



**SAHLGRENSKA ACADEMY**

# **Risk Factors for Readmission Following Inpatient Care for Depression**

Degree Project in Medicine

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## **List of abbreviations**

CBT Cognitive Behavioural Therapy

95% CI 95% Confidence Interval

DALY Disability Adjusted Life Years

DSM Diagnostic and Statistical Manual of Mental Disorders

ECT Electroconvulsive Therapy

GAD Generalized Anxiety Disorder

ICD International Classification of Diseases

OR Odds Ratio

RCT Randomized Controlled Trial

SD Standard Deviation

SNRI Serotonin-Norepinephrine Reuptake Inhibitors

SSRI Selective Serotonin Reuptake Inhibitors

TCA Tricyclic Antidepressants

YLD Years Lived with Disability

WHO World Health Organization

# Abstract

**Background:** Little is known about risk factors predisposing to higher readmission frequency in psychiatric inpatient care for depression. So far, few studies have been conducted on mapping various factors that might have an important association with readmission for depression.

**Aim:** This study aimed to identify risk factors associated with an increased risk of readmission within 90 days and 30 days, after being discharged from psychiatric inpatient care for depression.

**Method:** We designed a patient chart-based cohort study of medical records for psychiatric inpatients diagnosed with depression between 20<sup>th</sup> December 2018 to 12<sup>th</sup> December 2019 at Sahlgrenska University Hospital, Sweden. First, we used a univariate analysis using a t-test and a chi-square test. Then, we used a multivariate analysis using binary logistic regression.

**Results:** The rate of readmission within 90 days was 18.9% (95%-confidence interval 14.1–23.5) compared to 9.5% (95%-confidence interval 5.9–12.9) at 30 days. The length of stay was a significant risk factor associated with readmission in the binary logistic regression; OR = 1.024 (95% CI 1.003–1.046) for each additional day stayed. Eating disorders were significantly ( $p < 0.032$ ) associated with readmission within 90 days. Although no statistically significant differences were found between the sexes, female participants were numerically more likely to be readmitted to the psychiatric department within 30 days ( $n = 16, 64\%$ ), compared with male participants ( $n = 9, 36\%$ ,  $p = 0.52$ ), but not for the 90-day follow up ( $n = 25, 50\%$ ) for female and ( $n = 25, 50\%$ ,  $p=0.206$ ) male, respectively.

**Conclusion:** Of the patients admitted for depression, almost 1 out of 5 were readmitted within 90 days. Only a few risk factors predicted readmission, and only the length of stay appeared to be an independent risk factor. However, a larger cohort will be needed to determine which risk factors are independent.

**Keywords:** predictors, depression, inpatients, readmission, logistic regression

# 1. Background

## 1.1 Depression

Depression is a psychiatric disorder affecting more than 264 million people of all ages worldwide (1). The consequences of depression are individual suffering, functional impairment, high governmental costs and suicide risk (2). The World Health Organization (WHO) reports that depression is the leading cause of disability measured by years lived with disability (YLDs). The Global Burden of Disease Study was launched by the WHO, who estimated that depression is the fourth leading contributor to the global burden of disease (3). It is estimated that every fifth person will be diagnosed with depression in the Swedish population (4). Approximately 25% of all women and 15% of all men will have depression at some point in their lifetime. Since 2006, the rate of both inpatient care and outpatient care for depression has increased in Sweden. This is predominantly observed in patients <25 years old (5).

Two different classification systems are used to diagnose depression, ICD-10 – International Classification of Diseases and Related Health Problems (1992) outlined by the WHO and DSM-IV – Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000). Both the ICD-10 and DSM-IV diagnostic systems share several similarities; for example, symptoms must have been present for 2 weeks. However, this can be shorter in ICD-10 if the onset of symptoms is rapid or severe. Likewise, both ICD-10 and DSM-IV symptoms must cause impairment of functioning that increases with the episode severity. The differences are that in ICD-10, the patient must have two out of three core symptoms (depressed mood, loss of interest in daily activities, and energy reduction) and no less than two of the remaining seven symptoms. Conversely, in DSM-IV, the patient must have one out of two core symptoms (depressed mood and loss of interest) and four of the remaining symptoms. (6). ICD-10 is mainly used in the Swedish healthcare system (7). However, a heterogeneity of major depression exists, including depression

with somatic symptoms, depression with panic attacks, depression with obsessional traits, depression occurring with a known physical illness and pseudodementia depression (8).

The drugs of choice for treating depression are selective serotonin reuptake inhibitors (SSRIs). These were introduced in Sweden during the 1990s (9). The prescription of antidepressants has increased in Sweden as more people are being diagnosed with depression. According to the National Board of Health and Welfare, during 2019, for ages 20–64, the number of prescribed antidepressants (SSRIs) in Sweden was 144,859 for males and 286,739 for females. However, it is noteworthy that the exact number of SSRIs prescribed for patients diagnosed according to the International Classification of Diseases, mainly ICD F32 (depressive episode) and ICD F33 (recurrent depression), in this database is unknown (10). Furthermore, in 2008, the yearly cost for depression was 159,000 kr/patient, of which 88% was indirect costs due to productivity losses. The cost was eight times higher for inpatients who had depression with psychotic symptoms (11).

Previous research has established that serotonin-norepinephrine reuptake inhibitors (SNRIs) and tricyclic antidepressants (TCAs) are more efficient for treating severe depression than SSRIs. However, SNRIs are not recommended for youngsters because of an increased risk of adverse effects: intoxication and increased risk of suicidality (12). A study conducted in 2008 compared the effects of venlafaxine and fluoxetine in patients with major depressive disorder. The results showed no significant difference between the two drugs regarding time to rehospitalization (13). In a systemic review and network meta-analysis, Cipriani *et al.* (2018) investigated the efficacy of antidepressants, including placebo-controlled and head-to-head trials of 21 antidepressant drugs. To determine the efficacy of antidepressant drugs for acute treatment of major depressive disorder, Cipriani *et al.* (2018) found some antidepressants, such as escitalopram, agomelatine, mirtazapine, paroxetine and sertraline, had better responses and lower dropout rates than other antidepressants (14).

Patients with mild to moderate depression are recommended cognitive behavioural therapy (CBT). A meta-analysis of CBT for adult depression found that a combination of CBT and pharmacotherapy is superior to pharmacotherapy alone. The long-term effects of CBT in patients with depression included lower rates of relapse after 1 and 2-year follow-ups compared to people mainly treated with pharmacotherapy (15).

## 1.2 Inpatient treatment for depression

People suffering from depression are at increased risk of suicidality and 50% of people who committed suicide had a previous primary diagnosis of depression (3). According to Madsen et al. (2017), the risk of suicide is highest for recently admitted patients, and one quarter occur within the first week (16). Studies have shown that the most common method was hanging, especially on the ward, and jumping from heights or into traffic. However, it is challenging to predict suicide because many patients do not display signs of suicidality despite having one or more risk predictors (16). Safer hospital environments and excellent care for all patients are needed to reduce suicide rates (17). An important development is that suicide rates have decreased by 25% since introducing SSRIs in Sweden (18).

In Sweden, electroconvulsive therapy (ECT) is a complementary treatment for patients presenting with psychotic depression or severe depressive episodes. It is used in one-third of all the patients who do not respond to treatment (19). The degree of remission is 80% (20). Patients with treatment-resistant depression have a response rate of 50–70%. Surprisingly, the relapse rate remains higher in patients with treatment-resistant depression. (21). Healthcare and social services are provided consistent with the principle of voluntariness and patient/client involvement. However, an individual may be placed in compulsory care without their consent if the administrative court finds it necessary to protect the individual or others from physical, mental or social harm (22).

In 50%–66% of cases, patients suffering from depression do not fully recover when treated with antidepressants. Additionally, only one-third of the patients will have remission of their depressive symptoms (21). Uncertainty exists whether patients selected for efficacy trials are representative of patients treated in routine clinical practice. Surprisingly, patients with mild depression, chronic depression, psychiatric comorbidity, suicidal thoughts and anxiety disorder are often excluded (23). A literature review by Kennedy-Martin et al. (2015) showed that most randomized controlled trial (RCT) samples were highly selected and unrepresentative of daily practice. Notably, this may limit the external validity of these RCT samples (24).

### 1.3 Readmission and risk factors for readmission

Readmission rates can be used as healthcare quality indicators. Therefore, high readmission rates are associated with substandard care. In the last few decades, research on readmission has increased (25). The Swedish National Board of Health and Welfare database (Socialstyrelsen – a Swedish government agency) showed that in 2019, 6,628 people were diagnosed with depression, and the total number of inpatient admissions was 8,361 in Sweden (26).

Before this chart-based cohort study, a community cohort study was conducted in 2015, comprising 52,990 individuals. This indicated that older age groups (70+ years), female and previous admission due to psychiatric causes were associated with increased risk of readmission for depression (27). Studies focused on the association between physical comorbidities and psychiatric readmission found that patients diagnosed with schizophrenia, unipolar depression and bipolar disorder are at increased risk of psychiatric readmission (28). Studies have found that 10% of patients diagnosed with depression have generalized anxiety disorder (GAD) and that 27% have a GAD diagnosis before developing depression (29). In a prospective longitudinal community study, Wittchen H-U *et al.* (2000) investigated whether comorbidity existed between anxiety disorder and major depression with a 5-year follow-up. Wittchen H-U *et al.* (2000) concluded that anxiety disorders,



separation anxiety, social phobia, GAD and panic disorders substantially increase the risk of secondary depression (30). Therefore, being diagnosed with psychiatric comorbidities is a risk factor associated with readmission (31).

In 2005, a primary care study in Sweden showed that 17% of those who had a depression diagnosis also had a problem with alcohol drinking (29). Therefore, high alcohol consumption increases the risk of developing depression (32). Some studies have confirmed that alcohol or substance abuse is a risk factor for readmission (25).

Depression remains an illness requiring regular and continuous medical treatment. The association between depression and compliance has been investigated in several patient populations. The overall discontinuation of antidepressants is most likely to occur within the first month (33). Demyttenaere et al. (2001) stated that the most common reason for patients to discontinue their medication was “feeling better”, and 24% did not inform their doctor about stopping their antidepressant medications (34). In 2000, DiMatteo et al. investigated in their meta-analysis whether any relationship existed between depression and anxiety regarding patient non-compliance with treatment recommendations. The authors concluded that patient non-compliance is three times higher in depressed than non-depressed patients and may contribute to poor adherence to treatment advice (34). Several studies have identified non-compliance with treatment as a strong predictor for readmission (35).

A retrospective cohort study followed 180 admissions for 12 months. The authors state that the risk of readmission was higher during the first 90 days post-discharge (36). Furthermore, studies have found that a third or fourth depression relapse should be avoided. This increases the risk for depression to occur more frequently, and the asymptomatic periods can be much shorter. The disease gets its “own progression”. This is sometimes known as the “kindling” phenomenon (29).

The readmission frequency is defined within 30 days of being discharged in somatic inpatient care (37). However, such definition is missing for psychiatric inpatient care. Moreover, the readmission

period has been defined controversially in different studies such as period of 90 days, 6 months, 3 years. Therefore, this can result in different rates of readmission (31). A clear knowledge gap exists. Previous research that could link risk factors with readmission to psychiatric inpatient care for depression has limitations. The majority of studies conducted have included all psychiatric inpatients which may not be representative for depression. This suggests that there might be other factors related to readmission which have not been explored. So far, minimal work has been conducted on mapping various factors that might significantly influence readmission for depression.

## **2. Aim**

This study aimed to identify risk factors associated with an increased risk of readmission within 90 days and 30 days, after being discharged from psychiatric inpatient care for depression. Moreover, the main objectives of this study were to demographically and clinically describe the groups and determine whether any association exists between patients who are and are not readmitted. Therefore, the main research question of this project is whether readmission is predictable based on discharge factors.

## 3. Methods

### 3.1 Inclusion and exclusion

This is a patient chart-based cohort study. The study population comprised patients diagnosed according to the International Classification of Diseases, mainly ICD F32 (Depressive episode) and ICD F33 (Recurrent depression), in Västra Götalands Region – Gothenburg, Sweden, who received psychiatric inpatient care for more than 6 days at the psychiatric department. The study period was between 20<sup>th</sup> December 2018 to 12<sup>th</sup> December 2019. Other inclusion criteria were age 18–65 years old, male and female, according to their personal identity number. A list of exclusion criteria was applied:

- Schizophrenia, according to ICD
- Bipolar disorder type I or type II according to ICD
- Admission to psychiatric inpatient care 6 months ago
- Blocked medical record
- Patients not alive 90 days post-discharge.

The reason for these exclusion criteria was that previous research showed that patients with bipolar disorder and schizophrenia are at increased risk of readmission (28). Readmission 6 months ago was because we wanted to exclude those readmitted often. Therefore, we might overestimate the readmission days. Patients who died were excluded from the study because we would not know whether they would have been readmitted or not. A total of 133 patients were excluded by applying these exclusion criteria, of whom 58 were male and 75 female.

## 3.2 Individual variables included

Data was collected from 264 discharged patients during 2019 from Melior, a medical record and documentation system. The following variables were included:

- (1) Readmission 90 days: Readmission 90 days was defined from 0–90 days and was the number of days until the patient was readmitted. In the readmission 90 days sample, we also included patients readmitted within 30 days.
- (2) Readmission 30 days: Readmission 30 days was defined from 0–30 days and was the number of days until the patient was readmitted within 30 days.
- (3) Controls: Controls were defined as individuals not admitted to psychiatric inpatient care after being discharged.
- (4) Age: Age was that during admission and was categorized into 5-year groups.
- (5) Sex: Sex was defined as male or female according to the personal number.
- (6) Marital status: Marital status was categorized into single, cohabitant, living apart.
- (7) Cohabiting children: Children were defined as whether the inpatient had children under 18 years old.
- (8) Sick leave: Sick leave was defined on the discharge day and divided into three groups: no sick leave, on sick leave and others (sickness compensation, pension and income support).
- (9) Length of stay: Length of stay was defined from admission date to discharge date.
- (10) Revisit to Outpatient specialist care: Revisit to outpatient specialist care was defined as the patient had a follow-up via psychiatric outpatient specialist care post-discharge.
- (11) Was receiving outpatient specialist care: This variable was defined as whether the patient was at psychiatric outpatient care for their follow up visit post discharge.
- (12) Follow-up via primary care: Follow-up via primary care was defined as follow-up due to a psychiatric cause.

- (13) Comorbid diagnosis: Comorbid diagnosis was according to ICD codes on the discharge day. It was categorized into seven groups: substance use, anxiety and related, eating disorders, personality syndrome and related, neurodevelopmental disorders, other and no other diagnosis.
- (14) Psychotic depression: Psychotic depression was defined as had or had not at admission. Psychotic depression was displayed in the result as whether the patient had psychotic depression.
- (15) Compulsory Psychiatric Care Act: Compulsory care act was defined during admission and displayed in the result as whether the patient was placed under the Compulsory Care Act.
- (16) Electroconvulsive therapy (ECT): ECT was defined as whether a patient was treated with one or more ECTs during admission. It was displayed in the result as whether the patient was treated with ECT.
- (17) Previous depression: Previous depression was defined as any history of depression in the medical record and divided into two groups: first-time depression and previous depression.
- (18) Chronic pain: Chronic pain was defined as whether the patient had a history of chronic pain. It was displayed in the result as whether the patient had chronic pain.
- (19) Psychotropic medication at discharge: Medications were defined on the discharge day and categorized into groups: mood stabilizers (lithium, lamotrigine, valproate), benzodiazepines, non-benzodiazepine receptor agonist (alimemazine, propiomazine, promethazine and hydroxyzine) and antipsychotics (levomepromazine, haloperidol, flupentixol, quetiapine, olanzapine, risperidone and aripiprazole). Antidepressants were defined as drug groups or single drugs such as SSRIs, SNRIs, TCAs, mirtazapine and others (bupropion, vortioxetine and agomelatine)

### 3.3 Statistical methods

The statistical analysis was made using IBM Statistics version 27. We processed all data manually and depersonalized it into a Microsoft Excel spreadsheet only accessible by the author and the author's supervisor. Descriptive statistics were computed to determine the basic demographic and clinical characteristics of the independent variables in the entire sample and in readmitted patients. Readmission days were measured using the Kaplan-Meier method.

The association between the categorical variables and readmission were calculated using a chi-square test to compute counts, percentages and p-values. The Student's t-test was used for continuous variables to determine the mean, standard deviation and p-value depending on the type of analyzed data. Accordingly, we used a multivariate analysis using binary logistic regression to compute odds ratios (ORs) and 95% confidence intervals (CIs) as estimates of the relative risk of being readmitted. The response variable for the multivariate analysis was readmission within 90 days. The explaining variables were the variables of interest, and significant variables found in the univariate analysis. All p-values in our statistical analysis were two-sided and values below 0.05 were considered as statistically significant. Missing data were not imputed in the statistical analysis but rather shown in tables when applicable.

## **4. Ethical considerations**

Before conducting this study, an ethical application was sent to the Swedish Ethical Review Authority (EPM – Etikprövningsmyndigheten) and approved 3<sup>rd</sup> June 2021 with registration number 2020-05807. This study was performed in compliance with the Helsinki Declaration. Access to patient records was granted by the operation manager at the Department of Psychiatry at Östra/Sahlgrenska University Hospital. We handled data using a specific code linked to each patient, known only by the author and the author's supervisor, to guarantee anonymity. Patients were excluded from the study if the author knew them.

In all register-based studies a small risk of impingement on a person's privacy is involved. The risk for harm was however minimized by the data management described above. Since patients can block access to their charts, this was interpreted as withdrawing consent for the charts to be reviewed.



## 5. Results

### 5.1 Descriptive statistics

In total, 264 patients were discharged at the end of the study period in 2019 who fulfilled the inclusion criteria. Table 1 presents the demographic characteristics of psychiatric inpatients with depression: sex, age, marital status, cohabiting children and sick leave. Of the total 264, 153 (58%) were female. The age distribution of the inpatients is presented in Figure 1. The age data does not follow a normal distribution (Figure 1). The mean age was 38.24, and the std was 13.42. The age group <29 years was overrepresented, with 88 (33.3%) inpatients, followed by 64 (24.2%) inpatients aged 30–39 years old and 47 (17.8%) aged 50–59. Table 1 also shows that 169 (65.3%)

**Table 1**  
Demographic characteristics of psychiatric inpatients with depression in 2019 at Sahlgrenska University Hospital (n = 264)

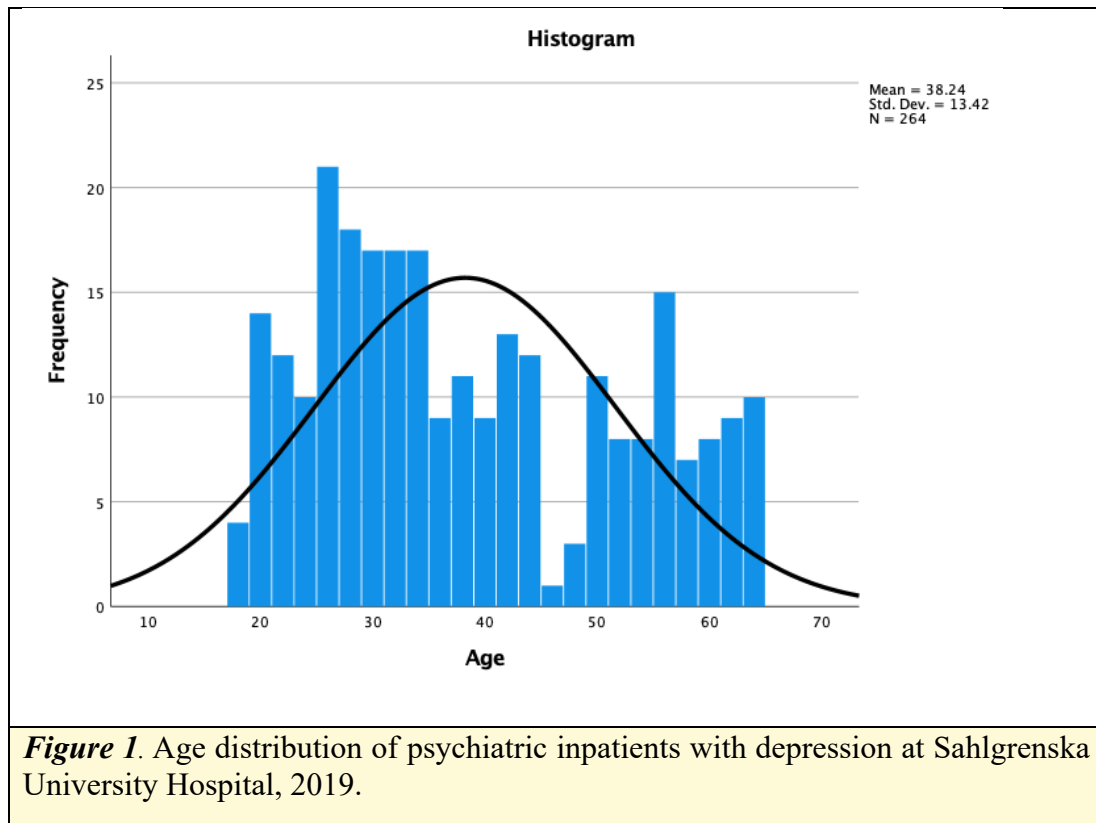
Variable	(n)	(%)
Sex		
Male	111	42.0
Female	153	58.0
Age (years)		
<29	88	33.3
30–39	64	24.2
40–49	42	15.9
50–59	47	17.8
60+	23	8.7
Marital status <sup>a</sup>		
Single	169	65.3
Cohabitant	78	30.1
Living apart	12	4.6
Cohabiting children <sup>b</sup>		
Yes	64	29.4
No	154	70.6
Sick leave <sup>c</sup>		
No sick leave	36	16.3
On sick leave	168	76
Other	17	7.7

<sup>a</sup>Missing data was 5

<sup>b</sup>Missing data was 46

<sup>c</sup>Missing data was 43

were single and 78 (30.1%) cohabitant. The majority of the participants didn't have cohabiting children 154 (70.6%). Patients on sick leave were overrepresented; 168 (76%) were on sick leave on the discharge day and 36 (16.3%) had no sick leave.



The clinical characteristics of the participants are displayed in Table 2. The mean length of hospitalization was 20.8 days (std 14.7), with a range of 6 to 92 days. The median number of days of hospitalization was 12. A total of 219 (84.6%) patients had a revisit to psychiatric outpatient specialist care, and 142 (53.8%) patients were at their follow-up appointment. Patients having follow-up via primary care totalled 32 (12.1%). The most common comorbid diagnosis was anxiety and related, totalling 49 (18.6%) individuals, followed by substance use, totalling 28 (10.6%) individuals. During admission, 29 (11%) participants had psychotic depression. A total of 52 (19.7%) patients were admitted under the Compulsory Psychiatric Care Act. Patients with a history of previous depression totalled 224 (84.8%); this was overrepresented compared to first-time depression, suffered by 6 (2.3%) patients. Chronic pain was suffered by 23 (8.7%) of the patients.

The two largest antidepressant drug groups prescribed to patients on the discharge day were SSRIs, prescribed to 102 (38.6%) patients and SNRIs, prescribed to 66 (25%). Patients prescribed

mirtazapine totalled 81 (30.7%). Benzodiazepines were prescribed for 94 (35.6%) patients. A total of 198 (75%) patients were prescribed non-benzodiazepine receptor agonist. Additionally, 96 (36.4%) patients were prescribed antipsychotic drugs. A total of 22 (8.3%) patients were prescribed mood stabilizers. However, none of the patients was prescribed valproate.

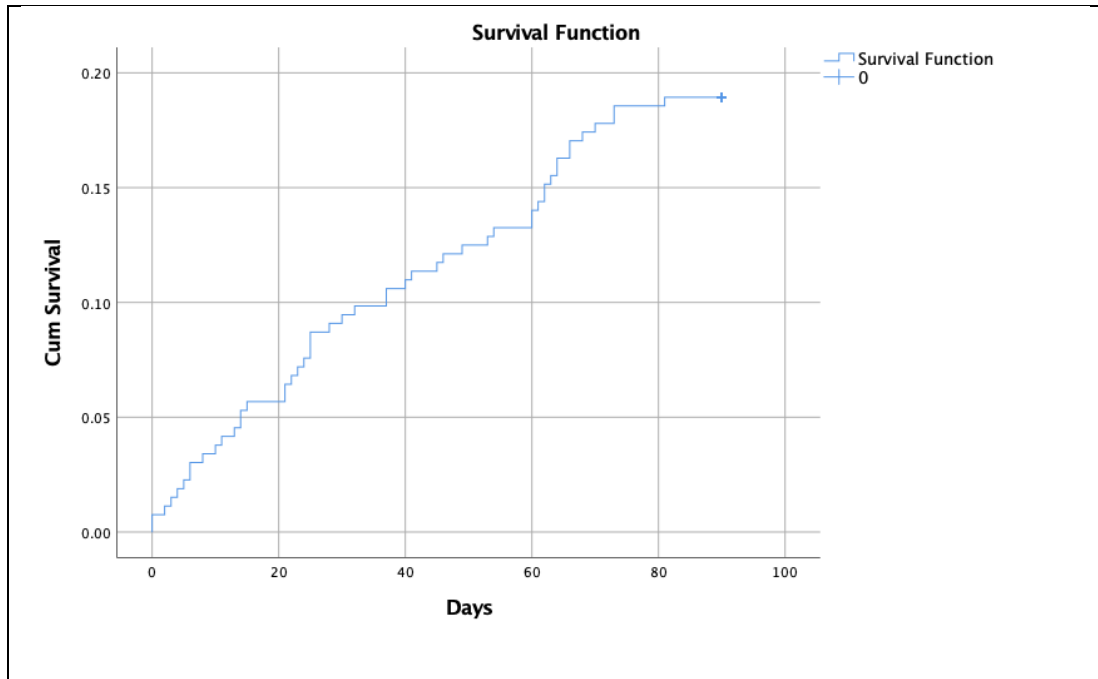
Table 2  
Clinical characteristics of psychiatric inpatients with depression in 2019 at Sahlgremska University Hospital (n = 264)

Variable	(n)	(%)	Mean (std)
Length of stay			20.8 (14.7)
Revisit to outpatient specialist care	219	84.6	
Was receiving outpatient specialist care	142	53.8	
Follow-up via primary care	32	12.1	
Comorbid diagnosis			
Substance use	28	10.6	
Anxiety and related	49	18.6	
Eating disorders	15	5.7	
Personality syndrome and related	16	6.1	
Neurodevelopmental disorders	18	6.8	
Other <sup>a</sup>	19	7.2	
No other diagnosis	142	53.8	
Psychotic depression	29	11	
Compulsory Psychiatric Care Act	52	19.7	
ECT during admission	34	12.9	
Previous depression			
Yes	224	84.8	
First-time depression	6	2.3	
Chronic pain	23	8.7	
Psychotropic medication			
Antidepressants			
SSRI	102	38.6	
SNRI	66	25	
TCA	11	4.2	
Mirtazapine	81	30.7	
Other	40	15.2	
Benzodiazepines	94	35.6	
Non-benzodiazepine receptor agonist	198	75	
Antipsychotics	96	36.4	
Mood stabilizers	22	8.3	

<sup>a</sup>Other ICD diagnoses

*Note.* Missing data was 34 for previous depression, 5 for revisiting outpatient specialist care, 44 for receiving outpatient specialist care and 2 for primary care follow-up.

Figure 2 shows the Kaplan-Meier estimate for patients readmitted within 90 days. The overall rate was 18.9% (95%-confidence interval 14.1–23.5) for those readmitted within 90 days and 9.5% (95%-confidence interval 5.9–12.9) for those readmitted within 30 days.



**Figure 2.** Kaplan-Meier estimate showing days until readmission. The overall rate was 18.9% for patients readmitted within 90 days and 9.5% for patients readmitted within 30 days.

## 5.2 Result of univariate analysis

### 5.2.1 Readmission within 90 days

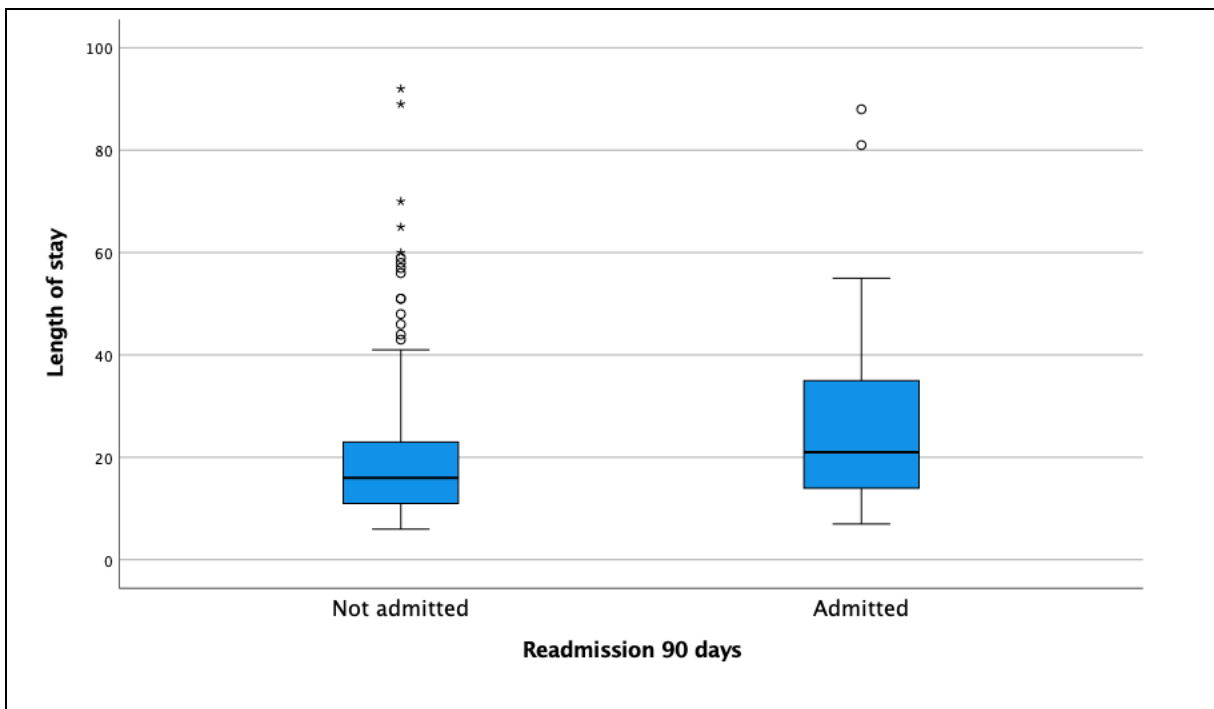
Table 3 shows the demographic characteristics of psychiatric inpatients for readmission within 90 days. A total of 264 patients were included, whereas 50 were cases and 214 controls. The mean age of readmitted patients was 37.3 years, and that of the controls was 38.5 years. Of the 50 cases, 25 (50%) were female. No significant association was found for the demographic characteristics, including age, sex, marital status, cohabiting children and sick leave.

Table 3  
Demographic characteristics of psychiatric inpatients with depression for readmission within 90 days for patient cases (n = 50) and controls (n=214) at Sahlgrenska University Hospital, 2019

Variable	Readmission 90 days	Controls	p-value
Age, mean (std) <sup>a</sup>	37.3 (13)	38.5 (13.5)	.6 <sup>a</sup>
	N (%)	N (%)	
Female sex	25 (50)	128 (59.8)	.206 <sup>c</sup>
Marital status			.203 <sup>c</sup>
Single	33 (66)	136 (65.1)	
Cohabitant	17 (34)	61 (29.2)	
Living apart	0 (0)	12 (5.7)	
Cohabiting children	13 (32.5)	51 (28.7)	.629 <sup>c</sup>
Sick leave			.458 <sup>c</sup>
On sick leave	30 (73.2)	138 (76.7)	
No sick leave	9 (25)	27 (75)	
Other	2 (4.9)	15 (8.3)	

<sup>a</sup>t-test mean, std and p-value  
<sup>c</sup>chi-square test p-value  
*Note.* Missing data was 5 for marital status for controls, 46 for children (10 cases, 36 controls) and 43 for sick leave (9 cases, 34 controls)

Table 4 shows the clinical characteristics of cases and controls. The length of stay was found to be significantly ( $p < 0.018$ ) associated with readmission. The mean length of stay for those readmitted within 90 days was 26 days with a std of 17.3 and 19.6 days with a std of 13.8 for controls. Patients readmitted within 90 days stayed longer than the controls (Figure 4). An eating disorder was found to be significantly ( $p < 0.032$ ) associated with readmission, totalling 6 (12%) for the readmission group and 9 (4.2%) for the controls. Patients presenting with psychotic depression totalled 4 (8%) for the readmission group and 25 (11.7%) for the controls, which was not significant. No significant associations were found for the remaining clinical characteristics, including revisiting psychiatric outpatient care, receiving outpatient specialist care, receiving follow-up via primary care, being admitted under the Compulsory Psychiatric Care Act, undergoing ECT, suffering previous depression, suffering chronic pain and being prescribed psychotropic medication.



**Figure 4.** Boxplot of the length of stay from the baseline to 90 days. The box represents patients who were readmitted and not readmitted.

Table 4

Clinical characteristics of psychiatric inpatients with depression for readmission within 90 days for inpatient cases (n = 50) and controls (n = 214) at Sahlgrenska University Hospital, 2019

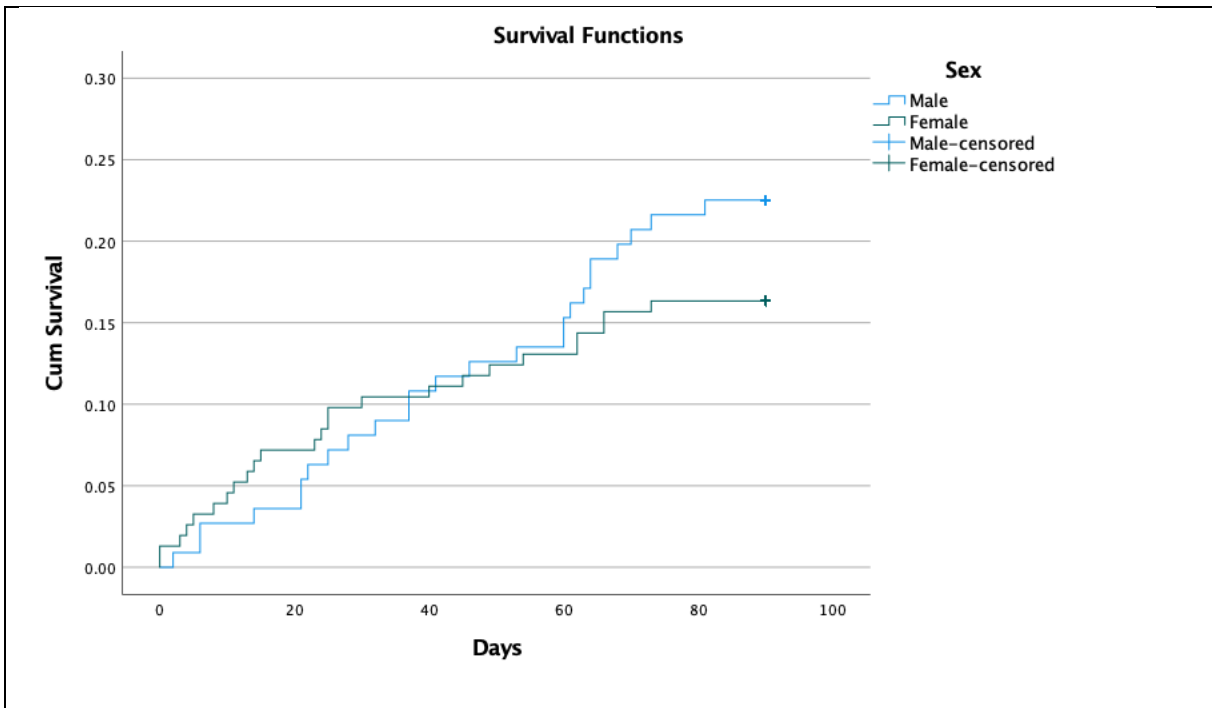
Variable	Readmission 90 days	Controls	p-value
Length of stay, mean (std) <sup>a</sup>	26 (17.3)	19.6 (13.8)	<b>.018<sup>a</sup></b>
	N (%)	N (%)	
Revisit to outpatient specialist care	45 (93.8)	174 (82.5)	.051 <sup>b</sup>
Was receiving outpatient specialist	30 (75)	112 (62.2)	.126 <sup>b</sup>
Follow-up via primary care	5 (10.2)	27 (12.7)	.634 <sup>b</sup>
Comorbid diagnosis			
Substance use	7 (14)	21 (9.8)	.387 <sup>b</sup>
Anxiety and related	10 (20)	39 (18.2)	.771 <sup>b</sup>
Eating disorders	6 (12)	9 (4.2)	<b>.032<sup>b</sup></b>
Personality syndrome and related	3 (6)	13 (6.1)	.984 <sup>b</sup>
Neurodevelopmental disorders	6 (12)	12 (5.6)	.106 <sup>b</sup>
Other	3 (6)	14 (6.5)	.888 <sup>b</sup>
No other diagnosis	23 (46)	119 (55.6)	.22 <sup>b</sup>
Psychotic depression	4 (8)	25 (11.7)	.453 <sup>b</sup>
Compulsory Psychiatric Care Act	10 (20)	42 (19.6)	.952 <sup>b</sup>
Electroconvulsive therapy (ECT)	7 (14)	27 (12.6)	.793 <sup>b</sup>
Previous depression			
Yes	44 (100)	180 (96.8)	.227 <sup>b</sup>
First-time depression	0 (0)	6 (100)	
Chronic pain	3 (6)	20 (9.3)	.450 <sup>b</sup>
Psychotropic medication			
Antidepressants			
SSRI	15 (30)	87 (40.7)	.164 <sup>b</sup>
SNRI	16 (32)	50 (23.4)	.218 <sup>b</sup>
TCA	3 (6)	8 (3.7)	.471 <sup>b</sup>
Mirtazapine	17 (34)	64 (29.9)	.572 <sup>b</sup>
Other	5 (10)	35 (16.4)	.259 <sup>b</sup>
Benzodiazepines	23 (46)	71 (33.2)	.088 <sup>b</sup>
Non-benzodiazepine receptor agonist	38 (76)	160 (74.8)	.856 <sup>b</sup>
Antipsychotics	22 (44)	71 (33.2)	.212 <sup>b</sup>
Mood stabilizers	2 (4)	20 (9.3)	.218 <sup>b</sup>

<sup>a</sup>t-test mean, std and p-value

<sup>b</sup>t-test mean, std and p-value

*Note.* Missing data was 34 for previous depression (controls 28), 2 for primary care follow-up (1 case, 1 control), 44 for receiving outpatient specialist care (10 cases, 34 controls), 5 for revisiting outpatient care (2 cases, 3 controls)

Figure 3 shows Kaplan-Meier estimates of the days until readmission based on sex. We found that the overall rate was 16.3% (95%-confidence interval 10.3–22) for female and 22.5% (95%-confidence interval 14.3–29.9) for male participants readmitted within 90 days.



**Figure 3.** Kaplan-Meier estimates showing days until readmission based on sex. The overall rate was 22.5% for males and 16.3% for females readmitted within 90 days. The readmission rate within 30 days was 10.5 for female and 9.5 for male participants, respectively.



### 5.2.2 Readmission within 30 days

Table 5 shows the demographic and clinical characteristics of psychiatric inpatients for cases and controls. A total of 264 patients were included, whereas 25 were cases and 239 controls. The Kaplan-Meier method showed that the overall rate was 10.5% (95%-confidence interval 5.5–15.2) for female and 8.1% (95%-confidence interval 2.9–13) for male participants readmitted within 30 days (Figure 3). The mean age of readmitted patients was 36 years with a std of 13, and that for the controls was 38.5 years with a std of 13.5. The mean length of stay was 25 days with a std of 13 for those readmitted within 30 days and 20 days with a std of 13.5 for controls. No significant associations were found for the remaining characteristics: age, length of stay, sex, marital status, cohabiting children, whether the patient had psychotic depression, whether they were admitted under the Compulsory Psychiatric Care Act, whether they received ECT and whether they had previous depression. Therefore, the overall power of the analysis was poor.

Table 5  
 Characteristics of psychiatric inpatients with depression for readmission 30 days for inpatient cases (n = 25) and controls (n = 239) at Sahlgrenska University Hospital, 2019

Variable	Readmission 30 days	Controls	p-value
Age, mean (std) <sup>a</sup>	36 (13)	38.5 (13.5)	.38 <sup>a</sup>
Length of stay, mean (std) <sup>a</sup>	25.4 (13.4)	20.3 (14.7)	.097 <sup>a</sup>
	N (%)	N (%)	
Sex			
Female	16 (64)	137 (57.3)	.52 <sup>b</sup>
Male	9 (36)	102 (42.7)	
Marital status			.181 <sup>b</sup>
Single	14 (56)	155 (66.2)	
Cohabitant	11 (44)	67 (28.6)	
Living apart	0 (0)	12 (5.1)	
Cohabiting children	6 (30)	58 (29.3)	.96 <sup>b</sup>
Psychotic depression	0 (0)	29 (12.1)	.065 <sup>b</sup>
Compulsory Psychiatric Care Act	4 (16)	48 (20.1)	.625 <sup>b</sup>
Electroconvulsive therapy (ECT)	3 (12)	31 (13)	.89 <sup>b</sup>
Previous depression			.42 <sup>b</sup>
Yes	22 (100)	202 (97.1)	
First-time depression	0 (0)	6 (2.9)	

<sup>a</sup> t-test mean, std and p-value

<sup>b</sup> chi-square test p-value

*Note.* Missing data was 5 for marital status (controls 5), 46 for children (cases 5, 41 controls) and 34 for previous depression (3 cases, 31 controls)

### 5.3 Result of binary logistic regression analysis

Table 6 shows binary logistic regression analysis for readmission within 90 days. The variable of interest and significant categorical predictor variables in the univariate analysis were fitted in the analysis. The result shows that length of stay was significantly associated with readmission ( $p < 0.023$ ). A patient staying at the psychiatric ward for each additional day was 1.024 (95%-confidence interval 1.003–1.046) times more likely to be readmitted. According to the model, no significant associations were found for the remaining characteristics: sex, psychotic depression, benzodiazepines and eating disorders.

Table 6  
Logistic regression results for psychiatric inpatients with depression for readmission within 90 days at Sahlgrenska University Hospital, 2019

Variable	B	Sig	Exp(b)	95% CI for Exp (B)	
				Lower	Upper
Length of stay	.024	<b>.023</b>	1.024	1.003	1.046
Female	-.613	.070	0.542	0.279	1.051
Psychotic depression	-.628	.297	0.534	0.164	1.739
Benzodiazepines	.502	.131	1.651	0.861	3.167
Eating disorder	.772	.218	2.165	0.633	7.402

## 6. Discussion

This study aimed to identify risk factors for readmission following psychiatric inpatient care for depression at Sahlgrenska University Hospital, Sweden. This was achieved by collecting data from medical records. First, the univariate chi-square test of association and t-test was fitted to the data. Then, we used significant variables and variables of interest for further investigation in a binary logistic regression model.

### 6.1 Principal findings

The most interesting key finding was that the strongest predictor for readmission to the psychiatric department was length of stay both in the univariate and binary logistic regression analyses (Table 4 and 6). To the best of our knowledge, no studies in the field show the length of stay as a predictor for readmission in patients diagnosed with depression. It is difficult to explain this result, but it might be related to a lack of space in the ward. This might have contributed to early discharge from the hospital. A short length of stay at the ward due to empty beds have been associated with increased readmission frequency in psychiatric patients (31). Several studies have notified length of stay as a highly related factor for readmission (31). However, the area investigated was psychiatric conditions but not depression specifically. Additionally, patients readmitted within 30 days and 90 days stayed longer than the control group. One explanation for this finding may be that these patients may have a more severe disorder and may have a limited family or social support.

Another interesting key finding was that eating disorders were a risk factor for readmission within 90 days. A possible explanation for this might be that a lower weight increase at first admission and a lower BMI at discharge are risk factors for readmission (38). Additionally, patients might be admitted to psychiatric inpatient care due to indications other than depression.

The readmission rate among patients presenting with psychotic depression was not significant. However, our data suggests that patients with psychotic depression are numerically less likely to be readmitted within 30 days than patients readmitted within 90 days. This finding was consistent with a retrospective, medical record-based analysis conducted in 2020 (39). Moreover, our data shows that psychotic depression is not a risk factor but a protective factor. One explanation to this finding may be the treatment these patients receive: both antipsychotic medication and ECT. These patients may have benefited from ECT, which has an 80% remission rate (40). Another possible reason why readmission were less likely to occur within 30 days could be that these patients might have higher motivation to receive treatment and relatives may offer bigger support. However, the sample size is too small, and we would have needed more participants to make more reliable assumptions.

Sex was not significant, but this study revealed a difference between females and males in terms of readmission, which is an important factor to consider. The analysis showed that women were numerically more likely to be readmitted within 30 days than men. This finding was also reported by Hamish et al. (27). However, this study could not demonstrate the extent to which it was a risk factor. Katherine et al. reported that a 30-day readmission rate was significantly lower in women, which may be contrary to our outcome (41). This finding must be interpreted with caution because it was not specific to patients with depression.

The number of patients treated with benzodiazepines compared to the control group was not significant. This result may be particularly prone to type-II errors.

The participant age was not significant in our study. Patients aged 70+ years have been associated with risk of readmission (27). However, this age group was excluded from our study which may explain why age was not related to readmission.

## 6.2 Study strengths and limitations

A significant strength of our study is that we can increase the sample size by including more participants in the future. A further strength is the Swedish hospital discharge registers which have been extensively validated and the validity is around 85-95% for many diagnoses (42). Another strength of our study is that it is a well-defined group and a relatively large sample. However, it is not sufficiently large to draw general conclusions.

No previous studies have analysed the length of stay as a predictor for readmission in patients diagnosed with depression which is a strength in our study. However, this may require future studies to verify its clinical importance.

Some limitations are acknowledged. For some of our variables, missing data was considerable (more than 15% of participants were missing data for cohabiting children, sick leave and whether the patient was at the outpatient specialist care); however, this was because these factors could not be found in the medical records. Therefore, some variables are not included in the study.

A previous study found that the major predictors of readmission were diagnoses such as schizophrenia and bipolar disorder (43). Therefore, a possible limitation in terms of accuracy may be the recorded discharge diagnoses. Although we have excluded these patient groups in our study, the depressed phase of patients having a bipolar illness may be difficult or even impossible to distinguish from depression (8). Additionally, patients with schizophrenia in the early phase reach the criteria for depressive disorder 40% of the time (44).

The study is observational, and we cannot establish causality. Additionally, with more participants, it would have been possible to make calculations with adjustments for possible confounders, such as comorbidities. Moreover, the low number of subjects makes the analysis prone to type-II errors. In summary, more research is required in this field because of the heterogeneity of depression (8).

Several questions remain unanswered, such as the effect of kindling on readmission since studies have found that the third or fourth depressive relapse should be avoided. This increases the depressive episode to occur more frequently and the asymptomatic phase is much shorter (29).

Further research should be undertaken to investigate the efficacy of psychotropic medication on depression for inpatients (45). The external validity should be improved since participants included in antidepressant trials represent a small group of patients treated for depression in routine clinical practice. Uncertainty exists regarding the impact of strict inclusion and exclusion criteria on the representativeness of participants in efficacy trials (23). Finally, is a definition required for readmission, and how should it be defined? This is an important question since such a definition is unavailable.

## 7. Conclusion

This study aimed to assess demographic and clinical characteristics associated with readmission in Sweden. The descriptive result showed that 18.9% of the patients were readmitted within 90 days and 9.5% within 30 days. Binary logistic regression and chi-square test were used in this study and was significant for length of stay. Both analyses showed that length of stay was found to be a risk factor for readmission to the psychiatric department amongst patients diagnosed with depression. In our study, eating disorders were a risk factor for readmission. A number of risk factors that might have been expected to predict readmission were not significant such as psychotic depression, sex and patients prescribed with benzodiazepines. The result of this study could be taken into account to help better understanding of factors associated with readmission amongst patient diagnosed with depression. This may in future result in excellent care, better clinical practice and earlier recovery for this patient group. In summary this study found a few discharge factors that were associated with readmission, but a larger cohort will be needed to determine which risk factors are independent.



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# Populärvetenskaplig sammanfattning

## Riskfaktorer för återinläggning efter vårdtillfälle för depression

Depression är ett genomgripande sjukdomstillstånd som ger upphov till lidande och nedsatt funktion. Depression är en sjukdom som drabbar mer än 264 miljoner människor världen över. Studier för att förklara återinläggningsrisker och frekvensen är viktiga eftersom tillståndet påverkar emotioner och kognitiva såväl som kroppsliga funktioner.

I Sverige har andelen slutenvårdspatienter för depression ökat. Ökningen ses bland män såväl som hos kvinnor, främst i åldrarna <25 år. Enligt Socialstyrelsens slutenvårdsregister var antalet patienter vårdade i slutenvården för 2019, 8361 patienter. Studier har visat att depressionen i sin natur består av skilda komponenter vilket kan vara ett hinder för vårdpersonal att effektivt behandla sjukdomen. På senare årtionden har intresset för att studera riskfaktorer för återinläggning efter vård pga. depression ökat. Idag vet vi att samsjuklighet, substansmissbruk, äldre patienter och kvinnlig kön utgör riskfaktorer för att bli återinlagd.

Socialstyrelsens nationella riktlinjer för behandling av depression ger riktningen för behandling av depression. Däremot tas det inte upp om vad vårdpersonal bör göra efter att patienten behandlats med antidepressiva läkemedel, kognitiv beteendeterapi och elektrokonvulsiv behandling (elbehandling). Uppemot 50–66% av fallen når inte fullt remission efter behandling med antidepressiva läkemedel. Endast en tredje del av patienterna får remission av sina depressiva symptom.

I denna studie studerades två olika grupper. En grupp som blev återinlagda inom 90 dagar samt en grupp som blev återinlagda efter 30 dagar. Sedan jämförde vi grupperna med en kontrollgrupp som inte blev återinlagda. Totalt ingick 264 patienter inom Västra Götalandsregionen som varit inlagda på slutenvården mellan 20 december 2018 till 12 december 2019. Syftet med studien var att kartlägga om det fanns riskfaktorer som var associerade med ökat återinläggnings frekvens efter

att ha skrivits ut från slutenvården. Vidare ville vi presentera en demografisk såväl som klinisk beskrivning av grupperna.

Resultaten visar att 1 av 5 patienter blir återinlagda inom 90 dagar och 1 av 10 blir återinlagda inom 30 dagar. I 90 dagars gruppen visade studien med statistisk säkerhet att vistelsetiden på avdelningen ökade risken att bli återinlagd med 2,4% för varje dag som patienten låg inlagd på en psykiatrisk slutenvårdsvårdsinrättning. Resultatet visar ytligare att ätstörningar var en riskfaktor för återinläggning. En trolig förklaring till detta är att låg vikt och BMI vid utskrivning predisponerar för återinläggning. Kön utgjorde inte en riskfaktor för att bli återinlagd. Vidare visar resultaten att kvinnligt kön numeriskt utgjorde en högre risk för att bli återinlagd inom 30 dagar jämfört med män som blev återinlagda inom 90 dagar. Ett antal riskfaktorer som förväntades att predicera återinläggning var inte signifikanta så som psykotisk depression, kön och patienter som ordinerats bensodiazepiner. Resultaten är viktiga observationer i att kunna designa större studier för att kunna studera riskfaktorerna för återinläggning på psykiatrisk slutenvård bland patienter diagnostiserade med depression.

Bättre klinisk praxis och utformande av rutiner för att ta hand om patienterna efter en slutenvårdssinläggning är en viktig aspekt i skapande av hållbara rutiner för denna patientgrupp. Det är också av särskilt vikt att kartlägga faktorer som främjar tillfrisknande och effekt av behandlingsinsatser som man kan utvärdera för att finna kausal samband mellan sjukdom och faktorer av tillfrisknande. Författaren föreslår större studier för att kunna fastställa kausala samband mellan riskfaktorerna för återinläggning och vård för depression inom psykiatrisk slutenvård. Framtida forskning är nödvändigt inom området, detta för att förstå faktorer som är associerade med ökat återinläggningsfrekvens, bättre vård och bättre återhämtning för denna patientgrupp.

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