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ORIGINAL RESEARCH

Psychological Factors Determine Depressive Symptomatology After Stroke

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Abstract

Objective: To identify psychological factors related to poststroke depressive symptoms.

Design: Cross-sectional study, with patients assessed at 2 months poststroke.

Setting: Patients with stroke from 6 general hospitals.

Participants: Stroke patients (N = 344; mean age ± SD, 66.9±12.3y).

Interventions: Not applicable.

Main Outcome Measures: The presence of clinical depressive symptoms was determined with the depression subscale of the Hospital Anxiety and Depression Scale 2 months poststroke. Psychological factors assessed were extraversion, neuroticism, optimism, pessimism, self-efficacy, helplessness, acceptance, perceiving benefits, proactive coping, and passive coping.

Results: Bivariate correlations and multivariate backward logistic regression were used to analyze associations between psychological factors and poststroke depressive symptoms, accounting for demographic and stroke-related factors. More neuroticism, pessimism, passive coping, and helplessness, and less extraversion, optimism, self-efficacy, acceptance, perceived benefits, and proactive coping were bivariately associated with the presence of depressive symptoms. Multivariate logistic regression analysis showed that more helplessness (odds ratio [OR] = 1.17) and passive coping (OR = 1.19) and less acceptance (OR = .89) and perceived benefits (OR = .89) were independently significantly associated with the presence of poststroke depressive symptoms (Nagelkerke R^2 = .49).

Conclusions: We found a relationship between psychological variables and the presence of depressive symptoms 2 months poststroke. It is important to take these factors into account during poststroke rehabilitation.

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Depressive symptoms are common after stroke and have a profound influence on functioning and quality of life.[1] Reported prevalence rates of poststroke depressive symptoms (PSDS) in the acute phase range from 5% to 54%, and prevalence rates of major depression 2 years poststroke are still around 20%.[1,2]

The etiology of poststroke depression is still unclear. Some researchers have proposed a biological mechanism in which depression is caused by brain damage disrupting neural circuits involved in mood regulation.[3] Others suggest that depression is caused by a psychological reaction to the social and psychological stressors associated with stroke.[4] There are several arguments for both theories, and poststroke depression is most likely to be multifactorial in origin, a combination of both biological and psychological mechanisms.[2]

Until now, research into the determinants of PSDS has focused mainly on stroke-related factors (eg, lesion location, severity of neurologic damage) and demographic factors (eg, age, sex).[5] Prognostic studies found that stroke severity,[6] lesion location,[7,8] functional

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status,[9] younger age,[10] sex,[11,12] cognitive dysfunction,[12] and history of depression[13] explained only a small part of the variance of PSDS.

This implies that additional variables, such as psychological factors, should be considered. The influence of psychological factors on PSDS is of growing interest. It is assumed that the way patients think about and perceive their illness accounts for much of the individual differences in their physical and psychological health status.[14] The Common Sense Model (CSM) by Leventhal describes part of this adaptation process and assumes that when people are confronted with a chronic illness, they try to make sense of it by creating a cognition of it, which influences their coping styles and hence their illness adaptation.[15] In addition, a person's stable characteristics, such as personality traits, are assumed to influence the process of creating the illness cognitions.[15,16] Thus, the influence of personality traits on depressive symptoms is mediated through illness cognitions and coping styles.

Some research has been done on the influence of psychological factors on PSDS. Associations with personality traits such as neuroticism, extraversion, and conscientiousness have been evaluated in a number of studies,[5,17-19] and only high levels of neuroticism were found to be related to higher levels of PSDS. However, these studies used small samples and therefore lacked statistical power. Optimism has only once been investigated as a determinant of PSDS, and was not found to be a significant predictor of PSDS,[19] unlike what was found by studies in other diagnostic groups.[20] General self-efficacy has not been associated with PSDS, but is a strong predictor of depression and quality of life in other diagnostic groups, such as cancer[21] and spinal cord injury.[22] A specific form of self-efficacy, self-care self-efficacy, was associated with depression in stroke patients.[23] The influence of illness cognitions on PSDS has been investigated in 2 studies,[24,25] which found that several illness cognitions, such as acceptance of the illness, are associated with PSDS. However, other illness cognitions, such as helplessness and perceiving benefits, also need to be investigated for their influence on PSDS. Several coping styles, such as avoidance coping, have been found to be related to depressive symptoms in individuals with stroke.[19,26,27] Proactive coping was found to correlate with health-related quality of life.[28] Since, the evidence is, however, still limited, there is a need to further examine the associations between various psychological factors and PSDS.

Ultimately, taking the influence of psychological factors into account should result in more personalized rehabilitation treatment. The objective of this study was therefore to examine the influence of a broad spectrum of psychological factors on PSDS 2 months poststroke, namely personality traits (extraversion, neuroticism, optimism, pessimism, self-efficacy), illness cognitions (helplessness, acceptance, perceiving benefits), and coping styles (proactive coping, passive coping), while controlling for the influence of demographic and stroke-related factors.

List of abbreviations:

ADL	**activities of daily living**
BI	**Barthel Index**
CSM	**Common Sense Model**
GSES	**General Self-Efficacy Scale**
HADS-D	**depression subscale of the Hospital Anxiety and Depression Scale**
LOT-R	**Life Orientation Test–Revised**
PSDS	**poststroke depressive symptoms**
UPCC	**Utrecht Proactive Coping Competence List**

Methods

Design and procedure

The current study is part of the longitudinal Restore4Stroke Cohort study, in which new stroke patients are followed up for 2 years.[29] Six general hospitals in the Netherlands participated, and stroke patients were recruited between March 2011 and March 2013. The medical ethics committees of all participating hospitals approved the Restore4Stroke Cohort study, and informed consent was obtained from all included patients. The present study reports data from stroke onset and 2 months poststroke.

The first assessment (t1) regarded demographic and stroke-related factors. After informed consent had been given, the stroke-related factors, assessed by the neurologist on day 4, were extracted from the medical charts. Information on demographic factors was obtained from the patient or family members. In the second assessment, which took place 2 months poststroke (t2), patients were asked to complete the self-report scales for depression and psychological factors, and cognitive screening was conducted by trained research assistants.

Participants

Stroke patients were eligible for this study if they were $\geq$18 years of age, had a clinically confirmed diagnosis of stroke (ischemic or intracerebral hemorrhagic lesion), and had suffered their stroke within the last 7 days.

Patients were excluded if they (1) had another serious health condition that could be expected to interfere with the study outcomes; (2) had already been dependent regarding activities of daily living (ADL) before their stroke, as defined by a Barthel Index (BI) of $\leq$17[30]; (3) had insufficient command of the Dutch language to understand and complete the questionnaires, based on clinical judgment; or (4) had already been experiencing cognitive decline before their stroke, as defined by a score of $\geq$1 on the Heteroanamnesis List Cognition.[31]

Measures

Dependent variable: presence of depressive symptoms

The presence of depressive symptoms 2 months poststroke was assessed using the depression subscale of the Hospital Anxiety and Depression Scale (HADS-D).[32,33] The Hospital Anxiety and Depression Scale has shown good psychometric properties[33] and is commonly used for stroke patients.[34]

Independent variables: demographic and stroke-related factors

We collected data on sex, age, and level of education. For level of education we used the Dutch Verhage classification ranging from 1 (did not finish primary school) to 7 (university graduation).[35] The severity of the stroke was assessed with the National Institutes of Health Stroke Scale.[36] ADL was assessed using the BI, which is a validated measure often used in stroke.[30] Cognitive functioning was assessed using the Montreal Cognitive Assessment.[37]

Independent variables: psychological factors

Extraversion and neuroticism were assessed with 2 subscales of the Eysenck Personality Questionnaire Revised Short Scale.[38] The extraversion (eg, "Are you a talkative person?") and neuroticism (eg, "Does your mood often go up and down?") scales both consist of

12 items with dichotomous (yes/no) response options. A higher sum score indicates a higher level of extraversion or neuroticism, respectively. The internal consistencies of the neuroticism and extraversion scales are satisfactory (Cronbach α coefficient in the present study was .83 for both scales). Optimism and pessimism were assessed with the Life Orientation Test−Revised (LOT-R).[39] The LOT-R is a 6-item measure with 2 subscales that measure optimism (eg, "In uncertain times, I usually expect the best") and pessimism (eg, "If something can go wrong for me, it will"), respectively, with 3 items each. The LOT-R is scored on a 5-point response scale, ranging from 0 (strongly disagree) to 4 (strongly agree). Higher sum scores on the 2 subscales indicate a higher level of optimism or pessimism, respectively. The internal consistency for optimism in the present study was moderate (Cronbach α coefficient, .62), while that for pessimism was sufficient (Cronbach α coefficient, .72). Self-efficacy was assessed with the General Self-Efficacy Scale (GSES).[40] The GSES consists of 10 items scored on a 4-point scale, ranging from "not at all true" to "exactly true" (eg, "I am confident that I could deal efficiently with unexpected events"). A higher sum score indicates a higher level of self-efficacy. Psychometric properties of the GSES scale are satisfactory to good.[40] Internal consistency in the present study was high (Cronbach α coefficient, .92).

Illness cognitions were measured with the Illness Cognition Questionnaire.[14] This scale consists of 18 items that are scored on a 4-point scale ranging from 1 (not at all) to 4 (completely). The items belong to 1 of 3 subscales: helplessness (eg, "My illness frequently makes me feel helpless"), acceptance (eg, "I can accept my illness well"), and perceived benefits (eg, "My illness has made life more precious to me"), each measured with 6 items and a scoring range of 6 to 24. The Illness Cognition Questionnaire is a reliable instrument to assess illness cognitions in patients with several chronic diseases, such as rheumatoid arthritis and multiple sclerosis.[14] The internal consistencies in the present study were high: Cronbach alpha coefficients were .88 for the helplessness and acceptance subscales and .83 for the perceived benefits subscale.

Proactive coping competencies were assessed with the Utrecht Proactive Coping Competence List (UPCC).[41] The UPCC consists of 21 items scored on a 4-point scale, with scores of competence ranging from "not at all" to "very," resulting in a mean score ranging from 1 to 4, with a higher score indicating a higher level of proactive coping. An example question is, "To what extent do you have the capacity to recognize signals that something might go wrong?" The UPCC has shown good psychometric properties in stroke patients.[28] Internal consistency in the present study was high (Cronbach α coefficient, .93). Passive coping was assessed with the passive reaction pattern subscale of the Utrecht Coping List.[42] This subscale consists of 7 items that are scored on a 4-point scale ranging from "seldom" to "very often" (eg, "take refuge in fantasies"). A higher sum score indicates a higher level of passive coping. The internal consistency of this subscale in the present study was sufficient (Cronbach α coefficient, .72), and the test-retest reliability is high (correlation coefficient, .76).[42]

Statistical analysis

Data were analyzed with the SPSS statistical software package (version 21).[a] Descriptive statistics were used to describe patients' characteristics.

Scores on the HADS-D were dichotomized into "no depressive symptoms" (HADS-D<8) and "depressive symptoms" (HADS-D≥8).[33] Bivariate logistic regression analyses were used to select bivariately significant determinants of PSDS ($P<.05$). Sex, age, and education were entered as demographic factors, and severity of stroke, ADL independence 2 months poststroke, and cognitive functioning 2 months poststroke were entered as stroke-related factors. The level of education was dichotomized into low (1−5) and high (6−7).[43] The BI score was dichotomized into "dependent" (BI<18) and "independent" (BI≥18). Scores on the psychological questionnaires were entered as continuous variables in the analyses.

Bivariately significant factors were tested for multicollinearity (correlation coefficient, >0.7), which did not reveal any problems. Demographic variables, stroke-related factors, and the bivariately significant psychological factors were used in a multivariate hierarchical backward logistic regression analysis. Ensuring that the demographic and stroke-related factors could not be removed from the model, we used the Enter method in the first 2 blocks (demographic and stroke-related factors), and the stepwise backward method (likelihood ratio) in the last block (P in .05, P out 0.1). Goodness of fit of the multivariate model was tested with the Hosmer-Lemeshow test. In addition, odds ratios and their 95% confidence intervals were reported. The critical value of α was set at .05.

Results

Participants

A total of 395 stroke patients were included in the Restore4Stroke Cohort study. The data of 344 participants (87%) were available for analysis. Three participants had died and 18 refused further participation. Furthermore, 30 participants could not take part in the t2 assessment, 5 because of severe aphasia and 25 because of their general physical condition.

The mean age ± SD at the onset of stroke was 66.9±12.3 years; 36% of the participants were women, and 93% had suffered an ischemic stroke (table 1). Four days poststroke, their mean ADL score was 17.2. Seventy-three percent of the participants were discharged home after acute care hospitalization. The descriptive statistics of the psychological measures are presented in table 2.

Depressive symptoms

Two months poststroke, 21.5% of the participants experienced depressive symptoms. Of these patients, 71.6% had a score between 8 and 11 (mild), 17.7% had a score between 12 and 14 (moderate), and 10.7% had a score of ≥15 (severe) on the HADS-D.

Bivariate analysis

Bivariate analysis showed that the presence of PSDS was associated with higher levels of neuroticism, pessimism, helplessness, and passive coping, and lower levels of extraversion, optimism, self-efficacy, acceptance, perceived benefits, and proactive coping (table 3).

None of the demographic factors were significantly associated with PSDS, and of the stroke-related factors only poorer cognitive functioning was associated with the presence of PSDS.

Multivariate analysis

The multivariate hierarchical backward logistic regression analysis showed that more helplessness and passive coping and less acceptance and perceived benefits were independently significantly associated with the presence of PSDS (see table 3). Nagelkerke R^2

Table 1 Patients' characteristics (N=344)

Characteristic	Values
Demographic Factors	
Sex (female)	36
Age (y)	66.9±12.3
Marital status, living together (n=342)	68.7
High education level* (n=342)	26.9
Stroke-related factors	
Ischemic stroke	93
Left hemisphere (n=343)	39.9
Severity of stroke	2.5±2.9
No stroke symptoms (NIHSS 0)	25
Minor stroke symptoms (NIHSS 1–4)	57.9
Moderate stroke symptoms (NIHSS 5–12)	16.3
Moderate to severe stroke symptoms (NIHSS ≥13)	0.9
ADL 4d poststroke (n=344)	17.2±4.4
ADL independent (BI 18–20)	68.9
ADL dependent (BI ≤17)	31.1
ADL 2mo poststroke (n=343)	19.3±2.03
ADL independent (BI 18–20)	91.0
ADL dependent (BI ≤17)	9.0
Cognitive functioning 2mo poststroke (n=339)	23.5±4
Normal cognition (MoCA 26–30)	32.2
Cognitively impaired (MoCA ≤25)	67.8
Destination after discharge from hospital	
Home	73.3
Rehabilitation center	13.4
Nursing home	13.4

NOTE. Values are percentages or mean ± SD.
Abbreviations: MoCA, Montreal Cognitive Assessment; NIHSS, National Institutes of Health Stroke Scale.
* Patients completed higher professional education or have a university degree.

Table 2 Descriptive statistics of the psychological measures

Psychological Factor	Measure	Actual Range	N	Mean ± SD
Extraversion	EPQ-RSS-E	0–12	340	7.1±3.2
Neuroticism	EPQ-RSS-N	0–12	341	3.6±3.1
Optimism	LOT-R	2–12	341	8.2±2.1
Pessimism	LOT-R	0–12	340	4.4±2.8
Self-efficacy	GSES	10–40	340	31.6±6.4
Helplessness	ICQ	6–24	341	11.9±4.9
Acceptance	ICQ	6–24	340	16.4±4.9
Perceived benefits	ICQ	6–24	339	15.0±4.8
Proactive coping	UPCC	1–4	340	3.1±0.6
Passive coping	UCL-P	7–23	341	10.5±2.8

Abbreviations: EPQ-RSS-E, Eysenck Personality Questionnaire Revised Short Scale—Extraversion; EPQ-RSS-N, Eysenck Personality Questionnaire Revised Short Scale—Neuroticism; ICQ, Illness Cognition Questionnaire; UCL-P, Utrecht Coping List.

of the final model was .49. The multivariate model showed a good fit (Hosmer-Lemeshow test, $P=.94$).

Discussion

Two months after stroke, 21.5% of the participants had depressive symptoms in the clinical range, most of whom had mild symptoms. All psychological factors investigated were bivariately related to the presence of depressive symptoms 2 months poststroke. More helplessness and passive coping and less acceptance and perceiving benefits were identified as independent predictors of the presence of PSDS 2 months poststroke.

This is the first study to investigate the influence of a broad range of psychological factors on PSDS. Among the personality traits, all factors were found to be predictors of PSDS in the bivariate analyses. This is not entirely in agreement with earlier research in stroke patients, as some factors that were found to be predictive in the present study, such as extraversion and optimism, were not found to be predictors in earlier stroke studies. The influence of illness cognitions on PSDS has been found in 2 other studies,[24,25] and the relationship between illness cognitions and depressive symptoms has also been confirmed in patients with other diagnoses.[44] The influence of passive coping on PSDS that we found is also in agreement with the literature.[18,25,26] Whereas more active coping styles can reduce depressive mood, passive coping styles can increase feelings of depression.[18]

According to the CSM, patients create illness cognitions of their illness when they are confronted with it. These cognitions lead to the use of different coping styles in order to adapt to the illness. Furthermore, a person's stable characteristics, such as personality traits, are assumed to influence the process of creating the illness cognition.[14,15] In the present study we showed that personality traits, illness cognitions, and coping styles are associated with PSDS. An interesting topic for future research would be to investigate whether the relationships between these factors follow the path assumed in the CSM—that is, whether the influence of personality traits on depressive symptoms is mediated by illness cognitions and coping styles.

None of the demographic and stroke-related factors were significant determinants of PSDS in the bivariate analyses, except for cognitive functioning. This contrasts with the findings of other studies.[5-11,13] Our findings might be attributed to the high proportion (82%) of participants who had suffered a minor stroke, experiencing no or minor stroke symptoms and being independent in ADL 2 months poststroke. On the other hand, a relatively high proportion of participants were cognitively impaired (68%). It is interesting that even patients who have a mild stroke can be cognitively impaired after the stroke.

To optimize rehabilitation interventions for PSDS, we need to know which factors influence PSDS and which factors can be modified by means of therapy. Traditionally, it was assumed that personality traits, such as neuroticism, remain relatively stable throughout a person's lifespan.[38,45] This assumption has been partly confirmed by studies showing that personality traits were indeed relatively stable over time, as reflected in test-retest correlations of personality measures.[46] However, there is also increasing evidence that personality traits have the potential to change and develop during one's life.[47] A study[48] assessing an individualized stroke self-management intervention found positive results in terms of changing self-efficacy after stroke.

Studies[49,50] in patients with other chronic diseases, such as inflammatory rheumatic diseases, have reported promising results concerning the possibility of modifying illness cognitions by means of multidisciplinary rehabilitation treatment and cognitive behavioral therapy. Research[51] has also shown that patients with traumatic brain injury can be taught to make use of more adaptive coping styles, such as active problem-focused styles. A recent meta-analysis[52] found moderate effectiveness of psychological treatment of depression in individuals with acquired brain injury,

Table 3 Bivariate and multivariate logistic regression analyses of PSDS

			Bivariate Analysis				Multivariate Analysis (N = 334)			
Factors	Measure	N	β	SE	*P*	Odds (95% CI)	β	SE	*P*	Odds (95% CI)
Demographic factors										
Sex (female)		344	.39	.27	.147	1.47 (.87–2.49)	−0.06	.36	.878	0.95 (.47–1.92)
Age		344	−.00	.01	.837	1.00 (.98–1.02)	−0.01	.01	.469	0.99 (.96–1.02)
Education (low)		342	.65	.33	.051	1.92 (1.00–3.69)	0.54	.44	.212	1.72 (.73–4.06)
Stroke-related factors										
Severity of stroke	NIHSS	344	−.01	.05	.916	1.00 (.91–1.09)	−0.09	.06	.136	0.91 (.81–1.03)
ADL (dependent)	BI	343	.48	.27	.080	1.62 (.95–2.76)	−0.07	.62	.907	0.93 (.28–3.10)
Cognitive functioning	MoCA	339	−.09	.03	.006*	.92 (.86–.98)	−0.02	.05	.663	0.98 (.89–1.08)
Psychological factors										
Extraversion	EPQ-RSS-E	340	−.10	.04	.021*	.91 (.84–.99)			†	
Neuroticism	EPQ-RSS-N	341	.30	.05	≤.001*	1.35 (1.24–1.48)	0.12	.07	.075	1.13 (.99–1.29)
Optimism	LOT-R	341	−.43	.07	≤.001*	.65 (.57–.75)			†	
Pessimism	LOT-R	340	.21	.05	≤.001*	1.24 (1.13–1.36)	0.14	.07	.050	1.15 (1.00–1.31)
Self-efficacy	GSES	340	−.08	.02	≤.001*	.92 (.89–.96)			†	
Helplessness	ICQ	341	.20	.03	≤.001*	1.22 (1.15–1.30)	0.16	.04	<.001*	1.17 (1.08–1.28)
Acceptance	ICQ	340	−.24	.04	≤.001*	.79 (.74–.85)	−0.11	.05	.023*	0.89 (.81–.98)
Perceived benefits	ICQ	339	−.14	.03	≤.001*	.87 (.82–.92)	−0.12	.05	.007*	0.89 (.81–.97)
Proactive coping	UPCC	340	−.95	.22	≤.001*	.39 (.25–.59)			†	
Passive coping	UCL-P	341	.38	.06	≤.001*	1.46 (1.31–1.64)	0.17	.08	.024*	1.19 (1.02–1.38)
Constant							−2.10			

Abbreviations: β, standardized regression coefficient; CI, confidence interval; EPQ-RSS-E, Eysenck Personality Questionnaire Revised Short Scale—Extraversion; EPQ-RSS-N, Eysenck Personality Questionnaire Revised Short Scale—Neuroticism; ICQ, Illness Cognition Questionnaire; MoCA, Montreal Cognitive Assessment; NIHSS, National Institutes of Health Stroke Scale.

* *P* values are significant.

† Variables that were removed from the analysis using a backward procedure are indicated with a single dagger (†).

including stroke patients, suggesting the value of such interventions in rehabilitation practice.

Study strengths

This study has several strengths. First, it included a large group of patients who had had a stroke. Second, it investigated the influence of a combination of psychological factors on PSDS. Third, it examined a combination of demographic, stroke-related, and psychological factors to identify their influence on PSDS. This has resulted in a more complete overview of the factors that together determine PSDS 2 months poststroke.

Study limitations

Our results must be interpreted with the following limitations in mind. First, patients with an ischemic lesion were overrepresented in our cohort: 93% of the patients had an ischemic lesion, compared with 75% in the total stroke population in the Netherlands.[53] This is probably a result of recruiting patients from general hospitals and not from academic hospitals. Another reason could be that hemorrhagic lesions are generally more severe, which means that fewer patients are able to receive and understand information about the study and agree to participate within 1 week after the onset of stroke. However, we do not think this overrepresentation of patients with ischemic stroke has led to problems regarding the generalizability of the results.

Second, this was a cross-sectional study in which both depressive symptoms and the psychological factors were assessed 2 months poststroke, so we were not able to determine causality. Future research should focus on longitudinal designs assessing the psychological factors in the subacute phase and the experience of depressive symptoms in the chronic phase poststroke. This will provide more insight into potential causal relationships between psychological factors and depressive symptoms.

Third, it is difficult to differentiate between psychological factors and depressed mood. For instance, depressed mood may lead to a high score for pessimism. In our opinion, however, these factors are conceptually different from depressed mood, and the questionnaires used to measure psychological factors and depressive symptoms use very different statements. Examples of questions used for depressive symptoms include "I feel tense or 'wound up'" and "I still enjoy the things I used to enjoy," while questions for neuroticism include "Do you worry too long after an embarrassing experience?" and those for acceptance include "I have learned to accept the limitations imposed by my illness." Furthermore, empirical research shows that the association between psychological factors and depressive symptoms is far from perfect, indicating that psychological factors and depression are at least partially distinct from each other. The literature shows that there are even psychological factors whose association with depressive symptoms in stroke has not yet been established. Earlier research[18] did not find optimism to be associated with depressive symptoms, but in the present study it was.

Conclusions

This study shows the relevance of psychological factors for the presence of depressive symptoms 2 months poststroke. It is

important to take these psychological factors into account during poststroke rehabilitation.

Supplier

a. SPSS statistical software package (version 21); IBM Corp.

Keywords

Depression; Mental health; Psychology; Rehabilitation; Stroke

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