Impact of Social Support on Outcome in First Stroke

Thomas A. Glass, PhD; David B. Matchar, MD; Michael Belyea, PhD; and John R. Feussner, MD

Background and Purpose: The purpose of this study is to examine the impact of social support on outcome after first stroke in a prospective cohort study. Although modest evidence exists for the importance of several psychosocial factors, studies have failed to use widely recognized measures of outcome and social support, have failed to control for time since onset, and have not used longitudinal techniques.

Methods: Forty-six surviving patients were followed for 6 months after stroke. Recovery was measured using repeated measures of functional status as indicated by the Barthel Index of activities of daily living. Perceived social support was measured at 1, 3, and 6 months after onset. Repeated-measures multivariate analysis of variance was used to analyze changes in functional status.

Results: Significant differences were found across levels of social support in trajectories of functional status \((p=0.002)\). A significant three-way interaction between stroke severity, social support, and outcome was also found \((p=0.012)\). Patients with more severe stroke and the largest amount of social support attained an average Barthel Index that was 68 points (65%) higher than the group reporting the least support.

Conclusions: High levels of social support were associated with faster and more extensive recovery of functional status after stroke. Social support may be an important prognostic factor in recovery from stroke. Socially isolated patients may be at particular risk for poor outcome. (Stroke 1993;24:64-70)

KEY WORDS • prognosis • social support • stroke outcome

Researchers have been increasingly drawn to the study of social relations in explaining various health-related phenomena. Attention has been focused on the ways in which social support affects mortality, disease susceptibility, illness course, treatment compliance, and rehabilitation. Social support has emerged as a complex and multidimensional concept, and measurement instruments and theoretical specifications abound. This research uses the conceptualization advanced by Pliske and Parks, who defined social support as “the sum of the social, emotional and instrumental exchanges with which an individual is involved having the subjective consequence that an individual sees him or herself as an object of continuing value in the eyes of significant others.” This definition emphasizes the patient’s own subjective experience of the supportive nature of social interactions.

A burgeoning literature has begun to document the importance of social support in recovery from a wide range of illness conditions. Recently, social support has been shown to play a significant role in recovery of function in hip fracture at 6 months in both univariate and multivariate tests. One study indicates that subjective assessments of social support have a powerful impact on recovery from major depression. Similar results have been shown among patients recovering from osteoarthritis and cancer. In addition, social support has been shown to be linked with risk of mortality subsequent to illness onset. Ruberman et al have reported a greater than fourfold increase in mortality for socially isolated men with high life stress after myocardial infarction.

A small body of literature has begun to examine the effects of social support on victims of stroke. Most studies have examined the effects of social support resources during recovery. Brocklehurst et al have shown that the majority of stroke survivors (97%) are able to continue living in the community with the assistance of a primary caregiver. Evans and Northwood found a significant relation between adjustment to disability and social support. One study has shown a relation between the rate of progress in stroke rehabilitation and greater family empathy. Social support may also be effective in helping patients to find alternatives to the frequent use of nonproductive defense.
mechanisms such as denial. Finally, Friedland and McColl\textsuperscript{20} have shown that social support from friends, community, and a close personal relation has a protective effect against poor psychosocial outcome.

There is some evidence that the amount or quantity of support provided may be important. Too much support may lead to overprotection and understimulation.\textsuperscript{21,22} Patients living alone may recover more favorably compared with those living in a family context.\textsuperscript{23} In our interviews, several patients voiced complaints about unwanted assistance, smothering attention from relatives, or patronizing attitudes among hospital personnel. There is some evidence that stroke itself may cause a deterioration in the quality of social interactions over time.\textsuperscript{24} Negative network interactions have been shown to be associated with lower morale and greater psychiatric symptoms.\textsuperscript{22} No studies to date have explicitly explored the relative impact of varying amounts of support on outcome.

The purpose of this article is to examine the impact of social support on functional outcome in a sample of first-time stroke survivors. Although there is modest support for the view that meaningful social relations play a role in recovery from stroke, three major shortcomings remain in this literature. First, in no case have longitudinal techniques been used to examine data on stroke rehabilitation. Second, although certain outcome measures have been examined, no study has used repeated observations of a widely recognized measure of functioning as an outcome variable. Finally, no study has examined the effect of different levels or quantities of social support. The project described here overcomes these shortcomings.

**Subjects and Methods**

This research was done in collaboration with a separate study designed to investigate the importance of serum glucose levels on stroke outcome. The sample is composed of an inception cohort of patients who were admitted with a new thromboembolic stroke event between January 1987 and March 1988. Patients were identified from admissions records at three local hospitals (Durham Veterans Affairs Medical Center, Duke University Medical Center, and Durham County General Hospital). Any hospital admission for stroke in Durham County will occur at one of these three hospitals.

To be included in the study, patients who presented with a presumptive diagnosis of stroke had to 1) give informed consent for both the parent study and the social support component, 2) be older than 40 years of age, 3) reside within 100 miles of Duke University, 4) be hospitalized within 24 hours of onset of neurological symptoms, 5) have a measurable deficit on admission, 6) have no preexisting stroke deficit, 7) have a deficit persisting more than 24 hours, and 8) lack any medical condition for which death was likely within 6 months. Eligible patients were assessed by computed tomographic scan to rule out hemorrhagic stroke; patients with hemorrhagic stroke were excluded from the study. In total, 64 patients were screened for inclusion in both studies. Of that group, 11 died or left the study area, four refused to participate in the social support study, and three of the remaining patients failed to return questionnaires despite repeated attempts at follow-up. Complete data were collected on 46 patients.

**Measurement of Key Variables**

Changes in functional status, the main outcome variable, were measured using the Barthel Index (BI) of activities of daily living (ADL) (collected at 5, 30, 90, and 180 days). The BI is a well-documented and often used measure of both mobility and ADL skills.\textsuperscript{25,26} In data from a clinical trial of 167 stroke patients, designed to assess various outcome measures, Wood-Dauphinee et al.\textsuperscript{27} found the BI to be the most efficient and best suited measure of functional status. In addition, research has shown that ADL measures are superior to measures of physical restoration alone.\textsuperscript{23} The BI consists of items that assess ability to perform essential activities such as feeding, bathing, ambulation, and toilet use. Items are scored on an ordinal scale, reflecting degrees of functional independence. Index scores range from 0 to 105. Stroke severity is indicated by level of consciousness (LOC) as defined by Oxbury et al.\textsuperscript{28} The LOC scale was assessed on admission and is coded from 0 to 5 (0=active and alert, 5=unconscious).

The assessments of functional impairment were made by a study nurse or physician's assistant trained in using the BI through review of a videotape plus up to five sessions with a physical therapist experienced with this scale. Only after the investigators and physical therapist were satisfied with the performance of the study nurse or physician's assistant did they proceed with actual patient measurements. The research nurse or physician's assistant obtained BI measurements from patients with ischemic strokes by interview in the hospital and after discharge at the patient's home. Assessments were made within 24 hours of admission and at 5, 30, 90, and 180 days after admission.

Perceived social support was assessed using a self-administered questionnaire given at 1, 3, and 6 months after onset. Based on the Inventory of Socially Supportive Behaviors (ISSB) designed by Barrera,\textsuperscript{29} this instrument seeks to measure the patient's perceptions of the amount of available social support in the previous 4 weeks. The ISSB is ideally suited to our study because it asks behaviorally specific questions in a fixed time period and is therefore less susceptible to measurement error than most of the simple, unidimensional measures used in this literature. A review by Heitzmann and Kaplan\textsuperscript{30} reports that the ISSB has favorable psychometric qualities with test–retest reliability of 0.88 and internal reliability of 0.93 on first admission. This instrument provides three separate subscales for three dimensions of social support argued to be important in the literature: emotional, instrumental, and informational. The three subscales are summed to provide an index of perceived social support. Several of the original items from the ISSB were omitted for use in a population of stroke patients because they were behaviors not possible or relevant to stroke recovery. This approach is advocated by several authors who argue that the sensitivity of social support scales can be optimized by removing items not relevant to the population under study without jeopardizing the properties of the scale.\textsuperscript{31,32}

In most cases, the patient was asked to fill out the questionnaire. In some cases, when language deficits rendered patients unable or unduly burdened by the demands of the protocol, a proxy respondent was
identified. All proxies lived with the patient, and most were spouses. If a proxy respondent was used, he or she remained the respondent across measurement waves. Similarly, if a patient respondent was used, the patient remained the respondent throughout the study. Although the use of proxy respondents is not without controversy, the ISSB was chosen for the behavioral specificity of the items, which require less interpretation of the patient’s evaluation of the adequacy and quality of supportive behaviors; it is therefore ideally suited for use with proxies.

Statistical Analysis

The literature on stroke outcome has suffered from methodological problems, which have resulted in inconsistent findings.33 Chief among these shortcomings has been a general failure to take into account the duration since stroke onset. Our design couples serial measurement of outcome at standard measurement intervals with the use of a statistical procedure ideally suited to the analysis of change. In the following analyses, we used repeated-measures multivariate analysis of variance (MANOVA), or growth curve models, to examine the determinants of change in functional status (ADL) over a 6-month period after first-time stroke. The repeated-measures design is robust with small samples, and it has the advantage of separating variability between subjects from experimental error. This has the effect of making maximum use of the information contained in the data.34 These techniques have recently been used to analyze data on stroke outcome in the Framingham study.35 Hypotheses about how trajectories of rehabilitation differ by levels of support and stroke severity were tested using univariate tests for within-subject effects in a multivariate analysis of repeated measures.34,36 More specifically, we test the hypotheses that after controlling for time since stroke and disease severity, patients with higher levels of social support exhibit a trajectory of change in functional status that has a steeper slope and a higher plateau than patients with lower social support.

Patients were divided into two groups according to level of severity: mild if Oxbury LOC was 0 (conscious and alert) and moderate/severe if LOC was 1 or greater. Patients were then divided at the 30th and 70th percentiles into three levels of social support (low, medium, and high). Using the repeated-measures MANOVA model, the effect of social support on the shape of these trajectories was tested. For each term in the model, the F test for that term is presented (the more conservative Wilks’ test is shown). In repeated-measures designs, because the dependent variable is a linear combination (growth curve) of multiple measures of the same scale, time is included in all terms.

Results

The demographic and clinical characteristics of patients with ischemic stroke are presented in Table 1. Fifty-six percent of the sample was male, and 76% was white. The sample was, on average, over retirement age (mean age, 69 years), and slightly over half were unmarried (52%). In data presented by Oxbury et al.28 the mean severity score (level of consciousness) for 93 stroke patients was 0.77 (on a scale ranging from 0 to 5, where 0 is alert and conscious). In these data the mean value for the full sample was 0.39, suggesting slightly less severe strokes. Average length of hospital stay for all patients was 18 days. The majority of the patients (59%) were admitted to the Duke University Medical Center.

In general, our patients had significant comorbidities, including heart disease and diabetes mellitus. Twenty-three percent of the patients had a history of diabetes mellitus; of these, 46% received oral hypoglycemic
agents, 32% were receiving insulin, 3% were receiving both insulin and oral hypoglycemic agents, and 19% were not receiving drug therapy. The median blood glucose was modestly elevated on admission at 6.9 mmol/l; however, the median glycosylated hemoglobin concentration was within the normal range (6.3%). In addition, 59% of patients had a history of heart disease, usually ischemic heart disease and compensated congestive heart failure. Since patients with risk factors for embolic stroke were excluded from the study, none had severe cardiomyopathy, recent myocardial infarction, or new onset atrial fibrillation.

Descriptive statistics for psychosocial variables are given for the total sample and cross-classified by level of perceived social support in Table 2. Overall, the patient was the primary source of data in both the interview and subsequent follow-up questionnaires in 55% of the cases. Reliability for the three support subscales was acceptable and ranged from $\alpha=0.95$ for emotional support to $\alpha=0.79$ for informational support. Patient and proxy responses are essentially identical in reported levels of social support. Mean values for the sum of the three social support scales range from 43.1 to 76.4.

### Table 2. Outcome, Test, and Control Variables by Quantity of Social Support

<table>
<thead>
<tr>
<th>Level of social support</th>
<th>Total (n=46)</th>
<th>Low (n=8)</th>
<th>Medium (n=24)</th>
<th>High (n=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional status (outcome) (ADL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>60.2</td>
<td>60.0</td>
<td>64.2</td>
<td>53.1</td>
</tr>
<tr>
<td>1 Month</td>
<td>74.7</td>
<td>71.3</td>
<td>75.4</td>
<td>75.8</td>
</tr>
<tr>
<td>3 Months</td>
<td>81.3</td>
<td>71.3</td>
<td>80.6</td>
<td>89.2</td>
</tr>
<tr>
<td>6 Months</td>
<td>80.9</td>
<td>65.0</td>
<td>80.8</td>
<td>91.7</td>
</tr>
<tr>
<td>Perceived social support (ISSB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total perceived support</td>
<td>62.8</td>
<td>43.1</td>
<td>61.4</td>
<td>76.4</td>
</tr>
</tbody>
</table>

Values are mean. ADL, Barthel Index of activities of daily living; ISSB, Inventory of Socially Supportive Behaviors (sum of three subscales: range, 34–82).

Perceived Support Availability: Growth Curve Analysis

Results of repeated-measures MANOVA are presented in Table 3. The main effect of time (term 1) is clearly significant ($p=0.000$), indicating that functional status improves with time since onset. The term for the severity by time interaction is also significant ($p=0.001$), indicating that patients with more severe strokes have significantly poorer trajectories of recovery than those with mild stroke.

The interaction between perceived social support and time is also significant ($p=0.002$), indicating that patients with more social support improve the most over time. This effect captures change by testing whether patients with different levels of support are significantly different using prospectively gathered assessments and controlling for stroke severity and time since onset.

Finally, to test the full multivariate model, the three-way interaction among time, support, and severity was examined. This tests the hypothesis that the effects of support and severity are mutually contingent. This parameter (term 4) is also significant ($p=0.012$), indicating that the benefits of social support are not equal among those with more severe strokes. Further interpretation of this effect will rely on visual inspection of average curves (shown below).

Support Timing: Graphic Analysis

Having established a significant relation among support, severity, and recovery, we now consider the shape of these curves. Figure 1 plots mean levels of ADL at the four measurement points for each level of total support and shows mean growth curves (or trajectories) of functional status for each level of support. This figure reveals substantial variability in the mean trajectories of outcome in stroke, which are in the expected direction. Stroke victims do not differ substantially in functional status before hospital discharge across levels of social support. Mean levels of ADL lie between 53 and 64. However, at 6 months after onset, this figure shows clearly that patients with more social support improve more extensively and more rapidly. The differences

### Table 3. Multiple Analysis of Variance (Growth Curve Analysis) on Trajectories of Recovery in Ischemic Stroke*

<table>
<thead>
<tr>
<th>Term</th>
<th>Source of variation</th>
<th>Exact $F$ (Wilks' test)</th>
<th>Probability value $F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Time</td>
<td>21.12 (0.36)</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>Severity†</td>
<td>7.48 (0.61)</td>
<td>0.001</td>
</tr>
<tr>
<td>3</td>
<td>Support†</td>
<td>3.83 (0.57)</td>
<td>0.002</td>
</tr>
<tr>
<td>4</td>
<td>Severity x support†</td>
<td>2.99 (0.64)</td>
<td>0.012</td>
</tr>
</tbody>
</table>

*In repeated-measures MANOVA, the interactions between time and each variable in the model are analogous to main effects in other models. This is true because in repeated-measures designs, the effect of any variable cannot be divorced from time because time is built into the specification of the dependent variable. Parameter estimates for the main effect without time would be meaningless and uninterpretable.
†To test the robustness of the cut points used to differentiate high, medium, and low support groups, this analysis was redone using ordinary least-squares regression with severity and social support as continuous variables. The results indicate that both parameters are significant, as is the overall model. For ease in interpretation and simplicity, only the MANOVA is presented here.
among the three groups are pronounced. Mean levels of ADL are 27 points higher among patients reporting the highest levels of support compared with those who had the least support. The impact of social support appears to unfold gradually and cumulatively.

Second, the high and medium support groups have upwardly sloping curves, which level out at about 3 months. The slope and height of the high support group are noticeably greater, suggesting that patients receiving the most support have better recovery than others. The high support group improved in functional status more rapidly (a steeper slope) and more extensively (a higher plateau) than those with less support, despite having the lowest baseline ADL. Table 1 also shows that the high support group had, on average, more severe strokes (mean LOC, 0.429). Finally, patients who received the least support improved normally for the first 2 months but were then observed to reverse the course of improvement and decline in functional status.

The significance of the three-way interaction among time, severity, and social support indicates that the effects of social support vary across levels of severity. Figure 2 shows mean trajectories of recovery for patients with mild stroke. The slopes are similar for patients with high and medium support. Contrary to expectation, patients who report moderate amounts of support were higher in functional status at baseline and plateaued higher than the other two groups among those with mild strokes. Patients with mild stroke and low social support declined in functional status over time. Figure 2 suggests that patients with mild stroke account for most of the decline seen in Figure 1 among those with the least support (all strokes).

Figure 3 shows mean trajectories of recovery for patients with moderate to severe stroke. The interaction between severity and social support can be seen clearly in patients with the largest amount of support. Patients with the most support improved the fastest (steepest slope) and continued to improve throughout the course of the data collection. In moderate or severe stroke, patients with moderate and low levels of support improved at about the same level, suggesting that more severely impaired patients may require more support
that is sustained over a longer period. Patients with the least support had higher initial functional status. Again, an inverse U-shaped curve was observed among those patients receiving the least amount of social support.

Discussion
In this study of 46 patients who survived first ischemic stroke, level of perceived social support was found to significantly predict change in functional status. Higher levels of social support were found to be predictive of a more rapid rate of recovery and a greater amount of overall improvement in functioning, even among patients with more severe stroke. These findings extend and strengthen reports that indicate the benefits of social support in recovery from stroke.\textsuperscript{18,19,22,37}

Inadequate social support (social isolation) may be a risk factor for poor outcome in stroke. In our study, patients with the least amount of social support available failed to maintain improvement and appeared (on average) to decline in functional status over time. These patients appeared to recover normally in the first month but reached an early apex, followed by a consistent pattern of decline in functional status. Moreover, among patients receiving more support, continued improvement was observed well after the first 4–6 weeks of recovery. In particular, patients with mild stroke and low social support declined in functional status between 3 and 6 months. Patients with milder strokes may not receive adequate support because families and friends may underestimate their need for support. Paradoxically, patients with milder strokes may be at greater risk for social isolation and less favorable outcome than more severely impaired patients.

The compromised functional status of patients with low social support is sharply contrasted with the surprising picture of patients with more severe stroke coupled with high social support. This group of patients illustrates the complex interactive effects among social support and stroke severity across time. Our data show that patients with high levels of support recover more rapidly and to a greater extent, even when the initial injury is relatively severe. This finding contrasts with research showing that patients with more severe initial injury recover more slowly and to a lesser extent.\textsuperscript{38} The failure to take social support into account may lead to an overly negative prognosis in patients with moderate to severe stroke.

Study Limitations
Our results must be interpreted with caution because of the small sample size. Sample size limitations make it impossible to rule out other possible confounding factors such as comorbidity, race, or age. However, in attempting to assess the possibility of confounding factors, several bivariate relations are reassuring. Although the low support group is slightly older in comparison with the other two groups (aged 72 compared with 68 years), it is unlikely that the rapid improvement in the high support group is a result of the confounding effects of age (see Table 1). As expected, patients receiving high levels of social support were more likely to be married (64% compared with 38% in the low support group).

In addition, differences in the percentages of patients receiving inpatient rehabilitation therapy are quite small (see Table 1). The vast majority of patients (92%) received at least minimal outpatient physical and/or occupational therapy. The intensity of that therapy is impossible to assess.

Finally, one factor that is highly correlated with perceived support is race. Nonwhites reported substantially less social support on average. Although race was not incorporated in these models, regression models using the BI as a continuous variable (not shown) indicate that the effect of social support remains significant after controlling for both age and race. The possibility that other race-linked factors (such as economic status) may partially account for this effect cannot be evaluated.

Premorbid measures of social support were not available. It is impossible to rule out the possibility that more perceived social support is itself a function of either recovery or severity of stroke. Because such measures are never or rarely available, the potential for this source of confounding is impossible to assess. Data from Table 2 comparing the support groups in regard to average level of consciousness suggest that these differences are modest or small. Even if premorbid measurement of social support was shown to weaken the association with outcome, such a possibility does not render the association between support and return of functional capacity less noteworthy and potentially clinically important.

Although our small sample size produced a clinically and statistically significant difference between levels of support, the sample may not be representative of all strokes. In particular, this sample excluded patients who did not receive medical attention within 24 hours. Those patients receiving prompt medical attention may have greater social support resources, because most patients must depend on family and friends for transportation to the hospital during the acute phase of the illness. Those patients excluded on this criterion are likely to be disproportionately low in social support.

The clinical significance of these findings is difficult to assess. Granger et al\textsuperscript{26} argue that a BI score of 61 or greater constitutes an important ceiling separating patients who are independent on basic ADL from those who are not. Among patients with moderate or severe stroke (see Figure 3), only those with high support attain functional independence, whereas those with low or medium support remain well below the critical value of 61. Social support may play an especially important role in bolstering the efficacy of rehabilitation treatment, although a direct test of this hypothesis is beyond the scope of these data.

Stroke recovery is a process that may be described as time dependent inasmuch as the rate of change in function varies with time from the moment of onset. Failure to take this aspect of stroke rehabilitation into account has clouded research on the effectiveness of early rehabilitation therapy. In summarizing the literature, Dombowy et al\textsuperscript{39} argue that "spontaneous recovery" has made it difficult to determine the efficacy of therapeutic interventions. Similar confusion has hindered attempts to capture the impact of psychosocial factors such as social support. These analyses seem to indicate that researchers studying predictors of outcome in stroke are remiss in ignoring the dynamic aspects of recovery. Longitudinal designs and a longer period of
observation may be required to adequately assess prognostic factors in stroke recovery.

In summary, through the use of longitudinal methods a sharper image of social support as a crucial feature of the process of rehabilitation begins to form. We find evidence in these data that higher levels of social support predict more favorable outcomes in first stroke. This study provides evidence for including social support as a risk factor in prognosis and clinical management. Efforts should be made to target family members and to potentiate their effectiveness as support providers through education and specialized training and assistance. Further research is needed to clarify the types of support that are most essential in buffering the stresses and strains associated with ischemic stroke as well as the most effective sources of that support.

Acknowledgments
The authors wish to thank Dr. Norma Gavin, Dr. George L. Maddox, and Dr. Fred Wolinsky for comments on earlier drafts.

References

Impact of social support on outcome in first stroke.
T A Glass, D B Matchar, M Belyea and J R Feussner

Stroke. 1993;24:64-70
doi: 10.1161/01.STR.24.1.64

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/24/1/64

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Stroke can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Stroke is online at:
http://stroke.ahajournals.org/subscriptions/