Adherence to Postacute Rehabilitation Guidelines Is Associated With Functional Recovery in Stroke

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Background and Purpose—The purpose of this study was to determine if compliance with poststroke rehabilitation guidelines was associated with better functional outcomes.

Methods—An inception cohort of 288 stroke patients in 11 Department of Veteran Affairs Medical Centers hospitalized between January 1998 and March 1999 were followed prospectively for 6 months. Data were abstracted from medical records and telephone interviews. The primary study outcome was the Functional Independence Motor Score (FIM). Secondary outcomes included Instrumental Activities of Daily Living (IADL), SF-36 physical functioning, and the Stroke Impact Scale (SIS). Acute and postacute rehabilitation guideline compliance scores (range 0 to 100) were derived from an algorithm. All outcomes were adjusted for case-mix.

Results—Average compliance scores in acute and postacute care settings were 68.2% (SD 14) and 69.5% (SD 14.4), respectively. After case-mix adjustment, level of compliance with postacute rehabilitation guidelines was significantly associated with FIM motor, IADL, and the SIS physical domain scores. SF-36 physical function was not associated with guideline compliance. Level of compliance with rehabilitation guidelines in acute settings was unrelated to any of the outcome measures.

Conclusion—Greater levels of adherence to postacute stroke rehabilitation guidelines were associated with improved patient outcomes. Compliance with guidelines may be viewed as a quality-of-care indicator with which to evaluate new organizational and funding changes involving postacute stroke rehabilitation.

Key Words: process assessment (health care) • quality of health care • rehabilitation outcome • stroke

Stroke is a leading cause of disability in the United States. There are an estimated 4.4 million survivors, with 40% having moderate functional impairments and 15% to 30% severely disabled.1 As the population of the United States ages, the social and economic burden of stroke is expected to expand. Despite some advances in acute stroke care, there is still a lack of widely applicable interventions to minimize or reverse the effects of stroke.2–4 Therefore, the majority of stroke survivors will need rehabilitation services to enhance their recovery and to minimize disability. With the passage of the Balanced Budget Act of 1997 that implements radical organizational and funding changes in rehabilitation services, there is an urgency to identify the most cost-effective rehabilitation practices.5,6

There is converging and convincing evidence, primarily from European studies, indicating that well-organized multidisciplinary stroke rehabilitation programs in the postacute period reduce death (OR [odds ratio]=0.66; 95% CI=0.49 to 0.88), death or institutionalization (OR=0.70; 95% CI=0.56 to 0.88), and death or dependency (OR=0.65; 95% CI=0.50 to 0.85).7 These benefits may persist for 5 years.8 In addition to the results of the randomized trials, the beneficial effects of organized postacute treatment have been supported by prospective cohort studies. In comparisons of stroke patients in the United States who received poststroke care in rehabilitation hospitals or in nursing homes, those who received care in rehabilitation hospitals were more likely to return to the community (adjusted OR=3.3; 95% CI=1.5 to 7.2)9 and recover activities of daily living (difference=0.63 ADL [Activities of Daily Living]; 95% CI=0.20 to 1.07). Stroke patients who were treated in subacute nursing homes were more likely than traditional and low-volume nursing home stroke patients to return to the community (adjusted OR=6.8; 95% CI=2.2 to 21.4).9

However, little is understood about the process of care that contributes to the differences in outcomes across the various

Received April 19, 2001; final revision received July 2, 2001; accepted August 22, 2001.

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The views expressed are those of the authors and do not necessarily reflect those of the Department of Veterans Affairs.

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Stroke is available at http://www.strokeaha.org
options for stroke rehabilitation care.\textsuperscript{10} Until a link with process of care is established, inferences about quality cannot be made from outcomes data alone.\textsuperscript{11} With the development of poststroke rehabilitation guidelines, the “black box” process known as stroke rehabilitation may be made explicit and measurable.

The most notable among stroke rehabilitation guidelines are those developed by the Agency for Health Care Policy and Research (AHCPR), now known as the Agency for Healthcare Research and Quality.\textsuperscript{12} The panel developed 26 major recommendations on the assessment and management of stroke patients in acute and postacute settings. These guidelines were developed by an independent multidisciplinary panel in accordance with the Institute of Medicine standards; that is, the guidelines were based on research evidence and a consensus of an expert multidisciplinary panel when the scientific evidence was lacking.\textsuperscript{13}

The Department of Veteran Affairs (DVA) Rehabilitation Service and the VA Office of Quality Management have endorsed many of the 26 recommendations as clinical guides for best stroke rehabilitation care.\textsuperscript{14} This situation provides the opportunity to assess the relationship between processes of stroke rehabilitation care and outcomes. We converted the AHCPR Post-Stroke Rehabilitation Guidelines into review criteria and developed and tested an algorithm for scoring adherence known as stroke rehabilitation may be made explicit and measurable.

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\section*{Methods}

\subsection*{Study Design}

The Post-stroke Rehabilitation and Outcomes Study (PROS) is an 11-site, prospective cohort study of veterans admitted to DVA facilities for acute stroke who were followed from admission to 6 months after discharge. The purpose of the study was to identify those structures and processes of rehabilitation care that are associated with improved stroke patient health outcomes. The study and its protocols were reviewed and approved by the Institutional Review Board at each participating site.

The 11 sites are distributed throughout the nation and reflect large-volume DVA medical centers providing acute care to stroke patients. Medical directors of the Physical Medicine and Rehabilitation Services in each of the facilities served as the site principal investigators of the study. Study coordinators in each site were hired, trained, and certified in the administration of the data collection instrumentation. All study coordinators were experienced clinicians in physical therapy, occupational therapy, or nursing. Nurses employed by an independent survey organization specializing in rehabilitation outcome measurement assessed 6-month follow-ups of patient outcomes and were blind to independent variables of interest.

\subsection*{Patient Sample}

Over an enrollment period of 15 months (January 1998 to March 1999), acute patients were identified for screening by reviewing admission diagnoses, regular visits to medical and neurological units, and referrals from multiple departments with regular contact of new stroke patients (e.g., emergency medicine, neurology, and physical medicine). Patients considered candidates for rehabilitation were screened by the study coordinators during their acute stroke admission for the following inclusion criteria: (1) confirmed diagnosis of stroke (defined as symptoms of rapid onset lasting more than 24 hours and of presumed vascular origin reflecting a focal disturbance of cerebral function, excluding isolated impairment of higher function),\textsuperscript{15} (2) living in the community prior to the stroke, (3) admitted within 10 days of stroke onset, (4) requiring assistance in at least 1 basic activity of daily living at time of enrollment, (5) responsive and able to follow a 2-step command, (6) age between 45 to 90 years, inclusive, and (7) not suffering from any medical condition in which they are not expected to survive 6 months. Consenting patients meeting enrollment criteria were enrolled on average 4.5 (SD 2.5) days following their acute stroke event. The diagnosis of stroke and all other inclusion criteria were confirmed independently by a centralized research assistant through review of copies of all medical records associated with the acute and postacute care of the patient.

\section*{Outcomes}

Our primary outcome was the functional independence measure (FIM) motor score at 6 months poststroke. The FIM motor score is 1 of 2 subscales of the FIM: motor and cognition. The motor subscale is summed composite ADL measure consisting of 13 items. Item scores range from 1 (total dependence) to 7 (total independence).\textsuperscript{16}

Secondary outcomes included the Medical Outcomes Study Short Form (SF-36) physical dimension score,\textsuperscript{17} Lawton Instrumental Activities of Daily Living (IADL) score,\textsuperscript{18} and the Stroke Impact Scale (SIS) aggregate physical dimension score, all measured at 6 months poststroke.\textsuperscript{19} The SF-36 physical dimension is a subcomponent of the SF-36, a commonly used health-related quality-of-life scale. The physical dimension of the SF-36 consists of 10 questions on physical activity limitations with responses of “Yes, limited a lot,” “Yes, limited a little,” or “No, not limited at all.” The Lawton IADL scale is a 9-item instrument tapping higher functional dimensions such as ability to use the phone, shop, and do laundry. Responses to each of the activities are limited to “without help,” “with some help,” or “completely unable to do.” The SIS is a new stroke-specific outcome measure that assesses the impact of stroke in 8 domains (strength, hand function, activities of daily living and instrumental activities of daily living [ADL/IADL], mobility, communication, emotion, memory and thinking, and social participation). The SIS aggregate physical dimension score is a composite of

\begin{table}[h]
\centering
\caption{AHCPR Dimensions of Stroke Care}
\begin{tabular}{ll}
\hline
\textbf{Acute care} & \\
1. Multidisciplinary team coordination & \\
2. Baseline assessment & \\
3. Early initiation of rehabilitation & \\
4. Management of general health functions & \\
5. Prevention of complications & \\
6. Prevention of recurrent stroke & \\
7. Use of standardized scales appropriate for stroke & \\
8. Screening for rehabilitation placement & \\
\hline
\textbf{Postacute care} & \\
1. Multidisciplinary team coordination & \\
2. Baseline assessment & \\
3. Goal setting & \\
4. Treatment plan & \\
5. Monitoring of progress & \\
6. Management of impairments/disabilities & \\
7. Prevention of complications & \\
8. Prevention of recurrent stroke & \\
9. Family involvement & \\
10. Patient and family education & \\
11. Discharge planning & \\
\hline
\end{tabular}
\end{table}
4 primary SIS domains: strength, hand function, ADL/IADL, and mobility. The SIS uses a 5-point Likert scale ranging from “not difficult at all” to “cannot do at all.”

**Primary Independent Variable**

Our primary independent variable was degree of compliance with AHCPR poststroke rehabilitation guidelines, which was reflected by a summary variable indicating percentage compliance with acute care and postacute care recommendations. Compliance with AHCPR guidelines was determined through review of the acute care and postacute care medical records. Acute care was typically provided on a neurology or medicine unit until the patient was deemed medically stable. Following acute care, patients were either (1) sent home with or without outpatient care or home health or (2) transferred to a postacute institutional setting for rehabilitation.

An extensive description of the methods used to quantify guideline compliance has been published elsewhere. Briefly, published AHCPR guidelines for stroke care were reviewed for both acute and postacute stroke care and classified into process of care dimensions. Acute stroke care yielded 8 distinct dimensions of care process, and postacute care yielded 11 dimensions of care process (Table 1); the chart review criteria for each dimension are published elsewhere. Within each dimension, chart review criteria were developed that closely represented the content of each care process. Item totals for the acute and postacute abstraction tools numbered approximately 140. Committee members who participated in the creation of the original AHCPR guideline validated the dimension criteria. Additionally, the committee created a weighting scheme through 2 rounds of a modified Delphi consensus process. The weighting algorithm at the dimension level allowed for the calculation of an acute and a postacute composite compliance score ranging between 0 and 100.

Many of the guideline recommendations were not applicable for outpatient care and home health (ie, extensive discharge planning, full medical evaluation). Therefore, the postacute guideline compliance scores in this study are limited to patients receiving inpatient rehabilitation care or nursing home rehabilitation care (often called subacute care). Prior to implementation of the study, the medical record abstractions were tested for interrater and test-retest reliability. The final reliability data set contained 30 medical records. Interrater reliability as measured by Cohen’s $\kappa$ was 0.76 for the acute care compliance score and 0.92 for the postacute compliance score. Intrarater reliability was 0.93 and 0.96, respectively. The primary chart abstractor for the study was blinded to patient outcomes.

**Case-Mix Measures**

To adjust for case-mix differences between sites, we selected patient covariates based on theoretical relationships of patient characteristics to patient outcomes and statistical findings such as explained variance and collinearity. We sought a valid set of patient covariates that (1) measured unique patient characteristics, (2) explained variation in patient outcomes, and (3) possessed face validity as a covariate. Candidate variables included age, race, social support, income, marital status, Charlson comorbidity index, walking ability prior to the stroke, prior physical function as measured by the SF-36 physical function scale, Orpington Prognostic Scale Score at baseline, Mini-Mental State Examination at baseline, Barthel score at baseline, FIM motor score, and FIM Functional Related Groups (FIM-FRGs). The final set of patient covariates were age, race, social support, comorbidity, walking ability prior to stroke, Mini Mental State Examination Score at baseline, and the FIM motor score at baseline.
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<tr>
<th>Demographics</th>
<th>Total Sample</th>
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<td>121 66.2 (10.5)</td>
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<td>14 5</td>
<td>9 6</td>
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</table>
Characteristic Options for Rehabilitation Care

For the purpose of comparing the sites of rehabilitation care in our sample with those in other stroke rehabilitation studies, we classified the study sites of rehabilitative care into broad categories similar to those examined in a previous report. Specifically, this rehabilitation typology was no postacute care, low-level postacute care (VA or private sector nursing home, VA subacute rehabilitation unit, home rehabilitation, or outpatient rehabilitation), and high-level postacute care (VA acute rehabilitation bed unit, VA geriatric evaluation and management unit, or private sector rehabilitation hospital).

Data Collection

At the time of enrollment, a patient assessment and review of the chart was conducted to obtain the following data: patient demographics, stroke characteristics, social support, Barthel Index, Barthel index at 1 week prior to stroke, SF-36 physical function 1 week prior to stroke, FIM,18 Mini-Mental State Examination,24 Modified Rankin Scale,29 Hemianopsia check, Orpington Prognostic Scale,23 and the Lawton IADL.22 1 week prior to stroke.

Approximately 2 weeks following the 6-month follow-up interview, a subset of patients were mailed the Stroke Impact Scale.21 The mailed survey packet contained an introductory letter, SIS instructions, the 64-item SIS instrument, and a return envelope. If no response was received within 3 weeks, a reminder letter was sent to the patient requesting survey completion. During data collection, the SIS was implemented as an outcome measure in 9 of the 11 sites. Not all patients in the study received this assessment. This investigation considers the SIS a supplementary or secondary patient outcome for comparison purposes only.

For all patients, the portion of their medical record pertaining to the acute and postacute stay was photocopied and shipped to the study coordinating center for review. Each chart was reviewed and abstraction projects for the Kansas Peer Review Organization.

Statistical Analyses

The analysis proceeded in phases. In the first phase, we generated descriptive profiles of the 11 sites and of patients overall and for the subset that received postacute rehabilitation services. The chi-square statistic and t test were used to determine whether those patients who received postacute rehabilitation differed from the larger sample of patients in important characteristics.

In the second phase, we examined the unadjusted association between our primary independent variables: acute and postacute guideline compliance and the key outcomes, including FIM motor score, SF-36 physical function score, Lawton IADL, and SIS aggregate physical domain score using ANOVA. We then proceeded to the multivariable linear modeling, in which we adjusted the above associations for case mix.

An additional model using FIM motor gain (from baseline) as the dependent variable was performed for comparison with the model using the 6-month motor score. Since both models used the baseline motor FIM score as a patient covariate, identical results were obtained. For consistency among the dependent variables, 6-month values were used for all dependent variables.

Of note, site, whose contribution after including the other variables in the model was not statistically significant, was excluded from the model.
from the list of variables used in case-mix adjustment. Recognizing that differing philosophies exist about the necessity to include a clustering variable such as site (some analysts prefer to include it even if not statistically significant because it is an element of the study design, while others prefer to exclude it if not significant since degrees of freedom and thus statistical power are at a premium), we adopted the position that the primary reasons for differences in outcome across sites are in observable patient characteristics and in observable differences in process of care, thus eliminating the need that site be included.

Results

Site Characteristics
Total inpatient volume across the 11 sites averaged 7512 admissions per site per year in Federal Fiscal Year 1998 (Oct.1, 1997 through Sept. 30, 1998) with a range of 4136 to 10 572 admissions. Yearly inpatient stroke volume averaged 76 patients per site with a range of 42 to 117 patients. Variation in significant structures of care, such as the presence of a rehabilitation bedservice unit (RBU) or a geriatric evaluation and management unit (GEM), was balanced by selection. Four sites had both a RBU and GEM, 3 sites had RBUs alone, 2 sites had GEM units alone, and 2 sites had neither a RBU nor a GEM unit. The distribution of the 288 patients across the 11 sites were as follows: 47, 38, 31, 28, 24, 23, 21, 21, 21, 19, and 15.

Patient Characteristics
Of the 1688 screened patients, 288 (17%) were enrolled in the current study (Figure 1). Eighty-two percent of the enrolled patients were interviewed at 6 months poststroke to obtain the study outcome measures. Five percent of the enrolled patients died during the 6-month follow-up period, 6% of patients refused the telephone interview at 6 months poststroke, and 7% of enrolled patients were lost to follow-up. Patients who could not be located for the follow-up interview were combined with patients who refused the 6-month interview and tested for statistical differences from the larger group completing the follow-up interview. Patients not interviewed were more physically impaired prior to stroke than interviewees (SF-36 physical 53 versus 66) and had less social support (66% versus 85%). Patients not interviewed were similar to those interviewed in all other patient covariate and AHCPR compliance scores. Figure 1 also displays sample size changes creating the final analytic data set for testing guideline compliance effects.

The typical patient was a married white male, aged 67 years, with a high school education (Table 2). The patient suffered an ischemic stroke and had significant residual impairment. Of the 288 patients enrolled, 77 (27%) patients received no postacute care, 93 (32%) received low-level care, and 118 (41%) received high-level rehabilitation care. The subset receiving inpatient postacute care (n=159) and the subset receiving no inpatient postacute care (n=129) were similar in all measured demographic and clinical characteristics with the exception of stroke severity (Table 2). Patients who received inpatient postacute care were more severely affected by their strokes compared with the subset not receiving inpatient postacute care. A greater proportion of patients in the postacute group fell in the more severe Rankin categories of 4 and 5. These patients also had lower ADL scores as measured by the FIM and Barthel Index and a more severe Canadian Neurological Scale score.

Compliance with Rehabilitation Guidelines
Compliance with guidelines could be scored only for patients receiving inpatient care in acute and postacute settings. Sufficient medical record data were available to compute acute care compliance scores for 98% of patients and postacute care compliance scores for 95% patients. Mean compliance scores were similar for acute (68.2%±14.0%) and postacute care (69.5%±14.4%) as were median scores: 70.5% versus 72.9% for acute and postacute, respectively (Figures 2 and 3). As shown by the figures, the range of individual scores was quite large, varying between 18% and 92% for acute rehabilitative care and between 26% to 91% for postacute rehabilitative care. Figure 4 displays the distribution of compliance scores by high level and low level (inpatient only) of postacute care.

Patient Outcomes
Unadjusted 6-month outcomes for all patients and those who received both acute and postacute rehabilitation are shown in

Figure 2. AHCPR guideline compliance with stroke acute care.

Figure 3. AHCPR guideline compliance with stroke postacute care.

Figure 4. AHCPR guideline compliance by intensity of postacute care (inpatient only).
Table 3. Overall, a high level of physical recovery is indicated by the FIM motor scores, the Lawton IADL scores, and the FIM gain scores (change from baseline) for all three groups. Less impressive recovery is indicated by the physical domain score for the SIS and especially the SF-36.

Association of Case-Mix Variables and Guideline Compliance With Outcomes

After adjustment for key influences on stroke recovery, level of compliance with postacute rehabilitation guidelines was significantly associated with recovery as measured by the FIM motor score, the Lawton IADL, and the SIS aggregate physical domain score (Table 4). Guideline compliance was not related to physical health-related quality of life (SF-36 physical function score). Level of compliance with acute rehabilitative care guidelines was unrelated to any of the outcome measures. In the multivariate models with significant findings for postacute compliance, the increase in the $R^2$ with adding the compliance variables was 7%, 9%, and 6% respectively, for the FIM motor, Lawton IADL, and SIS physical dimension scores.

Beyond level of compliance with postacute rehabilitation guidelines, only the baseline FIM motor score was consistently associated with our primary and secondary outcome measures of physical function recovery. Prestroke walking was significant and positively associated with better 6-month outcomes, except in the SIS physical domain. Cognitive function, as measured by the Mini-Mental State Examination, was positively associated with IADL function only. No other individual patient level covariates were statistically associated with the outcomes measured in this study. Patient level covariates, as a group, explained significant variation in patient outcomes. The 7 covariates explained 29%, 27%, 32%, and 19% in FIM motor scores, SF-36 physical function scores, Lawton IADL scores, and SIS physical scores, respectively.

In order to control for intensity of care, a variable representing low versus high level of postacute care was added to the covariate group when testing for compliance effects. No substantial effects to any of the model parameters were observed in any of our outcome variables.

We also examined overall compliance scores across different sites of rehabilitation care. Average postacute compliance scores for patients who received care in high-level postacute rehabilitation sites was 71.7% compared with 63.4% for patients who received care in low-level sites (nursing homes) ($P<0.005$).
The level of compliance for each of the postacute rehabilitation guidelines indicated substantial variation across the 11 dimensions (Table 5). Scores of 75% or greater were considered to represent good to high compliance. This level of compliance was found for direct care processes, including multidisciplinary evaluations, baseline function assessment, management of impairments and monitoring of progress, and prevention of complications and recurrent stroke. The remaining 5 dimensions—goal setting, treatment planning, family involvement, discharge planning, and patient and family education—had mean compliance scores between 37% and 65%, representing poor to moderate compliance.

### Table 5. AHCPR Postacute Guideline Compliance by Dimension (n=159)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Mean (%)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention of recurrent stroke</td>
<td>98</td>
<td>10</td>
</tr>
<tr>
<td>Management of impairments</td>
<td>95</td>
<td>17</td>
</tr>
<tr>
<td>Baseline assessment</td>
<td>82</td>
<td>13</td>
</tr>
<tr>
<td>Prevention of complications</td>
<td>79</td>
<td>41</td>
</tr>
<tr>
<td>Multidisciplinary evaluation</td>
<td>77</td>
<td>42</td>
</tr>
<tr>
<td>Monitoring of patient progress</td>
<td>75</td>
<td>30</td>
</tr>
<tr>
<td>Goal setting</td>
<td>66</td>
<td>32</td>
</tr>
<tr>
<td>Treatment plan</td>
<td>58</td>
<td>18</td>
</tr>
<tr>
<td>Family involvement</td>
<td>56</td>
<td>45</td>
</tr>
<tr>
<td>Discharge planning</td>
<td>42</td>
<td>30</td>
</tr>
<tr>
<td>Patient and family education</td>
<td>37</td>
<td>24</td>
</tr>
</tbody>
</table>

**Discussion**

This report is the first to examine stroke rehabilitation wherein the processes of care are explicitly defined and linked with relevant patient health outcomes, particularly recovery of physical function. We defined 8 dimensions of acute care and 11 dimensions of postacute rehabilitative care using published AHCPR poststroke rehabilitation guidelines—an accepted standard within the stroke rehabilitation community. We found a statistically significant, positive association between overall compliance with postacute stroke guidelines and important outcomes at 6 months poststroke, including physical functioning as measured by the FIM motor score, the Lawton IADL, and the Stroke Impact Scale.

The relationship between functional outcomes and postacute guideline compliance is both statistically significant and clinically meaningful. For example, when postacute guideline compliance increased from 50% to 100%, motor function increased by approximately 12 FIM points. This increase represents almost a full point gain in each of the 13 motor items on the FIM. A similar increase in guideline compliance would be associated with increases in IADL function at 6 months poststroke of 4 points (instrument range 9 to 27) and in SIS physical function scores of 26 points (instrument range 0 to 100).

However, compliance with postacute stroke guidelines was not associated with improved health-related quality of life as it relates to physical function (SF-36 Physical Function Domain). The lack of an association with health-related quality life may be a function of the scale used. The Medical Outcomes Study Short-Form (SF-36) demonstrated clear...
“floor” effects, perhaps because it focuses on the higher levels of physical functioning that conventional stroke rehabilitation programs do not typically achieve or the patient is incapable of achieving post-stroke. This finding, that physical health-related quality of life is unrelated to level of compliance with post-stroke rehabilitative guidelines, reinforces the general methodological point that outcomes measures should be selected based on sensitivity to the effects that a given medical intervention is intended to impact. A stroke-specific measure of health status, such as the SIS, may be required if the true effect of post-stroke rehabilitation on health-related quality of life is to be detected.

Interestingly, compliance with acute rehabilitative care guidelines was unrelated to any of the key patient outcomes at 6 months. It is not entirely clear why this is occurring, but it may represent confounding between processes of care and the severity of the residual disabilities. Compliance with acute rehabilitative care was inversely correlated with the acute-phase length of stay. In supplemental analyses, we found that patients with shorter lengths of stay in the acute phase had lower baseline disability and better cognitive FIM scores. This suggests that those patients who were least severely affected by their stroke physically and cognitively were transferred very quickly to postacute rehabilitation settings, leaving insufficient time for providers to complete acute guideline processes. Thus, patients who had good recovery at 6 months poststroke (perhaps largely attributable to lower initial physical deficits and fewer cognition problems) had worse acute care compliance scores, while those patients who had worse recovery had the highest compliance scores, canceling out any association between functional recovery and acute care compliance.

Although we did not examine the linkage between a specific process of care and patient outcomes, compliance was uniformly high for dimensions relating directly to the delivery of care: baseline assessments, monitoring of progress, management of impairments/disabilities, prevention of complications and recurrent stroke, and coordination of the multidisciplinary team. Compliance was substantially worse for processes such as treatment planning, goal setting, discharge planning, family involvement and patient/family education (about care after discharge). This is consistent with previous studies. Our findings suggest that these latter dimensions are essential to achieving good patient outcomes in that these processes guide or enhance the rehabilitative care that the patient receives.

We also found clear differences in level of compliance based on rehabilitative setting. Compliance within the nursing home setting was substantially worse than for inpatient rehabilitation settings. Other investigators report similar findings, showing that stroke patients who receive rehabilitative care in nursing homes experience worse outcomes. Together, these findings argue against current policies among health systems that provide care to veterans. Veterans differ systematically from the general population in a number of characteristics that may affect the findings reported here. Specifically, women are underrepresented while lower socioeconomic and minority populations are overrepresented. Therefore, the findings may not be representative of the effects in a general population. However, given the nature of the patient population, these findings may be conservative estimates of the effect of compliance with guidelines on stroke patient recovery.

Moreover, VHA rehabilitation is structurally similar to that of the private sector, having a diverse continuum of care in which rehabilitation may be provided. In general, stroke rehabilitation patients in the VHA tend to start rehabilitation late, have lengths of stay 30% to 200% longer than those in the private sector, and are more likely to be institutionalized. Still, rehabilitation outcomes vary with structure of care within the VHA in a fashion similar to that of the private sector. The more comprehensive rehabilitation programs found in VHA hospitals with rehabilitation units are associated with better outcomes compared with VHA hospitals with nursing home–level rehabilitation only. Furthermore, because the VHA is an equal-access health care system, ability-to-pay issues should not be confounding the observed patterns of rehabilitation care. Eligible patients are not responsible for the cost of their care, nor are physicians financially impacted by the use or nonuse of services. Thus, utilization of services is more likely to reflect patient need and availability rather than the patient’s financial capacity.

As another limitation, we may not have optimally adjusted for all factors that could influence patient outcomes. The number of potential covariates was large relative to the number of patients, and the covariates tended to be correlated. We opted to create a clinically plausible and parsimonious set of covariates and to focus on the relationship between process and outcome. Also, because of the large number of process items, we grouped items into dimensions and then grouped and weighted the dimensions into a single summated score. We did not have sufficient statistical power to definitely determine which of the above dimensions had the most effect on outcomes; however, a preliminary examination of these issues will be presented elsewhere.

A final important limitation is sample size. Although we sought a census of stroke patients who were eligible for rehabilitative care, as an observational study, our patient population was limited by the availability of patients who presented at the participating centers. Moreover, the number of patients receiving the various patterns of care (eg, only 159 received poststroke rehabilitation) was determined by clinical considerations and not study design. Although we sought to
control some of the inherent variation through inclusion/exclusion criteria, our ability to fully control for confounding factors (including those attributes of site not subsumed within process of care) was limited. We attempted to compensate for this limitation by modeling; that is, we selected as covariates those factors known empirically or identified theoretically as most important.

Despite these limitations, we believe that our findings are valid and as such have implications for health care policies. Currently, stroke patients represent the largest diagnostic-related group requiring inpatient rehabilitation, which is a costly health care component. This situation is unlikely to improve in the near future because the incidence of stroke seems to be increasing while the case fatality rate continues to decrease. In order to contain Medicare costs, the US Congress passed the Balanced Budget Act of 1997, which indirectly limited rehabilitation services in nursing homes (via per diem reimbursement) and introduced prospective payment for inpatient rehabilitation. This policy, however, is largely uninformed as knowledge regarding effective rehabilitation practices is lacking. While randomized clinical trials have proven that poststroke rehabilitation is effective as a whole, poststroke rehabilitation has been a “black box” as the processes of care have not been delineated and evaluated explicitly.

Our findings support the use of guidelines as a means of improving health outcomes. We have shown that compliance with the poststroke rehabilitative guidelines is associated with significant improvement in the recovery of physical functioning among stroke patients in 3 of 4 meaningful health outcomes. These guidelines, it should be noted, were based primarily on expert opinion with only 4 of the 19 guidelines being evidence-based. Guidelines also can be indicators of quality of care. Our findings argue that the observed worse patient outcomes among nursing home patients may be due, in large part, to lower levels of compliance with rehabilitative guidelines. Thus, guidelines can be used in conjunction with cost management strategies to yield high-quality, cost-effective health care. This study demonstrates that high-quality postacute care is crucial to improving functional outcomes in stroke patients. Without such, patients achieve less and live with greater dependency. Changes in organization or funding of postacute stroke care must ensure that quality of care is not compromised. Compliance with poststroke rehabilitation guidelines is a good indicator for quality of care.

Acknowledgments

This research was funded by the U.S. Department of Veterans Affairs, Health Services Research & Development Service through grants ACC 97-114.1 and the University of Kansas and Duke University Claude D. Pepper Older Americans Independence Center grants funded by the National Institute of Aging (P60AG 14635-02 and P60AG-11268). Dr. Hoening is a Paul Beeson Faculty Scholar with the American Federation of Aging Research.

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Stroke, the leading cause of adult neurological disability, represents the largest diagnostic-related group requiring inpatient rehabilitation.1–3 Of the estimated 4.4 million stroke survivors in the United States today, the majority have disabilities that would benefit from organized poststroke treatment.4 Although rehabilitation offers the best possibility for improvement, it has been difficult to differentiate between the influence of specific restorative interventions and the natural recovery process. With the advent of evidence-based guidelines over the past decade,4 there has been considerable promise for improvement in health care standards and delivery for a number of medical conditions. For stroke, the Post-Stroke Rehabilitation Clinical Practice Guidelines,5 which were published in 1995 by the Agency for Health Care Policy and Research (AHCPR), now the Agency for Healthcare Research and Quality, was a leader in this effort. The poststroke rehabilitation guidelines were developed to document the state of the science in stroke rehabilitation and to make recommendations for care, based on the best research available. In this article, Duncan et al examined the association between adherence to the guideline recommendations and better functional outcomes. The authors found that the patients whose care was directed by the poststroke rehabilitation guidelines scored higher on the physical health parameters related to recovery.

Evidence-based guidelines, such as those developed for stroke rehabilitation, link recommendations to scientific evidence for effectiveness by specifying benefits of interventions, estimating outcomes, and guiding clinical practice.6 The Post-Stroke Rehabilitation Clinical Practice Guidelines were formulated to enhance the quality, appropriateness, and effectiveness of health care services for patients with disabilities in the poststroke phases of treatment and to promote more effective use of rehabilitation services. Guidelines identify optimal practice. In this study, the authors hypothesized that patients who received the best process of care, as measured by compliance with the stroke rehabilitation guidelines, would have better functional outcomes. Their goal was to determine if compliance was associated with improved functional health. A cohort of 288


Editorial Comment

The Impact of Poststroke Rehabilitation Guidelines on Functional Recovery
stroke survivors, from 11 veterans medical centers, who received poststroke care either in an acute inpatient rehabilitation setting or in a subacute nursing home–type setting were followed prospectively for 6 months using standardized assessment instruments to determine physical functional outcomes. The authors found a significant positive association between overall compliance with poststroke rehabilitation guidelines and improved physical functioning. Compliance was uniformly high for dimensions relating directly to the delivery of care, namely, direct care, baseline assessment, management of impairments, monitoring of progress, and prevention of complications and recurrent stroke. An important treatment observation in this study was that compliance to the guideline recommendations within the nursing home setting was substantially worse than for those treated within the acute inpatient rehabilitation setting.

What are the implications of this report for the treatment of patients with poststroke residual disability? I believe the findings here support the application of guideline recommendations as an essential strategy to improving patient outcomes and for reducing the variability seen in current poststroke rehabilitation. This project lends credence to the assumption that quality care is critical to maximize recovery potential after stroke. The results also affirm the belief that short-term health care savings by admitting to a subacute setting is counterbalanced by costs and quality-of-life issues associated with worse outcomes.

Whether the results of this study can be generalized to other populations has yet to be answered. This sample included only veterans, underestimated women, and overestimated lower socioeconomic and minority populations. It would be appropriate to repeat the study in other populations to confirm the results found here. If other studies continue to produce a positive association between adherence to the guidelines and a better functional outcome, the impact on the quality of health care delivered will be an important public health advance. This study adds to the body of research exploring what elements make up the “black box” of the rehabilitation process and whether rehabilitation efforts or the natural recovery process most influence final outcomes. It confirms the belief that guideline recommendations are an important means for improving health outcomes in disabled stroke survivors. This study gives direction and encouragement to make implementation of the poststroke rehabilitation guidelines a national priority.

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Stroke. 2002;33:167-178
doi: 10.1161/hs0102.101014

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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