Fatalism, Optimism, Spirituality, Depressive Symptoms, and Stroke Outcome
A Population-Based Analysis

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Background and Purpose—We sought to describe the association of spirituality, optimism, fatalism, and depressive symptoms with initial stroke severity, stroke recurrence, and poststroke mortality.

Methods—Stroke cases from June 2004 to December 2008 were ascertained in Nueces County, TX. Patients without aphasia were queried on their recall of depressive symptoms, fatalism, optimism, and nonorganizational spirituality before stroke using validated scales. The association between scales and stroke outcomes was studied using multiple linear regression with log-transformed National Institutes of Health Stroke Scale and Cox proportional hazards regression for recurrence and mortality.

Results—Six hundred sixty-nine patients participated; 48.7% were women. In fully adjusted models, an increase in fatalism from the first to third quartile was associated with all-cause mortality (hazard ratio, 1.41; 95% CI, 1.06–1.88) and marginally associated with risk of recurrence (hazard ratio, 1.35; 95% CI, 0.97–1.88), but not stroke severity. Similarly, an increase in depressive symptoms was associated with increased mortality (hazard ratio, 1.32; 95% CI, 1.02–1.72), marginally associated with stroke recurrence (HR, 1.22; 95% CI, 0.93–1.62), and with a 9.0% increase in stroke severity (95% CI, 0.01–18.0). Depressive symptoms altered the fatalism–mortality association such that the association of fatalism and mortality was more pronounced for patients reporting no depressive symptoms. Neither spirituality nor optimism conferred a significant effect on stroke severity, recurrence, or mortality.

Conclusions—Among patients who have already had a stroke, self-described prestroke depressive symptoms and fatalism, but not optimism or spirituality, are associated with increased risk of stroke recurrence and mortality. Unconventional risk factors may explain some of the variability in stroke outcomes observed in populations and may be novel targets for intervention. (Stroke. 2011;42:3518-3523.)

Key Words: depression ■ fatalism ■ optimism ■ outcome ■ religion ■ spirituality ■ stroke

Fatalism, optimism, and spirituality are important psychological factors that are associated with health.1–4 Little attention has been paid to the role of these factors in stroke outcome. Potential mechanisms whereby these factors may influence stroke outcome include influencing medication adherence and behavioral strategies (eg, diet and exercise) to prevent recurrence and assertiveness in seeking acute medical care. Depression may influence the association of these psychological factors with stroke outcome because depression is clearly associated with stroke outcome5 and is also associated with these psychological factors.6–8 Depression has also been linked to vascular disease pathophysiology.9

In a population-based study, we asked subjects who had recently had a stroke to provide information on prestroke fatalism, optimism, and spirituality and examined associations with stroke outcome, including initial stroke severity, stroke recurrence, and all-cause mortality after stroke. We further wished to explore the role of prestroke depressive symptoms in the potential association of these psychological factors and the stroke outcome measures. We interviewed subjects soon after stroke and asked them to self-report their levels of prestroke fatalism, optimism, spirituality, and depressive symptoms and then estimated associations between their responses to these measures with stroke outcome.

Methods
This was a primary, prespecified analysis of the Brain Attack Surveillance in Corpus Christi (BASIC) project.

Received May 10, 2011; final revision received June 20, 2011; accepted June 30, 2011.
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© 2011 American Heart Association, Inc.
Stroke is available at http://stroke.ahajournals.org DOI: 10.1161/STROKEAHA.111.625491

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Subjects and Setting
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. Stroke cases presenting between June 2004 and December 2008 were ascertained in Nueces County, TX. The details of the BASIC methods were previously published. Briefly, through active and passive surveillance, BASIC ascertains all cases of acute cerebrovascular disease presenting to the emergency department or directly admitted to any of the 7 hospitals in Nueces County. Trained and certified abstractors verify stroke diagnoses based on rigorous criteria. Stroke cases are validated by neurologists using source documentation following international clinical criteria. Abstractors obtain demographic and clinical information from the medical chart.

Interview Methods
At the time of their stroke hospital admission, patients were approached and asked to participate in an in-person, structured interview. Patients unable to answer a series of orientation questions asked before the interview were excluded from this study as were patients with aphasia. Patients were queried on prestroke fatalism, optimism, spirituality, and depressive symptoms using validated scales. Bilingual abstractors conducted the interview in English or Spanish depending on patient preferences. Subjects were eligible only with their first BASIC stroke.

Scales
A description of the scales used to measure fatalism, optimism, spirituality, and depressive symptoms was previously reported. For each scale, an overall score was determined by summing responses to individual items. A modified version of the Mental Adjustment for Stress Scale and the Pearlin scale was used to assess Fatalism. Scores range from 6 to 24 (Cronbach α = 0.72). The nonorganizational religious items from the Strawbridge’s religiosity scale were reverse-coded and summed to obtain a scale ranging from 2 to 7. Optimism was assessed with the revised Life Orientation Test. Scores can range from 8 to 40 with higher scores indicating more fatalism. Optimism was assessed with the revised Life Orientation Test. A Likert scale was used here as well. Items were reverse-coded such that higher scores corresponded to more optimism with possible values ranging from 1, strongly agree, to 5, strongly disagree (Cronbach α = 0.66). Scores were used to check model assumptions and fit, and cumulative sums of residuals were used to examine any potential lack of linearity between stroke outcome and the scales and continuous predictors. No violations from model assumptions were found. We conducted sensitivity analyses by adjusting models for comorbidity (operation- alized as the count of the following conditions present in the patient: hypertension, diabetes, coronary artery disease, atrial fibrillation, high cholesterol, excessive alcohol, smoker, history of stroke, congestive heart failure, end-stage renal disease, any cancer, dementia, and chronic obstructive pulmonary disease).

Identification of Initial Stroke Severity, Recurrent Stroke, and Mortality
Initial stroke severity was measured by chart abstracted presenting National Institutes of Health Stroke Scale, a previously validated measure. Recurrent ischemic stroke, intracerebral hemorrhage (ICH), or subarachnoid hemorrhage (SAH) was determined from BASIC surveillance. All-cause mortality was determined from the medical record for in-hospital mortality or through Texas Department of Health databases or the Social Security Death Index. All-cause mortality and recurrence were ascertained through December 31, 2009.

Statistical Analysis
Descriptive statistics were computed for demographic and clinical characteristics using means and SDs for continuous measures or frequencies and percents for categorical variables. The correlation among the fatalism, optimism, spirituality, and depressive symptoms scales was calculated as well as the skewness of the scales’ distributions.

Results
A total of 3053 cerebrovascular patients were identified during the timeframe: 2040 ischemic stroke, 335 ICH, 57 SAH, 11 unknown, and 610 TIA. Of the events, 2439 were the first stroke captured by BASIC and eligible for this study (1623 ischemic stroke, 285 ICH, 56 SAH, 469 TIA, 6 unknown). Of these, a random sample of 1944 subjects was asked to participate in the structured interview and 1380 participated (970 ischemic stroke, 153 ICH, 28 SAH, 2 unknown, 227 TIA). Participants (13.9%) versus nonparticipants (9.5%) had significantly higher rates of atrial fibrillation (interaction), the psychological factor effect estimates were computed among those with zero depressive symptoms and among those with a depression score of 15, the 90th percentile of the depression scores in this sample for interpretation. Influence and residual diagnostics were used to check model assumptions and fit, and cumulative sums of residuals were used to examine any potential lack of linearity between stroke outcome and the scales and continuous predictors. No violations from model assumptions were found. We conducted sensitivity analyses by adjusting models for comorbidity (operation- alized as the count of the following conditions present in the patient: hypertension, diabetes, coronary artery disease, atrial fibrillation, high cholesterol, excessive alcohol, smoker, history of stroke, congestive heart failure, end-stage renal disease, any cancer, dementia, and chronic obstructive pulmonary disease).
excluded by predefined criteria, leaving 715 subjects. Because very few patients reported other ethnicities, only data from Mexican Americans or non-Hispanic whites were included for a study sample comprised of 669 patients (476 ischemic strokes, 42 ICH, 7 SAH, 144 TIA). The median (quartiles 1–3) time from stroke to interview for participants was 13.4 days (3.6–52.6). Table 1 presents the demographic and clinical characteristics of the study subjects. Excluded participants had higher rates (P < 0.01) of atrial fibrillation (17.8%), high cholesterol (33.8%), and a history of stroke (28.2%) as well as being older (mean age, 73.1 years) and having a higher severity (41.5% had National Institutes of Health Stroke Scale >7) compared with included participants. Median (interquartile range) length for follow-up for recurrence and mortality were 1128 (719–1505) and 1094 (708–1491) days, respectively. Kaplan-Meier estimates of 2-year cumulative mortality and stroke recurrence were 10.7% and 9.1%, respectively (Figure 1).

Median (interquartile range) scores for the depressive symptoms and fatalism and optimism were: depression: 4 (1–8); fatalism: 17 (13–21); and optimism: 19 (16–22) The derived spirituality scale was strongly positively skewed because 67.5% of subjects obtained the highest score due to reporting strong agreement with both questions that religious or spiritual beliefs provide meaning in their life and their daily activities; scale median (interquartile range) was 8 (7–8; Figure 2).

Responses to questions about fatalism and optimism were highly but not perfectly negatively correlated (r = −0.55) suggesting they provide distinct information. As expected,

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall</th>
<th></th>
<th>Men</th>
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<th>Women</th>
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<td>≥75</td>
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<td>History of stroke</td>
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<td>24.5</td>
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<td>80</td>
<td>24.5</td>
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<td>4–7</td>
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<td>102</td>
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<td>89</td>
<td>27.3</td>
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<td>&gt;7</td>
<td>102</td>
<td>15.3</td>
<td>49</td>
<td>14.3</td>
<td>53</td>
<td>16.3</td>
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</table>

NIHSS indicates National Institutes of Health Stroke Scale.

A

B

Figure 1. Kaplan-Meier survival curves (solid) and confidence intervals (dashed) for (A) stroke recurrence and (B) mortality.
depression and optimism were also negatively correlated ($r = -0.31$). Depression was only moderately correlated with fatalism ($r = 0.35$).

In fully adjusted models (Table 2), an increase from the first to third quartile, that is, an interquartile range increase, of depressive symptom scores was associated with increased mortality (HR, 1.32; 95% CI, 1.02–1.72), marginally associated with risk of stroke recurrence (HR, 1.22; 95% CI, 0.93–1.62), and with a 9.0% increase in stroke severity (95% CI, 1.0%–18.0%).

An interquartile range increase in fatalism was associated with increased mortality (HR, 1.41; 95% CI, 1.06–1.88) and marginally associated with increased risk of recurrence (HR, 1.35; 95% CI, 0.97–1.88; Table 2). The association between fatalism and severity was not significant. Depression may, at least in part, explain the relationship of fatalism with stroke mortality and recurrence because after adjustment for depressive symptoms, the fatalism–mortality and the fatalism–recurrence associations were attenuated and no longer significant (mortality: HR, 1.17; 95% CI, 0.85–1.62; recurrence:

Table 2. The Associations of Depression and Fatalism With Mortality, Stroke Recurrence, and Initial Stroke Severity*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mortality HR 95% CI</th>
<th>Recurrence HR 95% CI</th>
<th>Stroke Severity Exp (β) 95% CI</th>
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<td>Depression</td>
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<tr>
<td>Crude</td>
<td>1.19 (0.94, 1.51)</td>
<td>1.32 (1.01, 1.72)</td>
<td>1.09 (1.01, 1.18)</td>
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<tr>
<td>Adjusted demographics†</td>
<td>1.45 (1.13, 1.89)</td>
<td>1.31 (0.99, 1.72)</td>
<td>1.08 (0.99, 1.17)</td>
</tr>
<tr>
<td>Fully adjusted‡</td>
<td>1.32 (1.02, 1.72)</td>
<td>1.22 (0.93, 1.62)</td>
<td>1.09 (1.00, 1.18)</td>
</tr>
<tr>
<td>Fatalism</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crude</td>
<td>1.57 (1.19, 2.09)</td>
<td>1.42 (1.02, 1.98)</td>
<td>1.05 (0.96, 1.15)</td>
</tr>
<tr>
<td>Adjusted demographics†</td>
<td>1.52 (1.15, 2.02)</td>
<td>1.43 (1.02, 1.98)</td>
<td>1.06 (0.96, 1.16)</td>
</tr>
<tr>
<td>Fully adjusted‡</td>
<td>1.41 (1.06, 1.88)</td>
<td>1.35 (0.97, 1.88)</td>
<td>1.06 (0.97, 1.17)</td>
</tr>
<tr>
<td>Fully adjusted‡ + depression</td>
<td>1.17 (0.85, 1.62)</td>
<td>1.30 (0.90, 1.87)</td>
<td>1.02 (0.93, 1.14)</td>
</tr>
<tr>
<td>Fatalism effect modification at 2 levels of depression</td>
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<tr>
<td>Depression score=0</td>
<td>1.48 (0.92, 2.37)</td>
<td>1.16 (0.69, 1.95)</td>
<td>1.02 (0.88, 1.17)</td>
</tr>
<tr>
<td>Depression score=15</td>
<td>0.84 (0.46, 1.52)</td>
<td>1.49 (0.81, 2.75)</td>
<td>1.05 0.87, 1.27</td>
</tr>
</tbody>
</table>

HR indicates hazard ratio; CI, confidence interval.
*Effect estimates represent relative change in outcome per interquartile range increase in depression or fatalism.
†Demographics include: age (continuous), sex, and race–ethnicity.
‡In addition to demographics, stroke severity models included: smoking status; recurrence models included: history of stroke and diabetes; mortality models included: history of hypertension, National Institutes of Health Stroke Scale, history of stroke, coronary artery disease, and diabetes.
However, the role of depression in the fatalism–stroke outcome association may be more complex, because the effect of fatalism among patients reporting zero depressive symptoms was strong and marginally significant (HR, 1.48; 95% CI, 0.92–2.37) but not significant among patients with high depression scores.

Spirituality did not confer a significant effect on stroke severity, recurrence, or mortality (Table 3). Optimism was not associated with any of the stroke outcome measures, although the direction of the observed associations was toward protective effects of increased optimism on both recurrence and mortality.

The sensitivity analysis including an index of comorbidity in the models, based on N=555, detected only a change in the association of depression and initial stroke severity, which was attenuated to a 6% increase in severity (95% CI, −3% to 16%) versus 9% in the full sample.

**Discussion**

Unconventional risk factors may explain some of the variability in stroke outcome observed in populations and may be novel targets for intervention. In this study, prestroke depressive symptoms and fatalism, but not optimism or spirituality, were associated with increased risk of stroke recurrence and mortality. The association of depressive symptoms with a 32% increase in mortality after stroke is modestly lower compared with other reports from longitudinal studies in Alameda County, CA (HR, 1.66; 95% CI, 1.16–2.39), and in National Health and Nutrition Examination Survey (relative risk, 1.73; 95% CI, 1.3–2.31). Depressive symptoms were also associated with worsened initial stroke severity.

The association of fatalism and depressive symptoms with mortality after stroke was complex. Because depression was associated both with fatalism and stroke mortality, it attenuated the relationship of fatalism with mortality after stroke. Additionally, among subjects not reporting depressive symp-
toms, fatalism was associated with mortality after stroke, but this was not the case among subjects with more symptoms of depression.

More generally, this is the first study to associate prestroke fatalism with poor stroke outcome. Lewis et al. studied subjects who had survived ≥6 months poststroke and found a significant association of fatalism with long-term mortality. We hypothesize that those with more fatalistic attitudes are less likely to practice behavioral strategies to prevent disease, comply with medication, or aggressively seek acute care. However, some have questioned the causal relationship of fatalistic attitudes with health behavior. This is particularly true in Hispanic populations in which concerns regarding cultural sensitivity of survey instruments have made some authors suggest that measurement error explains the robust association of fatalism with health behavior noted in Hispanic populations. Whether fatalism and depression change or are modifiable through the life course remains to be determined and could impact the usefulness of these variables as targets for intervention.

Although the direction of the association of optimism with stroke outcome events was in the expected direction (ie, protective effects of optimism), our findings were neutral. Optimism has not been evaluated in stroke studies in the past but has been shown to be independently associated with reduced coronary heart disease risk. We also did not detect an association of spirituality with stroke outcome. The scale we used asked subjects about the role that spirituality had in their daily lives. We found that the overwhelming majority of subjects reported high spirituality in Hispanic populations. Whether fatalism and depression change or are modifiable through the life course remains to be determined and could impact the usefulness of these variables as targets for intervention.
outcome. Studies examining the association of stroke and spirituality have shown mixed results. One study of 112 subjects in stroke rehabilitation found no association of spirituality with any measure of stroke recovery.24 One study found an association of spirituality with reduced emotional distress after stroke.25 That study suggests that spirituality may reduce depression, which has been associated with poor stroke functional recovery.26 This article has important limitations. We asked participants to recall prestroke beliefs soon after stroke. This is subject to recall bias because the stroke event may alter one’s recall of their feelings. An alternative explanation for our findings is that poststroke rather than prestroke depression and fatalism are associated with stroke outcome. We excluded subjects with severe deficits because we previously demonstrated that proxy reports for psychological measures correlated only fairly with subject responses.27 This means our current work speaks only to subjects with mild or moderate stroke and without aphasia. This study, although population-based, is from a single community of specific race/ethnic composition; generalizing the results to other communities may be inappropriate.

Conclusions

This study suggests that reported prestroke fatalism and depression are associated with stroke outcome measures. Further research is needed to better clarify this relationship. Using measures of religious practice rather than spirituality to detect a possible association with stroke outcome should also be studied.

Sources of Funding

This study was funded by the National Institute of Neurological Disorders and Stroke/National Institutes of Health (RO1NS08916).

Disclosures

None.

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Fatalism, Optimism, Spirituality, Depressive Symptoms, and Stroke Outcome: A Population-Based Analysis

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Stroke. 2011;42:3518-3523; originally published online September 22, 2011;
doi: 10.1161/STROKEAHA.111.625491

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