyses

First, we estimated the association between SEP and the different binary outcome variables (that is, the five different types of health care contact: *No health care contact*, *GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*) in separate logistic regression models, both uni- and multivariable. Each model was stratified into three MDI categories: no/few symptoms (MDI < 21), symptoms of mild depression (MDI 21-25), and symptoms of moderate to severe depression (MDI ≥ 26). The SEP category '*No postsecondary education* and income *<40,250€*' was used as the reference category. To examine a possible interaction between SEP and MDI category, we employed logistic regression models for each outcome, with patients having *No postsecondary education* / *<40,250€* and *no/few depression symptoms* as key reference.

Second, in order to evaluate differences in visits and prescription rates, we estimated incidence rate ratios (IRR) by Poisson regression models for each type of contact (*GP consultation*, *Mental health counselling by GP*, *Antidepressants*, and *Specialized mental health services*). For each type of contact, analyses were restricted to those patients who had at least one contact. For exposure, death and emigration within 180 days after index date were taken into consideration. As above, analyses were stratified into MDI category, and the SEP category '*No education* and *< 40,250€*' was used as a reference category.

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Finally, we performed a linear regression analysis for the effect of combined SEP and MDI category on the highest reached treatment level (see treatment progression described above). The treatment levels were categorized as shown in Supplementary Table 1 (0: no treatment/contact; 1: GP consultation; 2: MHC by GP; 3: antidepressants; 4: psychologist; 5: private psychiatrist; 6: public psychiatrist; 7: psychiatric hospital). Patients having *No postsecondary education* / *< 40,250€* and *no/few depression symptoms* were the key reference groups.

All multivariable regression models included age (*20-59* versus *60+*), gender, present treatment with antidepressants, and psychologist or psychiatrist (*yes/no*), in addition to the variable studied in the univariate (crude) analysis. In analyses including income, cohabitation was also included.

The significance level was 5% throughout, and all reported confidence intervals were 95%. All statistical analyses were performed using Stata 14[40].

Patient and Public Involvement

The study did not involve patients or public in planning or execution.

Ethics

Access to data from the GESUS was approved by the GESUS board in December 2015. The data were stored at a server at Statistics Denmark. The collection and handling of the data has been approved by the Danish Data Protection Agency, Journal number: 2015-41-3984. Approval by an ethics committee is not required for register studies in Denmark.

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Results

The study included 19,011 respondents from the GESUS study; the original 21,253 were reduced by 1,627 respondents who entered before May 2010 due to data unavailability for 2009. The respondents were further reduced by an additional 615 who did not have a valid MDI score (see flowchart, Supplement Figure 1). 29 deaths and four persons emigrating were included in the analysis only until death or migration. In all, 988 (5.2%) had symptoms of depression. Of these, 441 had symptoms of mild depression and 547 had symptoms of moderate and severe depression, and of the latter group 271 were rated severe.

Table 1. Baseline characteristics of the study sample by MDI grade

MDI score **Symptoms of depression** All	All n (pct.) 19626 (100)	**MDI < 21** None/few 18023 (100)	**MDI 21 - 25** Mild 441 (100)	**MDI 26+** Moder./sev§ 547 (100)	**MDI missing** NA 615 (100)
In treatment*					
No	18076 (92.1)	16860 (93.5)	334 (75.7)	335 (61.2)	547 (88.9)
Yes	1550 (7.9)	1163 (6.5)	107 (24.3)	212 (38.8)	68 (11.1)
Gender					
Male	8927 (45.5)	8349 (46.3)	162 (36.7)	168 (30.7)	
Female	10699 (54.5)	9674 (53.7)	279 (63.3)	379 (69.3)	
Age group					
20-29	294 (1.5)	266 (1.5)	10 (2.3)	17 (3.1)	
30-39	2382 (12.1)	2206 (12.2)	79 (17.9)	86 (15.7)	
40-49	4186 (21.3)	3891 (21.6)	106 (24)	146 (26.7)	
50-59	4417 (22.5)	4100 (22.7)	115 (26.1)	144 (26.3)	
60-69	5123 (26.1)	4771 (26.5)	74 (16.8)	93 (17)	
70+	3224 (16.4)	2789 (15.5)	57 (12.9)	61 (11.2)	
Marital status					
Married	13398 (68.3)	12519 (69.5)	234 (53.1)	259 (47.3)	
Separated/divorced	2174 (11.1)	1936 (10.7)	71 (16.1)	117 (21.4)	
Widow/er	1385 (7.1)	1172 (6.5)	37 (8.4)	45 (8.2)	
None of the above	2669 (13.6)	2396 (13.3)	99 (22.4)	126 (23)	
Cohabitating					
No	4342 (22.1)	3745 (20.8)	147 (33.3)	217 (39.7)	
Yes (incl missing)	15284 (77.9)	14278 (79.2)	294 (66.7)	330 (60.3)	
Education					
None (No postsecondary)	2988 (15.2)	2502 (13.9)	93 (21.1)	136 (24.9)	
Vocational/1-3yrs (1-3 years postsecondary)	8227 (41.9)	7645 (42.4)	169 (38.3)	199 (36.4)	
Academy/professional <3yrs (1-3 yrs postsecund.)	2156 (11)	2005 (11.1)	56 (12.7)	58 (10.6)	
Baccalaureate /3-4yrs (3+ years postsecondary)	5024 (25.6)	4706 (26.1)	104 (23.6)	137 (25)	
Academic/5+yrs (3+ years postsecondary)	1231 (6.3)	1165 (6.5)	19 (4.3)	17 (3.1)	
Income					
less than 150.000DDK (< 40,250€)	1063 (5.4)	847 (4.7)	38 (8.6)	69 (12.6)	
150,000 - 299,999DDK (<40,250€)	3406 (17,4)	3003 (16.7)	100 (22.7)	139 (25.4)	
300,000 - 449,999 DDK (≥40,250 <80,500€)	3601 (18.3)	3344 (18.6)	73 (16.6)	98 (17.9)	
450,000 - 599,000DDK (≥40,250 <80,500€)	3025 (15.4)	2863 (15.9)	64 (14.5)	66 (12.1)	
600,000 - 749,999DDK (≥80,500€)	3245 (16.5)	3086 (17.1)	74 (16.8)	64 (11.7)	
750,000 - 899,999DDK (≥80,500€)	1856 (9.5)	1794 (10)	22 (5)	29 (5.3)	
900,000 - 1,049,999DDK (≥80,500€)	693 (3.5)	667 (3.7)	12 (2.7)	9 (1.6)	
1,050,000DKR + (≥80,500€)	706 (3.6)	691 (3.8)	8 (1.8)	5 (.9)	
Missing	2031 (10.3)	1728 (9.6)	50 (11.3)	68 812.4)	
Comorb. former depression					
No	16755 (85.4)	15826 (87.8)	255 (57.8)	210 (38.4)	
Yes	2484 (12.7)	1917 (10.6)	173 (39.2)	319 (58.3)	
Missing	387 (2)	280 (1.6)	13 (2.9)	18 (3.3)	
Comorbidity somatic, all ¤					
No	13791 (70.3)	13109 (72.7)	195 (44.2)	168 (30.7)	
Yes	5835 (29.7)	4914 (27.3)	246 (55.8)	379 (69.3)	
Medication antidepressants #					
No	18537 (94.5)	17213 (95.5)	363 (82.3)	385 (70.4)	576 (93.7)
Yes	1089 (5.5)	810 (4.5)	78 (17.7)	162 (29.6)	39 (6.3)

§ Moderate or servere
* In treatment at index date or 120 days before by psychologist, psychiatrist, or antidepressant prescription, according to GESUS or registers
¤ Somatic comorbidities: Ischemic heart disease, diabetes, cancer, metabolic diseases
replied in questionnaire

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The baseline characteristics of the study sample are shown in table 1, in total, and stratified by severity of symptoms of depression. Respondents with symptoms of mild to severe depression tended to be: younger, more singles, living without a partner, and without formal education, compared to those with no/few symptoms.

In the study sample respondents with no education beyond the secondary level were underrepresented and constituted half the proportion of the study population, according to Statistics Denmark; and the proportion with more than 3 years of postsecondary education was 32% in the sample compared to 19% in the population in Næstved[41].

Table 2 shows odds ratios for mental health care treatment contacts. Among respondents with no/few symptoms, the group with three or more years of postsecondary education were 30% more likely to have *no healthcare contacts at all* when compared to the group without postsecondary education (adjusted odds ratio (aOR) 1.32, confidence interval (CI) 1.18 - 1.49). Similarly were respondents in the highest income group 66% more likely to have *no healthcare contacts at all* when compared to the lowest income group (aOR 1.66, CI 1.46-1.89). Higher education (3+ years) as well as high income was associated with fewer consultations with a GP and fewer prescriptions of antidepressants, compared to those without postsecondary education or with low income. However, increased educational level was associated with more contact with specialized services (aOR 1.81, CI 1.13 - 2.88; aOR 1.92, CI 1.18 - 3.13); a difference not seen between the income groups.

Among respondents with symptoms of mild depression, there was no statistically significant difference across educational groups or income groups in odds for contacts and prescriptions in the adjusted analyses, except those with 1-3 years of postsecondary education had a lower use of mental health counselling by GP (aOR 0.30, CI 0.10 - 0.91) compared to respondents without any postsecondary education.

In the group with symptoms of moderate to severe symptoms of depression there was no difference across socioeconomic categories in any type of health care contact, when adjusted for age, gender and present treatment.

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Table 2: Odds ratios for type of *Mental health care treatment* by educational- and income level stratified by MDI grade

Symptoms, depression	No/Few (MDI <21)		Mild (MDI 21-25)		Moderate/severe (MDI >25)	
No contact at all	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*	Crude OR	OR (adjusted)*
Education	(N=18023 pts.)		(N = 441 pts.)		(N = 547 pts.)	
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**1.26 (1.13–1.40)**	1.10 (0.98–1.23)	1.96 (0.91–4.22)	1.62 (0.71–3.67)	1.73 (0.79–3.77)	1.62 (0.72–3.65)
3+ years postsec. educ.	**1.54 (1.38–1.72)**	**1.32 (1.18–1.49)**	**2.38 (1.05–5.38)**	2.01 (0.84–4.83)	1.99 (0.87–4.55)	1.79 (0.76–4.23)
Income	(N=16295)		(N=391)		(N=479)	
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**1.69 (1.53-1.87)**	**1.39 (1.24-1.56)**	1.20 (0.62-2.33)	0.79 (0.36-1.76)	1.74 (0.89–3.40)	1.59 (0.72-3.52)
Income ≥80,500€	**2.27 (2.06-2.51)**	**1.66 (1.46-1.89)**	1.90 (0.99-3.63)	1.35 (0.55-3.33)	1.16 (0.51–2.63)	1.04 (0.38-2.82)
GP consultation						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.80 (0.72–0.89)	0.92 (0.82–1.02)	0.52 (0.26–1.06)	0.64 (0.31–1.35)	0.68 (0.35–1.31)	0.70 (0.36–1.37)
3+ years postsec. educ.	0.66 (0.59–0.74)	**0.77 (0.68–0.86)**	**0.46 (0.21–0.97)**	0.54 (0.24–1.19)	0.69 (0.34–1.41)	0.74 (0.36–1.53)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**0.60 (0.54-0.66)**	**0.72 (0.64-0.80)**	0.90 (0.48-1.67)	1.25 (0.60-2.61)	0.55 (0.30-1.00)	0.53 (0.27-1.07)
Income ≥80,500€	**0.45 (0.41-0.50)**	**0.60 (0.53-0.68)**	0.63 (0.34-1.84)	0.79 (0.34-1.84)	0.94 (0.44-1.97)	0.81 (0.33-2.01)
GP Mental health counseling						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	1.20 (0.84–1.71)	1.09 (0.76–1.57)	**0.34 (0.12–0.97)**	**0.30 (0.10–0.91)**	1.20 (0.61–2.33)	1.27 (0.65–2.50)
3+ years postsec. educ.	1.31 (0.90–1.89)	1.21 (0.83–1.76)	1.26 (0.50–3.17)	1.03 (0.38–2.81)	1.23 (0.59–2.55)	1.30 (0.62–2.73)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	1.07 (0.80-1.43)	1.09 (0.78-1.53)	1.14 (0.43-3.05)	1.40 (0.44-4.47)	**2.06 (1.05-4.02)**	1.79 (0.81-3.97)
Income ≥80,500€	0.84 (0.62-1.14)	0.85 (0.57-1.28)	1.20 (0.44-3.31)	1.33 (0.34-3.96)	1.66 (0.77-3.59)	1.35 (0.52-3.53)
Antidepressants						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.85 (0.71–1.01)	0.75 (0.55–1.01)	0.96 (0.52–1.77)	1.11 (0.47–2.65)	0.72 (0.47–1.10)	0.82 (0.43–1.56)
3+ years postsec. educ.	**0.69 (0.57–0.83)**	**0.69 (0.50–0.95)**	1.17 (0.60–2.29)	1.40 (0.54–3.63)	0.65 (0.40–1.05)	0.86 (0.42–1.77)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	**0.67 (0.57-0.78)**	**0.71 (0.52-0.95)**	0.77 (0.43-1.39)	1.29 (0.51-3.25)	0.67 (0.43-1.03)	0.53 (0.25-1.11)
Income ≥80,500€	**0.44 (0.37-0.52)**	**0.56 (0.39-0.80)**	0.63 (0.33-1.20)	1.25 (0.39-3.96)	**0.53 (0.32-0.89)**	0.53 (0.20-1.36)
Specialized services¤						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**1.94 (1.24–3.03)**	**1.81 (1.13–2.88)**	1.34 (0.52–3.46)	0.79 (0.27–2.36)	1.30 (0.70–2.43)	1.73 (0.87–3.41)
3+ years postsec. educ.	**1.91 (1.20–3.05)**	**1.92 (1.18–3.13)**	2.01 (0.75–5.41)	1.41 (0.45–4.36)	1.25 (0.63–2.49)	1.67 (0.78–3.57)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥ 40,250 <80,500€	1.03 (0.75-1.42)	1.11 (0.76-1.64)	0.67 (0.30-1.49)	0.79 (0.36-1.76)	1.32 (0.73-2.37)	1.47 (0.69-3.14)
Income ≥80,500€	0.89 (0.64-1.23)	0.99 (0.63-1.55)	0.96 (0.44-2.09)	1.35 (0.55-3.33)	1.05 (0.53-2.11)	1.36 (0.52-3.56)

* Adjusted for age- group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
** Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
¤ Psychologist or psychiatrist public or private
Results significant within a 95% confidence interval are marked in bold

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Table 3 Incidence rate ratios for *Mental health care treatments* by education- and income level stratified by MDI grade

Symptoms of depression	No/few (MDI <21)		Mild (MDI 21-25)		Moderate/severe (MDI >25)	
GP consultation	**IRR (crude)**	**IRR (Adjusted)***	**IRR (crude)**	**IRR (Adjusted)***	**IRR (crude)**	**IRR (Adjusted)***
Education	(N=18023)		(N=441)		(N=547)	
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	**0.82 (0.80–0.84)**	**0.87 (0.85–0.89)**	**0.79 (0.69–0.89)**	**0.88 (0.77–0.99)**	**0.81 (0.73–0.89)**	**0.81 (0.74–0.89)**
3+ years postsec. educ.	**0.77 (0.75–0.80)**	**0.84 (0.81–0.86)**	**0.74 (0.64–0.86)**	**0.83 (0.72–0.97)**	**0.76 (0.68–0.85)**	**0.77 (0.69–0.86)**
Income	(N=16295)		(N=391)		(N=479)	
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥40,250 <80,500€	**0.81 (0,80-0.83)**	**0.88 (0.85-0.90)**	**0.75 (0.66–0.85)**	0.88 (0.76–1.02)	**0.74 (0.67-0.82)**	**0.81 (0.72-0.91)**
Income ≥80,500€	**0.67 (0.66-0.69)**	**0.78 (0.76-0.81)**	**0.63 (0.55–0.73)**	**0.78 (0.65–0.94)**	**0.66 (0.59-0.75)**	**0.75 (0.65-0.86)**
GP Mental health counseling						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.93 (0.73–1.20)	0.93 (0.72–1.20)	1.36 (0.70–2.64)	1.22 (0.58–2.56)	1.08 (0.74–1.58)	1.13 (0.77–1.65)
3+ years postsec. educ.	0.93 (0.72–1.22)	0.93 (0.71–1.21) **	0.85 (0.44–1.61)	0.82 (0.40–1.69) **	0.76 (0.48–1.18)	0.79 (0.50–1.24) **
Income < 40,250€	Ref	Ref	Ref	Ref	Ref	Ref
Income ≥40,250 <80,500€	0.98 (0.79-1.22)	0.93 (0.74-1.18)	0.73 (0.39–1.36)	0.97 (0.49-1.91))	0.83 (0.56-1.23)	0.69 (0.42-1.14)
Income ≥80,500€	1.00 (0.80-1.25)	0.94 (0.71-1.24)	**0.45** (0.22–0.96)	**0.39** (0.18-0.88)	1.07 (0.69-1.64)	0.86 (0.50-1.48)
Antidepressants#						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.95 (0.85–1.05)	0.93 (0.84–1.03)	1.03 (0.73–1.46)	1.05 (0.73–1.50)	1.07 (0.89–1.28)	1.06 (0.88–1.27)
3+ years postsec. educ.	1.00 (0.89–1.12)	1.01 (0.90–1.13) **	1.10 (0.76–1.59)	1.11 (0.77–1.62)	1.12 (0.91–1.37)	1.08 (0.88–1.33)
Income < 40,250€	Ref	Ref **	Ref	Ref **	Ref	Ref**
Income ≥40,250 <80,500€	0.98 (0.90–1.08)	1.00 (0.90–1.11)	1.09 (0.79–1.49)	1.29 (0.90–1.84)	0.97 (0.80-1.18)	0.92 (0.73-1.16)
Income ≥80,500€	0.92 (0.83-1.02)	0.95 (0.84-1.09)	1.02 (0.71–1.46)	1.18 (0.74–1.88)	1.18 (0.94-1.47)	1.11 (0.84-1.46)
Specialized services¤						
No postsecondary educ.	Ref	Ref	Ref	Ref	Ref	Ref
1-3 years postsec. educ.	0.97 (0.77–1.22)	0.94 (0.75–1.19)	1.11 (0.71–1.71)	0.93 (0.58–1.48)	0.93 (0.72–1.21)	0.94 (0.72–1.22)
3+ years postsec. educ.	1.06 (0.84–1.34)	1.02 (0.80–1.29)	1.32 (0.85–2.05)	1.02 (0.63–1.66)	1.09 (0.82–1.43)	1.10 (0.83–1.46)
Income < 40,250€	Ref	Ref**	Ref	Ref**	Ref	Ref**
Income ≥40,250 <80,500€	1.09 (0.92-1.28)	1.20 (0.99-1.45)	1.30 (0.91–1.85)	1.30 (0.88-1.94)	1.01 (0.78-1.30)	0.77 (0.57-1.06)
Income ≥80,500€	1.18 (1.00-1.39)	**1.35 (1.09-1.68)**	**1.58 (1.14–2.19)**	1.21 (0.79-1.86)	1.46 (1.12-1.92)	1.00 (0.69-1.45)

* Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
** Adjusted for age-group 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
¤ Psychologist or psychiatrist, public or private
Number reimbursed prescriptions
Results significant within a 95% confidence interval are marked in bold

Table 3 shows the rate (incidence rate ratios (IRR)) of visits and number of prescriptions of antidepressants stratified by severity of symptoms. At all grades of symptoms of depression short education and low income were associated higher rates of visitsto GP..
Among participants with no/few symptoms of depression, high income was associated with more frequent visits to a specialist, compared to the low income group (aIRR 1.35, CI 1.09-1.68).

Among participants with mild symptoms of depression high income was associated with a lower visit rate for GP-MHC than the low-income group (aIRR 0.39, CI 0.18-0.88).

In the group with symptoms of moderate to severe depression there were no significant differences between income- or educational groups in visit rates to services beyond GP, when adjusted for age, gender, and present treatment among those using services.

Table 4 shows the highest gained treatment level within the 180 day window in crude numbers. (Supplementary table 2 shows Number and mean number of mental health care treatment by MDI grade). More severe symptoms were met with a higher level of treatment, though 10% of the respondents with symptoms of moderate to severe

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depression had no contact at all. 47% of the 547 with symptoms of moderate to severe depression had no treatment or contacts beyond a GP consultation.

Table 4. Highest gained treatment level by MDI grade

Final treatment level\MDI grade	No/few	Mild	Mod./severe
No contacts	4540 (25.2)	73 (16.6)	56 (10.2)
GP consultation	12084 (67)	257 (58.3)	259 (47.3)
GP MHC	160 (.9)	5 (1.1)	20 (3.7)
Antidepressants#	931 (5.2)	64 (14.5)	125 (22.9)
Psychologists	162 (.9)	17 (3.9)	27 (4.9)
Priv psychiatrist	96 (.5)	18 (4.1)	39 (7.1)
Out-pat. Psychiatry	17 (.1)	3 (.7)	7 (1.3)
Admission MH & EA **	33 (.2)	4 (.9)	14 (2.6)
Sum	18.023 (100)	441 (100)	547 (100)

Percent's in brackets
Reimbursed prescriptions
* Contact to either psychologist or psychiatrist, public or private
** MH: Mental hospital; EA: Emergency access psychiatric ward

Table 5 shows that respondents with symptoms of depression gained a significantly higher treatment level, increasing with higher symptom score, compared to those with no/few symptoms and no postsecondary education or low income. (Supplementary table 3 shows highest treatment level gained within six months by education, income and severity of symptoms, in crude numbers and percentage.) For the group with no/few symptoms, respondents with 3+ years of postsecondary education or higher income reached a lower level overall. We found no statistically significant differences between educational groups stratified by grade of symptoms, but a significant increase in treatment level within each educational group when depression score increased from no/few symptoms to symptoms of mild depression, and again when it changed to symptoms of moderate/severe depression (results not shown). SEP measured by income had similar outcomes, but differed in the group with mild symptoms of depression, where only respondents with high income gained a higher treatment level compared to the low income group with no/few symptoms.

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Table 5. Mean level of *Mental health care treatment* by educational and income level and MDI grade

		β*
No/few symptoms of depression		
Education	.97 (N=19011)	
No postsecondary education	0.98 (N=2502)	(Ref)
1-3 years postsecondary education	0.94 (N=9650)	**-0.06 (-0.09; -0.03)**
3+ years postsecondary education	0.87 (N=5871)	**-0.05 (-0.08; -0.02)**
Income	.96 (N=17165)	
Income < 40,250€	1.07 (N=3850)	(Ref)**
Income ≥40,250 <80,500€	0.93 (N=6207)	-0.01 (-0.04; 0.02)
Income ≥80,500€	0.81 (N=6238)	**-0.12 (-0.15; -0.09)**
Mild symptoms of depression		
No postsecondary education	1.49 (N=93)	**0.15 (0.01; 0.29)**
1-3 years postsecondary education	1.47 (N=225)	**0.14 (0.05; 0.24)**
3+ years postsecondary education	1.58 (N=123)	**0.22 (0.10; 0.35)**
Income < 40,250€	1.62 (N=138)	0.05 (-0.06; 0.17)
Income ≥40,250 <80,500€	1.46 (N=137)	0.11 (-0.01; 0.23)
Income ≥80,500€	1.47 (N=116)	**0.22 (0.09; 0.34)**
Moderate/severe symptoms of depression		
No postsecondary education	2.18 (N=136)	**0.37 (0.26; 0.49)**
1-3 years postsecondary education	1.99 (N=257)	**0.35 (0.26; 0.44)**
3+ years postsecondary education	2.01 (N=154)	**0.45 (0.33; 0.56)**
Income < 40,250€	2.10 (N=208)	**0.28 (0.18; 0.37)**
Income ≥40,250 <80,500€	2.06 (N=164)	**0.40 (0.29; 0.51)**
Income ≥80,500€	1.80 (N=107)	**0.34 (0.21; 0.47)**

* Adjusted for agegr 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist
* *Adjusted for agegr 60 +/-, gender, present treatment of antidepressants, psychologist or psychiatrist, cohabitation
Treatment levels: 0; no contact; 1: GP consultation; 2: GP MHC; 3: Antidepressants; 4: psychologist;
5: priv. psychiatrist; 6: publ. psychiatrist; 7: psychiatric hospital & emergency visits

Discussion

Participants with symptoms of depression were treated according to the severity of the symptoms, independent of SEP; however, more than half with moderate to severe symptoms received no treatment beyond GP consultation. People in low SEP and with no/few symptoms of depression were more often treated with antidepressants.

Symptoms of depression & use of services

Respondents in need and in contact with health care providers were treated according to their needs. This finding aligns with other studies on treatment of depression[42] and a recent Swedish study designed as ours [43]. Some studies likewise found SEP had no independent impact on the type of treatment[19 44 45] or intensity of treatment[37;46]. Yet some studies have found that higher education was associated with more use of specialized mental health care, even when adjusted for needs[47-49]. However, beside the Swedish study all these prior studies rely on recalled service use only, however, and thus may be subject to recall bias.

Symptoms of depression & no use

A Swedish follow-up study of more than 2,000 respondents with symptoms of depression (MDI>20) or anxiety likewise found that one-third did not seek care at all. People with a higher education were less likely to seek care at all, and if they did, they more often sought help from a psychologist[50]. Other studies report that 35-52% of respondents with symptoms of severe common mental disorders have no treatment contacts[36;51]. As in the

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Swedish study, we found respondents with 3+ years of postsecondary education or high income were less likely to have contacts at all, compared to respondents without postsecondary education or low income, but these differences were not significant in the groups with symptoms of depression.

GPs' ability to detect depression could be questioned, since only half the respondents with moderate to severe symptoms of depression are treated. When compared to ratings determined through semi-structured interviews, the detection rates for depression in primary health care are relatively low, with a sensitivity rate of 50% and a specificity rate of 81%[52] in 2009, and more recently in 2014, a sensitivity rate of 51% and a specificity rate of 87%, when compared to a standardised instrument as the Patient Health Questionnaire-9[53]. The use of depression scoring tools validated for primary care could improve detection rates; if self-administered, it would be less time-consuming for GPs and perhaps a more realistic approach[49]. It is noteworthy that the proportion receiving the highest treatment level from a GP was the same across educational groups.

A German study on trends in non-help-seeking for mental disorders found a downward trend, finding that 57% of the citizens with present symptoms of a mental disorder had never sought help for a mental problem in the years 2009-2012[54]; this result is very similar to the findings of our study.

No/few symptoms of depression & use of services

The group that was treated, but scored with no/few symptoms of depression, may indicate emerging needs or an overuse of services. Since respondents did not each undergo additional screening by a professional, there is a lack of verification for the level of need beyond the self-reported symptoms on the inventory. However, we consider a comparison across socioeconomic groups relevant in this group, as in the other symptoms groups.

Firstly, we found no/few symptoms of depression was associated with more use of specialized mental health services for respondents with postsecondary education when compared to those with no postsecondary education, adjusting for age, gender, and present treatment. Notably, when income was used as an indicator of SEP, no difference in use of specialist services was found. Other researchers have found higher education is associated with more use of specialized services and suggest it could be due to the fact that higher-educated individuals might recognize and accept psychiatric needs more than lower-educated individuals[47]; or that mental health treatment makes heavy demands on a client's cognitive capacities and this presents a greater obstacle for people with less education[48]. What is seen in the group with no/few symptoms could be the treatment of emerging mental health problems, and a result of specialized services being requested more by patients with postsecondary education, or that specialized services are a more evident first choice by the GP for some patients. We had also expected the expenses associated with the use of psychologists in Denmark[55] would have an impact, but it did not.

An Australian study found that only a small proportion (4%) of individuals without any disorders or need indicators were among those receiving mental health care. Though this group comprised a fair proportion of service users, the vast majority only sought brief primary care or counselling treatment rather than consultations with psychiatrists, where they constituted only 7% of psychiatry patients[56]. That study did not relate the use of services to SEP. However, a Canadian study did find that individuals using mental health care and having no symptoms of mental disorders were better educated compared to those with mental disorders using the services[16].

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Secondly, we found that prescription of antidepressants was more common in the group with no/few symptoms and in low SEP. Similar findings were shown in another Australian study, where low SEP was associated with higher prescription rates not attributable to higher rates of depression[57]. The most plausible reason for this association is that depressive disorders are more prevalent in this group and antidepressants are the first choice of treatment, or that antidepressants are more commonly used as analgesic medications in this group, as chronic pain is more common for persons with low SEP[58] .

Strengths and limitations

A major strength of this study was that we were able to obtain reliable data on need from a large sample of people in the GESUS as well as high-quality data on healthcare contacts and prescriptions of antidepressants from national registers, addressing challenges common in studies of equality in health care[9]. To our knowledge, this is the first study combining survey data of depression scores and SEP with register data on mental health care treatment. Thus we managed to avoid the inherent problem of recall bias, which is a common problem in these types of studies[59].

SEP may be defined in different several ways[35], but in the present study we used education and income as indicators of SEP. The span of respondents seen in the sample, from a few students to a high proportion of older and retired persons, indicated that income and employment status would be less potent to differentiate the resources that respondents could be expected to have. For that reason, education was the first choice, paired with income, even though older age is associated with lower educational attainment[27]. Additionally, education seems a particularly important factor when evaluating the use of health care specialists[10].

The study related respondents' use of services based on an indication of need (MDI score) that might not capture the fluctuations in all six months afterwards, which is a potential limitation. Even though need will change over time, such change would not be expected to differ among the socioeconomic groups; however, if it did, it would be expected to trend towards higher need for those in low SEP.

The actual reasons for treatment contacts were not known, nor were the reasons for prescriptions of antidepressants known; both could have been for disorders other than depression, indicating a potential limitation of the study design. The variety of other possible disorders would tend to be more common for people in low SEP, and may explain the generally higher use of GP by respondents in low SEP.

Another potential limitation is that not all services used are included in the registers. If a patient is not referred by a GP and pays the full expense for a treatment out of pocket, there is no state reimbursement and subsequently no registration of the treatment in the registers. This would usually indicate high-income individuals, which is often associated with more years of postsecondary education. We do not expect this to be a common scenario, though we have no data to support this.

Implications

For clinicians and policy makers it is of particular interest to know that the treatment of patients with symptoms of depression matched the severity of symptoms and was independent of the SEP of the patient.

A high proportion with symptoms of depression was not treated. Initiatives to improve mental health literacy might help people with symptoms of depression to address mental health problems when consulting their GP and thereby increase treatment rates. Better attention to mental health by the GP is also necessary, and probably a more systematic approach in evaluating patients' mental health should be implemented.

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An interesting disparity between education and income on use of specialized services was found in the group with no/few symptoms. Are specialized services – most likely psychologists – the first choice for the GP when the patient has more years of postsecondary education? Is the initial treatment of patients with depressive symptoms different depending on their education, and why are the prescription rates of antidepressants much higher for persons in low SEP compared to those in high SEP? These issues deserve in-depth exploration in order to more fully address issues of health inequity.

Conclusion

We found no differentiation between socioeconomic groups in the treatment of respondents with symptoms of moderate to severe depression when looking at treatment contact, frequency of contacts, or level of treatment. However, more than half the respondents with moderate to severe symptoms had no treatment beyond GP consultation. Respondents with no/few symptoms of depression used services differently; people with low SEP were more often treated with antidepressants than people with high SEP, whereas people with postsecondary education were more likely to receive specialist services compared to those without postsecondary education, though this association was not found for income.

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Author contributions

The statistical analyses were performed by statistician SW. AP conceived the research and wrote the first draft of the manuscript assisted by FBW. FBW contributed substantially to the study design and choice of analysis. AH, ES, and LH contributed to the data analysis, interpretation of results and critical revision of the manuscript.

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Data sharing: no additional data available.

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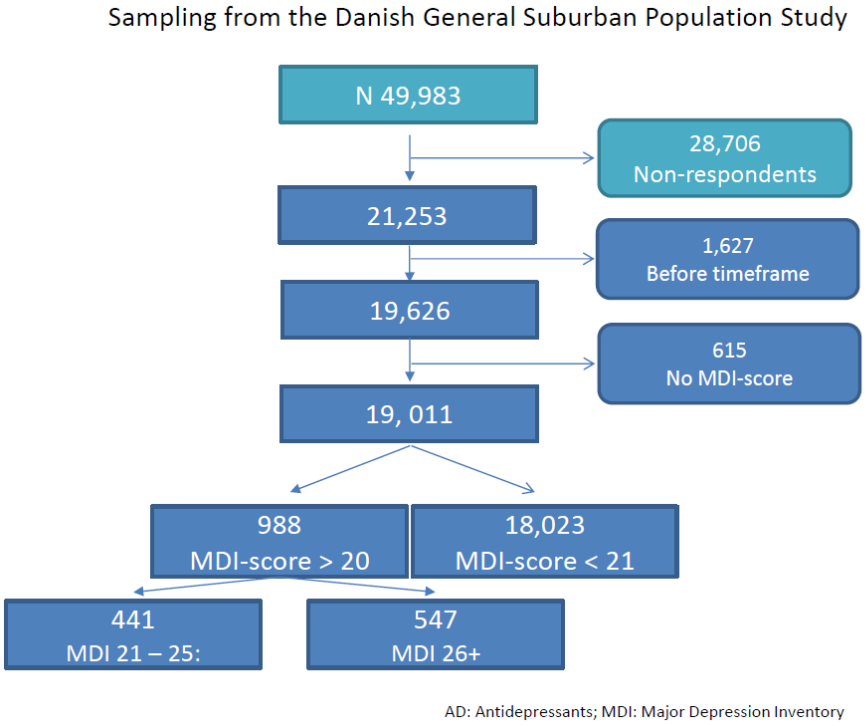
Socioeconomic position, symptoms of depression and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Supplementary figure and tables

Figure 1



AD: Antidepressants; MDI: Major Depression Inventory

Supplement Table 1. Definition of treatment levels

Level	Primary health care	Additional health care	Defined by source and code
0	*No contact*		Not in NPR, NHSR, NPrR
1	*GP*	Consultation	+ NHSR GP (800101 + 800120 +(800411 – 800491) + 804001)
2	*GP*	Mental health counselling by GP	+ NHSR GP & contact concerning mental health (806101)
3	*GP*	Antidepressants	+ NPrR by ATC: NO6A – excluding N06AX12
4	*GP*	Private psychologist	+NHSR (630110 – 630211) + (630214 – 630340)
5	*GP*	Private psychiatrist	+NHSR (240110 – 240140) + (240210 – 240236) + 241401
6	*GP*	Out-patient psychiatry	+NPR by ICD-10: F 00-– F99.99
7	*GP*	Mental hospital & Emergency visits	+NPR by ICD-10: F 00-– F99.99

NPR: The National Patient Register; NHSR: The National Health Service Register; NPrR: The National Prescription Registry; ATC: Anatomical Therapeutic Chemical classification.

Socioeconomic position, symptoms of depression and subsequent mental health care treatment: a Danish register-based six-month follow-up study on a population survey.

Supplement Table 2. Number and mean number of *Mental health care treatments* by MDI grade

Symptoms of depression		No/few	Mild	Moderate/severe	Total
	Persons n (Pct.)	18023 (100)	441 (100)	547 (100)	19011 (100)
No contact					
	Persons n (Pct.)	4540 (25.2)	73 (16.6)	56 (10.2)	4669 (24.6)
GP consultation					
	Persons n (Pct.)	13329 (74.0)	356 (80.7)	474 (86.7)	14159 (74.5)
	Visits n	45044	1433	2252	48729
	Visit rates¤	3.38	4.03	4.75	3.44
GP MHC					
	Persons n (Pct.)	329 (1.8)	28 (6.3)	64 (11.7)	421 (2.2)
	Visits n	611	57	168	836
	Visit rates¤	1.86	2.04	2.63	1.99
Antidepressants#					
	Persons n (Pct.)	1056 (5.9)	87 (29.7)	186 (34.0)	1329 (7.0)
	Prescriptions n	2769	227	670	3666
	Prescrip rates¤	2.62	2.61	3.60	2.76
Psychologists					
	Persons n (Pct.)	167 (0.9)	19 (4.3)	31 (5.7)	217 (1.1)
	Visits n	706	112	144	962
	Visit rates¤	4.23	5.89	4.65	4.43
Private psychiatrist					
	Persons n (Pct.)	100 (0.6)	20 (4.5)	42 (7.7)	162 (0.9)
	Visits n	274	57	201	532
	Visit rates¤	2.74	2.85	4.79	3.28
Out-patient Psychiatry					
	Persons n (Pct.)	22 (0.1)	4 (0.9)	9 (1.6)	35 (0.2)
	Visits n	103	34	46	183
	Visit rates¤	4.68	8.50	5.11	5.23
Specialized services*					
	Persons n (Pct.)	283 (1.6)	40 (9.1)	76 (13.9)	399 (2.1)
	Visits n	1083	203	391	1677
	Visit rates¤	3.83	5.07	5.14	4.20
Admission MH & EA **					
	Persons n (Pct.)	33 (0.2)	4 (0.9)	14 (2.6)	51 (0.3)
	Visits n	49	11	37	97
	Visit rates¤	1.48	2.75	2.64	1.90

¤ Mean number of visits by respondents using the service/prescriptions

Reimbursed prescriptions

* Contact to either psychologist or psychiatrist, public or private

** MH: Mental hospital; EA: Emergency access psychiatric ward

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Supplement Table 3. Highest treatment level gained within six months by education, income, and severity of symptoms, in crude numbers and percentage

Crude	Highest gained treatment level*								
No postsec education	0	1	2	3	4	5	6	7	
MDI < 21	512	1783	17	162	5	11	6	6	2502
MDI 21 - 25	9	62	2	13	3	3	0	1	93
MDI >25	9	63	5	39	3	11	2	4	136
Missing	15	208	2	27	2	0	1	2	257
1-3 years postsecondary education									
MDI < 21	2361	6512	84	515	93	54	10	21	9650
MDI 21 - 25	39	134	1	31	6	9	3	2	225
MDI >25	28	122	8	59	14	20	2	4	257
Missing	42	177	5	22	2	3	0	0	251
3+ years postsecundary education									
MDI < 21	1667	3789	59	254	64	31	1	6	5871
MDI 21 - 25	25	61	2	20	8	6	0	1	123
MDI >25	19	74	7	27	10	8	3	6	154
Missing	25	68	0	12	1	1	0	0	107

Crude	Highest gained treatment level*								
Income < 40,250€	0	1	2	3	4	5	6	7	
MDI < 21	649	2809	28	292	26	27	7	12	3850
MDI 21 - 25	19	80	2	20	9	6	1	1	138
MDI >25	17	99	4	58	7	16	1	6	208
Missing	33	204	3	26	2	3	1	1	273
Income ≥ 40,250 <80,500€									
MDI < 21	1586	4113	74	318	62	34	6	14	6207
MDI 21 - 25	22	83	1	19	4	7	0	1	137
MDI >25	22	73	7	32	8	13	5	4	164
Missing	20	81	2	13	1	1	0	0	118
Income ≥80,500€									
MDI < 21	1969	3923	44	209	63	26	0	4	6238
MDI 21 - 25	27	62	2	12	4	5	2	2	116
MDI >25	10	61	5	15	7	7	0	2	107
Missing	13	24	0	1	1	0	0	0	39

Pct										Spec#
No postsec education	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**		
MDI < 21	20	71	0,7	6,5	0,2	0,4	0,2	0,2		0,9
MDI 21 - 25	10	67	2,2	14,0	3,2	3,2	0,0	1,1	100	6,5
MDI >25	7	46	3,7	28,7	2,2	8,1	1,5	2,9	100	11,8
1-3 years postsecundary education										
MDI < 21	24	67	0,9	5,3	1,0	0,6	0,1	0,2	100	1,6
MDI 21 - 25	17	60	0,4	13,8	2,7	4,0	1,3	0,9	100	8,0
MDI >25	11	47	3,1	23,0	5,4	7,8	0,8	1,6	100	14,0
3+ years postsecundary education										
MDI < 21	28	65	1,0	4,3	1,1	0,5	0,0	0,1	100	1,6
MDI 21 - 25	20	50	1,6	16,3	6,5	4,9	0,0	0,8	100	11,4
MDI >25	12	48	4,5	17,5	6,5	5,2	1,9	3,9	100	13,6

Pct										Spec#
Income < 40,250€	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**		
MDI < 21	17	73	1	8	1	1	0	0	100	1,6
MDI 21 - 25	14	58	1	14	7	4	1	1	100	11,6
MDI >25	8	48	2	28	3	8	0	3	100	11,5
Income ≥ 40,250 <80,500€										
MDI < 21	26	66	1	5	1	1	0	0	100	1,6
MDI 21 - 25	16	61	1	14	3	5	0	1	100	8,0
MDI >25	13	45	4	20	5	8	3	2	100	15,9
Income ≥80,500€										
MDI < 21	32	63	1	3	1	0	0	0	100	1,4
MDI 21 - 25	23	53	2	10	3	4	2	2		9,5
MDI >25	9	57	5	14	7	7	0	2		13,1

Treatment level: 0: none; 1: GP (general practitioner); 2: GP-mental health consultations; 3: antidepressants; 4: psychologist; 5: private psychiatrist; 6: public psychiatrist; 7: mental hospital

#Spec: Specialized services includes 4+5+6

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STROBE Statement for the study: **Socioeconomic position, symptoms of depression, and subsequent health care utilization and treatment: a Danish register-based six-month follow-up on a survey study.**

	Item No	Recommendation	Addressed on page:
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	4 - 5
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4 – 5 Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4 – 5 Table 1*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	4 + 8 & Suppl Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4 - 6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6 – 7
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	7
		(*d*) If applicable, explain how loss to follow-up was addressed	4
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8 Suppl fig 1
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
		(c) Summarise follow-up time (eg, average and total amount)	

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Outcome data	15*	Report numbers of outcome events or summary measures over time	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 4 Supp tab 2+3
		(*b*) Report category boundaries when continuous variables were categorized	4
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13 - 16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15-16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	1

*Give information separately for exposed and unexposed groups.

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

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