

How strong is the relationship between functional status and quality of life among persons with stroke?

Gregory P. Samsa, PhD; David B. Matchar, MD

Center for Clinical Health Policy Research, Department of Biostatistics and Bioinformatics, and Department of Medicine, Duke University, Department of Veterans Affairs Medical Center, Durham, NC

Abstract—The quantitative relationship between functional status and self-reported quality of life is relatively unexamined. As part of the 1-, 6-, and 12-month telephone follow-up of consecutive patients in an observational study of patients with stroke, we found that while higher functional status was associated with better quality of life, this relationship was relatively weak (Spearman correlation <0.25). Patients with similar levels of disability reported quite different qualities of life. Any improvement in quality of life over time was modest at best. Mean utilities for patients with minor stroke were near 0.80, while those for patients with major stroke were near 0.60, the latter figure exceeding previous reports. Quality of life with major stroke may not necessarily be as low as that reported before such a stroke occurs. Quality of life after stroke is heterogeneous and depends on more than just level of physical function.

Key words: functional status, quality of life, stroke, time trade-off.

INTRODUCTION

Among adults, stroke is the third leading cause of death and the most common cause of disability [1]. The recovery of function after stroke has been well studied [2]. For example, most recovery of physical function usually occurs during the first 3 months after stroke, with the majority of the gains during this 3-month period often occurring within the first 30 days. Significant literature also exists regarding quality of life (QOL) after stroke [3–4].

Relatively less well examined among persons with stroke is the relationship between functional status and QOL. While it is self-evidently true that on average, the higher the functional status, the better the self-reported QOL, some additional questions remain. First, recognizing that many applications such as decision and cost-effectiveness models require a precise quantitative specification of QOL, what is the quantitative relationship between functional status and QOL? Second, how much heterogeneity in the relationship between functional status and QOL exists from patient to patient? Finally, recognizing that the level of function of a person who has suffered a stroke might change over time (e.g., because of successful accommodation to disability, because of the loss of hope for greater recovery), does this relationship between functional status and QOL change over time?

Abbreviations: BI = Barthel Index, DS = direct scale, QOL = quality of life, TTO = time trade-off, VASt = Department of Veterans Affairs Acute Stroke.

This material was based on work supported in part by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service, through Program 824 funds and Service-Directed Research Project grant SDR 93-003.

Address all correspondence to Gregory P. Samsa, PhD; Duke Center for Clinical Health Policy Research, Suite 220, Wachovia Building, 2200 W. Main St., Durham NC 27705; 919-286-2996, fax: 919-286-5601; email: samsa001@mc.duke.edu.

One of the goals of the Department of Veterans Affairs Acute Stroke (VASt) study was to collect data regarding these questions.

METHODS

The VASt is described in detail elsewhere [5]. Briefly, the goal was to recruit all patients at eight VA Medical Centers presenting within 7 days of their stroke. The variables of interest in the current analysis were obtained by telephone interview approximately 1, 6, and 12 months after the stroke. These variables include the Barthel Index (BI), a measure of basic activities of daily living [2]. The BI includes questions about 10 tasks, such as walking and dressing, and most questions are scored as 0 for fully dependent, 5 for partially independent, and 10 for fully independent. For the present purposes, the BI was categorized into independent (95–100), partially independent (65–90), and dependent (0–60).

Quality of life was measured with the time trade-off (TTO) and a direct scale (DS). The TTO asked patients to report an equilibrium value between 10 years in their present health state and fewer years of perfect health. In particular, patients were first asked whether they preferred 10 years of life in their present health state or 10 years of life in perfect health. If these options were equally preferable, then no further questions were asked. Otherwise, patients were asked to compare 10 years of life in their present health state with 9 years in perfect health, 10 years of life in their present health state with 5 years in perfect health, 10 years of life in their present health state with 1 year in perfect health, and so forth. The number of years of perfect health that was equally preferable to 10 years in their present health state is the “equilibrium” value of the TTO above. The DS asked patients to rate their current health on a scale of 0–100. These initial measurements were placed on a 0–1 scale (for the TTO, with 0 corresponding to a state no better than death and 1 corresponding to perfect health) by dividing by 10 and 100, respectively.

At each time point, the primary analysis was limited to patients having data on all three of the measures, BI, TTO, and DS. The statistical presentation summarizes the distribution of the QOL measures (e.g., mean, standard deviation) according to the grouped values of BI, and otherwise correlates functional status and QOL. Considerable literature already exists comparing QOL measures;

accordingly, the analysis focuses on comparisons between BI versus TTO and BI versus DS rather than TTO versus DS.

The study protocol was supervised by the institutional review board at the coordinating center, and also reviewed by the institutional review boards at the participating sites.

RESULTS

A total of 1,073 patients were identified. Complete functional status and QOL data were available on 329, 276, and 199 patients at 1, 6, and 12 months, respectively. Patients with complete data had, on average, better functional status than those who did not. For example, at month 1 the mean BI for the 329 patients with complete data on BI, TTO, and DS was 87.0, whereas the mean BI for the remaining 322 patients with BI measurements was 60.5. A similar pattern was observed at the other two time points (data not shown). Thus, the analyzed patients include a disproportionately large number of those having high functional status.

A noteworthy degree of heterogeneity in QOL was reported, even among patients with similar levels of functional status. **Table 1** presents the 1-month results, which were similar to those at the other two periods (data not shown). As an example of the heterogeneity in self-reported QOL, 43 percent of patients with BI in the dependent range reported a TTO of 0.8 or above, while 7 percent of patients with BI in the independent range reported a TTO of 0.19 or below. The correlation between BI and TTO was positive but modest (Spearman correlation = 0.24), as was the correlation between the BI and the DS (Spearman correlation = 0.21).

Table 1.
Self-reported quality of life grouped by functional status: 1 month poststroke.

BI Group	TTO 0–0.19	TTO 0.2–0.39	TTO 0.4–0.59	TTO 0.6–0.79	TTO 0.8–1.0
0–60 (n = 37)	8 (21.6%)	2 (5.4%)	6 (16.2%)	5 (13.5%)	16 (43.2%)
65–90 (n = 119)	14 (11.8%)	3 (2.5%)	9 (7.6%)	24 (20.2%)	69 (58.0%)
95–100 (n = 173)	12 (6.9%)	4 (2.3%)	12 (6.9%)	34 (19.6%)	111 (64.2%)
	DS 0.8–1.0	DS 0–0.19	DS 0.2–0.39	DS 0.4–0.59	DS 0.6–0.79
0–60	2 (5.4%)	4 (10.8%)	18 (48.6%)	8 (21.6%)	5 (13.5%)
65–90	6 (5.0%)	15 (12.6%)	41 (34.4%)	41 (34.4%)	16 (13.4%)
95–100	7 (4.0%)	11 (6.4%)	45 (26.0%)	70 (40.5%)	40 (23.1%)

Table 2 illustrates the relationship between functional status and mean QOL. At each time point, better functional status was associated with better mean QOL. This pattern was observed for both the TTO and the DS; this latter measure tended to provide somewhat lower absolute estimates of QOL.

The relationship between the BI and the TTO was qualitatively similar at 1, 6, and 12 months. For example, for patients with the highest functional status, the mean TTO was 0.79, 0.80, and 0.80 at 1, 6, and 12 months, respectively. The same comparison for the DS indicates at most a modest increase over time, the mean DS values in question being 0.63, 0.68, and 0.71.

DISCUSSION

Our first goal was to examine the quantitative relationship between functional status and QOL. As expected, we found that, at the level of the group, higher functional status was associated with better self-reported QOL. The relationship was relatively weak, however, as the average QOL reported by persons with low functional status was noticeably high.

Our second goal was to assess the heterogeneity in QOL among patients with similar functional status. Patients with similar functional status reported quite different QOLs. This is consistent with the clinical observation that while disabling conditions can be devastating for some patients, others are able to adjust quite successfully.

Table 2.

Mean (standard deviation) of TTO, DS, and BI grouped by functional status at 1, 6, and 12 months poststroke.

BI Group	TTO	DS	BI
1 Month			
0–60 (<i>n</i> = 37)	0.58 (0.35)	0.53 (0.21)	48.5 (10.5)
65–90 (<i>n</i> = 119)	0.72 (0.30)	0.55 (0.20)	81.8 (8.3)
95–100 (<i>n</i> = 173)	0.79 (0.26)	0.63 (0.22)	98.7 (2.2)
6 Months			
0–60 (<i>n</i> = 9)	0.57 (0.35)	0.56 (0.25)	47.2 (10.0)
65–90 (<i>n</i> = 91)	0.74 (0.31)	0.60 (0.16)	82.7 (7.2)
95–100 (<i>n</i> = 176)	0.80 (0.24)	0.68 (0.19)	99.2 (1.9)
12 Months			
0–60 (<i>n</i> = 11)	0.69 (0.34)	0.60 (0.14)	47.3 (11.5)
65–90 (<i>n</i> = 55)	0.69 (0.34)	0.61 (0.16)	82.5 (7.8)
95–100 (<i>n</i> = 133)	0.80 (0.25)	0.71 (0.17)	99.4 (1.7)

Our final goal was to assess whether the relationship between functional status and QOL changed over time. Although there may be a trend toward increasing QOL over time for patients with similar levels of functional status, particularly when measuring QOL using the DS, the magnitude of this trend was modest at best.

The most significant limitation to these findings involves attrition. In particular, of 1,073 VASt patients, no more than 329 had complete data at any time point. More specifically, the study inclusion criteria were intended to be as broad as possible; essentially, to capture all patients presenting to the eight participating medical centers within 7 days of their stroke. Chart reviews of the initial hospitalization were performed on all 1,073 of these patients. All surviving patients were eligible for subsequent telephone interviews at 1, 6, and 12 months poststroke. Except for a pause in data collection associated with a temporary shutdown of nonessential government functions, all interviews were attempted. Those patients that were willing and able to successfully complete an interview tended to have noticeably higher functional status than others. While this phenomenon would definitely provide an optimistic bias for assessing the time course of functional status poststroke, it need not necessarily affect the assessment of the relationship between functional status and QOL at any particular time point (except to the degree that this relationship might potentially be different for groups of patients with considerably lower functional status).

As a more technical consideration, those patients with complete data at one time point did not necessarily have complete data elsewhere. This pattern of attrition precluded explicitly linking patients and time points; for example, through a repeated measures analysis of variance.

Some time ago, our research group completed the largest examination of QOL for persons at risk for major stroke [6]. Approximately 1,200 patients at risk for major stroke (due to minor stroke, transient ischemic attack, atrial fibrillation, or other condition placing the patient at increased risk) were interviewed, the mean BI was 97, and the mean TTO and DS for the current health state was 0.81 and 0.71, respectively. These results were almost identical to those of the highest-functioning patients observed in the present study.

The previous study also asked about a hypothetical major stroke, comparable to a BI in the range of 0–60, and obtained mean TTO and DS scores of 0.30 and 0.27, respectively. Over 40 percent of those interviewed

preferred instant death to living with a major stroke, yet some respondents assigned relatively high values to this health state. The mean TTO and DS scores for the current patients are noticeably higher than those of the previous study, although the heterogeneity in responses remained. One possible explanation is the difference between *ex post* and *ex ante* measurement, which in turn reflects the ability of patients to adapt to situations that might have been considered intolerable before the stroke. Another possible explanation is that our sample, by definition, only includes the fraction of patients with major stroke that were able to complete an interview; those patients with aphasia and other conditions that made successful completion of an interview less likely might have poorer QOL than those for whom the interview could be successfully accomplished.

CONCLUSIONS

Using the TTO, the mean utility associated with a minor stroke (or a major stroke with near-complete recovery of function) is in the range of 0.80, and for most practical purposes, this value holds regardless of the time since the stroke occurred. The self-reported QOL associated with a disabling stroke falls within the range of 0.20–0.30 (previous studies) to 0.50–0.60 (current study) and may increase modestly over time. The QOL for survivors of major stroke may not necessarily be as low as that reported before such a stroke occurs. As is clear to

those who have observed various patients make quite different responses to the same disabling condition, perceived QOL depends on much more than one's level of physical function.

REFERENCES

1. Samsa GP, Reutter RA, Parmigiani G, Ancukiewicz M, Abrahamse P, Lipscomb J, et al. Performing cost-effectiveness analysis by integrating randomized trial data with a comprehensive decision model: application to treatment of acute ischemic stroke. *J Clin Epidemiol.* 1999;52:259–71.
2. Lai SM, Duncan PW. Stroke recovery profile and the modified Rankin assessment. *Neuroepidemiology.* 2001;20:26–30.
3. Post PN, Stiggebout AM, Wakker PP. The utility of health states after stroke: a review of the literature. *Stroke.* 2001;32:1425–29.
4. Tengs TO, Yu M, Luistro E. Health-related quality of life after stroke: a comprehensive review. *Stroke.* 2001;32:964–71.
5. Bosworth HB, Horner RD, Edwards LJ, Matchar DB. Depression and other determinants of values placed on current health state by stroke patients: evidence from the VA Acute Stroke (VAsT) study. *Stroke.* 2000;31:2603–9.
6. Samsa GP, DB Matchar, A Bonito, PW Duncan, J Lipscomb, C Enarson, D Witter, et al. Utilities for major stroke: results from a survey of preferences among persons at increased risk for stroke. *Am Heart J.* 1998;136:703–13.

Submitted for publication August 5, 2003. Accepted in revised form October 15, 2003.