Determinants of Antidepressant Treatment and Outpatient Rehabilitation Within the First Year After Stroke

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Abstract

This study aims to identify individual determinants of antidepressant treatment and outpatient rehabilitation after stroke. People with ischemic stroke ($N = 303$) recruited at 2 inpatient rehabilitation clinics were included into a prospective longitudinal study with follow-up telephone interviews 6 and 12 months later. Participants reported on their use of antidepressant medication and psychotherapy as well as physical, occupational, speech, and neuropsychological therapy. The use of antidepressants at discharge ($n = 65$, 23.8%) was predicted by the severity of depressive symptoms, severity of stroke, history of depression, and use of antidepressants at admission (all $p < .05$, $R^2 = .55$). The number of outpatient rehabilitation services used at follow-ups was predicted by higher functional and cognitive impairment, higher education, younger age, severity of depressive symptoms, and lower self-efficacy (all $p < .05$; $R^2_{6M} = .24$, $R^2_{12M} = .49$). The relevance of identified determinants for the improvement of treatment rates after stroke is discussed.

Keywords

stroke, depression, health service use, rehabilitation, prospective longitudinal

Introduction

Strokes are one of the most common causes of acquired disability in adults worldwide and its burden is expected to increase even further due to the aging of populations and economic transitions worldwide.^{1,2} Depressive disorders affect a third of all stroke survivors at any given point of time within 5 years after the event and are associated with marked negative consequences for rehabilitation.^{3–5} For the treatment of post-stroke depression, reviews identified antidepressant medication (ADM) and cognitive behavioral therapy as the most efficacious options while broader evidence is still needed.^{6,7} Despite the existence of these treatments, they remain substantially underused as is demonstrated by our recent meta-analysis, including the data of 32 prospective longitudinal studies.⁸ Out of the 2,381 people after stroke with depressive disorder according to ICD/DSM or scores above cut-points on standard screening instruments, 24% used ADM, while the use of psychotherapy was only reported in 1 sample where none of 89 people received this treatment.

Multidisciplinary rehabilitation, including physical, occupational, speech, and neuropsychological therapy, is recommended by national and international guidelines to address the variety of potential deficits and reduce long-term disability after stroke.^{9,10} However, research on health service utilization suggests that outpatient rehabilitation is often not used. In a German sample of 1,929 people with motor deficits up to 12 months after stroke, Peschke et al.¹¹ found that 49% used

outpatient physical or occupational therapy. In a sample from the United Kingdom,¹² 45% of 278 people with aphasia after stroke received outpatient speech and language therapy. Hence, at least half of the people with a specific indication for outpatient rehabilitation after stroke did not use the respective therapy in these studies.

Summarizing, people with and without depression after stroke have an explicit need for different health services which is not met in the majority of cases. This raises the question which people use antidepressant treatment and outpatient rehabilitation after stroke as predictive individual characteristics may facilitate the improvement of health care.¹³

Andersen's behavioral model of health service use¹⁴ may serve as a theoretical framework to approach this issue. Introduced in the 1960s, the model was continuously refined in subsequent decades.^{14,15} It is regularly applied in studies of health care utilization,^{16,17} and provides the basis for national health reporting systems.¹⁸ The model aims to explain and predict

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Figure 1. Andersen's behavioral model of health service use; adapted from Andersen (2008).

health care use by conceptualizing use as a function of individual *predisposing* factors, *enabling* resources, and *need* for care (see Figure 1).¹⁹ While *predisposing* factors are associated with the likelihood of health service use, *enabling* resources provide *potential access* to health services. Finally, the model proposes *need* to represent the most important individual determinant of *realized access* to health services and differentiates self-perceived from professionally evaluated need. In more recent versions of the model, Andersen^{14,19} introduced health outcomes to exert “feedback loops” on *predisposing* and *need* factors—for instance, satisfaction with a treatment may influence health beliefs regarding this treatment and thereby affect future use.

For antidepressant treatments, depressive symptoms may represent the primary *need* variable. Additionally, disability and dependence probably used to be considered as further *need* variables for pharmacological treatment as selective serotonin reuptake inhibitors were shown to improve motor deficits and dependence after stroke.²⁰ However, a more recent large double-blind placebo-controlled trial did not prove any benefit for functional outcomes after stroke.²¹

As the promotion of independence at home is a main rehabilitation goal of both professionals and people after a stroke,^{10,22} functional impairment may be the primary *need* variable for the use of outpatient rehabilitation. Moreover, depressive symptoms are associated with less efficient use of services in inpatient stroke rehabilitation and might therefore be considered a potential barrier to outpatient services.²³

The provision of rehabilitation services after a stroke may vary significantly among countries. In Germany, national guidelines recommend that decisions on the setting and duration of rehabilitation consider individual prognoses. Therefore, trajectories of service use may vary significantly among people after stroke and tracking of service use up to 12 months after stroke is usual (cf. Peschke et al.).¹¹ The costs of this rehabilitation service use are covered by general health insurance in Germany.

Based on the behavioral model of health service use,¹⁴ this study aims to identify determinants of antidepressant treatment and outpatient rehabilitation to enhance the understanding of health service use after stroke. Findings may be used to identify predictive individual characteristics and to develop respective improvement strategies.

Methods

Participants were consecutively recruited from 2 inpatient rehabilitation clinics between 2011 and 2016. They were included in a prospective longitudinal study if they (i) underwent rehabilitation for ischemic stroke as recorded in patient charts, (ii) gave written informed consent to participate in the study, and (iii) showed sufficient language comprehension ascertained by a Token Test score < 12. Participants were excluded if they had another very impeding disease, i.e. dementia, neurodegenerative diseases, epilepsy, cancer, AIDS,

Figure 2. Participation and attrition within the first year after stroke.

^aParticipants not reached or too impaired at 6 months were tried to reach again at 12 months.

Annotation. Values in brackets represent standard deviations.

intellectual disability or other acute life-threatening conditions like pneumonia. The study was approved by the ethics commission of the Institute of Psychology, Humboldt-Universität zu Berlin (Reg.-No 2010–13) and conducted in accordance with the 1964 Helsinki Declaration and its later amendments.

Neuropsychologists in the clinics evaluated inclusion and exclusion criteria in patients and referred them to trained doctoral and master students, if eligible. Students approached potential participants, obtained informed written consent, and assessed them before discharge from the clinic. Demographics were recorded. Functional independence was measured by the Barthel Index (range: 0–100),²⁴ cognitive status by the Mini Mental Status Examination (range: 0–30),²⁵ general self-efficacy by the general self-efficacy scale (GSES; range: 10–40),²⁶ and social support by the 22-item version of the social support questionnaire (F-SozU K-22, range: 22–110).²⁷ Depressive symptoms were assessed using the 15-item version of the Geriatric Depression Scale (GDS; range: 0–15),²⁸ which shows

satisfactory psychometric properties in people with stroke.²⁹ All scores imply a higher degree of the assessed construct. Diagnosis of minor or major depression according to DSM-IV³⁰ was ascertained by the structured clinical interview for DSM-IV (SCID)³¹ and translated into DSM-5 criteria.³² History of depression was recorded from self-report. The stroke severity, as measured by the modified National Institutes of Health Stroke Scale (mNIHSS),³³ was collected from patient charts, as was the medication at admission to and discharge from the rehabilitation clinics. Scores of the mNIHSS range from 0 to 31 with higher scores, implying higher stroke severity. In follow-up telephone interviews 6 and 12 months after stroke, trained students re-evaluated depressive symptoms (GDS),²⁸ diagnosis of minor/major depression (SCID),³¹ and general self-efficacy (GSES).²⁶ Participants were asked to report on current medication and use of psychotherapy as well as use of physical, occupational, speech, and neuropsychological therapy. If telephone interviews could not be conducted due

Table 1. Sample Characteristics at All Measurement Occasions.

	Baseline N = 303		6 Months n = 196		12 Months n = 181	
History of Depression (Yes) ^a	42 (14.0%) ^c		24 (12.2%)		21 (11.6%)	
Gender (Female) ^a	122 (40.3%)		82 (41.8%)		74 (40.9%)	
Depression (DSM-5; Yes) ^b	111 (36.6%)		63 (32.1%)		47 (25.7%)	
	M	SD	M	SD	M	SD
Age ^a	63.6	10.9	63.7	10.5	63.7	10.7
Education (Years) ^a	11.4 ^c	3.1 ^c	11.6	3.2	11.7	3.3
Stroke Severity (mNIHSS) ^a	3.9 ^d	3.6 ^d	3.9	3.6	3.7	3.4
Functional Independence (Barthel Index)	85.5 ^e	20.7 ^e	86.3	19.9	86.6	19.4
Cognitive Status (MMSE) ^a	27.7 ^c	2.9 ^c	28.0	2.5	28.0	2.3
Social Support (F-SozU K-22) ^a	94.4	15.2	95.6	13.9	95.7	13.8
Self-Efficacy (GSES)	31.2	6.0	31.2	6.3	31.2	6.9
Depressive Symptoms (GDS)	3.9	3.7	3.9	3.9	3.7	3.8

DSM = Diagnostic and Statistical Manual of Mental Disorders, F-SozU K-22 = Social Support Questionnaire 22-items short version, GDS = Geriatric Depression Scale, GSES = General Self-Efficacy Scale, MMSE = Mini-Mental State Examination, mNIHSS = modified National Institutes of Health Stroke Scale.

^aVariables only assessed at baseline, later values refer to sample assessed at follow-ups.

^bMinor or Major Depression.

^cData of *n* = 300 participants available.

^dData of *n* = 277 participants available.

^eData of *n* = 299 participants available.

to impairments, e.g. hearing, participants dropped out from follow-up (see Figure 2: “too impaired”).

Use of antidepressants (yes) was coded if participants reported the use of a drug belonging to the following categories: selective serotonin (norepinephrine) reuptake inhibitors, noradrenergic and specific serotonergic antidepressants, tricyclic and tetracyclic antidepressants or monoamine oxidase inhibitors. Use of outpatient rehabilitation was quantified as the number of outpatient therapies reported (physical, occupational, speech and/or neuropsychological therapy).

To identify the determinants of ADM use at discharge, a multiple stepwise logistic regression analysis was conducted. According to Andersen's model,¹⁴ the steps were defined as 1) *past use and health status*, including history of depression and use of antidepressants at admission, 2) *predisposing* variables, including age and gender, 3) *enabling* variables, including years of education, and 4) *need* variables, including stroke severity, functional independence, current depressive symptoms, and clinic site. The model does not specify *past use and health status* as a group of determinants, they were however included to consider the proposed “feedback loops” of past use and health status on current service use.¹⁴ While the model does not assume a hierarchy or time-dependency of determinants, the order of steps was defined based on proximity to the individual and mutability, beginning with non-mutable events in the past and ending with potentially mutable current clinical characteristics. Predictors of antidepressant treatment (ADM and/or psychotherapy) at follow-ups were not investigated in multivariate regression analyses as the statistical power would have been too low due to the limited number of people using these treatments.³⁴

Additionally, to predict the use of outpatient rehabilitation at follow-ups, multiple stepwise linear regression analyses were conducted. Steps were defined as 1) *past use and health status* including history of depression and use of outpatient rehabilitation at the 6 month mark to predict the use at 12 months, 2) *predisposing* variables including age and gender, 3) *enabling* variables, including education, current self-efficacy and social support, 4) *need* variables, including stroke severity, functional independence, cognitive status, and current depressive symptoms. Missing data were addressed by pairwise deletion. The significance level was set at $\alpha = .05$. Drop-out analyses were performed using χ^2 -tests for categorical and independent *t*-tests for continuous variables.

Results

Out of the 757 patients who were approached, 325 (43%) declined participation, 103 (14%) could not be assessed due to early discharge or lack of time for the assessment during rehabilitation, and 26 (3%) did not fulfill inclusion and exclusion criteria. Finally, 303 participants were included at baseline, 196 were interviewed at 6 months follow-up and 181 at 12 months follow-up—for details see Figure 2. Drop-out analyses showed that participants with lower cognitive status and higher severity of depressive symptoms at baseline were more likely to drop out from 6 months follow-up. Furthermore, younger participants and people with higher stroke severity at baseline were more likely to drop out from 12 months follow-up (see Supplementary Table 1). Sample characteristics at all measurement occasions are shown in Table 1.

Figure 3. Use of antidepressant treatments and outpatient rehabilitation at all measurement occasions.

ADM = Antidepressant medication, PsyT = Psychotherapy.

^aMinor or major depression (DSM-5).

Annotation. Subsample sizes differ from all participants due to missing values.

Figure 3 depicts the frequencies of antidepressant treatments with and without depression diagnosis as well as the number of outpatient rehabilitation services used. Out of 49 participants using antidepressant treatment at 6 months, 27 (55.1%) only used ADM, 13 (26.5%) only used psychotherapy, and 9 (18.4%) used both. Out of 45 participants using antidepressant treatment at 12 months, 29 (64.4%) only used ADM, 11 (24.4%) only used psychotherapy, and 5 (11.1%) used both. ADM was selective serotonin reuptake inhibitors in the majority of participants—for details on classes of ADM used see Supplementary Table 2.

Out of 191 people reporting on use of outpatient rehabilitation after 6 months, 115 (60.2%) used at least 1 service ($M = 0.98$, $SD = 0.97$). The type of service was physical therapy in $n = 96$ (50.3%), occupational therapy in $n = 67$ (35.1%), speech therapy in $n = 18$ (9.4%), and neuropsychological therapy in $n = 7$ (3.7%). Out of 151 people reporting on use of outpatient rehabilitation after 12 months, 78 (51.6%) used at least 1 service ($M = 0.84$, $SD = 0.95$). The type of service was physical therapy in $n = 56$ (37.1%), occupational therapy in $n = 46$ (30.5%), speech therapy in $n = 16$ (10.6%), and neuropsychological therapy in $n = 9$ (5.9%).

Table 2 shows the results of the multivariate stepwise logistic regression analysis to predict the use of ADM at discharge

from inpatient rehabilitation. The use of ADM at admission, history of depression, higher stroke severity, and higher severity of depressive symptoms were associated with a higher likelihood of using ADM at discharge.

Table 3 shows the results of the multiple stepwise linear regression analysis to predict the use of outpatient rehabilitation at 6 months. Younger age, higher education, lower functional independence, and lower cognitive status were associated with a higher likelihood of using outpatient rehabilitation at 6 months after discharge.

Table 4 shows the results of the multiple stepwise linear regression analysis to predict use of outpatient rehabilitation at 12 months. In addition to higher education, lower functional independence, and lower cognitive status, a higher number of outpatient rehabilitation services used at 6 months, lower self-efficacy, and lower severity of depressive symptoms were associated with a higher likelihood of using outpatient rehabilitation at 12 months after discharge.

Discussion

Overall, our study revealed that antidepressant medication was used by people with more depressive symptoms and higher stroke severity while outpatient rehabilitation was used by

Table 2. Results of Multivariate Logistic Regression Analyses to Predict Use of Antidepressant Drugs at Discharge From Inpatient Rehabilitation.

	Antidepressant medication at discharge n = 273 (ADM yes: n = 65, 23.8%)							
	Past Use & Health Status		Predisposing		Enabling		Need	
	OR	95% CI ^a	OR	95% CI ^a	OR	95% CI ^a	OR	95% CI ^a
ADM _{admission}	88.84**	19.93 / 396.14	90.60**	20.16 / 406.78	93.13**	20.54 / 422.30	68.01**	14.28 / 323.85
History of Depression	5.51**	2.26 / 13.41	5.91**	2.31 / 15.08	6.06**	2.35 / 15.60	3.83*	1.29 / 11.37
Age	—	—	1.01	0.97 / 1.05	1.01	0.98 / 1.05	1.01	0.97 / 1.05
Gender	—	—	1.36	0.64 / 2.86	1.23	0.57 / 2.65	1.08	0.48 / 2.44
Education (years)	—	—	—	—	0.93	0.81 / 1.06	0.92	0.78 / 1.07
Stroke Severity (mNIHSS)	—	—	—	—	—	—	1.16*	1.03 / 1.31
Functional Independence (Barthel Index)	—	—	—	—	—	—	1.00	0.98 / 1.02
Depressive Symptoms _{baseline} (GDS)	—	—	—	—	—	—	1.17**	1.05 / 1.30
Clinic Site	—	—	—	—	—	—	1.79	0.78 / 4.10
Explained variance (Nagelkerke's R ²)	R ² = .47		R ² = .47		R ² = .48		R ² = .55	

ADM = antidepressant medication, F-SozU K-22: Social Support Questionnaire 22-items short version, GDS = Geriatric Depression Scale, GSES = General Self-Efficacy Scale, mNIHSS = modified National Institutes of Health Stroke Scale.

^aCI = Confidence Interval (lower limit/upper limit), OR = Odds Ratio, *p < .05; **p < .01.

people with higher cognitive and functional impairment, i.e. people with a corresponding need used the respective health service after stroke. This finding is in line with Andersen's model of health service use.^{14,15} However, the use of antidepressant medication (38%) and/or psychotherapy (46 to 64%) in people with a diagnosis of depression indicated undertreatment of post-stroke depression. Lower education, older age, higher severity of depressive symptoms and higher self-efficacy emerged as barriers to the use of outpatient rehabilitation, while their impact depended on the time elapsed since stroke.

To evaluate these findings, the representativity of our sample should be considered. Depression rates were in accordance with representative meta-analyses,^{5,35} ranging between 26% and 37% at different points of time after discharge. The frequency of ADM and/or psychotherapy use (14% to 31%) was in the same range as in other stroke populations.^{36,37} The use of antidepressant treatment in people with minor or major depression was more frequent in this sample (38% to 64%) than in our recent meta-analysis (24%, 95% CI = 20%-27%) where the use of psychotherapy was scarcely reported.⁸ Noticeably, outpatient rehabilitation was used by more than half of all people with stroke in our sample (52% and 60%). Other studies report similar frequencies only in people with specific indications for a service after stroke,^{11,12} which may result from the fact that our study considered a larger variety of rehabilitation services.

Antidepressant Medication (ADM)

To our knowledge, this is the first study to demonstrate the association of depressive symptoms with the use of ADM after

stroke. While this finding seems self-evident, no other study investigating the determinants of ADM use after stroke considered information about depression.^{13,36-39} Only 1 study explored if the application of a depression screening determined ADM use and found no association, with the restriction of only 6 out of 123 people with stroke being screened.⁴⁰ Furthermore, history of depression and previous use of ADM were predictors of current use, reflecting the "feedback loop" of past health status and health service use on future use, as formulated by Andersen's model.¹⁴

Stroke severity was confirmed as a predictor of ADM use as it may represent a further *need* variable.¹⁴ Previous studies proved the efficacy of selective serotonin reuptake inhibitors for the reduction of motor deficits and functional impairment after stroke.²⁰ However, further research is needed as a recent large double-blind randomized controlled trial does not support the rehabilitation boosting effects of selective serotonin reuptake inhibitors.²¹ As a possible explanation for this association, one might assume that it was mediated by a correlation of stroke severity and depressive symptoms at baseline.⁴¹ However, a post-hoc mediation analysis showed no effect of stroke severity on depressive symptoms at baseline in our data.⁴²

Outpatient Rehabilitation

While the association of functional independence with outpatient rehabilitation use was also reported for an Australian sample,⁴³ other studies did not demonstrate the predictivity of cognitive status for outpatient rehabilitation use.^{43,44} This may be due to the binary operationalization of cognitive

Table 3. Results of Multiple Stepwise Linear Regression Analyses to Predict Use of Outpatient Rehabilitation at 6 Months Follow-Up.

	<i>n</i> = 175							
	Past Use & Health Status		Predisposing		Enabling		Need	
	β	95% CI ^a	β	95% CI ^a	β	95% CI ^a	β	95% CI ^a
History of Depression	-.04	-.19 / .11	-.04	-.20 / .11	-.10	-.26 / .06	-.07	-.22 / .07
Age	—	—	-.02	-.18 / .14	-.05	-.22 / .13	-.15*	-.30 / -.01
Gender	—	—	.01	-.14 / .15	.01	-.14 / .16	.04	-.09 / .17
Education (years)	—	—	—	—	.11	-.05 / .26	.15*	.01 / .29
Self-Efficacy _{6 Months} (GSES) ^b	—	—	—	—	-.10	-.25 / .07	.02	-.14 / .18
Social Support (F-SozU K-22)	—	—	—	—	-.10	-.27 / .06	-.01	-.17 / .16
Stroke Severity (mNIHSS) ^c	—	—	—	—	—	—	.06	-.09 / .21
Functional Independence (Barthel Index)	—	—	—	—	—	—	-.42**	-.58 / -.26
Cognitive Status (MMSE) ^d	—	—	—	—	—	—	-.15*	-.29 / -.01
Depressive Symptoms _{6 Months} (GDS) ^e	—	—	—	—	—	—	.11	-.08 / .29
Explained variance (Adjusted R^2)	R^2 = -.01		R^2 = -.02		R^2 = -.01		R^2 = .24	

F-SozU K-22 = Social Support Questionnaire 22-items short version, GDS = Geriatric Depression Scale, GSES = General Self-Efficacy Scale, MMSE = Mini-Mental State Examination, mNIHSS = modified National Institutes of Health Stroke Scale.

^aCI = Confidence Interval (lower limit/upper limit), * p < .05; ** p < .01.

^bData of n = 190 participants available.

^cData of n = 178 participants available.

^dData of n = 189 participants available.

^eData of n = 190 participants available.

impairment in these studies whereas we applied a dimensional assessment²⁵ which probably increased sensitivity.

Older age, lower education, higher self-efficacy, and higher severity of depressive symptoms were identified as barriers to the use of outpatient rehabilitation in this study. While Andersen does not specify determinants to be exclusively promoting or impeding, these variables are included in the model as predisposing biological factors (age) and health beliefs (self-efficacy) as well as enabling means (education). Depressive symptoms may be interpreted as negative manifestation of enabling means, e.g. drive and energy, which usually promote the use of health services.

In contrast to our results, Cook et al.⁴⁵ reported older age to be associated with a higher likelihood of using rehabilitation services after stroke. This may be explained by the exclusion of people younger than 65 years in their study who are more likely to work. As return to work is a major subject of rehabilitation in younger people with stroke,⁴⁶ they may use services more likely to achieve this goal.

Education was not proven to be a determinant of rehabilitation service use after stroke in previous studies.⁴³⁻⁴⁵ This discrepancy could be explained by the fact that these studies used a categorical assessment of education, while our study assessed years of formal education, which probably resulted in an increased sensitivity.

Self-efficacy, the belief to exert control over one's own functioning, is, according to Bandura's theory, thought to facilitate coping with challenging situations.^{47,48} Therefore, it was hypothesized that people with higher self-efficacy are more

likely to transform their individual need into demand. As practitioners decide about the prescription of outpatient rehabilitation, the explanation of our result may be found in patient-practitioner interaction. On the one hand, practitioners may perceive patients with high self-efficacy to be more confident and less in need. On the other hand, patients with high self-efficacy may take care of their needs themselves and not seek the help of a practitioner. However, the effect was of small size and only present at 12 months follow-up. Further research is needed on the relationship between the undertreatment of depression, self-efficacy, and patient-practitioner interaction after stroke.

The impeding effect of depressive symptoms on outpatient rehabilitation use is in line with results from inpatient rehabilitation,²³ but was not demonstrated in other outpatient settings.^{43,44} This may be based on the premature assessment of mood and rehabilitation use a few weeks after stroke in these studies. Depressive symptoms emerge most likely 6 months after stroke when people are confronted with the adjustment of their daily lives to persisting disabilities.⁴⁷ Therefore, the impeding effect of depression on outpatient rehabilitation use may be the strongest only later than 6 months after stroke.

According to Andersen's model, individual predictive characteristics are amenable to interventions if they are mutable. Therefore, both self-perception and professional evaluation of need should be targeted to promote health service use.¹⁹ Among the 4 identified barriers to outpatient rehabilitation, depressive symptoms and the hypothesized effects of self-efficacy can be considered mutable factors, in contrast to

Table 4. Results of Multiple Stepwise Linear Regression Analyses to Predict Use of Outpatient Rehabilitation at 12 Months Follow-Up.

	<i>n</i> = 131							
	Past Use & Health Status		Predisposing		Enabling		Need	
	β	95% CI ^a	β	95% CI ^a	β	95% CI ^a	β	95% CI ^a
History of Depression	-.03	-.18 / .11	-.02	-.17 / .12	-.07	-.22 / .09	.06	-.09 / .21
Outpatient Rehabilitation at 6 Months	.58**	.44 / .72	.58**	.44 / .73	.55**	.40 / .69	.33**	.18 / .48
Age	—	—	.06	-.08 / .22	.08	-.07 / .22	-.01	-.14 / .14
Gender	—	—	.03	-.11 / .17	.05	-.10 / .19	.07	-.06 / .21
Education (years)	—	—	—	—	.16*	.01 / .31	.19**	.05 / .33
Self-Efficacy _{12 Months} (GSES)	—	—	—	—	-.16	-.31 / .01	-.19*	-.36 / -.01
Social Support (F-SozU K-22)	—	—	—	—	.01	-.16 / .16	-.01	-.16 / .15
Stroke Severity (mNIHSS) ^b	—	—	—	—	—	—	.07	-.08 / .23
Functional Independence (Barthel Index)	—	—	—	—	—	—	-.32**	-.48 / -.16
Cognitive Status (MMSE) ^c	—	—	—	—	—	—	-.22**	-.37 / -.08
Depressive Symptoms _{12 Months} (GDS) ^d	—	—	—	—	—	—	-.22*	-.41 / -.04
Explained variance (Adjusted R ²)	R ² = .33		R ² = .32		R ² = .35		R ² = .49	

F-SozU K-22 = Social Support Questionnaire 22-items short version, GDS = Geriatric Depression Scale, GSES = General Self-Efficacy Scale, MMSE = Mini-Mental State Examination, mNIHSS = modified National Institutes of Health Stroke Scale.

^aCI = Confidence Interval (lower limit/upper limit), **p* < .05; ***p* < .01.

^bData of *n* = 134 participants available.

^cData of *n* = 137 participants available.

^dData of *n* = 138 participants available.

age and education, therefore serving as starting points for improving undertreatment.

Study Limitations

We acknowledge that the sample size did not allow for the analysis of determinants of antidepressant treatment at follow-ups. Moreover, the loss to follow-up was selective as participants excluded at 6 months follow-up had lower cognitive status and higher severity of depressive symptoms than responders. People excluded at 12 months follow-ups showed higher stroke severity. This may have led to an underestimation of treatment rates and a neglect of people with higher impairment in our analyses. Additionally, participants excluded at 12 months were younger which may have been due to the higher likelihood of employment and limited availability for interviews in this group. However, the size of the non-responder group at 12 months was very small. Hence, these results need to be interpreted cautiously. Moreover, regression analyses of outpatient rehabilitation services at 12 months were limited by missing cases, as data of 131 participants were included while 181 people were assessed at 12 months follow-up. Most of these missing values occurred in the use of outpatient rehabilitation services, only 139 participants reported use at 6 and 12 months. Hence, results need to be interpreted cautiously and in the context of other studies. Furthermore, the applied definition of undertreatment as a match of self-perceived health status and used health service might not adequately depict the

complexity of health service use. Health status may not necessarily equal perceived need and need may not always be transformed into demand, i.e. presented to a health care provider.⁴⁹ Moreover, adequacy of treatment could not be considered, as indication, dosage, and timing of therapy were not recorded. Finally, these findings may not be generalizable to health care systems with markedly different infrastructure, as the availability of and access to health services represent essential prerequisites of health service use.¹⁴

Despite these limitations, a strength of our study may be that we included factors such as education, depressive symptoms, cognitive status, social support, and self-efficacy as well as data on psychotherapy use. These factors and outcomes have been rarely considered in previous studies, presumably because they are not easily accessible in register-based research.^{8,13,36,38,45}

Future studies should consider the indication and adequacy of treatment, the dynamic nature of unmet need, the differentiation between health status and need as well as self-perceived and professionally evaluated need.^{14,49} The replication of these findings is necessary to elaborate on the time-dependency of age and self-efficacy in predicting service use and in order to inform public health strategies adequately. Moreover, determinants of psychotherapy use demand further research.

Conclusion

This study aimed to identify determinants of health service use after stroke, with a special focus on antidepressant medication

and use of outpatient rehabilitation. The main findings were that depressive symptoms and stroke severity predicted the use of antidepressant medication while functional and cognitive impairment predicted the use of outpatient rehabilitation. Older age, lower education, and higher severity of depressive symptoms represented barriers to outpatient rehabilitation after stroke. On the one hand, these results point to the population of older and less educated people who are at risk of underusing rehabilitation services and therefore, should be evaluated very closely for need of health services. On the other hand, depressive symptoms represent a mutable factor that may be targeted by health care professionals. Hence, use of ADM and outpatient rehabilitation may be facilitated by standardized screening after stroke and training of practitioners in identifying depressive symptoms.

Abbreviations

ADM: Antidepressant medication; DSM-IV/-5: Diagnostic and Statistical Manual of Mental Disorders, fourth/fifth edition; F-SozU K-22: Social Support Questionnaire, 22-item version; GDS: Geriatric Depression Scale, 15-item version; GSES: General Self-Efficacy Scale; ICD: International Statistical Classification of Diseases and Related Health Problems; M: Arithmetic Mean; mNIHSS: modified National Institutes of Health Stroke Scale; OR: Odds Ratio; SCID: Structured Clinical Interview for DSM; SD: Standard deviation.

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Supplemental Material

Supplemental material for this article is available online.

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