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Stroke survivors' endorsement of a "stress belief model" of stroke prevention predicts control of risk factors for recurrent stroke

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Abstract

Perceptions that stress causes and stress-reduction controls hypertension have been associated with poorer blood pressure control in hypertension populations. The current study investigated these "stress-model perceptions" in stroke survivors regarding prevention of recurrent stroke and the influence of these perceptions on patients' stroke risk-factor control. Stroke and transient ischemic attack survivors (N=600) participated in an in-person interview in which they were asked about their beliefs regarding control of future stroke; blood pressure and cholesterol were measured directly after the interview. Counter to expectations, patients who endorsed a "stress-model" but not a "medication-model" of stroke prevention were in better control of their stroke risk-factors (blood pressure and cholesterol) than those who endorsed a medication-model but not a stress-model of stroke prevention (OR for poor control=.54, Wald statistic=6.07, p=.01). This result was not explained by between group differences in patients' reported medication adherence. The results have implications for theory and practice, regarding the role of stress-belief models and acute cardiac events, compared to chronic hypertension.

Keywords

Adherence; stroke prevention; blood pressure; health beliefs; risk factors

Blood pressure (BP) and cholesterol control are essential for preventing recurrent stroke among stroke and transient ischemic attack (TIA) survivors (Lakhan & Sapko, 2009). Very little is known about the psychological factors of survivors for predicting their adherence to stroke-prevention medications and their hard outcomes (BP/cholesterol levels).

More is known regarding these factors in hypertensive patients. Despite hypertension being essentially asymptomatic, hypertensive patients who believe their medications control their hypertension-related symptoms are more adherent (Meyer et al., 1985), and their treatment-control beliefs positively predict BP control (Ross et al., 2004). Researchers have identified common clusters of patient beliefs (belief *models*) that are important for predicting hypertension-treatment adherence and outcomes (Heckler et al., 2008; Kleinman, 1980).

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Specifically, patients who endorse a *stress model* of hypertension perceive their condition to be caused by stress and controlled through stress-reduction; patients who endorse a *medical/medication model* of hypertension perceive their condition to be caused by biological and/or lifestyle factors and controlled through medication (Leventhal et al., 2008). Although there may be some overlap in patients who endorse these models, stress model endorsement in hypertension patients (particularly African-Americans) has been associated with poorer adherence and BP control, compared to medication/medical-model endorsement (Heckler et al., 2008; Heurtin-Roberts & Reisin, 1990).

The current study assesses the prevalence of stress-model endorsement of *stroke prevention* (versus medication-model endorsement) and its relationship to patients' medication adherence and stroke risk-factor control (BP/cholesterol) in a low-income, urban, largely African American population of stroke/TIA survivors. Unlike hypertension, strokes are symptomatic, and those who have experienced a stroke/TIA may have different models of illness that, if uncovered, could lead to improvements in the key factor that leads to recurrence—blood pressure control.

If we find that stress-model endorsement for stroke prevention influences adherence to medications and/or risk factor control, then interventions to address such beliefs may be warranted (Broadbent et al., 2009). Further, this research may have implications for survivors of other acute events, such as heart attacks. Affleck and colleagues (1987) found that stress-*causal* beliefs predicted 8-year morbidity post-heart attack, but the effect of 'stress *models*' of acute events has yet to be investigated.

We test two *a priori* hypotheses:

Hypothesis 1 Stress-model and medication-model endorsement will not be mutually exclusive; some individuals will endorse stress-reduction, some will endorse medication, and some will endorse both for preventing stroke.

Hypothesis 2 Stress-model endorsement in conjunction with *not* endorsing a medication-model will be most detrimental for medication adherence and future-stroke risk factor control.

Methods

Participants and Procedure

Volunteers (n=600) from low income, Black and Latino communities participated in a stroke-prevention intervention (inclusion criteria: ≥40 years, ≥1 stroke/TIA in the past 5 years, no significant cognitive impairment, English or Spanish speaker). Research staff recruited in person from community and medical centers (+response rate=47%), obtained informed consent, and collected the measures listed below in a baseline interview, with approval from the supporting institution's ethics committee.

Measures

Stress- and medication-model endorsement—Patients were asked, "If you were going to advise someone, what are the 3 most important things you would recommend they

do to lower their risk of having a stroke?" Responses were coded as "recommending stress reduction/avoiding stressful situations" and "recommending medications" (BP, cholesterol, antithrombotic/blood thinner), among other codes not relevant to this analysis ("recommending control of diabetes"). These codes were developed from previous literature (Reeves, Hogan, & Rafferty, 2002) and pilot tested with a stroke-survivor focus group before administration to the current sample. Patients were categorized as "medication-only endorsers" if they recommended medication adherence but not stress reduction; as "stress-model-only endorsers" if they recommended stress reduction but not medication adherence; or as recommending "both" or "neither".

Risk-factor control—This was calculated as a dichotomous variable (0=poor control; 1=good control), based on patients' BP/cholesterol levels at baseline. Patients' BP was measured three times and averaged. Direct LDL cholesterol was measured via blood samples. Poor control was defined as systolic BP level ≥ 140/90mmHg and/or LDL ≥ 100mg/dl.

Medication adherence—This was measured using the Morisky Medication Adherence Scale (MMAS; Morisky et al., 2008), an 8-item self-report measure with 7 yes/no items (e.g., "Did you take your medicine(s) yesterday?") and one 5-option item ("How often do you have difficulty remembering to take all your medicines?"). Conventional scoring was used but reversed so that higher scores represented *greater/better* adherence.

Analysis Overview—The proportion of the total sample in each of the designated groups was calculated to test Hypothesis 1. Hierarchical, categorical logistic regression was used to test Hypothesis 2. ANOVA was used to compare mean adherence rates between the groups.

Results

As shown in Table 1, the sample was characteristic of the target population, with approximately 80% being Black or Latino and 60% earning less than $15,000 per year. There were no significant differences in any of the variables or relationships of interest between TIA-only survivors (n=284) and stroke-survivors (n=316); therefore, all analyses were conducted with the full dataset.

Hypothesis 1

The data support the hypothesis: there were patients in each of the four endorsement groups; 20% endorsed medications but not stress-reduction for stroke prevention, 27% endorsed stress-reduction but not medications for stroke prevention; 44% endorsed both; and 9% endorsed neither.

Hypothesis 2

Surprisingly, the hypothesis was not only rejected, but stress-only endorsers were in statistically *better* control of their risk factors (OR for poor control=0.54, Wald statistic=6.07, p=.01). This did not appear to be due to differences in adherence to

medications; no significant difference existed between groups in their self-reported adherence ($F(3, 588)=1.54$, $p=0.20$).

Sixty-three percent of the patients who endorsed both models were in poor control (n.s. different from the medication-only endorsers); 57% of patients who endorsed neither model were in poor control (OR for poor control compared to mediation-only endorsers=0.63, Wald statistic=3.97, $p<0.05$).

Discussion

This study was designed to assess stroke/TIA survivors' stress-model beliefs regarding prevention of recurrent stroke and their relationship to risk-factor control. A substantial percentage of survivors endorsed *both* stress-model-only and medication-only models for prevention of recurrent stroke, indicating that they are not mutually exclusive groups, or neither, suggesting that future research should evaluate beliefs that are neither stress-related nor medical in nature and their influence on patients' behaviors and outcomes.

Counter to our second hypothesis, we found that stress-model-only endorsers had better control of their stroke risk factors—BP and cholesterol—than the medication-model-only endorsers. This finding is not explained by differences in self-reported medication adherence between the two groups. Several possible explanations exist: first, those who endorse a medication-only model may be those who deny the importance of life-style factors in the onset of stroke and may therefore be less healthy in their lifestyles overall. Second, patients' beliefs regarding the effect of stress on stroke avoidance might change with the experience of a stroke. This is the first research to investigate the effect of stress-model endorsement for preventing *acute* events, such as heart attack or stroke; researchers have yet to theorize what the effect on stress-related causal and control beliefs might be *after experiencing* an acute event. Our hypothesis regarding poorer control of stroke risk factors with stress-model endorsement may only be relevant to individuals *before* they experience their first stroke. We tested a third possibility—that race or ethnic differences in those who endorsed a stress-only model may have accounted for the differences in risk factor control. Although a larger proportion of Latinos endorsed a stress-only model than did Whites or Blacks, Latinos were no different in their level of BP/LDL control than the other ethnic groups.

Patients who endorsed both models were in no better control of their risk factors than were those who endorsed medications-only. Medication endorsement, regardless of stress-model endorsement, may result in poorer risk factor control; conversely, poorer risk factor control may make individuals more likely to endorse medication. Research should investigate the causal influences, if any, of each factor on the other. Patients who endorsed neither model were in slightly better control than the medication-only group; research should identify the nature of these patients' belief models in order to evaluate the potential causes of this difference.

A limitation of the current study was the fact that the response codes used by interviewers to record patients' responses to the item regarding the top three things they would recommend to prevent stroke were not easily parsed into mutually exclusive categories needed for

testing the hypothesis. If a patient gave a vague response (e.g., 'control blood pressure'), it was not clear to the interviewer whether the patient meant through stress reduction, by taking medication, or through some other behavior. To better assess the hypotheses, future research can utilize this simple measure but improve upon the coded response options through training interviewers to follow-up with questions for specificity.

These findings call into question the generalizability of the findings among hypertensive patients that link stress-model endorsement to poorer medication adherence and BP control. Addressing stress-model beliefs in clinical practice or via interventions for acute events may not be advisable. More research is warranted to determine the effects of these belief-models before interventions are suggested for patients or providers.

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Table 1

Demographic information and descriptive statistics of study variables for the full sample.

Variable/Characteristic	Possible or Observed Range	Mean (SD) or Percentage
Sample size		600
Age	40–90 years	63.40(11.22)
Female Gender		59%
Black Race, Non-Hispanic		47%
White Race, Non-Hispanic		15%
Hispanic Ethnicity		38%
Number of Stroke/TIA Events	1–14	1.68(1.28)
Years since last Stroke/TIA	0–5 years	1.81(1.45)
'Poor Control' of BP/cholesterol	0–100%	
Stress-model-only		53%
Medication-model-only		68%
Medication Adherence (Morisky scale; higher values scored to indicate better adherence)	0–8	6.06(1.71)