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The Psychosocial Outcomes of Stroke: A Longitudinal Study of Depression Risk

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Depression is a frequently cited outcome of stroke. There is much controversy and disagreement in the literature on post-stroke depression about both the prevalence of this disorder and the predictors of occurrence and severity. Estimates on the prevalence of post-stroke depression range from 5% to 68% (Spencer, 1992). In comparison, the prevalence of a depressive disorder in the normal elderly population ranges from .5% to 3.1%, while the prevalence of depressive symptoms is approximately 15% (Blazer, 1989). Analysis of the post-stroke depression prevalence literature reveals several methodological decisions that can be linked to higher rates of prevalence. Generally, studies with the highest prevalence rates in the past decade were characterized by sampling subjects from only one hospital or rehabilitation center and by taking post-stroke measurements of depression at or before 3 months postonset (see Spencer, 1992, for details).

The predictors of depression after stroke generally fall into three categories: psychosocial (e.g., social functioning, social network/support), physical (e.g., activities of daily living), and neurologic (e.g., lesion location, presence of aphasia, intellectual impairment). The literature reports opposing findings about the importance of each of these factors in modulating depression (Spencer, 1992). A disproportionate amount of attention has been given to the neurologic factor of lesion site. There is currently much disagreement between those studies finding inter- and intrahemispheric differences with respect to depression (Parikh, Lipsey, Robinson, & Price, 1988; Robinson, Kubos, Starr, Rao, & Price, 1984; Sinyor et al., 1986; Starkstein, Robinson, & Price, 1987; Stern & Bachman, 1991) and those reporting no influence of lesion

location (Damecour & Caplan, 1991; Ebrahim, Barer, & Nouri, 1987; Feibel & Springer, 1982; Gordon et al., 1991; House, Dennis, Warlow, Hawton, & Molyneux, 1990). Those studies that do find differences tend to show that left hemisphere lesions, especially those closer to the frontal pole, are associated with greater depression (Parikh et al., 1988; Robinson, Starr, Kubos, & Price, 1983; Sinyor et al., 1986).

In general, the combined influence of psychosocial, physical, and neurologic factors on the presence and severity of post-stroke depression is not well known. Methodologic factors that may cloud interpretations include a lack of conceptual models guiding data collection or analysis, inadequate sampling, lack of exclusion criteria, and outcome measures that in some cases are subjective, poorly validated, and/or inappropriate for the older stroke population (Spencer, 1992).

The study reported here was designed to meet some of the challenges posed by research on depression and psychosocial adjustment after stroke. A longitudinal study was conducted with a large sample of patients with documented first strokes. The patients came from several hospitals and were selected according to strict inclusion criteria. Multiple measures with good psychometric properties, appropriate for elderly respondents, were used to sample a broad range of variables considered important for understanding the nature and prevalence of post-stroke depression. The primary goal of this study was to identify the first-occurrence stroke patients most likely to face adjustment problems following their strokes. This information has important implications for appropriate patient referral, counseling, and follow-up. Results of support person analyses are reported elsewhere (Schulz, Tompkins, & Rau, 1988; Tompkins, Schulz, & Rau, 1988). The analyses in this paper focus on prevalence rates, and factors predicting depressive symptoms in the patients themselves, at two points in time after an initial stroke.

METHOD

Survey Instrument

The survey instrument required about 90 minutes to complete, and was extensively pretested with elderly subjects, stroke patients, and primary support persons before data collection began (see Schulz et al., 1988, for a model guiding data collection). Predictor variables sampled demographics and health information, stroke-related variables, marital factors, and social network/social support characteris-

tics (see Table 1 and Schulz et al., 1988, for more detail). The primary outcome measure of psychological well-being was a 28-item version of the *Center for Epidemiologic Studies–Depression Scale* (CES-D) (Radloff, 1977), which provides a cutoff score to identify respondents at risk for significant clinical depression. This scale avoids the problem of placing too much emphasis on somatic items that often characterize nondepressed older persons. Radloff (1977) reported that its internal consistency, test–retest reliability, and validity are high and that correlations between the CES-D and age, social class, and gender are minimal. The longer scale yields scores from 0 to 84, with higher scores reflecting greater depressive symptomatology.

Subjects

Subjects were 162 stroke patient–primary support person dyads recruited from nine hospitals in two metropolitan areas. Among the

Table 1. Selected Measures of Predictor and Outcome Variables

Predictor variables

Demographics and health information
- Age, sex, income
- Number of prescription medications
- Subjective health rating

Stroke-related information
- Site of lesion
- Objective severity (Barthel Index, Mahoney & Barthel, 1965)
- Perceived severity
- Concern about future care

Social network/social support information
- Number in social network
- Density and degree of network connections
- Average number of contacts with network members
- Satisfaction with social contacts
- Number providing instrumental, affective, and informational support
- Perceived reciprocity of social support
- Negative aspects of social networks

Outcome measures

Center for Epidemiologic Studies–Depression Scale (CES-D) (Radloff, 1977)

Life Orientation Test (LOT—measure of optimism) (Scheier & Carver, 1985)

Index of Psychological Well-Being (IPWB) (Berkman, 1971)

study inclusion criteria were the following: medical documentation of completed cerebrovascular accident, no medically documented previous stroke, no prior psychiatric history, no evidence of co-existing terminal illness or progressive medical condition, and prestroke community dwelling status. Thirty-seven percent (n = 60) of the stroke patients were judged to be too cognitively or communicatively disabled to answer questions for themselves (65% with left hemisphere damage [LHD] and 35% with right hemisphere damage [RHD]). These patients did not differ from the other stroke patients in demographic variables (Spencer, 1992). One hundred forty of the original 162 patients were available for the second interview; 62% of these responded for themselves. Data were analyzed only for the subset of patients (n = 87) who responded for themselves. Selected descriptive data for this self-report sample are presented in Table 2.

Interview Procedures

An initial interview occurred from 3 to 10 weeks after the stroke (Time 1), and the second 6 months later (Time 2). A third interview was conducted 6 months after the second, but it is not considered here. Interviews were carried out by four clinicians who had extensive experience in clinical interviewing and counseling. Most interviews were conducted in the subjects' homes. Interview questions that required subjects to choose from several predetermined answers were supplemented with cue cards containing possible responses. The interview was structured and given in an invariant order.

RESULTS

Before considering major results, we assessed two indicators to ascertain whether data from patients with different lesion sites could be validly combined for analysis. First, one-way analysis of variance was used to compare CES-D scores across lesion groups. Results were significant for Time 1 [$F(2, 79) = 3.81$, $p < .05$], but not for Time 2 [$F(2, 67) = 0.68$, $p > .05$]. Analysis of the significant differences at Time 1 indicated that patients with RHD and LHD were not differentiated by depressive symptoms (M = 19.7 and 20.2, respectively), but that subjects with brainstem strokes had significantly lower scores (M = 11.1). For the second indicator, we looked at the extent to which patients accurately judged their physical deficits. Stroke patient ratings on the Barthel Index (a measure of physical disability; Mahoney

Table 2. Descriptive Statistics for Selected Predictor and Outcome Variables

Predictor Variable	*Median*[a]	SD	*Possible Values*
Demographics and Health Information			
Age			
Time 1	(*M*) 66.7	10.8	—
Sex	49% male	—	—
Income (in thousands)			
Time 1	$15–20	—	—
No. prescription medications			
Time 1	(*M*) 2.2	2.2	—
Time 2	(*M*) 4.2	3.4	—
Subjective health			
Time 1	2.5	1.1	1 = excellent
Time 2	3.0	1.0	5 = poor
Stroke-Related Information			
Site of lesion			
Time 1	44% left hem. 43% right hem. 11% brainstem	—	—
Objective severity (Barthel Index)			
Time 1	(*M*) 90.4	13.5	0 = dependence
Time 2	(*M*) 93.9	10.5	100 = independence
Perceived severity			
Time 1	3.0	0.9	1 = no problems
Time 2	2.0	1.1	5 = very severe problems
Concern about future care			
Time 1	1.0	1.6	1 = very unconcerned
Time 2	1.0	1.6	5 = very concerned
Social Network/Social Support Information			
Density of network connections			
Time 1	(*M*) 85.4	19.7	100 = maximum
Time 2	(*M*) 82.2	19.2	
Degree of network connections			
Time 1	(*M*) 5.5	2.3	9 = maximum
Time 2	(*M*) 5.7	2.2	

(Continued)

Table 2. (continued)

Predictor Variable	*Median*[a]	SD	*Possible Values*
Satisfaction with social contacts			
Amount			
Time 1	5.0	.9	1 = very dissatisfied
Time 2	5.0	.9	5 = very satisfied
Quality			
Time 1	5.0	.7	1 = very dissatisfied
Time 2	5.0	.7	5 = very satisfied
Outcome Measures			
Depressive symptoms (CES-D)			
Time 1	(*M*) 18.5	10.9	84 = maximum
Time 2	(*M*) 17.8	12.1	23 = cutoff for depression risk (extrapolated from 20-item version[b])
Optimism (LOT)			
Time 1	(*M*) 22.1	5.1	32 = maximum
Time 2	(*M*) 21.4	5.3	
Positive well-being (IPWB)			
Time 1	(*M*) 4.7	2.3	9 = maximum
Time 2	(*M*) 3.8	2.4	
Negative well-being (IPWB)			
Time 1	(*M*) 4.0	3.0	15 = maximum
Time 2	(*M*) 3.6	3.0	

Note: Data describe subjects who participated in *both* interviews (N = 87). CES-D = *Center for Epidemiologic Studies–Depression Scale* (Radloff, 1977); LOT = *Life Orientation Test* (Scheier & Carver, 1985); IPWB = *Index of Psychological Well-Being* (Berkman, 1971).

[a]All are median values unless indicated as mean (*M*) or percentage. [b]Original cutoff = 16.

& Barthel, 1965) were compared with judgments given by their support persons, and *t*-tests were performed to compare discrepancy scores for LHD and RHD patients. There was no difference between groups in the discrepancy scores at either Time 1 or Time 2. Both of these indicators suggested that LHD and RHD patients' scores could be validly combined for the following analyses. Subjects with brainstem strokes differed from cortical stroke patients only at Time 1; thus, we kept them in the overall group to maximize the sample size.

Thirty-three percent of stroke patients at Time 1 and 25% of stroke patients at Time 2 exceeded the CES-D cutoff for depression risk. A total of 48% of the stroke patients had depressive symptoms exceeding the CES-D cutoff at one time or the other.[1] Although group depression levels did not change significantly from Time 1 to Time 2, there was considerable individual variation. Sixty percent of stroke patients who were at risk for depression at Time 1 were no longer at risk at Time 2. In addition, 22% of patients who were not at risk at Time 1 were found to be at risk 6 months later.

Hierarchical multiple linear regression analyses were carried out to examine the combined effects of several variables on the patients' levels of depression at the two measurement points. Three control variables (age, income, and number of prescription medications), known or assumed to be important from past literature as predictors of well-being, were entered in the first step of each analysis. Surprisingly, these control variables did not contribute significantly to any of the regression analyses. Predictors for the second analysis step were chosen using both theoretical and statistical criteria. Individual variables from each category of predictors were more likely to be chosen for entry if they had higher univariate correlations with depression, and if they had sufficient variance in scores.

Table 3 shows the regression of Time 1 depression scores on Time 1 variables. When added to the control variables, concern about future care, perceived severity, and dispositional optimism accounted for 32% of the variance in stroke patient depression [$F(6, 62) = 4.94$]. Regression predicting Time 2 depression scores from Time 2 variables is reported in Table 4. Satisfaction with amount of social contact, scores on the Barthel Index, and concern about future care, when added to the control variables, accounted for 34% of the variance [$F(6, 61) = 5.26$]. The regression analysis predicting Time 2 depression levels from Time 1 variables (Table 5) accounted for 32% of the variance in Time 2 scores [$F(6, 65) = 5.19$]. Time 1 depression level added a substantial 25% to the prediction of Time 2 depression scores. The influence of Time 1 depression was so powerful that no other potential predictors added more than 2% to the overall variance explained.

Because overall regression analyses did not reveal powerful predictors, additional analyses were performed on subgroups of stroke patients reflecting the extremes of the depression data: one in which

1. The percentage of patients at risk for depression at Time 2 does not differ depending on the version of the CES-D used (25% with the 28-item scale vs. 27% with the 20-item scale). Time 1 variables could not be located to test this conclusion for the first measurement point.

Table 3. Multiple Linear Regression of Time 1 Depression Scores on Selected Time 1 Predictor Variables (N = 69)

Predictor Variable	R^2 *Total/R^2 Adj*	R^2 *Change*	β	t	p
Block 1	.03/−.01	.03			
Income			.15	1.21	.23
No. prescription medications			.23	2.02	.05
Age			.13	1.13	.26
Block 2	.32/.26	.29			
Concern about future care			.22	1.92	.06
Perceived severity			.25	2.24	.03
Optimism			−.32	−2.71	<.01

Note: R^2 adj = Adjusted R^2, an estimate of cross-validation.

Table 4. Multiple Linear Regression of Time 2 Depression Scores on Selected Time 2 Predictor Variables (N = 68)

Predictor Variable	R^2 *Total/R^2 Adj*	R^2 *Change*	β	t	p
Block 1	.06/.01	.06			
Income			−.01	−.11	.91
No. prescription medications			.23	2.05	.04
Age			−.15	−1.37	.18
Block 2	.34/.28	.28			
Satisfaction with amount of social contact			−.24	−2.25	.03
Barthel Index			−.44	−4.20	<.01
Concern about future care			.19	1.69	.10

Note: R^2 adj = Adjusted R^2, an estimate of cross-validation.

subjects exceeded the cutoff for depression risk at both measurement points (N = 9), and the other in which subjects were below the cutoff at both measurement points (N = 40). Mann–Whitney U tests indicated that the subgroup at risk for depression at both measurement points were distinguished from the subgroup never at risk for depression by several variables. Given the multiple analyses run on these data, we chose to interpret only those reaching the conservative significance level of .01. Generally, those at risk for depression were more impaired on the Barthel Index, were less optimistic, perceived their impairments as more severe, were more concerned about another stroke, and were

Table 5. Multiple Linear Regression of Time 2 Depression Scores on Selected Time 1 Predictor Variables (N = 73)

Predictor Variable	R^2 *Total/*R^2 *Adj*	R^2 *Change*	β	t	p
Block 1	.05/.01	.05			
Income			−.01	−.87	.93
No. prescription medications			.23	.89	.06
Age			−.05	−1.15	.67
Block 2					
Time 1 depression	.30/.27	.25	.45	3.75	<.001
Block 3	.32/.26	.02			
Perceived severity			.09	.79	.43
Optimism			−.10	−.86	.39

Note: R^2 adj = Adjusted R^2, an estimate of cross-validation.

less satisfied with the amount of social contact they had with others at Time 2 (see Table 6).

DISCUSSION

Mean levels of depressive symptoms for this stroke patient sample were substantially higher than extrapolated population means for similarly aged individuals. This contrast is heightened by the fact that 48% of our sample was at risk for significant depression at either or both measurement points.

It is extremely difficult to make valid cross-study comparisons given substantial differences in theoretical and methodological foundations between studies. However, rudimentary comparisons of prevalence were made with the 11 studies that used instruments designed to quantify depressive symptoms after stroke (see Spencer, 1992, for details). Generally speaking, the prevalence of depressive symptoms found in this study is lower than that reported for many past studies. We considered five possible reasons for this discrepancy. First, our subjects were recruited from nine different hospitals and two different geographic regions, whereas many studies sampled patients from one hospital or rehabilitation center. The latter strategy may result in socioeconomic or severity biases in patients chosen for study. Second, our study employed strict inclusion–exclusion criteria, which may have minimized some of the confounds that have influenced sample composition in prior studies. Third, our patients had experienced relatively

Table 6. Summary Data for Two Subgroups of Stroke Patients

	Not At Risk for Depression (N = 40)		*At Risk for Depression at Both Times (N = 9)*		
Variable	*Median*	SD	*Median*	SD	p <
Barthel Index					
Time 1	100	12.56	85	6.01	.03
Time 2	100	5.93	80	14.67	.01
Level of optimism					
Time 1	24	3.99	17	6.02	.003
Time 2	24	4.53	16	6.27	.002
Perceived severity					
Time 1	2	.84	3	.88	.004
Time 2	2	.95	3	1.17	NS
Concern about another stroke					
Time 1	4	1.46	4	1.45	NS
Time 2	4	1.47	5	1.30	.01
Satisfied with amount of social contact					
Time 1	5	.65	4	.97	NS
Time 2	5	.75	4	.88	.002
Age	64 yrs.	9.06	72 yrs.	12.58	NS
Income (in thousands)	$20–25	—	$20–25	—	NS
Site of lesion[a]	Left hem. = 37% Right hem. = 49% Brainstem = 11%		Left hem. = 50% Right hem. = 50%		NS
Sex[a]	79% female		78% female		NS
Hospital speech therapy[a]	46% yes		89% yes		.02
Post hospital speech therapy[a]	21% yes		33% yes		NS
Subjective health	3(= good)	1.11	3(= good)	1.12	NS
No. who make life more difficult					
Time 1	.10	.31	.11	.33	NS
Time 2	.13	.41	.44	.73	NS
No. who help less than expected					
Time 1	.13	.34	.78	1.3	NS
Time 2	.05	.22	.33	1.0	NS

Note: Analysis based on Mann–Whitney U—Wilcoxon Rank Sum W Test unless otherwise indicated. NS = nonsignificant.
[a]Chi-square analysis.

mild strokes. Average scores on the Barthel Index indicated that the patients were nearly independent in basic physical activities of daily living. Furthermore, those patients most impaired in the cognitive/communicative domain did not contribute to these estimates of depression risk, as they were judged to be incapable of responding for themselves. Fourth, including subjects with brainstem lesions may appear to have decreased overall depression levels in our study; however, the influence of these subjects does not appear to be great because there were few of them in the sample, and overall depression scores did not change much when their data were removed from consideration. Finally, it is possible that our data were influenced by including patients who were receiving treatment for depression, whether pharmacological or psychological, or taking medications with side effects consistent with depressive symptomatology. This could potentially mask depression risk in a number of patients. General information on the types of medications taken by patients was obtained during the interview, but this information was incomplete. We examined a subset of 35 cases, and one patient did appear to be taking antidepressant medications. However, the failure to identify and exclude patients receiving any form of treatment for depression appears to be a confound in many past studies of post-stroke depression as well, and should be controlled in future research.

Although this study was not designed to determine the influence of lesion location on depressive symptoms, a general comparison was made between LHD and RHD patients. There were no significant differences between these two groups on the CES-D, unlike prior literature which often reports greater prevalence of depression in LHD patients (Ebrahim et al., 1987; Finklestein et al., 1982; Robinson & Price, 1982). One possible reason that we did not find higher depression rates for LHD patients had to do with the nature of subjects whose strokes were considered too severe for the patients to respond for themselves. Interviewers for this study made subjective decisions about whom to interview. Patients with LHD were excluded primarily for severe communication problems; the majority of patients who were excluded (65%) had LHD. If these patients had been able to participate in the study, depressive symptoms might have been higher in the LHD than in the RHD group.

Patients with RHD were ruled out for reasons that we cannot quantify entirely after the fact, but it is likely that many exhibited anosognosia and denial. If other studies included RHD patients who denied their depressive symptoms, differences between LHD and RHD subjects' depression rates may have been partly an artifact of a minimization bias in the RHD groups' scores. We examined the potential influence of anosognosia or denial by assessing the discrepancy between patients'

and support persons' judgments of physical activities of daily living. There was only one patient with RHD who had an especially large discrepancy between self-rated and support person–rated functional ability on the Barthel Index, which we considered a potential indicator of anosognosia; however, when we recalculated the group's CES-D score with that one score removed, the result was not appreciably different.

With respect to predictors of depression risk, the overall picture emerging from these results is that the psychological well-being of stroke patients in the acute adjustment phase is related to aspects of the stroke (particularly its severity) and to dispositional optimism, and that demographic factors do not attenuate these relationships. By Time 2, social network variables come into play for predicting patient well-being, while demographics continue to lack significant influence. The emergence of satisfaction with social contacts is interesting, and similar to findings for primary support persons (Schulz et al., 1988). Social network/social support functioning requires closer study, with assessment of changes in qualitative and quantitative aspects over time, and their relation to depressive symptoms. Somewhat surprisingly, the control variables (age, objective health, and income) were not related to depression risk at either measurement point. This could be related to the traumatic nature of a first-occurrence stroke, where immediate concerns regarding stroke severity and questions of recovery are shared regardless of age, income, and other life situation variables. Over a longer period of time, when a family's situation stabilizes, the control variables possibly become more important.

Finally, using initial screening information to predict future depression levels, Time 1 scores were the only contributing factor. However, our data on individual variation suggest that long-term monitoring of psychological adjustment to stroke is important; a substantial subset of patients with few depressive symptoms at Time 1 had moved into the "at-risk" category 6 months later.

Analyses comparing the two extreme groups of stroke patients converge on the results of the multiple regression analyses. Namely, patients at risk for depression at both points in time had more severe strokes, were less optimistic, and were less satisfied with the amount of social contact they had with others. A particularly interesting fact is that negative aspects of social network (e.g., people who did not help as much as expected) did not distinguish the subgroup at continuing risk for depression from the subgroup never at risk for depression. Similarly, negative well-being scores did not distinguish the two subgroups. These observations suggest that depressed mood did not have a blanket effect on patients' self-report responses.

Two limitations of the present study deserve further comment. First, the findings are valid only for those patients who could respond for

themselves. It is also important to be able to measure depression risk in patients with more severe strokes, although this remains a challenging methodological issue (see, e.g., Gordon et al., 1991). Second, future research should address predictors of depression risk separately for LHD and RHD adults. Prevalence rates in our study were similar for the two groups, but predictive factors may differ, particularly when more specifically focused cognitive and communicative variables are examined (e.g., severity and nature of aphasic deficits; extent of neglect and perceptual impairments).

In closing, for numerous reasons, it is important to address depressive symptoms in both stroke patients and their caregivers. First, depression is a significant barrier to rehabilitation (Chalmers, 1990; Reynolds, 1992). To provide patients with the maximum opportunity for recovery and therapeutic gains, there needs to be an increased awareness of depressive symptoms (Swindell & Hammons, 1991). Second, depression is an important outcome in its own right; any person suffering from a mental illness unquestionably deserves treatment. Third, the consequences of unrecognized and untreated depression include increased use of health care services and longer hospital stays (Reynolds, 1992). Fourth, depression increases morbidity and mortality from medical illness and from suicide (Reynolds, 1992). Finally, the quality of life of patient and of caregiver may be dramatically altered by the manifestations of depression.

As professionals who regularly work with stroke patients, speech–language pathologists are able to contribute in several ways to the identification and treatment of patients at risk for depression. First, speech–language pathologists can administer a screening tool for depression risk, such as the CES-D, to all patients and possibly to their primary support persons. Those patients with scores indicating potential risk for depression should be referred to the appropriate professional. Second, speech–language pathologists may be able to help identify the nature of the risk factors, such as dissatisfaction with amount of social contacts, and then cooperate with other interdisciplinary team members in addressing these factors through counseling and other forms of intervention. Third, speech–language pathologists can participate in the education of the patient and family about depression and its many forms of treatment. Finally, because they frequently maintain extended contact with their patients, these clinicians could regularly monitor patients for compliance and symptom change, and be aware of developing side effects or medical conditions that may complicate antidepressant treatment (Reynolds, 1992).

Post-stroke depression is a serious disorder that is often ignored or overlooked. It has been estimated that medical doctors may miss depression in elderly persons as much as 60% of the time (Pennsylvania Department of Aging, 1992). Without adequate recognition and treat-

ment, depression has been found to retard recovery from cognitive and physical impairments and, more importantly, it may dramatically affect the quality of life for patients and those around them. It is therefore essential to determine the predictors of depression risk and to screen for depression in post-stroke patients. Without early diagnosis and treatment, there is little hope of preventing or reducing the impact of post-stroke depression.

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