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The Impact of Pre-stroke Depressive Symptoms, Fatalism, and Social Support on Disability after Stroke

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Abstract

Background—Psychological and social factors have been linked to stroke mortality; however, their impact on stroke disability is unclear. The purpose of this study was to evaluate the impact of pre-stroke fatalism, depressive symptoms, and social support on 90-day neurological, functional, and cognitive outcomes.

Methods—Ischemic strokes (2008–2011) were identified from the Brain Attack Surveillance in Corpus Christi Project. Validated scales were used to assess fatalism, depressive symptoms, and social support during baseline interviews. The National Institutes of Health Stroke Scale (NIHSS), Activities of Daily Living/ Instrumental Activities of Daily Living (ADL/IADL) scale, and Modified Mini-Mental State Exam (3MSE) were used to assess 90-day outcomes. The associations between the pre-stroke variables and 90-day outcomes were estimated from regression models adjusting for demographics, risk factors, tPA treatment, and comorbidities.

Results—Among 364 stroke survivors, higher pre-stroke fatalism was associated with worse functional (0.17 point higher ADL/IADL per IQR higher fatalism; CI 0.05, 0.30) and cognitive (2.81 point lower 3MSE per IQR higher fatalism; CI 0.95, 4.67) outcomes. Higher pre-stroke depressive symptoms were associated with worse functional (0.16 point higher ADL/IADL per IQR higher PHQ-9; CI 0.04, 0.28) and cognitive (2.28 point lower 3MSE per IQR higher PHQ-9; CI 0.46, 4.10) outcomes. Participants in the middle tertile of social support had better cognitive outcomes (3.75 points higher 3MSE; CI 0.93, 6.56) compared to the highest tertile.

Conclusions—The associations between pre-stroke fatalism, depressive symptoms, and social support and 90-day outcomes suggest that psychosocial factors play an important role in stroke recovery.

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Keywords

depression; fatalism; social support; stroke; disability

Introduction

Social and psychological factors including social support, fatalism, and depression have been shown to be associated with health outcomes (1–10). Depression is associated with stroke incidence (3, 11) and mortality (3, 5, 6) as well as with stroke recovery and cognitive status (5–7). Several studies support the hypothesis that social support has an impact on stroke outcome (12–15). We have previously shown that pre-stroke fatalism is associated with increased risk of stroke recurrence, with this relationship partially explained by depressive symptoms (3). As stroke mortality decreases, more people will be living with disability related to stroke, and it is important to understand the impact of social and psychological factors on post-stroke morbidity.

Hypothesis and Aims

In this study, we sought to explore the role of pre-stroke social support, fatalism, and depressive symptoms in functional, cognitive, and neurological outcomes after ischemic stroke. We hypothesized that higher pre-stroke depression and fatalism, and lower pre-stroke social support would be associated with poor outcomes.

Methods

Data are from the Brain Attack Surveillance in Corpus Christi (BASIC) Project, November 2008 through December 2011 (16, 17). The BASIC project is a population-based study in an urban, bi-ethnic community in Nueces County located in South Texas. Corpus Christi, a city of approximately 315,000 people, makes up 90% of the Nueces County population (18). Approximately 50% of the residents of Corpus Christi are Mexican American (MA) (19). Most of the population are second, third and fourth generation US citizens and there are few undocumented residents.(19, 20). In this way, Corpus Christi represents the future of the US' growing MA population. BASIC ascertains, through active and passive surveillance, cases of ischemic and hemorrhagic stroke presenting to the emergency department or directly admitted to any of the 7 hospitals in Nueces County. Stroke diagnosis is verified by trained abstractors through rigorous criteria and validated by neurologists using source documentation blinded to interview data on social support, depression and fatalism.

This project was approved by the University of Michigan and both Corpus Christi Health Systems' Institutional Review Boards. Informed consent was obtained from all subjects. At the time of stroke admission, patients were approached and asked to participate in an in-person structured interview. Patients were only eligible for participation with their first BASIC stroke. Patients were also excluded if they were unable to answer a series of orientation questions or if they had aphasia and were therefore unable to complete the psychological scales. Bilingual abstractors conducted the interviews in English or Spanish according to patient preference.

A detailed description of validated scales used to measure fatalism and depression was previously reported (21). The fatalism scale included eight items, scored using a Likert scale ranging from 1, strongly agree, to 5, strongly disagree. Scores ranged from 8 to 40, with higher scores indicating more fatalism. Pre-stroke depressive symptoms were evaluated using the Patient Health Questionnaire-9, a nine-item scale with scores ranging from 0 to 27 and higher scores indicating more depressive symptoms. Pre-stroke social support was evaluated using a 7-item scale adapted from the Sacramento Area Latino Study on Aging (personal communication, Mary Haan). Scores range from 1 (never/rarely) to 3 (always). Seven is subtracted from the summed score yielding a final score 0–14, with higher scores indicating more social support.

Neurological, functional, and cognitive outcomes were evaluated using validated scales. The National Institutes of Health Stroke Scale (NIHSS), administered by a NIHSS-certified study coordinator, was used to assess neurological deficits (22). The score ranges from 0 to 42 with higher scores indicating more neurological impairment. Functional outcome was assessed using activities of daily living (ADL) and instrumental activities of daily living (IADL) scales (23). The ADL scale assesses walking, bathing, grooming, eating, dressing, transferring, and toileting. The IADL scale includes 15 additional questions related to daily functioning. The 22 items are scored according to self-report, with four possible responses including no difficulty (1 point), some difficulty (2 points), a lot of difficulty (3 points) and can only do with help (4 points). The points are summed and divided by the total number of items resulting in an average score 1 to 4, with higher scores indicating poorer functioning. Global cognitive functioning was evaluated with the Modified mini-mental State Examination (3MSE) (24). Scores range from 0 to 100 with lower scores indicating more cognitive impairment.

Demographic, clinical, and pre-stroke functional status variables were abstracted from medical records and obtained during baseline interviews. Demographic variables include age, sex, race/ethnicity, marital status, educational attainment, insurance status, and pre-stroke nursing home residence. Clinical variables include self-reported stroke risk factors (history of stroke/TIA, hypertension, diabetes mellitus, coronary artery disease, atrial fibrillation, smoking), body mass index, treatment with tissue-type plasminogen activator (tPA), initial NIHSS (abstracted from medical record or calculated using a validated method) (25) and a comorbidity index (summing individual RFs and comorbidities; range 0 – 9). Pre-stroke functional status was measured using the modified Rankin scale, characterized as 0 to 1, 2 to 3, or 4. Pre-stroke cognitive status was measured using the validated 16-item Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) with each item scored on a scale ranging from 1 to 5 (higher indicating poorer cognitive function) and averaged to give scores from 1 to 5. All variables were included in adjusted models.

Descriptive statistics were calculated using means and standard deviations for continuous variables and proportions or frequencies for categorical variables. Multiple regression was used to investigate crude and adjusted associations between pre-stroke depressive symptoms, fatalism, social support and functional (ADL/IADL), cognitive (3MSE), and neurologic (NIHSS) outcomes. Because functional and cognitive scores had distributions that demonstrated ceiling and/or floor effects, Tobit regression was used. NIHSS was log-

transformed ($\log \text{NIHSS} + 1$) prior to regression analysis given its highly-skewed distribution. The associations between continuous predictors and the outcomes were initially treated as linear. However, initial stroke severity consistently exhibited a non-linear association, and was modeled using both a linear and quadratic term. Social support demonstrated a non-linear u-shaped association. For interpretation purposes, the social support distribution was divided into tertiles and averages of the outcomes across the tertiles were compared, with highest tertile as the reference. Estimated associations for neurological outcome are expressed as percent difference in NIHSS associated with predictors of interest. Measures of association for depression and fatalism were expressed as the comparison between the 25th and 75th percentile (interquartile range increase) of the independent variables in order to compare the magnitude of association across scales and to provide a more meaningful interpretation of the associations.

We have previously demonstrated that pre-stroke depressive symptoms alter the effect of fatalism on mortality in the BASIC cohort. To evaluate the potential effect modification of depressive symptoms on the fatalism–outcome associations, models included interaction terms of the fatalism effects by depressive symptoms. Interaction terms were constructed using the continuous scales, and estimated for the outcomes where main effects of depressive symptoms and/or fatalism were significant. We estimated the association of fatalism with the outcome at the 25th, 50th, or 75th percentiles of the depressive symptoms distribution.

Results

There were 1,382 patients with ischemic stroke during the study period. Of these, 580 were excluded due to participant refusal (402), previous BASIC interview (71), inability to locate (71), more than 90 days since stroke (37), and incomplete interview (7). Of the remaining 790 patients (57.2%), 534 (67.6%) were able to complete the psychological scales and were eligible for the study. Among 534 eligible participants, mortality at 90 days was 1.7% ($n = 9$), resulting in 525 patients eligible for the outcome interview. Of the eligible patients, 45 (8.6%) declined participation in the outcome interview and 50 (9.5%) could not be located to complete the interview. This left a total of 430 (81.9% of 525 eligible) patients participating in the outcome interview of whom 428 had complete 90-day outcome data, and 364 (69.3% of eligible) had complete covariate data. Table 1 displays baseline characteristics (including median fatalism, depression and social support scores) for the 364 patients with outcome and covariate data. Median fatalism score was 17 (IQR 12, 20); median pre-stroke depression score was 3 (IQR 0, 9); and median social support score was 10 (IQR 7, 12).

In the fully adjusted models, higher pre-stroke fatalism was associated with worse 90-day functional and cognitive outcomes (Table 2). Comparing the 75th to 25th percentile of fatalism (IQR difference), there was a 0.17 point higher ADL/IADL score (higher worse; 95% confidence interval [CI] 0.05, 0.30) and a 2.81 point lower 3MSE score (lower worse; 95% CI 0.95, 4.67). Pre-stroke fatalism was not associated with 90-day neurological outcome as assessed by NIHSS.

Depressive symptoms were also significantly associated with poorer functional and cognitive outcomes (Table 2). There was a 0.16 point higher ADL/IADL score (higher worse; CI 0.04, 0.28) and a 2.28 point lower cognitive score (lower worse; CI 0.46, 4.10) comparing the 75th to 25th percentile of depressive symptoms. Depressive symptoms were not associated with 90-day NIHSS.

There was a marginally significant interaction between fatalism and depressive symptoms for the functional outcome ($p = 0.09$). Among those with depression scores of 0, 3, or 9 (25th, 50th, 75th percentiles of the depression distribution), a one IQR higher fatalism score was associated with worse functional outcome, respectively: 0.22 (95%CI: 0.04, 0.40), 0.18 (95%CI: 0.02, 0.33), and 0.08 (95% CI: -0.12, 0.30). That is, higher fatalism scores were significantly associated with worse functional outcome only for those with lower depression scores.

Social support exhibited a non-linear relationship with the post-stroke outcomes (Figure 1), that was statistically significant among cognitive outcomes ($p=0.03$) and with a trend toward significance for neurological outcomes ($p=0.06$). Participants in the low vs medium tertile did not differ from each other for any outcome, although those in the medium vs. highest tertile consistently exhibited better outcomes. For example, compared to the third tertile, those in the middle social support tertile had 3.75 points higher 3MSE scores (95%CI: 0.93, 6.56).

Discussion

In this bi-ethnic study of stroke survivors, there was an association between pre-stroke psychological factors and functional and cognitive outcome after stroke. Stroke survivors who reported more pre-stroke depressive symptoms and more fatalistic beliefs were more likely to have a clinically meaningful negative impact on post-stroke functional and cognitive outcomes. One IQR increase in depression and fatalism scores was associated with the functional equivalent of the loss of the ability to perform one activity of daily living independently. Furthermore, an IQR increase in depression or fatalism scores was related to a nearly 3 point loss on the 3MSE, which could reflect poorer function in any of the cognitive domains tested, including registration, attention and calculation, recall, language, ability to follow simple commands or orientation.

Prior studies have shown an association between post-stroke depression and outcomes; however, there is far less data on the relationship between pre-stroke depressive symptoms and disability after stroke (5, 7). The Bergen Stroke Study investigators sought to explore the relationship between pre-stroke depression and disability after stroke and demonstrated that pre-stroke depression is associated with increased 6-month disability as measured by the Barthel Index and modified Rankin scale (6). The effect of depression and depressive symptoms on outcome could be mediated by a number of factors. Pre-stroke depression predicts development of post-stroke depression which is related to stroke outcome (6). Depressive symptoms may impact behaviors such as willingness to participate in rehabilitation, thereby limiting improvements in function. Finally, the PHQ-9 scale assesses disinterest which relates to apathy and hypersomnia (26). Both of these factors have been

shown to be associated with willingness to participate in therapy and poor outcome after stroke (27). Awareness of the presence of pre-stroke depressive symptoms in stroke survivors may help practitioners identify patients at risk for post-stroke depression and poor outcomes. Practitioners could implement efforts to screen at-risk patients for post-stroke depression, initiate treatment, and develop enhanced strategies for encouraging participation in rehabilitation and adherence to secondary prevention strategies.

Fatalism has been defined as “the belief that an individual’s health outcome is predetermined or purposed by a higher power and not within the individual’s control” (28). Fatalism is associated with health behaviors and outcomes such as medication adherence and glycemic control among patients with diabetes, adherence to highly active anti-retroviral therapy among persons with HIV, and cancer screening and follow-up (29–31). The scale used in this study assesses beliefs regarding pre-determinism and attitudes about stroke (1, 32). We hypothesize that the effect of fatalism on stroke outcomes may be mediated by its effects on motivation for behavior change. Specifically, more fatalistic beliefs may impact self-efficacy or activation to engage in ADLs and IADLs.

We have previously shown an interaction between pre-stroke depressive symptoms and fatalism on mortality after stroke (3). We show similar findings here, in that fatalism is associated with functional outcome for stroke survivors with lower depression scores. The interaction is not synergistic; in fact, the effect of fatalism is negated in the presence of moderate to severe depressive symptoms. This suggests that depressive symptoms are driving poor outcomes to such a degree that the impact of fatalism is not as important when depressive symptoms are more severe.

Several prior studies have shown better stroke outcome with higher social support (12, 13, 15). However, in this study, the highest tertile of social support is associated with poorer cognitive outcome and a trend toward poorer neurological outcome when compared to the middle tertile of social support. Social support encompasses several aspects of social isolation including perceived isolation (loneliness) and social connectedness, both of which are captured by our scale. It is possible that patients with very high levels of social support are more socially connected because they need additional social support. One study showed that receiving help at home prior to stroke predicted poor outcome after stroke (12). Another showed that patients living alone or with a spouse had better outcomes than patients with visiting services or living with family; the latter two groups were found to have poorer pre-stroke function (33). While our results were non-linear and should be explored in future studies; they could be explained if higher levels of pre-stroke social support reflect poorer pre-stroke function. It is possible that we did not capture all aspects of pre-stroke function despite adjusting for pre-stroke disability and cognition. Finally, our findings may be related to the components of social support captured by our scale, as loneliness (perceived isolation) and social connectedness may have different impacts on health outcomes (9).

Approximately 49% of our study participants are Mexican American, and though the majority are 2nd, 3rd, and fourth generation US citizens, it is possible that factors related to culture influence the relationships between pre-stroke factors and stroke outcomes. We did not assess aspects of culture in this study, and are therefore unable to draw conclusions about

the potential impact of culture on outcomes. Nonetheless, we recognize that beliefs, values, and traditions may be more common in certain ethnic groups and that these factors can affect health behaviors and health outcomes. For example, familism is a recognized cultural value that can affect beliefs around care for the elderly in Mexican Americans families (34). We have previously shown that Mexican Americans from this population are more likely than White Americans to go home with home therapy rather than to more intensive inpatient rehabilitation after an acute stroke (35). One possible explanation for this finding is that certain Mexican American families may have the support system and preference to care for their family member at home despite the recommendation for inpatient rehabilitation. This could relate to the findings in this study because patients with the highest levels of social support could have poorer outcomes if they were more likely to receive home therapy instead of inpatient rehabilitation.

This article has important limitations. The data is subject to recall bias because we asked participants to report on pre-stroke beliefs after their stroke. The experience of the stroke may have impacted their recall such that they may be reporting post-stroke beliefs. A number of participants were excluded because of refusal to participate and missing data and the relationships between psychological variables and outcomes may differ between those included and excluded. Patients with severe stroke and aphasia were not included in this study because they could not report pre-stroke beliefs, and therefore, the data only relates to stroke survivors with mild to moderate stroke. Finally, this data is from a single bi-ethnic community and may not be generalizable.

We have shown that pre-stroke fatalism and depressive symptoms are associated with disability after stroke. These relationships are complex and further research is needed to elucidate their independent and combined effects on outcomes. These variables should be considered in designing interventions to improve outcomes after stroke.

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Figure 1.

Relationships between Tertiles (T1, T2, T3) of Social Support and 90-day Outcomes.

*Values represent relative difference in outcome score (with 95% CI) when tertile is compared to highest tertile (T3). **P-values for hypothesis that the average outcome within at least one tertile of social support differs from the other tertiles.

Table 1

Baseline Demographics and Psychological Variables

Variable	Mean (SD) or n (%)
Age	66 (12.2)
Female	180 (49.5%)
Mexican American	177 (48.7%)
Insured	316 (86.8%)
Treated with tPA	37 (10.1%)
NIHSS (initial)	4.8 (4.7)
Baseline modified Rankin scale	
0–1	196 (53.8%)
2–3	155 (42.5%)
4–5	13 (3.6%)
Marital Status	
Single	20 (5.5%)
Married	205 (56.3%)
Widowed	75 (20.6%)
Divorced	64 (17.6%)
Education	
Less than high school	122 (33.5%)
High school	109 (29.9%)
Some college	77 (21.1%)
BA/some graduate school	56 (15.4%)
Hypertension	291 (79.9%)
Diabetes Mellitus	164 (45.1%)
Coronary disease	103 (28.3 %)
Prior stroke	100 (27.5%)
Body mass index	30 (6.5)
Atrial fibrillation	46 (12.6%)
Current smoking	126 (34.6%)
Comorbidity score	3.3 (1.8)
IQCode	52.2 (6.8)

Variable	Mean (SD) or n (%)
Psychological Factors	Median (IQR) *
Depression	3 (0,9)
Fatalism scale	17 (12, 20)
Social support scale	10 (7, 12)

*
Interquartile range

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Table 2

Associations of Pre-stroke Depressive Symptoms and Fatalism with 90-day outcomes in Fully-adjusted Models

	90-day Outcomes Estimate (95% Confidence Interval)		
	Functional (ADLs/ IADLs)	Cognitive (3MSE)	Neurological (NIHSS)[‡]
<i>Depressive Symptoms</i>			
Adjusted ⁺	0.16 (0.04, 0.28) **	-2.28 (-4.10, - 0.46) *	5.04 (-7.2,18.86)
<i>Fatalism</i>			
Adjusted ⁺	0.17 (0.05, 0.30) **	-2.81 (-4.67, - 0.95) **	7.9 (-5.22,22.83)

⁺ Effect estimates represent difference in outcome per interquartile range increase in depression (IQR=9) or fatalism (IQR=8), adjusted for demographic, clinical, and pre-stroke functional status variables listed in methods section.

[‡] Expressed as percent change in NIHSS associated with IQR increase in baseline variable estimated as $100 [\exp(\beta \cdot \text{IQR}) - 1]$.

*
p < .05;

**
p < .01.