

# Research Corner

## Outcomes in Cardiopulmonary Physical Therapy: Acute Care Index of Function

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### INTRODUCTION

To determine effectiveness of physical therapy interventions and improve delivery of care, physical therapists are increasingly using outcome tools to gather data on patient status at the initial examination and following treatment in a variety of health care settings. Outcome assessment in acute care settings, however, remains a difficult challenge due to the extreme variation in patient acuity and the types of interventions used to manage their conditions.<sup>1</sup> Medical outcomes for patients in acute care settings include complication rates or number of hospital days,<sup>2</sup> however, these measures are not useful for physical therapists. Physical therapy outcomes in acute care, like outcome measures in other settings, should include measures of a patient's ability to function in the environment. Currently, there is a lack of literature reporting measurement of physical therapy outcomes for patients in acute care settings, and there are no clear recommendations for specific outcome tools to be used in this setting. As recently as 1998, the statement was made, "Unfortunately, very little direct clinical evidence has been published demonstrating the impact of physical therapy on patient outcomes in the acute care setting."<sup>3</sup>

Physical therapy outcomes in acute care should capture the functional status of patients at the time of their discharge from the inpatient setting. Functional status should include items such as mobility, self care and ambulation, and the amount of assistance needed to perform these activities. Several studies have measured the functional status outcome of patients following an acute care stay, using tools such as the Katz Activity of Daily Living Instrument,<sup>4</sup> the Nottingham Health Profile,<sup>4</sup> Barthel Index,<sup>5</sup> and Duke Activity Status Index.<sup>6</sup> However, each of these studies measured outcome retrospectively by phone call to the patient after the patient had returned home, and did not specifically measure functional status at time of

discharge. The Katz Index of Independence in Activities of Daily Living is often used by nursing professionals to evaluate functional status in hospitalized patients, but has not consistently been used by physical therapists.<sup>7,8</sup> The Katz instrument measures of function include bathing, dressing, toileting, eating, transferring, and remaining continent, but does not address other functions such as mental status and the ability to move in bed, which are important functional activities for patients in the acute setting. Therefore, The Acute Care Index of Function (ACIF)<sup>9</sup> was developed to address mental status, low level activities such as bed mobility, and other aspects of mobility.

Information about patient's functional status may also be used to determine discharge placement, such as whether a patient's functional ability allows for return to home, or whether additional care in a rehabilitation or skilled nursing facility is necessary.<sup>9</sup> Few instruments focus on the functional skills of the patient that are necessary in the acute care setting and are also useful in predicting discharge placement. Neither the Katz nor other instruments<sup>5-7</sup> of function were developed to predict discharge status of hospitalized patients. The ACIF was developed by Roach and Van Dillen<sup>9</sup> to measure the following issues: (1) functional status at levels of function required in acute care and (2) prediction of discharge placement. Additional objectives in developing the Acute Care Index of Function included ease of administration and ability to reflect changes in functional status. In this review, we will address the background of the ACIF, followed by discussion of the reliability, validity, responsiveness to change and ability to predict discharge status, and conclude with thoughts on future directions.

### Background of Instrument

The ACIF was developed by physical therapists in the acute neuromedicine/surgical unit of a hospital because no suitable instrument existed that could measure basic mobility for the patients in this setting which could also be used to assist in discharge placement decisions.<sup>9</sup> This section will address development of the ACIF in regard to feasibility, the ability to reflect change, the development of the scoring system, and the types of patients.

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**Table 1. Subscale Items of the Acute Care Index of Function**

Mental Status	Bed Mobility	Transfers	Mobility
1. verbal commands	1. roll supine to right	1. wheelchair to mat	1. gait with device
2. commands	2. roll supine to left	2. mat to wheelchair	2. gait without device
3. learning	3. supine to sit	3. sit to stand	3. ascend stairs
4. safety awareness	4. sit to supine	4. stand to sit	4. descend stairs
		5. sitting balance	5. propel wheelchair
		6. standing balance	6. set-up wheelchair

Adapted from: Roach KE, Van Dillen LR. Development of an Acute Care Index of functional Status for patients with neurologic impairment. *Phys Ther.* 1988;68:1102-1108.

### Focus on Acute Care Activities

The ACIF uses 20 items divided into 4 subscales: mental status, bed mobility, transfers, and mobility (Table 1). Assessment of mental status is used to improve the ability of the instrument to discriminate the patients into discharge placement groups. Low level activities include bed mobility (rolling and coming to sit), as these tasks are difficult for patients with acute neurologic conditions. Gait and mobility items were selected to measure functions needed to perform inside the home, but not in the community. The mental status subscale is evaluated first. Patients are given instructions before being asked to perform the tasks. If patients cannot follow verbal directions, then observation of the task is allowed. The 3 other physical function subscales of bed mobility, transfers, and mobility are then performed for scoring safety in performing the activities is scored in the mental status subscale.

### Feasibility

The components of the tool were chosen based on items normally completed by a physical therapist as part of examination and treatment. Therefore, the administration of the test is easy and appropriate for physical therapists working in the acute setting. In addition, the time to administer is relatively short, reported as 12 minutes on average.<sup>9</sup> The cost of administration of the tool is negligible as the items on the ACIF are often completed by a physical therapist as part of an initial examination.

### Reflecting changes in functional status

Administration of all 4 subscales of the ACIF is to be completed by a physical therapist. Initial exam by the physical therapist is to be done within 24 hours of admission to the unit. Due to the shorter time frame that patients are in the acute setting, this immediate initial administration of the ACIF is important to effectively capture any changes in functional status. Scores increase as patients become independent in activities. One limitation of this measurement tool is that health care was very different when the ACIF was developed in 1988 in comparison to today. Often, the length of stay in acute care was much longer than it is today and therefore variations in the change in functional status might have been higher over this longer duration of care.

### Scoring

The scoring system was developed for the dual role of identifying change in functional status and predicting distinct discharge categories of home, nursing home, or rehabilitation centers. Items in the 3 subscales (bed mobility, transfers, and mobility) on the ACIF are based on a 3 category scale described by degree of assistance needed to perform the tasks: 'unable to perform,' 'dependent (requiring physical or verbal assist),' and 'independent (performance requiring no assistance).' Each of the items on the subscale are independently weighted (unable = 0, dependent = 4-21, or independent = 10-30) to provide a better scoring range useful for the dual roles of detecting change in status and discriminating between discharge settings. Mental status items are rated as 'yes' indicating a present behavior or 'no' indicating an absent behavior.

Total subscale scores are determined by adding the number of points scored and dividing by number of points possible.<sup>9</sup> The overall score is calculated using a weighted equation, where mobility and gait subscales are weighted twice as heavily as the mental status and bed mobility subscales. The scores can be used as percentages or decimal, although the original article reports scores as decimals (0.7), for example. A data sheet in the original article by Roach et al<sup>9</sup> illustrates the scoring categories, respective scores for each subset item, and the formula to calculate the overall patient score.

The original ACIF scoring was later modified for use in patients with lower extremity orthopedic diagnoses.<sup>3</sup> The mobility items addressing wheelchair mobility and stairs were eliminated and the remaining 2 items (gait with and without device) were incorporated into the mobility subscale. In this way, changes in mobility and transfers could be examined separately from changes in bed mobility and mental status. When comparing the revised scoring system to the original system, there was no significant difference in the score calculations.<sup>3</sup>

### Subjects

Initial data for tool development (n=75) and reliability data (n=91) were collected on male and female patients aged 15 to 97 years old. The diagnoses of the patients

included cerebrovascular accident (CVA), multiple sclerosis (MS), Parkinson's disease, cancers of the central nervous system, head injury, and other neurologic conditions (such as amyotrophic lateral sclerosis).<sup>9,10</sup> Although there is no specific mention of cardiac or pulmonary conditions in the patients studied, the incidence of these complications in patients with acute neurologic conditions is high and it is likely that the patients had concurrent cardiac and pulmonary conditions.<sup>11</sup> The ACIF scale was also later used in a retrospective chart analysis for inpatients (n= 173) with diagnoses including lower extremity fractures or surgery.<sup>3</sup>

## Reliability

The original article by Van Dillen et al<sup>10</sup> reported testing inter-rater reliability for the ACIF in a 5-week study using 6 physical therapist raters trained in usage of the ACIF instrument. These raters were all employed in the acute care setting with ages ranging from 22 to 32 years (mean = 25.67, SD = 3.7) and clinical experience ranging from 1.5 to 10 years (mean = 3.75, SD = 2.67). A total of 166 patient tests were conducted on 91 patients. The weighted Kappa values ranged from 0.88 to 0.98 on the scores for physical function items and 0.60 to 0.98 on the scores for the mental function items. The least agreement between raters was on the safety awareness item in the mental function subscale with weighted Kappa value of 0.60. Inter-rater reliability measured with interclass correlation (ICC) ranged between 0.98 and 1.00 for both the subscale scores and total score.<sup>10</sup> Test-retest reliability of the ACIF was not measured.

## Validity

Validity of the ACIF to measure functional ability was examined. Criterion-related validity was determined by comparing the ACIF scores to experienced physical therapist's judgment according to 10 hypothetical patient descriptions. The hypothetical patient descriptions were ranked in order of functional status and compared to the scores previously obtained from the ACIF. The weighted Kappa for agreement among physical therapist judgment was 0.75 for rank ordering the 10 patient descriptions.<sup>10</sup> The Spearman rank-order correlation coefficient was 0.81 ( $p < 0.01$ ) when comparing the average of the physical therapists' ranking with the ACIF ranking.<sup>10</sup>

## Responsiveness to Change

The ACIF is able to determine a change in functional status in all patients and also to predict discharge placement based on scores. Change in functional status is described as a difference between initial and discharge scores. Discharge placement is determined by a range of scores, with lower scores (0 – 0.30) associated with nursing home discharge placement, moderate scores (0.30-0.70) suggesting rehabilitation and high scores (above 0.70) associated with return home.

Responsiveness was measured by identifying differences between initial and final discharge scores in patients with acute neurologic conditions.<sup>9</sup> The ACIF scores for this group of patients did not differ at baseline. At final mea-

surement, patients who were discharged to a nursing home did not demonstrate a significant improvement over their initial score. However, a significant difference ( $p < 0.01$ ) was reported to exist between the initial and final scores of patients who were discharged to a rehabilitation facility. The initial and discharge scores of the patients discharged to rehabilitation improved by more than 20 points, while the scores of those who were discharged to a nursing facility changed by 8 points.<sup>9</sup> The range of clinically significant improvement in scores lies within these ranges, but specific thresholds cannot be determined based on the information provided in the articles.

Final ACIF scores can also predict discharge setting. Discharge ACIF scores were significantly different ( $p < 0.01$ ) between those patients that went on to a rehabilitation facility versus a nursing facility.<sup>9</sup> In the original study of patients with acute neurologic conditions, 100% of the patients who scored less than or equal to 0.30 were discharged to a nursing facility. Of the patients who scored in the 0.31-0.70 range, 65% were discharged to a rehabilitation facility. Finally, 72% of the patients scoring greater than 0.70 on the ACIF were discharged to home.

The ACIF showed a significant ( $p < 0.05$ ) difference in change in physical function between admission and discharge scores in a group of patients with lower extremity orthopedic diagnoses.<sup>3</sup> Mean change scores were 6.27% for the mental status score and ranged from 15.42 to 18.42% for the mobility categories.<sup>3</sup>

Overall, the psychometrics of the ACIF are strong, demonstrating good agreement between raters, good validity with clinical judgment, and responsiveness to change. Inter-rater reliability was best among the subscales of transfers and mobility, and least for the mental status subscale. The ACIF demonstrates consistency with physical therapists' clinical judgment, but has not been tested against other measures of mobility. Patient scores improve from initial measurement to discharge, which indicates that a change in score is associated with a change in function.

## Clinically significant difference [Minimally clinically important difference (MCID)]

Interpreting the scores for clinical significance is difficult, as the scores and statistics are not reported in similar fashion as other outcome measures are currently reported. Of the data that were reported, the standard deviations of scores for each subscale are close to 50% of the mean score.<sup>3</sup> For example, the mean discharge score for bed mobility was 57.63% with a standard deviation of 31.59%. This large degree of variability makes it difficult to set a value for MCID.

## Suggestions for Use

The 2 primary uses for this tool include measurement of change in physical function over the course of an inpatient stay and prediction of discharge setting. This instrument has good inter-rater reliability for physical therapist raters, is easy to administer, and is consistent with physical therapists' clinical judgment. As discussed above, the ACIF

score should increase as function improves, but MCID or a threshold score cannot be identified from the information provided. The discharge score ranges appear to be able to discriminate whether patients should be discharged to a rehabilitation or nursing home setting.

There is limited information about whether this tool is appropriate for acute care patients with cardiovascular or pulmonary conditions. Because the ACIF was developed for use in patients with acute neurologic conditions, an apparent underlying assumption of the tool is that limitations in performing mobility tasks are due to the status of the neurologic system. There is no description of the cardiopulmonary status of the patients studied, although it is likely that patients had pulmonary conditions associated with their conditions.<sup>11</sup> It is unclear as to whether the pulmonary status of patients may have affected the functional scores or discharge status. However, given the likelihood that the patients studied had concurrent pulmonary dysfunction the ACIF probably can be used successfully with patients with other medical conditions. Although there is no published literature on the feasibility of using the ACIF in patients with other acute conditions, we are aware of several examples where physical therapists are using the ACIF in acute care patients following total knee arthroplasty and with medical/surgical conditions such as cirrhosis. We are also aware that the tool has been used in intensive care units with patients who required mechanical ventilation. These unpublished reports indicate that the ACIF may be useful for a majority of patients in acute care. Since the ability to deliver oxygen is a key component of movement, further evaluation of the role of pulmonary status in mobility activities is warranted.

The scoring system used in the ACIF has the ability to detect changes in function, but lacks precision for patients with lower functioning. The precision may be low due to the limited number of performance categories available for scoring and the wide range of performance levels within the dependent category (physical or verbal assistance).<sup>9</sup> In addition, the tool primarily investigates gross motor activities, and does not focus on activities of daily living. Scoring of the mental status scale had the least agreement between raters, probably due to the lack of clarity in the operational definition for this item.<sup>10</sup> Overall, however, the scoring system was consistent with physical therapists clinical judgment, as demonstrated by a ranking exercise.<sup>10</sup>

A significant question for this instrument is the accuracy of predicting discharge setting, largely due to changes in delivery of rehabilitation in various settings in the 20 years since the ACIF was developed. In developing the ACIF, the score weighting system was selected to assist in discharge planning by creating scores that differentiated patients that were discharged to home, rehabilitation, or nursing home. While the scoring system has not changed, rehabilitation services are currently provided in similar fashion in both rehabilitation centers and skilled nursing facilities.<sup>12</sup> Further study of this tool in the current practice environment is needed to determine if the scoring criteria can adequately predict discharge status.

In summary, the Acute Care Index of Function currently is one of the few validated physical therapy outcome measures for use in acute care settings. Inter-rater reliability of the tool is good, as is the validity of the tool to concur with therapist's clinical judgment. The tool is able to detect changes in function, although no clinical change score has been determined. The ability of the tool to predict discharge placement is unclear, as changes have occurred in delivery of rehabilitation in the 20 years since the tool was first developed. Finally, the feasibility, reliability, and validity of this tool in other types of patients in acute care, including cardiac and pulmonary conditions, needs to be documented.

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