Factors Influencing Stroke Survivors’ Quality of Life During Subacute Recovery

Deborah S. Nichols-Larsen, PhD, PT; P.C. Clark, PhD, RN, FAHA; Angelique Zeringue, MS, MA; Arlene Greenspan; Sarah Blanton, DPT, NCS

Background and Purpose—Health-related quality of life (HRQOL) is an important index of outcome after stroke and may facilitate a broader description of stroke recovery. This study examined the relationship of individual and clinical characteristics to HRQOL in stroke survivors with mild to moderate stroke during subacute recovery.

Methods—Two hundred twenty-nine participants 3 to 9 months poststroke were enrolled in a national multisite clinical trial (Extremity Constraint-Induced Therapy Evaluation). HRQOL was assessed using the Stroke Impact Scale (SIS), Version 3.0. The Wolf Motor Function Test documented functional recovery of the hemiplegic upper extremity. Multiple analysis of variance and regression models examined the influence of demographic and clinical variables across SIS domains.

Results—Age, gender, education level, stroke type, concordance (paretic arm=dominant hand), upper extremity motor function (Wolf Motor Function Test), and comorbidities were associated across SIS domains. Poorer HRQOL in the physical domain was associated with age, nonwhite race, more comorbidities, and reduced upper-extremity function. Stroke survivors with more comorbidities reported poorer HRQOL in the area of memory and thinking, and those with an ischemic stroke and concordance reported poorer communication.

Conclusions—Although results may not generalize to lower functioning stroke survivors, individual characteristics of persons with mild to moderate stroke may be important to consider in developing comprehensive, targeted interventions designed to maximize recovery and improve HRQOL. (Stroke. 2005;36:1480-1484.)

Key Words: quality of life rehabilitation stroke
Methods

Subjects
As part of a national multisite clinical trial of stroke recovery, 229 subjects were recruited at 6 clinical sites (Extremity Constraint-Induced Therapy Evaluation [EXCITE]). Inclusion/exclusion criteria for all participants included: (1) enrollment between 3 to 9 months of their first clinical stroke; (2) at least 10 degrees of wrist extension and metacarpophalangeal (MP) and interphalangeal (IP) extension of 2 digits and the thumb; (3) ability to transfer to and from the toilet independently and maintain standing for two minutes; and (4) no major cognitive deficit (Mini-Mental Status Examination, ≥24). (Refer to Weinstein et al for more details on clinical trial methods.) Institutional review boards at each site approved the study, and all participants provided written informed consent.

Instrumentation
The SIS (Version 3.0; Rehabilitation Outcomes Center; Gainesville, Fla), a 59-item self-report assessment of stroke outcome was used to assess HRQOL in 8 domains: (1) strength, (2) hand function, (3) mobility, (4) physical (ADL) and instrumental (IADL) activities of daily living, (5) memory and thinking, (6) communication, (7) emotion, and (8) social participation. Potential scores for each domain range from 0 to 100; higher scores indicated higher HRQOL. Reliability and validity have been established in the stroke population, and the SIS has been found to be sensitive to change in function across domains. Four of the scales (strength, hand function, ADL/ instrumental ADL, mobility) can be combined into an overall physical component score.

The Wolf Motor Function Test (WMFT), an impairment-based assessment, was used to document functional level of the upper extremity. The WMFT consists of 15 timed performance items (maximum time 120 seconds), progressing from simple joint movement to complex movements, and 2 strength items. The reliability and validity of the WMFT has previously been established for evaluating upper-extremity functional impairment in stroke.

Comorbidities were measured by summing the major health problems (eg, diabetes, cardiovascular disease) reported by stroke survivors as a proxy for severity of illness. This total score was used in the analysis.

Statistical Analysis
Descriptive statistics were computed for each domain. Data were examined for potential covariates. Multiple analysis of variance (MANOVA), which allows comparison of group means across several dependent variables without the multiple testing problems associated with repeated ANOVA, was used to examine variables that exerted influence across multiple SIS domains (SAS Version 8.2; SAS Institute). All SIS domains were used in the MANOVA to prevent diminishing the influence of the 4 components of the physical domain. The MANOVA appeared to be robust to a lack of normality in some domains resulting from ceiling and floor effects. Mean WMFT times were skewed but easily corrected to normal with a natural-log transformation. One covariate (education) was missing for one participant; thus, the overall mean was imputed. Regression models were used to examine the influence of demographic and clinical variables for the combined physical component and each additional domain of the SIS. Both because of its reported robustness and a marked lack of normality in some other domains, the combined physical domain was used for the regression. Potential interactions were tested and only significant ones retained in the final models.

Results
Of the 229 subjects randomized for EXCITE, 13 were excluded from analysis because of nursing home residence, incomplete SIS, or withdrawal before the baseline visit. Participants were primarily white, male, living at home, had at least a high school education, and had a mean age of 62 years (Table 1). On average, they had 2.79 ± 1.42 comorbidities, were primarily right-hand dominant with ischemic stroke, and presented with right hemiparesis.

Descriptive data for the SIS subscales can be found in Table 2 along with the internal consistency coefficient α for each subscale.
TABLE 3. MANOVA Results Across SIS Domains

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wilks $\lambda$ Value</th>
<th>$F$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>0.789</td>
<td>6.61</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Race</td>
<td>0.938</td>
<td>1.63</td>
<td>0.118</td>
</tr>
<tr>
<td>Gender</td>
<td>0.923</td>
<td>2.06</td>
<td>0.042</td>
</tr>
<tr>
<td>Education*</td>
<td>0.909</td>
<td>2.48</td>
<td>0.014</td>
</tr>
<tr>
<td>Lives with</td>
<td>0.971</td>
<td>0.72</td>
<td>0.674</td>
</tr>
<tr>
<td>Stroke type</td>
<td>0.909</td>
<td>2.48</td>
<td>0.014</td>
</tr>
<tr>
<td>Concordance</td>
<td>0.881</td>
<td>3.33</td>
<td>0.002</td>
</tr>
<tr>
<td>Comorbidities*</td>
<td>0.925</td>
<td>1.99</td>
<td>0.049</td>
</tr>
</tbody>
</table>

Note: A proc generalized linear model was used in SAS to do the MANOVA.
*Denotes a continuous variable. Binary variables were coded as follows: male = 1, female = 0; concordant = 1, discordant = 0; ischemic = 1, hemorrhagic = 0; white = 1, nonwhite = 0; lives with spouse/relative = 1, lives alone/with housekeeper = 0.
†Mean of the Wolf times was log transformed to correct to normal.

Table 3 has the results of the separate regression models. It should be noted that the $R^2$ values, although significant, were relatively low. Importantly, these results may indicate that factors other than those measured may have a relatively large influence on the variability of the HRQOL scores. Older stroke survivors, nonwhites, and those with more comorbidities and lower upper-extremity function reported poorer HRQOL in the physical domain. Stroke survivors with more comorbidities reported poorer HRQOL in the area of memory and thinking; those with an ischemic stroke and concordance of paretic arm with dominant arm reported poorer communication. The 3-way interaction with age, gender, and race was significant for both the emotion and social participation subscales. (See the Figure, which illustrates the interaction for social participation.) For social participation, this interaction indicated improved social participation for nonwhite men with increasing age, decreased participation for white men and nonwhite women with increasing age, and low scores across ages for white women. For emotion, this interaction delineated higher emotional QOL for younger white males than the other 3 groups, with nonwhite males having the lowest emotional QOL at younger ages. Women, both white and nonwhite, tended to have relatively stable emotional HRQOL across ages. All groups responded similarly at older ages.

TABLE 4. QOL Regression Models With Stroke Survivor Characteristics

<table>
<thead>
<tr>
<th>Physical Domain Subscales 1, 5, 6, 7</th>
<th>Memory Subscale 2</th>
<th>Emotion Subscale 3</th>
<th>Communication Subscale 4</th>
<th>Participation Subscale 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter Estimate $t$ &amp; $P$</td>
<td>Parameter Estimate $t$ &amp; $P$</td>
<td>Parameter Estimate $t$ &amp; $P$</td>
<td>Parameter Estimate $t$ &amp; $P$</td>
<td>Parameter Estimate $t$ &amp; $P$</td>
</tr>
<tr>
<td>Intercept</td>
<td>91.58</td>
<td>14.47</td>
<td>&lt;0.0001</td>
<td>88.45</td>
</tr>
<tr>
<td>$R^2$ adjusted estimates</td>
<td>0.31</td>
<td>(p&lt;0.001)</td>
<td>0.06</td>
<td>(p&lt;0.13)</td>
</tr>
<tr>
<td>Age*</td>
<td>-0.36</td>
<td>-5.43</td>
<td>&lt;0.0001</td>
<td>-0.14</td>
</tr>
<tr>
<td>Race</td>
<td>5.60</td>
<td>3.00</td>
<td>0.0031</td>
<td>0.86</td>
</tr>
<tr>
<td>Gender</td>
<td>2.61</td>
<td>1.51</td>
<td>0.1319</td>
<td>-0.20</td>
</tr>
<tr>
<td>Education*</td>
<td>-0.36</td>
<td>-1.39</td>
<td>0.1664</td>
<td>0.44</td>
</tr>
<tr>
<td>Live with</td>
<td>2.95</td>
<td>1.00</td>
<td>0.3174</td>
<td>1.93</td>
</tr>
<tr>
<td>Stroke Type</td>
<td>1.22</td>
<td>0.49</td>
<td>0.6241</td>
<td>-4.26</td>
</tr>
<tr>
<td>Concordance</td>
<td>-2.61</td>
<td>-1.61</td>
<td>0.1097</td>
<td>0.72</td>
</tr>
<tr>
<td>Comorbidities*</td>
<td>-1.32</td>
<td>-2.20</td>
<td>0.0290</td>
<td>-1.65</td>
</tr>
<tr>
<td>Mean Wolf time</td>
<td>-3.75</td>
<td>-5.12</td>
<td>&lt;0.0001</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Note: *Denotes a continuous variable. Binary variables were coded as follows: male = 1, female = 0; concordant = 1, discordant = 0; ischemic = 1, hemorrhagic = 0; white = 1, nonwhite = 0; live with spouse/relative = 1, lives alone/with housekeeper = 0.
††If none of the interaction terms were significant, they were removed from the model and a main effects model was fit.
Discussion
The association of age and gender with all of the SIS domains indicates the powerful influence that these demographic variables have on the quality of life of stroke survivors. Other factors influencing HRQOL across domains were stroke type, concordance, and upper-extremity motor function. Previous studies have also reported that age, gender, disability, and diabetes (as a common comorbidity) negatively influence HRQOL. However, in examining the individual domains of the SIS, it is apparent that demographic and clinical variables have disparate impacts, which has not previously been delineated in the subacute mild-to-moderate stroke population.

HRQOL in the area of overall physical functioning (sub-scales 1, 5, 6, and 7) was significantly influenced by age, race, comorbidities, and upper-extremity function. The last is not surprising, as upper-extremity function is an underlying component of the physical domain scales; additionally, the level of disability has repeatedly been found to correlate with diminished HRQOL in the area of physical functioning. The impact of multiple comorbidities, most commonly high blood pressure (n = 142), diabetes (n = 49), and arthritis (n = 48), might be expected to impact physical function more than other HRQOL areas, as all 3 disorders affect general health and physical function. Finally, the effect of race (white/nonwhite) on HRQOL needs further evaluation, as no other study has reported a differential effect of race on HRQOL outcomes after stroke. The existing knowledge regarding health disparities and the fact that low-income blacks have significantly lower functional recovery during the first year after stroke compared with whites may be a partial explanation for these differences. Blacks with osteoarthritis, which affects physical function, have also reported worse HRQOL. There was a lack of association and little variance explained among many of the clinical characteristics and remaining domains of the SIS with only comorbidities (memory and thinking), stroke type and affected side (communication), age, race, and gender (social participation, emotion) affecting HRQOL in these areas. This lack of association may be attributable to the relatively high function of this sample and the rigorous inclusion criteria, including screening for aphasia and cognition. An alternative explanation may be that the perceptions of stroke survivors about changes in their thinking and emotions may be less accurate than their perceptions about physical limitations. This explanation is consistent with proxy ratings where others have rated stroke survivors HRQOL lower than survivors did.

Stroke type and upper-extremity concordance were differentially associated with communication. The influence of concordance is consistent with the unilateral representation of speech in the left hemisphere such that those with right hemiparesis and right-handedness would be most likely to experience communication difficulties secondary to damage of the left hemisphere. The effect of stroke type may be indicative of the disparity in the number of ischemic versus hemorrhagic strokes (189 versus 27) in this cohort.

The presence of diabetes mellitus has previously been associated with poorer HRQOL scores. The present study supports this finding and suggests that additional comorbidities may be associated specifically with changes not only in physical function but in memory and thinking as well. Mackenzie and Chang also report a decrease in psychological HRQOL with heart disease. Diabetes has previously been reported to affect only physical HRQOL and social participation. Nonetheless, comorbidities of stroke survivors are important contributors to HRQOL and should be included in data collection to gain a greater understanding of potential stroke research outcomes.

The 3-way interactions of race, gender, and age for social participation and emotion both complement and contradict other studies, reflecting the complexity of evaluating the impact of these variables and emphasizing the need to include them in any analysis. In our study, white women reported poorer HRQOL in the area of social participation across ages, which is consistent with findings in other studies; conversely, nonwhite women, primarily black, reported higher initial social participation that decreased with age. This finding was similar to the pattern for white men. Both white males and nonwhite females mirror previous findings for the effects of aging. Nonwhite men reported relatively low participation initially with improved participation with increased age. Others have reported poorer HRQOL for black men with arthritis; however socioeconomic status (SES) was a confounding variable. Lower SES may be related to employment type (white versus blue collar); blue collar workers are less likely to return to work after stroke as are those with less education. The potential confound of returning to work may also explain the better emotional QOL reported by white men and poorer QOL for nonwhite men at younger ages in the present study. These confounding variables of SES and employment may help explain the findings for race but were not evaluated in this study. Consistent with prior reports of decreased HRQOL for women, women, regardless of race, had a stable emotional HRQOL across ages that was poorer than that for white men until after age 70 years. However, it is important that the HRQOL of minorities and women after stroke be further explored.

In summary, it should be noted that the participants in this study were relatively high functioning for the subacute stroke population and had, on average, a high school education; thus, these findings may not generalize to more severely involved stroke survivors nor lower socioeconomic groups. However, our results indicate the need for further examination into the issues that may be related to the HRQOL of stroke survivors. Other areas may need exploration to better explain factors affecting stroke survivor HRQOL. General family functioning and family conflict surrounding stroke recovery have been associated with negative psychological outcomes in caregivers of stroke survivors and may affect stroke survivors as well. Socioeconomic status, return to work, and other support systems not explored in the current study may also offer greater understanding of the effect of stroke on HRQOL. Yet, the findings of this study emphasize the impact of and the need to take demographic and personal characteristics, including age, race, gender, concordance, and comorbidities, into account in the planning of poststroke rehabilitation programs and discharge preparation. Use of the SIS throughout the subacute stage of recovery may facilitate...
a better understanding of individual needs and, thereby, planning for programming during recovery.

**Acknowledgments**

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**References**


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