The Effects of Meditation, Race, and Anxiety on Stroke Survivor Resilience

CE 1.0 ANCC Contact Hour

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ABSTRACT

BACKGROUND: Significant gaps exist in the identification and management of psychological effects of stroke on survivors. Interventions to enhance resilience, the ability to rebound from stress or adversity, could positively impact stroke recovery. The purpose of this study was to test the effect of meditation on resilience of community-dwelling stroke survivors and to identify resilience predictor variables in these survivors. **METHODS:** This was a substudy with secondary analysis of existing data from the parent study, MEditatioN for post stroke Depression. The effect of meditation on stroke survivor resilience in the intervention group (n = 20) was evaluated with a paired samples *t* test, with measures at baseline and immediately after the 4-week intervention. Baseline resilience predictor variables for all stroke survivors (n = 35) were evaluated with univariable analysis and multiple linear regression modeling. **RESULTS:** The increase in stroke survivor resilience scores from baseline (mean [SD], 3.46 [0.81]) to intervention completion (mean [SD], 3.58 [1.02]) was not statistically significant ($t = 0.60$, $df = 19$, $P = .56$). One-way analysis of variance with Tukey post hoc analysis revealed that baseline resilience was significantly lower ($P = .02$) for non-Hispanic black participants than for non-Hispanic white participants. Multiple linear regression with resilience as the dependent variable, race as a fixed factor, and trait anxiety as a covariate was significant ($F_{3,33} = 6.32$, $P = .002$) and accounted for nearly 33% of the variance in baseline resilience. **CONCLUSION:** The effects of meditation on stroke survivor resilience should be tested in larger clinical trials that would explore the influence of social determinants of health, perceived stress, race-related stress, and anxiety subtypes on resilience.

Keywords: anxiety, meditation, mind-body therapies, mindfulness, nursing, race, resilience, stress, stroke

Stroke, a leading cause of death and disability in the United States, exerts substantial physical and psychological stress on stroke survivors.[1] Post-stroke treatment focuses on rehabilitating functional impairments and preventing future stroke, resulting in significant gaps in identifying and managing psychological effects of stroke.[1] Initial response to stroke may be characterized by apprehension and fear, whereas responses later in stroke recovery may include feelings of hopelessness and lack of motivation.[2] Resilience can be defined as the ability to rebound or bounce back from stress or adversity.[3] Focusing on resilience may positively impact stroke survivor recovery.

Demographic, psychological, and clinical variables may impact resilience, but few studies have examined associations between such variables and poststroke resilience.[3] A qualitative study by White and colleagues[4] identified 4 trajectories in poststroke psychological recovery: resilience, ongoing mood disturbance, emergent mood disturbance, and recovery from mood

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disturbance. The resilient trajectory was characterized by adaptability, an ability to embrace the future, previous experiences of mastery/resilience, being optimistic rather than pessimistic, and feeling appreciative to be alive after the stroke.[4] In another qualitative study, resilience facilitated adaptation to changes in functional abilities and engagement in health behaviors among stroke survivors.[2] Low stress resilience in young men has been associated with a higher risk of stroke during middle age (unadjusted hazard ratio, 1.54; 95% confidence interval [CI], 1.40–1.70).[5]

Among patients with other cardiovascular diseases (CVDs), including heart failure and acute coronary syndrome, depressive symptoms, anxiety symptoms, perceived stress, and posttraumatic stress have shown significant inverse relationships with resilience.[6–11] Demographic factors positively associated with resilience among CVD populations include higher income, higher economic status, male sex, and living with family.[7,9,12] In 2 studies that examined the relationship between age and resilience of CVD patients, opposing results were reported.[9,10] Moderate to large positive correlations between resilience and composite measures of self-care have been noted in CVD populations, including patients with heart failure.[8,12]

Resilience, a dynamic process of adaptation in the face of considerable stress, is amenable to change through intervention.[4] Mind-body therapies (eg, meditation, tai chi, yoga) focus on the interactions among the brain, mind, body, and behavior.[13] A key component of meditation practice is cultivating mindfulness, which is defined as the nonjudgmental acceptance of the present moment.[13] Empirical evidence suggests mind-body practices have the potential to improve resilience, possibly through the cultivation of mindfulness.[14]

Although a recent systematic review of mind-body therapies in stroke survivors indicated trends for improvement in quality of life, anxiety, and depression, none of the studies included resilience.[15] The effects of a 6-month tai chi intervention on resilience of heart failure patients were examined in a prospective, quasi-experimental study.[16] Postintervention increases in all 6 dimensions of the Resilience Scale were noted, with statistically significant increases in the self-efficacy (mean difference, 3.55; $P = .01$; Cohen $d = 0.63$) and self-esteem (mean difference, 1.35; $P = .01$; Cohen $d = 0.65$) dimensions.[16] A randomized controlled trial compared the effects of meditation with relaxation in healthy adults and found a significant interaction effect for meditation and time 3 months post intervention on both resilience ($F_{1,46.11} = 4.644$, $P = .036$) and mindfulness ($F_{1,42.39} = 4.145$, $P = .048$).[14] To our knowledge, the only clinical trial to explore the effect of an intervention on stroke survivor resilience was a feasibility study of the effect of a peer-support group intervention.[17] Studies regarding the effect of mind-body therapies on stroke survivor resilience are largely absent.

Resilience is a dynamic process of adaptation in the face of considerable stress.

The purpose of this study was to test the effect of meditation on stroke survivor resilience. The relationships between stroke survivor resilience and demographic variables, psychological variables, and clinical variables were also explored. Younger age, female sex, and symptoms of anxiety and depression were expected to be associated with lower levels of resilience. The central hypothesis was that poststroke resilience would be improved by meditation practice.

Methods

This study was a substudy with secondary analysis of existing deidentified data from the MEditatioN for post stroke Depression (MEND) study (ClinicalTrials.gov identifier: NCT03239132). The MEND study was a pilot randomized controlled trial regarding the effect of a 4-week meditation intervention on outcomes for adult community-dwelling stroke survivors and their informal caregivers. The meditation intervention was delivered by an expert, doctorally prepared interventionist with extensive experience in teaching meditation and researching the effect of meditation on cancer patients. The breath-based meditation techniques first fostered calming the mind, then stilling and opening the mind, and later connecting to and expanding qualities of warmth, which included loving kindness toward oneself and others. Participants were encouraged, but not required, to attend all 4 meditation sessions and to practice meditation daily at home on nonsession days.

Participants were recruited and enrolled at a university-affiliated stroke clinic located in a large US metropolitan city. Adult community-dwelling stroke survivors were eligible for MEND if they had experienced a stroke event within the past 12 months. Stroke survivors with severe cognitive impairment were excluded. Whereas stroke survivors receiving psychotherapy or practicing meditation were also excluded, those receiving treatment with antidepressants or anxiolytic medications were included.

MEditatioN for post stroke Depression stroke survivors with resilience data available at baseline and immediately post intervention were included in the substudy data analysis of the effect of the meditation intervention on resilience. All stroke survivors with baseline resilience data were also included in the substudy data analysis for predictor variables of resilience. The informal caregivers enrolled under the MEND trial were excluded. The MEND study and the substudy were approved by the same university-affiliated institutional review board, and written informed consent was obtained from all participants before MEND study enrollment, including providing consent for future data sharing.

Measures

Self-reported demographic variables examined included age, sex, race, ethnicity, education, marital status, income, and religious beliefs. Electronic health record clinical variables included type of stroke and time since stroke. Self-reported psychological variables examined included symptoms of anxiety, measured with the State-Trait Anxiety Inventory (STAI-Y),[18] and symptoms of depression, measured with the Center for Epidemiologic Studies Depression Scale.[19]

Baseline and postintervention measures of resilience were also available. Resilience was measured with the Brief Resilience Scale (BRS), a self-report instrument with 6 items on a 5-point Likert-type scale, with higher scores corresponding to higher levels of resilience.[20] Multivariate analysis of the BRS resulted in a model with 5 variables hypothesized to influence resilience: mindfulness, mood clarity, purpose in life, optimism, and active coping.[21] The BRS has demonstrated adequate evidence for internal consistency reliability (Cronbach α of 0.8–0.9), test-retest reliability ($r = 0.7$, 1-month interval), construct validity, and convergent validity among an adult sample that included cardiac rehabilitation patients and women with fibromyalgia.[20]

Data Analysis

Descriptive statistics were computed for the demographic, clinical, psychological, and resilience variables. Internal consistency reliability of the BRS scale was analyzed with Cronbach α coefficient. A paired samples t test was used to test the effect of meditation on resilience of stroke survivors in the intervention group. Power analysis with G*Power for a 2-tailed test with $\alpha = .05$ and a sample size of n = 20 indicated that a paired t test would have 80% power when the effect size for the change in resilience from baseline to immediately post intervention was a Cohen d of 0.66.[22]

Predictors of resilience were evaluated from baseline data for the included stroke survivors. The univariable relationship between resilience and each predictor variable was evaluated with the appropriate statistical test based on the measurement level of the predictor variable. Univariable results were inspected for statistical significance ($P \leq .05$). Multiple linear regression was used to develop the model that best explained the relationship of predictor variables to baseline stroke-survivor resilience, with a univariable significance level of $P \leq .10$ required for initial model inclusion. Data analysis was performed with SPSS version 25.

Results

The stroke survivors (n = 35) were mostly younger than 65 years (mean [SD], 58.3 [13.9] years), more likely to be female (62.9%), and within the first 6 months of stroke recovery (74.3%). A total of 49% of participants were non-Hispanic (NH) black, followed by those who were NH white (34.3%) and those who were Hispanic (17.1%) (Table [1]). Internal consistency reliability testing with Cronbach α coefficient indicated adequate evidence of reliability for both baseline and postintervention BRS ($\alpha = .8$). All interval-level variables met the assumptions for normality. The increase in stroke survivor (n = 20) BRS scores from baseline (3.46 [0.81]) to intervention completion (3.58 [1.02]) was not statistically significant ($t = 0.60$, $df = 19$, $P = .56$). The BRS mean difference of 0.12 (95% CI, −0.29 to 0.53) resulted in a Cohen d of 0.13, with $\alpha \leq .05$ and $\beta = .20$ (see Table 3, Supplementary Digital Content, available at http://links.lww.com/JNN/A231).

Univariable analyses resulted in 4 predictor variables that met the a priori criterion ($P \leq .10$) for inclusion in multivariable analysis. Baseline resilience was inversely correlated with depressive symptoms (Center for Epidemiologic Studies Depression Scale; $r = -0.32$, $P = .07$), trait anxiety (STAI-T; $r = -0.51$, $P = .003$), and state anxiety (STAI-S; $r = -0.36$, $P = .05$) (see Table 4, Supplementary Digital Content, available at http://links.lww.com/JNN/A231). One-way analysis of variance results for the univariable relationship between baseline resilience (BRS score) and self-reported race (NH white, NH black, Hispanic) were statistically significant ($F_{2,33} = 3.97$, $P < .03$). Tukey post hoc analysis revealed that the baseline resilience scores were statistically significantly lower ($P = .02$) for NH black participants than for NH white participants. Baseline resilience was not significantly different between Hispanic and NH black ($P = .53$) or Hispanic and NH white ($P = .52$) participants.

Multiple linear regression was applied to baseline stroke-survivor data, with resilience as the dependent variable, race as a fixed factor, and trait anxiety, state

TABLE 1. Participant Characteristics

Baseline Characteristics	Stroke Survivors (N = 35)
Time since stroke, d; mean (SD), range	112.5 (103.4), 5–345
5–188 d, n (%)	26 (74.3)
189–345 d, n (%)	9 (25.7)
Stroke type, n (%)	
Ischemic	26 (63.4)
Hemorrhagic	5 (12.2)
Transient	10 (24.4)
Age, y; mean (SD), range	58.3 (13.9), 32–83
Sex, n (%)	
Female	22 (62.9)
Male	13 (37.1)
Race and ethnicity, n (%)	
NH black	17 (48.6)
NH white	12 (34.3)
Hispanic	6 (17.1)
Marital status, n (%)	
Single	19 (54.3)
Married	16 (45.7)
Education, n (%)	
High school/GED	10 (28.6)
Vocational/some college	14 (40)
College degree	11 (31.5)
Annual income, n (%)	
<$25 000	10 (29.4)
$25 000–$49 999	10 (29.4)
$50 000–$99 999	6 (17.7)
$100 000 or higher	8 (23.5)
Religious beliefs, n (%)	
Christian	31 (93.9)
Other	2 (6.1)

Abbreviation: NH, non-Hispanic.

anxiety, and depressive symptoms as covariates. Although the initial model was statistically significant ($F_{5,32} = 4.95$, $P = .002$), the only psychological variable with statistical significance was trait anxiety ($F_{1,32} = 9.80$, $P = .004$). Depressive symptoms, state anxiety, and trait anxiety demonstrated high bivariate correlations ($r \geq 0.87$-0.90, $P \leq .001$). Depressive symptoms and state anxiety were removed from the model, resulting in a final model with baseline resilience as the dependent variable, race/ethnicity as a fixed factor, and trait anxiety as a covariate. This model was statistically significant ($F_{3,33} = 6.32$, $P = .002$) and accounted for 33% of the variance in baseline resilience (Table 2).

Discussion

The effect of meditation on resilience was not statistically significant in this sample of community-dwelling stroke survivors. The resilience measure was collected immediately after the 4-week intervention, whereas a longer-term measure would have provided additional evidence regarding the effectiveness of the intervention. In the previously cited clinical trial comparing a brief, intensive meditation intervention with relaxation in healthy adults, there were also no significant short-term (immediately post intervention) interaction effects of time and group on resilience or mindfulness, but there were significant longer-term (3 months post intervention) interaction effects on both measures.[14]

The inverse correlations of resilience with symptoms of anxiety and depression align with previous findings in other CVD populations.[6,7,9] However, only trait anxiety remained significant in the final multivariate model. The STAI-Y was developed to measure both state and trait anxiety,[18] but recent research has suggested that specific items on the STAI-Y trait scale may reflect dysphoric mood, or depression, rather than anxiety.[23] Phobic anxiety was recently reported as the most prevalent type of anxiety for a cohort of stroke survivors in the first 3 months of recovery.[24] These differences in anxiety measures and subtypes should be considered in future studies of resilience predictor variables for stroke survivors.

The significantly lower baseline resilience for NH black stroke survivors in this study, as compared with that for NH white stroke survivors, was an unexpected finding. The percentage of NH black participants in our sample, which was higher than typically seen in clinical trials, may have provided adequate power to uncover effects not seen in other studies. However, this racial difference in baseline resilience may be related to the influence of other factors, including social determinants of health, nontraditional stroke risk factors such as psychosocial stress, or race-related stress.

Previous studies have shown relationships between race and socioeconomic status, and between resilience and socioeconomic status among CVD populations. In a large cohort of Swedish men, the significant association between low stress resilience in late adolescence and a higher risk of early stroke was slightly attenuated by indicators of lower childhood socioeconomic status.[5] Adult socioeconomic position, but not childhood socioeconomic position, was a predictor for adverse cardiac events in both younger and female African Americans in the Jackson Heart Study.[25]

Nontraditional stroke risk factors, such as psychosocial stress, may also impact stroke survivor resilience. Recent evidence suggests perceived psychosocial stress is associated with an increased risk of stroke[26]; notably, blacks are more likely than whites to identify stress as a

TABLE 2. Baseline Predictors of Resilience: GLM Between-Subjects Effects

	Type III Sum of Squares	*df*	Mean Square	*F*	Significance Level, 2-Tailed
Corrected model	7.41[a]	3	2.47	6.32	.002
Intercept	75.37	1	75.37	192.78	.000
Race	2.95	2	1.48	3.77	.04
STAI-T	3.51	1	3.51	8.98	.005

Abbreviations: *df*, degrees of freedom; GLM, General Linear Model; STAI-T, State-Trait Anxiety Inventory–trait anxiety.
[a] $R^2 = 0.387$ (adjusted $R^2 = 0.326$).

stroke risk factor.[27] A study of 112 African American cardiac rehabilitation participants found that higher baseline depression symptoms were associated with higher stress scores and lower levels of resilience factors.[6] In a subcohort of black women enrolled in the Women's Health Initiative Observational Study and Clinical Trial, women with higher resilience reported lower stress and higher education than those with lower resilience.[28] However, the significant association between higher levels of stressful events and incident CVD (hazard ratio, 1.61; 95% CI, 1.04–2.51) among these women was not modified by resilience, nor was resilience significantly associated with incident CVD.[28]

Race-related stress, which encompasses racism and discrimination experienced by African Americans, may negatively influence resilience, but few studies have addressed relationships between race-related stress and resilience. Two studies of African American adults have identified social support, collective efficacy, and interconnectedness as potential resilience resources for this population.[29,30] Among African Americans in the Family and Community Health Study, the negative effects of living in disadvantaged neighborhoods on accelerated cardiometabolic aging and subsequent chronic illness, including hypertension and CVD, were buffered by perceived neighborhood collective efficacy.[31]

The sex and racial demographic characteristics of our sample mirror trends recently reported for the US stroke population.[32] Acute stroke hospitalizations between 1995 and 2012 increased significantly for both men and women between the ages of 18 and 54 years.[33] This increase in stroke hospitalizations among younger patients was associated with an increased prevalence of traditional stroke risk factors, including a near doubling of the prevalence of multiple risk factors.[33] These findings underscore the need for primary and secondary stroke prevention efforts in both younger and black populations, with attention to traditional and nontraditional risk factors. Because resilience has been associated with higher levels of healthy behaviors and self-care measures in other populations, including those with CVD diagnoses, strategies to enhance resilience might also improve adherence to self-care measures among stroke survivors. Potential racial differences in stroke survivor resilience, including the relationships between resilience and psychological factors, social factors, perceived stress, and race-related stress, should be explored in larger samples of diverse stroke populations.

Strengths and Limitations

The MEND study was a rigorously designed pilot study with adequate randomization and allocation concealment. The demographic characteristics of the MEND participants were also a strength, providing preliminary evidence regarding stroke survivor resilience in this more diverse population. However, this substudy was limited to variables collected in the MEND study. Future studies of the effect of meditation on resilience should include variables such as mindfulness, which might elucidate specific intervention mechanisms on resilience.

The MEND study was powered for depression as a primary outcome, but not specifically for resilience. The substudy focus on within-group resilience measures may have resulted in history and maturation threats to internal validity. The nonprobability, purposive sampling strategy may have resulted in selection bias, and sampling in a single stroke clinic limits generalizability of study findings. In addition, the exclusion of participants lost to follow-up may have resulted in nonresponse bias. Although the BRS has been validated in cardiovascular patients, as well as in various racial and cultural groups, to our knowledge, it has not been validated in black populations.

Conclusion

The small, but nonsignificant, postmeditation increase in resilience observed in this sample of community-dwelling stroke survivors warrants further study in clinical trials powered for the resilience outcome. Our findings of lower baseline resilience among NH black stroke survivors, and for those with higher levels of trait anxiety, merit further study in larger samples.

New knowledge gained from studies of stroke survivor resilience may facilitate the identification of stroke survivors in need of interventions, such as meditation, to enhance resilience. Fostering resilience supports recovery of stroke survivors and may offer a first step toward improved engagement in important self-care and secondary prevention measures.

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