Published in final edited form as:
Psychosom Med. 2008 May ; 70(4): 404–409. doi:10.1097/PSY.0b013e31816fd7d0.

Associations between Positive Emotion and Recovery of Functional Status Following Stroke

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Abstract

Objective—Accumulating evidence indicates the beneficial effects of positive emotion on health and general well-being in older age. Less evidence is available on whether positive emotion supports improvement in functional status after an acute medical event such as stroke. This study examined the association between positive emotion at discharge from in-patient medical rehabilitation and functional status three months later in persons with stroke.

Methods—A longitudinal study using information from the Stroke Recovery in Underserved Patients database. The study included 823 persons aged 55 years or older with stroke and admitted to an in-patient medical rehabilitation facility. Information was collected during in-patient medical rehabilitation stay and approximately 3 months post discharge.

Results—The mean age of the sample was 72.8 years (*SD* = 9.5), 51.5% were women and 53.8% were married. The sample was mostly non-Hispanic white (79.2%), followed by non-Hispanic black (15.0%) and Hispanic (5.8%). The average length of stay was 20.1 days (*SD* = 10.1). In multivariate regression analyses discharge positive emotion score was significantly associated with higher overall functional status (b= 0.70, SE .21, p = .001) as well as with higher motor (b= 0.37, SE .17, p = .003) and cognitive (b= 0.30, SE .05, p = .0001) status at 3 month follow-up after adjustment for relevant risk factors.

Conclusions—Our results indicate positive emotion is associated with gains in functional status post-stroke. Findings have implications for stroke recovery programs and suggest the need to include measures of positive emotion in patient assessments.

Keywords

Positive affect; cerebrovascular accident; recovery of function

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INTRODUCTION

Accumulating evidence indicates the beneficial and protective effects of positive emotion on health and general well-being in older age. In the past decade, studies have reported a gradient of association where higher levels of positive emotion significantly lowers the incidence of heart and stroke disease (1,2). Other studies have shown positive emotion to reduce the risk of new onset disability and frailty in older minority populations (3,4). There is also some indication that positive emotion is associated with increased longevity (5,6).

In comparison, less evidence is available on whether positive emotion plays a role in recovery after an acute medical event such as stroke. Although reports show that individuals can experience high levels of positive emotion following a stressful event independent of negative emotions including depression (7-9), it is not clear whether these positive subjective feelings or attitudes can affect change in functional status following a stroke event. Stress and coping theory (10) provides a framework in which to consider this association. In persons with stroke, a positive appraisal would view the stroke event as more of a challenge than threat, where a favorable outcome is possible. In cancer patients positive appraisals have been associated with increased motivation to initiate and sustain aversive treatments. In a study of women with primary operable breast cancer, Greer et al (11) found those with a fighting spirit reported the best health outcomes compared with those who appraised the situation as hopeless. A positive appraisal, in turn, is thought to influence positive coping, a process important for managing stress and maintaining a positive outlook. Relevant positive coping processes are those which provide comfort to the individual, and give a continued sense of meaning and purpose to life. Positive coping also includes setting new and valued goals that are in agreement with changing priorities. It is important to note that in persons with stroke, new and valued goals may not necessarily focus on curing the disease but on achieving other goals such as regaining functional ability necessary for independence and quality living.

Of the approximately 5.7 million Americans currently living with stroke (12) about half report hemiparesis, 30% cannot walk without assistance, and up to 26% report limitations in basic activities of daily living (13). With an annual projected rate of 700,000 new (500,000) and recurrent (200,000) strokes, a key priority of the American Heart and Stroke Association is to understand “characteristics associated with successful recovery of functional independence” (14). A goal of the current investigation, therefore, was to test whether positive emotion, independent of known risk factors including depression, would predict improvement in functional status among a large sample of 823 men and women aged 55 and older with stroke. In particular, we were interested in examining associations between positive emotion score at discharge from in-patient medical rehabilitation and motor and cognitive status 3 months later. We hypothesized that higher discharge positive emotion score would predict higher motor and cognitive status. One possible implication of this association is that assessment of positive emotion may be important in the discharge planning process for patients with stroke and help understand why some are more successful in recovering from their event than are others.

METHODS

Source of Data

Data came from the Stroke Recovery in Underserved Populations (SRUP) database, an observational follow-up study of persons with stroke who received in-patient medical rehabilitation services in 2005−2006. A total of 11 in-patient medical rehabilitation facilities were included in the study. These facilities were located across diverse regions of the country including: California, Florida, Iowa, Illinois, Kentucky, New Jersey, New York (2), Texas (2), and Washington DC. Operating bed sizes ranged from 12 to 155 (median bed size = 78); all eleven facilities were accredited by the Joint Commission on Accreditation of Healthcare

Organizations; and all but one facility was accredited by the Commission on Accreditation of Rehabilitation Facilities.

Data Collection

For the current study, sociodemographic characteristics and health-related measures were collected within 72 hours of discharge from in-patient medical rehabilitation facility, and approximately 3 months post discharge (Mean 93 days, SD 20.7). In-hospital interviews were by nursing staff at the medical rehabilitation facility. Follow-up information was collected by trained nurse researchers by telephone interview. Training nurse interviewers involved attending a one-day program, working with an experienced nurse to observe effective patient interviewing, demonstrating mastery of skills, and passing a credentialing exam. The interrater reliability and stability of the follow-up information collected has been established, with ICC values for functional assessments ranging from 0.86 to 0.99 (15,16). In-hospital and follow-up interviews were conducted in Spanish or English.

Study Population

Patients eligible for inclusion into the SRUP study had to be admitted to an in-patient medical rehabilitation facility with a diagnosis of stroke (ICD-9 codes 436−439) and aged 55 years or older of either gender. Patients were screened for cognitive appropriateness by nursing staff at the medical rehabilitation facility, in their ability to respond to basic questions about orientation to person, place, and time. A total of 1,006, non-proxy and cognitively appropriate patients were interviewed.

The current study included 823 patients with stroke who had complete information on key variables of interest including positive emotion at discharge and functional status at a 3 month follow-up interview. Of the original 1006 patients 29 died, 44 refused follow-up interview and 26 could not be contacted. An additional 84 patients were removed from the analysis because of missing sociodemographic and health-related measures. To evaluate the potential bias of those lost to follow-up, we tested for significant differences across various sociodemographic and health-related measures. After reviewing these measures we did not identify any potential confounders with known or suspected associations with functional status. Central and local ethical committee approval was sought and obtained. Consent was obtained at the time of the discharge interview.

Measures

Positive emotion—A four-item positive emotion summary score was created from a 20-item Center for Epidemiologic Studies - Depression (CES-D) scale (17-20). The four positive items asked whether patients experienced certain feelings or symptoms in the past week and included: “I felt that I was just as good as other people”, “I felt hopeful about the future”, “I was happy”, and “I enjoyed life” (18). Responses were scored on a four-point scale (0 to 3) and ranged from 0 (rarely or none of the time) to 3 (most of the time). Summing the responses from the 4-items created a discharge positive emotion summary score ranging from 0 − 12. The positive emotion summary score was used as a continuous measure and as a categorical measure (0−3, 4−6, 7−9, and 10−12) according to previously established criteria (4). The reliability and validity of the positive emotion summary scale has been established (5,17,20). In the current study, the four-item positive emotion summary score showed high internal consistency (alpha .78), and was weakly correlated with the remaining 16-items from the CES-D scale (−0.43).

Covariates

Sociodemographic characteristics and health-related measures relevant to functional status were included as covariates in the statistical models described below. Sociodemographic characteristics included age (≥ 55), gender, marital status, (married vs. unmarried), ethnicity (non-Hispanic white, non-Hispanic black and Hispanic) and years of schooling completed. Health-related measures included comorbidities (heart attack, diabetes, arthritis, kidney disease and cancer), length of hospital stay, stroke type (ischemic, hemorrhagic or other), body involvement (right or left, bilateral or no paresis), depressive symptoms and discharge functional status. Length of stay was calculated in days from in-patient admission to discharge. Depressive symptoms experienced over the past week were calculated by summing the 16 negative emotion items from the CES-D scale (range of 0 to 48), where higher scores indicated increased depression. The 16-item depressive symptom summary score showed high internal consistency (alpha .87).

Outcome

Functional status was assessed by the Inpatient Rehabilitation Facilities-Patient Assessment Instrument (IRF-PAI). The IRF-PAI is a 54-item instrument used to assign medical rehabilitation inpatients to a case-mix group. The case-mix group determines prospective reimbursement for medical rehabilitation by the Centers for Medicare and Medicaid Services (CMS) (21,22). The functional status items in the IRF-PAI are from the FIM™ instrument, a standardized measure including 18 items covering six domains: self-care, sphincter control, transfer, locomotion, communication, and social cognition. All 18 items are scored into one of seven levels of function, ranging from complete dependence (level 1) to complete independence (level 7). Total FIM ratings have a potential range of 18 to 126, where higher scores indicate greater functional independence. Total FIM ratings can be grouped into Motor and Cognition ratings. Motor ratings contain self-care, sphincter control, mobility, and locomotion items, and Cognition ratings contain communication and social cognition items. Ratings for the Motor subscale ranges from 9 to 91, and for the Cognition subscale from 5 to 35. The reliability, validity, and responsiveness of the FIM instrument have been widely investigated (23,24). The reliability (intraclass correlation coefficient) of the total FIM and of its domains has consistently been found to be >0.85 (23,24).

Statistical Analysis

Descriptive statistics were reported as means (and standard deviations) for continuous measures and as percentages for categorical measures. To compare associations for discharge positive emotion and follow-up Total FIM ratings we computed three generalized linear regression models. The first model included positive emotion score, age and discharge Total FIM rating as predictors of follow-up Total FIM rating. The second model added sociodemographic characteristics including gender, ethnicity, marital status and education. The third model added health-related measures including comorbidities, depressive symptoms, length of hospital stay, type of stroke, and main area of body involvement.

Two additional regression models examined associations between discharge positive emotion score and Motor and Cognition FIM rating, respectively, adjusting for discharge sociodemographic characteristics and health-related measures described above. For all regression models, testing was 2-sided using an alpha of .05. Model assumptions for the regression models were tested and met. All analyses used the SAS software, version 9.3 (SAS Institute, Cary, NC).

RESULTS

The study included a total of 823 patients with complete information at discharge and 3 month follow-up interview. A majority of the patients were women (51.5%), non-Hispanic white (79.2%) and aged 55 − 74 (52.3%). Most had a high school education or more (77.6%) and most were currently married (53.8%). A large majority had 1 or more comorbidities (75.6%). The average positive emotion and depressive symptom score at discharge interview was 9.1 (SD 3.1) and 7.7 (SD 7.1), respectively.

The most prevalent type of stroke was ischemic (74.6%), followed by hemorrhagic (15.4%) and other stroke (10.0%). A high percentage of patients with stroke had left (42.5%) or right body involvement (39.5%). A small percentage had bilateral body involvement (2.9%) and 15.1% had no paresis. The average length of hospital stay was 20.1 (SD 10.1) days.

Table 1 shows associations for sociodemographic characteristics and health related measures at discharge stratified by mean Total FIM and mean Motor and Cognition FIM ratings at follow-up. Functional status did not significantly differ by age category or by gender. Hispanics had significantly lower Total FIM and Motor FIM ratings than either non-Hispanic whites or non-Hispanic blacks. Similarly, married individuals, those with less than a high school education and those with 2 or more comorbidities had significantly lower mean Total FIM and Motor FIM ratings than the unmarried, those with a high school education or more, and those with fewer than 2 comorbidities.

Figure 1 shows the unadjusted mean Total FIM and mean Motor and Cognition FIM ratings at follow-up by discharge positive emotion category score. The figure indicates a gradient of association, where higher positive emotion was significantly related to higher mean Total FIM and higher mean Motor and Cognition FIM ratings at follow-up. Individuals in the highest positive emotion category (score 10−12) reported a mean Total FIM rating of 107.5, while those in the lowest positive emotion category (score 0−3) reported a mean Total FIM rating of 84.8. Mean ratings for Motor and Cognition FIM by positive emotion category ranged from a low of 58.5 and 26.3 respectively, to a high of 74.6 and 33.0.

To examine the independent association between discharge positive emotion and follow-up Total FIM rating we tested three generalized linear regression models (Table 2). For each model, unstandardized parameter estimates (b) and standard error (SE) were presented, $p < 0.05$ was considered significant. Time to follow-up interview was not significantly associated with FIM ratings ($p = 0.97$) and was not included as a variable in any of the models.

In each of the multivariate models, discharge positive emotion score was significantly associated with follow up Total FIM rating three months later. In Models 1 and 2, each 1-point increase in positive emotion score was significantly associated with a 0.95 and 1.01 point increase in Total FIM rating, respectively. In Model 3 (full model), each 1-point increase in discharge positive emotion score was significantly associated with a 0.70 point increase in follow up Total FIM rating after adjustment for sociodemographic characteristics and clinical measures of health status. Significant covariates of follow-up Total FIM rating in Model 3 included ethnicity, (i.e., non-Hispanic blacks and Hispanics reported lower follow-up Total FIM ratings than non-Hispanic whites), as well as number of comorbidities, depressive symptoms, increasing length of stay, type of stroke and Total FIM ratings at discharge.

Table 3 shows the association between discharge positive emotion score and Motor and Cognition FIM, adjusting for sociodemographic characteristics and health-related measures included in Table 2 (Model 3). The findings showed higher positive emotion score was significantly associated with higher Motor FIM and higher Cognition FIM at follow-up. Common predictors of both Motor and Cognition FIM at follow-up included ethnicity,

depressive symptoms and number of comorbidities. Gender, education, length of stay and type of stroke were significantly associated with Motor FIM but not Cognition FIM at follow-up.

DISCUSSION

This study serves three purposes. First, it adds to the increasingly accepted idea that positive emotions are linked with health. Second, it indicates that persons with stroke can report high levels of positive emotion at discharge from in-patient medical rehabilitation. And third, it demonstrates that positive emotion is a significant independent predictor of functional status following stroke. Our main findings can be summarized as follows. More than one-third of our sample of 823 older men and women with stroke reported high levels of positive emotion at discharge from in-patient medical rehabilitation and that level of positive emotion did not significantly differ by sociodemographic characteristic. Higher discharge positive emotion score was significantly associated with higher Total FIM rating as well as with higher Motor and Cognition FIM ratings, with and without adjustment for sociodemographic characteristics and health-related measures known to affect functional status. It is also important to note that the significant association between positive emotion and functional status was maintained after additional adjustment for depressive symptoms, so was not a reflection of the established connection between depression and functional ability (25,26).

The observed gradient of association between higher positive emotion score at discharge and functional status post stroke has relevance to rehabilitation medicine and its focus on restoring physical and mental capabilities. Several studies have equated increased FIM points with minutes per day of help required from another person to complete basic daily living tasks. According to Granger and colleagues (27) each increase of 1 FIM point in persons with stroke corresponds to approximately 2.2 minutes of less assistance required by another person in performing activities of daily living. In the current study, we found a 22 point difference in Total FIM rating between those with low (score 0−3) and high (score 10−12) discharge positive emotion, which equates to a change of about 48 minutes per day of caregiver assistance. In terms of increased independence and quality of life for the individual with stroke this finding is noteworthy. The finding is also potentially noteworthy in relation to caregiver burden, resource use and cost. A number of reports specific to stroke research indicate the high prevalence of caregiver stress and burden (28,29), and the negative impact this can have on the carer as well as the person he or she is providing care for.

Importantly for patients with stroke, positive emotion appears to have a strong influence on both motor and cognitive function. As measures of outcome, motor and cognition are essential to objectively assess the impact of stroke and stroke recovery in the individual. Good motor function is necessary to carry-out basic activities required for daily living and research clearly shows that the independence gained through greater motor function translates into a higher quality of life (30,31). On the other hand, those with poor motor function following a stroke are known to be at a significantly increased risk for nursing home placement and death (32, 33). In relation to cognition, there is some suggestion that patients with good cognitive function after stroke are better able to cope and adapt to environmental demands. Good cognitive function also has been correlated with greater motor gains and better overall outcome (34).

The difficulty, however, is how to translate positive emotion findings from epidemiologic and clinical studies into clinical practice. A first step would be for health care professionals in rehabilitation medicine to be aware that some persons who have experienced a traumatic event such as a stroke can express positive emotions and that the experiencing of these positive emotions may help the recovery process. Lazarus (35) hypothesized that, under stressful conditions, positive emotions may help prevent negative emotions such as depression or anxiety. In testing this theory, Fredrickson and Levenson (8) showed that positive emotions

may reverse or act as a buffer against potentially negative physiological consequences of stress. Although not tested in the current study it would be of interest to examine how change in positive emotion affects change in depression or anxiety longitudinally post stroke and whether this association is linked with better health outcome. Fredrickson (36) has presented a model showing that positive emotions can affect health by increasing a person's cognitive, physical and social resources. In persons with stroke, those with high levels of positive emotion may be able to draw on personal resources which in turn may reduce feelings of depression and increase the chances of a successful recovery.

Other ways that health care professionals in rehabilitation medicine could translate positive emotion research into clinical practice would be to provide opportunities for persons with stroke to reflect positively on their health challenge. In this situation, patients would play a key role in their own recovery. The patient, for example, could be asked to reflect on new goals or future goals that would give purpose and meaning to their life; or they could be asked to reflect on their potential to grow and develop as a person. These and other coping strategies could serve multiple functions such as regulating stress and managing day to day challenges as well as motivating the person to continue with therapeutic programs aimed at improving functional status and independence. Studies suggest that these person-centered strategies may further play an important part of keeping the body in balance via chemical and neural responses (37,38). In a sample of middle-aged adults high levels of purpose in life have been associated with lower cortisol levels and lower cardiovascular risk and musculoskeletal symptoms (39,40). Positive emotion and positive coping strategies also have been linked to lower levels of inflammatory markers and lower levels of stress hormones (41).

The current study was carried out in a large ethnically diverse sample of persons with stroke. To increase the clinical applicability of the study the sample included individuals with a diagnosis of stroke admitted to an accredited medical rehabilitation facility in the U.S. The current study has some limitations. First, and common to all observational studies, is that the finding of an association between higher positive emotion score and better functional status does not prove that these two measures are causally related. Although we controlled for relevant risk factors, it may be that an underlying third variable was responsible both for the higher positive emotion score and subsequent improvement in functional status. Second, because positive emotion was not measured at admission to rehabilitation facility we were unable to assess the change in this measure over the in-patient stay. It would have been interesting to compare our current results with results that considered change in positive emotion with improvement in functional status. Although both comparisons are valid, perhaps change in positive emotion would differ in its association with improvement in functional status compared with discharge positive emotion's association with improvement in functional status. Third, functional status was only measured once post discharge. Future studies that examine relations between positive emotion and functional status over multiple follow ups could potentially add important information on how emotions may affect long term recovery and independence in persons with stroke.

Despite these limitations this study showed that persons with stroke can experience high levels of positive emotion, which subsequently are associated with functional status during a critical period of recovery. Assessing whether positive emotion continues to affect functional status over longer periods of time and better understanding how positive emotion may interact with coping processes to improve patient quality of life post stroke is warranted.

Acknowledgements

This research was supported by funding from the National Institutes of Health and the National Institute of Aging for G. Ostir (R01-AG024806 & K01-HD046682), and K. Ottenbacher (K02-AG019736) and National Institutes of Child Health and Human Development for I. Berges (K12-HD052023).

Acronyms

CES-D, Center for Epidemiologic Studies - Depression; CMS, Centers for Medicare and Medicaid Services; FIM, Functional Independence Measure; IRF-PAI, Inpatient Rehabilitation Facilities-Patient Assessment Instrument; SE, standard error; SRUP, Stroke Recovery in Underserved Populations.

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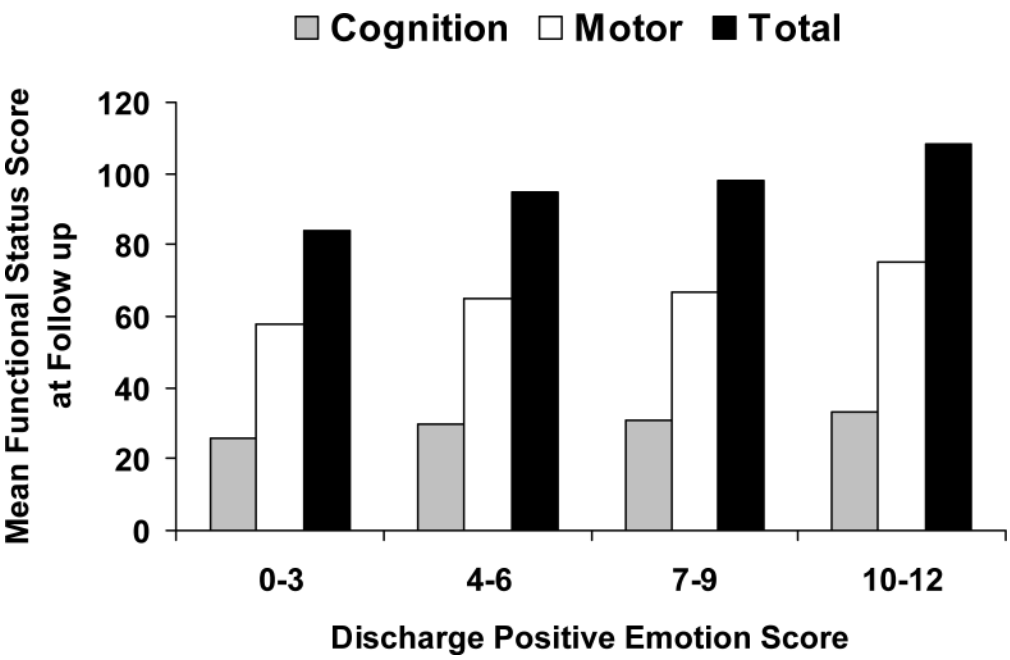

Figure 1.
The association between discharge positive emotion score and mean Total FIM, Cognition FIM and Motor FIM ratings at 3 month follow-up.

Table 1

Patient characteristics at discharge from in-patient medical rehabilitation and mean 3 month follow-up FIM ratings.

	Mean 3 Month Follow-up FIM rating (N = 823)		
Patient Characteristic at Discharge	**Total FIM Mean (SD)**	**Motor FIM Mean (SD)**	**Cognition FIM Mean (SD)**
Age			
55 − 64	107.1 (21.9)	74.3 (19.4)	32.8 (4.1)
65−74	103.0 (22.0)	71.1 (18.8)	31.9 (4.9)
75 − 84	99.1 (24.5)	67.7 (20.8)	31.4 (5.6)
≥ 85	99.8 (23.4)	68.6 (20.0)	31.2 (5.2)
Gender			
Men	103.0 (24.3)	71.5 (20.7)	31.5 (5.2)
Women	101.5(22.2)	69.3 (19.2)	32.2 (4.5)
Ethnicity			
Non-Hispanic white	102.9 (22.8)	71.0 (19.6)	31.9 (4.9)
Non-Hispanic black	101.5 (22.7)	69.4 (19.6)	32.1 (5.0)
Hispanic	93.5 (28.8)	63.8 (24.3)	29.7 (6.2)
Marital status			
Unmarried	104.4 (21.6)	72.1 (18.5)	32.3 (4.5)
Married	100.2 (24.5)	68.8 (21.1)	31.4 (5.5)
Education			
< 12 years	98.1 (24.7)	66.6 (21.7)	31.5 (4.8)
≥ 12 years	103.4 (27.7)	71.5 (19.3)	31.9 (5.1)
Comorbidities			
0	103.8 (24.3)	71.8 (20.8)	32.0 (4.8)
1	103.7 (21.6)	71.1 (18.7)	32.6 (4.7)
≥ 2	98.8 (24.3)	67.4 (20.7)	31.4 (4.3)

Table 2

The association between discharge positive emotion and Total FIM rating at 3 month follow-up (N = 823).

	Three Month Follow-up Total FIM Rating		
Patient Characteristic at Discharge	**Model 1 b (SE) p**	**Model 2 b (SE) p**	**Model 3 b (SE) p**
Positive emotion (continuous)	0.95 (.18) .0001	1.01 (.18) .0001	0.70 (.21) .001
Age	−0.07 (.06) .21	−0.10 (.06) .09	−0.09 (.06) .10
Men (vs. women)		1.27 (1.12) .26	1.53 (1.11) .16
Ethnicity			
Non-Hispanic black (vs. Non-Hispanic white)		−5.10 (1.85) .006	−5.17 (1.50) .0006
Hispanic (vs. Non-Hispanic white)		−10.10 (2.38) .0001	−11.12 (2.33) .0001
Married (vs. Unmarried)		−2.30 (1.14) .04	−2.05 (1.12) .07
Education			
≥ 12 years (vs. < 12 years)		0.32 (.19) .07	0.26 (.18) .13
Comorbidities			−1.81 (0.63) .004
Depressive Symptoms			−0.26 (.09) .002
Length of Stay			−0.12 (0.06) .03
Type of Stroke			
Hemorrhagic (vs. other)			8.00 (2.18) .0003
Ischemic (vs. other)			4.85 (1.76) .006
Body Involvement			
Left (vs. Bilateral)			−0.49 (1.53) .75
Right (vs. Bilateral)			1.65 (1.52) .28
Discharge Total FIM	0.70 (.02) .0001	0.69 (.02) .0001	0.66 (.02) .0001
R^2	.55	0.58	0.60

Table 3

Association between discharge positive emotion and Motor FIM and Cognition FIM ratings at 3 month follow-up (N = 823).

	Three Month Follow-up	
Patient Characteristic at Discharge	**Motor FIM b (SE) p**	**Cognition FIM b (SE) p**
Positive emotion (continuous)	0.37 (.17) .003	0.30 (.05) .0001
Age (continuous)	−0.08 (.05) .09	−0.03 (.02) .06
Men (vs. women)	1.91 (0.94) .04	−0.43 (0.31) .16
Ethnicity		
Non-Hispanic black (vs. Non-Hispanic white)	−3.75 (1.26) .003	−0.94 (0.42) .03
Hispanic (vs. Non-Hispanic white)	−8.11 (1.97) .0001	−2.69 (0.65) .0001
Married (vs. Unmarried)	−1.80 (0.94) .06	−0.49 (0.31) .11
Education		
≥ 12 years (vs. < 12 years)	0.31 (.15) .03	−0.01 (.05) .89
Comorbidities	−0.97 (0.53) .05	−0.47 (0.18) .008
Depressive Symptoms	−0.21 (0.07) .003	−0.06 (0.02) .02
Length of Stay	−0.11 (0.05) .02	−0.003 (0.01) .96
Type of Stroke		
Hemorrhagic (vs. other)	6.46 (1.84) .0005	0.87 (0.61) .15
Ischemic (vs. other)	4.32 (1.50) .004	0.25 (0.49) .60
Body Involvement		
Left (vs. Bilateral)	−0.03 (1.30) .98	0.43 (0.43) .32
Right (vs. Bilateral)	1.21 (1.28) .35	0.23 (0.42) .58
Discharge Motor FIM	0.75 (.03) .0001	
Discharge Cognition FIM		0.31 (.02) .0001
R^2	0.61	0.33