ORIGINAL RESEARCH

Changes in the Activity Measure for Post-Acute Care Domains in Persons With Stroke During the First Year After Discharge From Inpatient Rehabilitation

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Abstract

Objective: To describe functional changes after inpatient stroke rehabilitation using the Activity Measure for Post-Acute Care (AM-PAC), an assessment measure sensitive to change and with a low risk of ceiling effect.

Design: Retrospective, longitudinal cohort study.

Setting: Inpatient rehabilitation unit of an urban academic medical center.

Participants: Among 433 patients with stroke admitted from 2012-2016, a total of 269 (62%) were included in our database and 89 of 269 patients (33.1%) discharged from inpatient stroke rehabilitation had complete data. Patients with and without complete data were very similar. The group had a mean age of 68.0 ± 14.2 years, National Institutes of Health Stroke Score of 8.0 ± 8.0, and rehabilitation length of stay of 14.7 ± 7.4 days, with 84% having an ischemic stroke and 22.5% having a recurrent stroke.

Intervention: None.

Main Outcome Measures: Changes in function across the first year after discharge (DC) were measured in a variety of ways. Continuous mean scores for the basic mobility (BM), daily activity (DA), and applied cognitive domains of the AM-PAC were calculated at and compared between inpatient DC and 6 (6M) and 12 months (12M) post DC. Categorical changes among individuals were classified as “improved,” “unchanged,” or “declined” between the 3 time points based on the minimal detectable change, (estimated) minimal clinically important difference, and a change ≥1 AM-PAC functional stage (FS).

Results: For the continuous analyses, the Friedman test was significant for all domains (P<.002), with Wilcoxon signed-rank test significant for all domains from DC to 6M (all P<.001) but with no change in BM and DA between 6M and 12M (P>.60) and a decline in applied cognition (P = .002). Despite group improvements from DC to 6M, for categorical changes at an individual level 10%-20% declined and 50%-70% were unchanged. Despite insignificant group differences from 6M-12M, 15%-25% improved and 20%-30% declined in the BM and DA domains.

Conclusions: Despite group gains from DC to 6M and an apparent “plateau” after 6M post stroke, there was substantial heterogeneity at an individual level. Our results underscore the need to consider individual-level outcomes when evaluating progress or outcomes in stroke rehabilitation.

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Stroke is a major source of disability in the United States (US), with 610,000 new and 185,000 recurrent strokes annually. A total of 20%-50% of persons fail to achieve independence, mandating a thorough understanding of recovery patterns,
especially during the first year. Many studies have examined functional improvement from both acute stroke hospitalization and inpatient stroke rehabilitation discharge (DC) through the first year. Very few studies are US-based, where the model tends to consist of separate units, one focusing on the acute management and another on the rehabilitation and recovery after stroke. Given the effectiveness of inpatient stroke rehabilitation, observations starting from inpatient stroke rehabilitation DC have specific relevance to the trajectory of recovery.

Longitudinal research like this tracks large functional gains over time, resulting in near maximum scores on a given assessment scale. This is called “ceiling effect” and risks not detecting further improvement should it occur and inappropriately concluding a “plateau” has occurred. A scale’s ability to detect any or clinically significant change over time, called sensitivity and responsiveness, respectively, is also critical. The Barthel Index (BI) and the FIM are commonly used functional outcome measures but with limitations regarding both ceiling effect and responsiveness. A lesser used tool is the Activity Measure for Post-Acute Care (AM-PAC), assessing functional severities and diagnoses. The AM-PAC was developed using item response theory as a self-administered test and paper-pen AM-PAC are strongly correlated. The computer adaptive test and paper-pen AM-PAC are strongly correlated.

List of abbreviations:
AM-PAC Activity Measure for Post-Acute Care
BI Barthel Index
BM basic mobility
DA daily activity
DC discharge
FS functional stage
MCID minimal clinically important difference
MDC minimal detectable change
MoCA Montreal Cognitive Assessment
6M 6 months
12M 12 months
US United States

Participants
All patients met the clinical criteria for admission to the rehabilitation unit including (1) able to tolerate 3 hours of therapy daily, (2) medically stable, (3) need for at least 2 therapies (occupational therapy, physical therapy, and/or speech therapy), (4) need for daily rehabilitation nursing and physician care, (5) age 18 years or older, and (6) an expectation of recovery over a reasonable time with (7) a reasonable disposition plan. Patients with new or recurrent strokes and ischemic or hemorrhagic strokes were eligible. If admitted for ≥1 stroke, only the last admission was included. Patients were excluded if unable to speak English or had a rehabilitation length of stay ≤3 days.

Clinical data
Clinical and demographic data were collected from the electronic medical record and included the following: acute and rehabilitation lengths of stay, side and type of lesion (ischemic or hemorrhagic), previous stroke history, and estimated stroke severity using the National Institutes of Health Stroke Score taken from emergency department or initial neurology service notes. When no National Institutes of Health Stroke Score was available (typically outside admissions), it was retrospectively determined by a physician using a standardized protocol. Medical comorbidities were assessed using the Charlson Comorbidity Index, retrospectively determined via physician chart review. Cognition was assessed at admission using the Montreal Cognitive Assessment (MoCA). Functional status was assessed at admission and DC by certified staff using the FIM.

Primary outcome measure
The AM-PAC was developed using item response theory as a self- or proxy-reported measure of activity limitation. The AM-PAC domains have excellent test-retest reliability with an intraclass correlation between 0.91 and 0.97 and sensitivity to change in both directions. Jette et al reported overall intraclass correlation coefficients ranging from 0.5 to 0.72 between persons with stroke and a caretaker or clinician, with no evidence for systemic bias. We used the computer adaptive test version, which generates scores on a laptop computer using questions from an item bank of between 50-131 questions for each domain. The computer adaptive test and paper-pen AM-PAC are strongly correlated. Standardized scores for the BM domain range from −11.95 to 104.9, for DA from −2.73 to 115.4, and from applied cognition from −6.84 to 68.28. The “negative” scores occur as a results of the analyses stemming from item response theory. There is no “total score” for the AM-PAC.

All 3 AM-PAC domains were assessed by a trained research assistant at 3 time points: at DC from inpatient stroke rehabilitation in person and via phone 6M and 12M post DC. Because of concerns about patient over- or underestimation of functional status, DC scores were reviewed for accuracy by the treating occupational therapist/physical therapist and, if needed, completed as a proxy. Reassessment occurred at 6M and 12M with the patient or a family member or caretaker if the patient was...
unavailable. Multiple avenues for contact were gathered at DC and we offered an Institutional Review Board–approved gift card as an incentive to complete follow-up. After 3 attempts, the patient was deemed “lost to follow-up.”

**Statistical analysis**

Frequency distribution, proportion, mean, median, range, standard deviation (SD) were used to characterize demographic, clinical and outcome variables. Differences between subjects who did or did not complete the AM-PAC were assessed using independent-sample t tests or chi square test, as appropriate.60 Because AM-PAC scores were nonnormally distributed, we used nonparametric tests (Friedman analysis of variance and Wilcoxon signed-rank test) to analyze group domain scores from DC to 6M (early recovery), 6M-12M (late recovery), and DC and 12M.

Changes at an individual level during early and late recovery were categorized as “improved,” “unchanged,” or “declined” using 3 methods: (1) Gains/losses exceeding the published minimal detectable change (MDC) (or the magnitude of change surpassing random error) reported as 4.28, 3.70, and 5.55 points for the BM, DA, and applied cognition domains, respectively.33,61 (2) Gains/losses exceeding the minimal clinically important difference (MCID). Because no stroke-specific MCID has been reported for the AM-PAC, we estimated the MCID by a gain or loss of ≥5 SD of the pooled DC scores for each domain (N=269), as described by Norman62 and Lee63 and colleagues. (3) Gain/loss of ≥1 functional stages (FSs) among those patients between FS2 and FS4 at inpatient stroke rehabilitation DC. A unique aspect of the AM-PAC is past research establishing 5 FS for each domain (see table 1). Using scores from 516 patients tracked from inpatient rehabilitation DC (mixed diagnoses) to 1 year post DC, Tao et al developed 5 FSs for each domain. These categories demonstrated better sensitivity to change over time and less ceiling effect (especially in cognition) than a similar staging system using FIM. Movement from one stage to the next (or back to the previous stage) was shown to be clinically meaningful.42 Exclusion of FS1 and 5 was required to avoid floor and ceiling effects.34,42 The proportion of patients classified by FS in a given domain at each time point was depicted graphically.62 Categorical data were visually inspected for trends.

**Results**

**Sample characteristics**

Of 433 patients with stroke admitted for inpatient stroke rehabilitation from 2012-2016, a total of 273 (63%) were initially included in the database. Of the 164 patients not included, 79 declined, 60 had a rehabilitation length of stay <3 days or sudden DC precluding routine evaluations, 10 were non-English speaking, 10 were deemed inappropriate after consent was provided (old stroke, traumatic etiology, advanced cancer, etc), and 1 died. Another 4 patients were missing DC AM-PAC scores, leaving 269 persons with complete data. Of these 269, a total of 89 (33.1%) were successfully contacted for both follow-up assessments. With

![Table 1](https://www.archives-pmr.org)
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Complete Data: n = 89</th>
<th>Incomplete Data: n = 180</th>
<th>P Value</th>
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<tr>
<td>Age</td>
<td>68.0±14.2 / 26-92</td>
<td>68.0±15.0 / 21-98</td>
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<tr>
<td>Sex, n (%)</td>
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<td>.926</td>
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<td>Male</td>
<td>48 (53.9)</td>
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<tr>
<td>Female</td>
<td>41 (46.1)</td>
<td>84 (46.7)</td>
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<td>Ethnicity, n (%)</td>
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<td>White</td>
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<td>22 (12.2)</td>
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<td>21 (11.7)</td>
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<td>Asian/Pacific Islander</td>
<td>10 (11.2)</td>
<td>18 (10.0)</td>
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<tr>
<td>Other</td>
<td>3 (3.4)</td>
<td>17 (9.4)</td>
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</tr>
<tr>
<td>Education, n (%)</td>
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<td>Less than high school</td>
<td>7 (7.9)</td>
<td>24 (13.3)</td>
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<td>Completed high school</td>
<td>17 (19.1)</td>
<td>52 (28.9)</td>
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<tr>
<td>College or greater</td>
<td>65 (73.0)</td>
<td>101 (56.1)</td>
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<td>Unknown</td>
<td>0 (0)</td>
<td>3 (1.7)</td>
<td>.104</td>
</tr>
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<td>Side of lesion, n (%)</td>
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<td>Left hemisphere</td>
<td>36 (40.4)</td>
<td>97 (53.9)</td>
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<tr>
<td>Right hemisphere</td>
<td>45 (50.6)</td>
<td>68 (37.8)</td>
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<tr>
<td>Bilateral</td>
<td>8 (9.0)</td>
<td>15 (8.3)</td>
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<td>Recurring stroke, n (%)</td>
<td>20 (22.5)</td>
<td>43 (23.9)</td>
<td>.796</td>
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<td>MoCA</td>
<td>20.8±5.7 / 3-30</td>
<td>18.6±5.4 / 6-30</td>
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<td>Acute length of stay</td>
<td>10.4±12.7</td>
<td>10.2±8.8 / 1-41</td>
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<td>Rehab length of stay</td>
<td>14.7±7.4</td>
<td>15.3±8.6 / 3-57</td>
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<td>NIHSS</td>
<td>8.0±8.0 / 0-38</td>
<td>7.6±6.3 / 0-29</td>
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<td>Charlson score</td>
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<td>1.6±1.9 / 0-9</td>
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<td>FIM Motor</td>
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<td>Admission</td>
<td>36.1±14.1 / 10-64</td>
<td>33.5±13.8 / 9-64</td>
<td>.152</td>
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<td>DC</td>
<td>54.3±14.7 / 14-81</td>
<td>52.8±16.5 / 14-80</td>
<td>.472</td>
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<tr>
<td>FIM Cognitive</td>
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<td></td>
<td></td>
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<tr>
<td>Admission</td>
<td>26.7±7.6 / 8-35</td>
<td>25.2±7.8 / 5-35</td>
<td>.145</td>
</tr>
<tr>
<td>DC</td>
<td>28.3±6.1 / 12-35</td>
<td>26.8±7.0 / 9-35</td>
<td>.089</td>
</tr>
<tr>
<td>FIM total</td>
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<tr>
<td>Admission</td>
<td>64.4±20.0 / 22-102</td>
<td>59.9±19.7 / 16-99</td>
<td>.075</td>
</tr>
<tr>
<td>Discharge</td>
<td>84.6±19.2 / 36-114</td>
<td>81.0±21.8 / 27-118</td>
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<tr>
<td>FIM total gain</td>
<td>20.2±10.1 / -1 to 54</td>
<td>21.2±12.3 / -6 to 57</td>
<td>.503</td>
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<tr>
<td>AM-PAC BM</td>
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<td></td>
</tr>
<tr>
<td>DC</td>
<td>52.1±11.1 / 4-78</td>
<td>51.4±11.9 / 17-78</td>
<td>.632</td>
</tr>
<tr>
<td>6M</td>
<td>56.1±11.8 / 12-94</td>
<td>50.3±15.2 / 19-109</td>
<td>.837</td>
</tr>
<tr>
<td>12M</td>
<td>55.9±13.6 / 6-94</td>
<td>50.0±16.9 / 7-109</td>
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<tr>
<td>DC FS = 1 (%)</td>
<td>8.9</td>
<td>38.2</td>
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<tr>
<td>DC FS = 5 (%)</td>
<td>0</td>
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the single exception of admission MoCA, the 89 patients with and the 180 without complete data were remarkably similar (Table 2). DC AM-PAC scores were quite similar. The demographic characteristics of the 89 patients included in the final analyses are detailed in Table 2. One-half SD of the pooled DC scores for BM, DA, and applied cognition was calculated as 5.8, 5.3, and 5.0, respectively, and used as the definition of MCID. At DC, 69.3% of AM-PAC scores were assigned via proxy, while 27.3% and 31% were assigned via proxy at 6M and 12M, respectively. Mean scores were lower in the proxy group at 6M and 12M but not DC for all domains (data not shown).

![Image](https://www.archives-pmr.org)

**Fig 1** Changes in mean AM-PAC domain scores over 12M. The box and whisker plot above depicts the mean (X), median (line), 25th-75th percentiles (IQR) (colored box), 1.5×IQR (top and bottom horizontal lines) and outliers (dots) for AM-PAC scores at DC from inpatient stroke rehabilitation and subsequently 6M and 12M after DC. The *P* value below the plots refers to Friedman test used for each domain to examine significant differences among the 3 time points. The *P* values above the plots refer to pair-wise Wilcoxon signed-rank tests between 2 time points. Note that the applied cognitive domain significantly decreased (*P*=.002) from 6M to 12M.; Abbreviations: IQR, interquartile range; NS, not significant.
AM-PAC as a continuous variable

The overall Friedman test was significant for all 3 domains (BM $P < .002$, DA $P < .001$, applied cognition $P < .001$) (fig 1). Wilcoxon signed-rank tests were significant for all domains from DC to 6M (all $P < .001$) and DC to 12M (BM $P < .001$, DA $P < .001$, applied cognition $P = .031$). There was no statistically significant change in BM and DA scores between 6M and 12M ($P > .60$), while applied cognition scores significantly declined ($P < .002$).

AM-PAC as a categorical variable

Figure 2 summarizes the percentage of our sample classified as improved, unchanged, or declined by definition (MDC, MCID, FS), domain (BM, DA, AC), and recovery period (early [DC to 6M] or late [6M-12M]). Visual inspection suggests the greatest consistency among change definitions in AC, with BM intermediate and DA the least consistent. The estimated MCID was larger than MDC for BM and DA but not AC. The proportion classified as “unchanged” ranges from 30%-70%, depending on time period or domain. Despite statistically significant group early mean improvement in all domains scores, 10%-17% declined at an individual level. Conversely, statistically nonsignificant late group differences for BM belied a 16%-24% improvement and 12%-20% decline at the individual level. For DA, 16%-20% of individuals demonstrated late improvement and 28%-32% decline despite nonsignificant group changes. The proportion of late vs early improvement is about one-half for BM, about one-third for DA, and about one-fifth for AC.

Figure 3 illustrates the proportion of each FS at 3 time points. There are clear incongruities in severity among the 3 domains. While the bulk of the sample remains evenly split between FS3 and 4 for applied cognition during the first year, the lower FS3 predominates for BM and lower still FS2 for DA. In general, the proportion of lower FS drops, and proportion for upper FS increases but with a plurality remaining in the middle.

Discussion

This study examined functional changes in persons with stroke over the first year after DC from inpatient rehabilitation using a psychometrically sound measure in a US-based cohort. The identification of substantial individual heterogeneity not reflected in the group analyses is an important finding and supports a nuanced interpretation. As a group, we found statistically significant early improvement in BM, everyday self-care activities and functional cognition with no significant late improvement. In fact, from 6M-12M cognition statistically decreased (see fig 1). Therefore, one might conclude that “most people get better” during the first 6M after inpatient stroke rehabilitation DC but are “pretty stable” after that. Yet, 50%-70% of those with “significant” early improvement were unchanged or declined during the late period (see fig 2). Conversely, despite no “significant” late improvement as a group, 15%-24% of individuals experienced an improvement, and 20%-30% experienced a decline in BM and DA. With a statistically significant decrease in mean applied cognition scores, 8%-9% of participants actually improved, and a full 60% were unchanged. Previous studies have noted heterogeneity of stroke recovery based on initial severity or type of stroke. Our data reiterate the risk of depending only on mean group changes and overlooking clinically important individual change. Our results support a 6-month functional plateau after stroke at the group level, albeit a somewhat “wobbly plateau.”

Definitions of plateau range from “no improvement” to “no clinically significant improvement” to “no statistically significant improvement” to “proportionally less” improvement.
of impairment or activity limitation over variable time periods. Physiological adaptation to an exercise regimen (requiring novel treatment strategies) or use of insensitive assessment instruments could be misinterpreted as a plateau. In the existing literature, the proposed windows to achieve a plateau range from 2-6 months to as long as a year. The relative absence of a ceiling effect for the AM-PAC is an important facet of our study. No one was discharged at the highest FS for BM or DA, and only 10 of 89 participants (11%) were at FS = 5 for AC, well below the recommended 15%-20%. Despite 50%-70% of individuals classified as “stable” from 6M-12M, the AM-PAC was still able to detect further change in 10%-20% of the group. We are confident in concluding there was little actual change after 6M and not measurement artifact.

Prior group analyses have supported a front-loaded, but heterogeneous, recovery pattern after stroke. Meyer et al documented increases in mean BI and Rivermead Motor Assessments among 532 patients at 2 and 6 months only to find a decline back to the 2-month level by 2 years. Other studies suggest a plateau by 3 months. A recent meta-analysis found a small but significant improvement in activities of daily living measures from 3-6 months but noted substantial variation at the individual level. Using a variety of objective and subjective assessments including the Action Research Arm Test, Sickness Impact Profile,
BI and walking speed, among others, Kwakkel et al also observed despite no activities of daily living change from 6M-12M at the group level, a small subset of individuals improved or declined. With sampling only at 6M and 12M, we cannot refute the premise of a “3-month plateau.” Neither can we directly compare functional improvement with other studies given that there is no “crosswalk” among measures and studies. Nonetheless, our findings do indicate substantial heterogeneity at the individual level, consistent with previous studies using a broad array of assessment strategies.

At the individual level, we characterized “improved,” “unchanged,” or “declined” between 2 time points based on the magnitude of AM-PAC change from 3 perspectives. The reader is referred a number of statistical and philosophical works on analyzing change in clinical research. The MDC is generally considered to be a mathematical construct consisting of the quantity of change over time that surpasses the random fluctuation (error) of a given scale. The MCID, on the other hand, is more of a philosophical construct, representing the minimal amount of change that results in a clinically noticeable effect determined from either an adequate treatment effect size or anchor to another clinical measure. For MCID, we have only a single study in back pain with which we might compare our results. Using the Norman method, our estimated MCID for the BM domain was 5.8, higher than the MCID for persons with back pain estimated by Lee et al and higher than the published MDC of 4.28 (consistent with previous discussions). Because an MCID is disease specific, a higher value in patients with stroke seems reasonable given the clinical expectation of greater functional heterogeneity in stroke compared with back pain. For DA, our estimated MCID was 5.3, also higher than the published MDC of 3.7 points. However, our calculated MCID of 5.0 for applied cognition was lower than the published MDC of 5.5. That the threshold for “clinically” significant change would be less that of “statistically” significant change seem counterintuitive. Yet, this has been observed by others.

There are surprisingly few categorical studies reporting stroke outcomes. Most use a dichotomous approach of better vs same, independent vs not independent, dead or alive, or higher or lower than an arbitrary cutpoint on the BI. We allowed for both “unchanged” and “declined,” in addition to “improved.” While we consciously chose to examine responsiveness (“clinically significant change”) in either direction, this decision led to a rather liberal definition of “unchanged” (i.e., any change, either positive or negative but <MDC or <MCID) and possibly accounting for the frequency of “unchanged” seen among our sample. Although painting a somewhat static picture of outcomes after stroke, it also augments our confidence of interpreting “improved” or “declined” when looking at individual outcomes at odds with group analyses. This approach does still allow for the dichotomous clinical question, “will the patient get better or not,” not meaning same or worse.

Although our primary objective was to examine change, our findings are generally consistent with other AM-PAC studies, including a similar 3%-10% ceiling effect reported by Sandel et al. Using a slightly different population with stroke, Chan et al reported 6-month mean AM-PAC changes were >MDC for all domains. Our 6M surpassed the MCD only for BM and DA and not for AC. Relative to our sample, Coster et al found a greater ceiling effect (BM = 1%, DA = 26%, AC = 44% at 12M) and greater mean 6-month gains (8.4-13.2 vs 4-6) in a group of mixed diagnoses. Our sample was likely more severely disabled (all neurologic), making them both unlikely to achieve maximal scores or achieve comparable functional gains. That said, the samples were similar with respect to the proportion of patients achieving early gains >MDC (28%-42% vs 39%-55%) and late gains >MDC (14%-21% vs 8%-23%) and the observation of frequent functional declines over time, consistent with other studies.

Regarding our reporting FS change within individuals, Tao et al used FS primarily to describe the breadth of functional limitations in a sample, although they did report individual change data. Although it is clinically satisfying to have a narrative description of patient status (e.g., “on your own,” “daily tasks are a struggle,” “moving around indoors,” etc) (see table 1), there are also drawbacks. Because of the potential limitations from ceiling and, more substantially, floor effects, we were only able to analyze 55-81 of the 89 patients using the FS, excluding those at FS = 1 and FS = 5 at baseline. This was not the case with MDC or MCID, except for 2 patients with a baseline applied cognition score too high to improve by the MDC or MCID (data not shown).

Tao takes a similar approach using only those participants with a baseline FS ≤ 4 but do not report participant who decline. Yet, it may not be a major consideration because we found only 2 of 10 participants with a baseline FS = 5 for whom applied cognition improved by ≥MDC or ≥MCID by 6M. Likewise, of those at FS = 1 at DC, only 1 of 8 in BM, 4 of 34 in DA, and 0 of 4 in applied cognition decreased by ≥MDC or ≥MCID by 6M. For comparison, we also recalculated fig 2 using all FS data and observed only a slight shift in early DA proportions to “improved” (36.3% to 42.7%) and away from “declined” among late proportions (30.9% to 22.5%, data not shown). Although this suggests a low risk for ceiling or floor effects in this scenario, further research is warranted in this area. In summary, in our hands the AM-PAC seems to have behaved in a manner consistent with previous studies of patients with and without stroke.

Study limitations

A few limitations to this study should be noted. Our data were collected at a single institution and limited to only 3 time points over a year. Our findings cannot be generalized beyond patients completing inpatient stroke rehabilitation and their recovery during the 12M after that DC. With a sample size of 89 participants, we limited formal statistical comparisons to minimize the risk of type I errors. The sample size also limits our descriptive observations and may allow for greater confidence in the direction of a trend, rather than absolute magnitude. Larger samples are required to determine trends of individual changes in persons with stroke over time. Only one-third of the patients discharged from inpatient stroke rehabilitation had complete data, risking potential bias. However, an extensive comparison of those with and without complete data revealed only a 2-point difference in admission MoCA scores. We cannot rule out that this difference affected either our results or our follow-up rate. Moreover, comparisons between the 89 patients included and 344 not included indicated higher motor and cognitive function at admission to and DC from inpatient stroke rehabilitation in the former but no differences in stroke severity or demographic factors (data not shown). We did not control or track the degree or quality of rehabilitation after DC, which also could have affected the outcomes. The analysis for FS required excluding 8-44 cases (depending on the domain) already at FS = 5 at DC. Although this may risk an underestimation of outcomes because of ceiling effect, we found very few patients within that group who actually achieved the MDC or
Activity limitation after stroke rehabilitation

MCID, suggesting a low risk. Moreover, a sensitivity analysis using all FS cases revealed only slight differences, mostly in the DA domain. There may be a risk of misclassification with our categorical measures, which could only be delineated with a comparison to either the patient’s or care partner’s perception of “change.” Finally, the AM-PAC is a subjective measure of activities limitation and could be influenced by patients’ increased insight into their limitations or an adaptation to their physical limitations over time rather than an actual decline in function. This might be an explanation for the decrease in applied cognition from 6M-12M and warrants further exploration. Proxy completed scores were lower at 6M and 12M than patient completed scores.

Conclusions

In conclusion, using an instrument responsive to change and generally unencumbered by ceiling effects in a US-based sample, we demonstrated a significant meaningful functional improvement between inpatient stroke rehabilitation DC and 6-month assessment with no further group improvement between 6M and 12M. Although supporting the concept of a plateau at 6M after DC from inpatient stroke rehabilitation, we also found substantial heterogeneity in outcomes when examined at an individual level. Many individuals were unchanged or had declined in the early period and a smaller proportion made gains in the late period. Our results underscore the critical importance of considering individual outcomes in stroke research including those who do not change or decline. Further research should apply this approach to larger samples to improve generalizability. The identification of variables predicting which individuals are at risk for decline could prompt additional and tailored rehabilitation interventions.

Keywords

Disability; Rehabilitation; Functional assessment; Stroke

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