Outcome Measures in Neurological Physical Therapy Practice: Part II. A Patient-Centered Process

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Physical therapists working in neurological practice must make choices about which standardized outcome measures are most appropriate for each patient. Significant time constraints in the clinic limit the number of measures that one can reasonably administer. Therapists must choose measures that will provide results that guide the selection of appropriate interventions and are likely to show clinically meaningful change. Therefore, therapists must be able to compare the merits of available measures to identify those that are most relevant for each patient and setting. This article describes a process for selecting outcome measures and illustrates the use of that process with a patient who has had a stroke. The link between selecting objective outcome measures and tracking patient progress is emphasized. Comparisons are made between 2 motor function measures (the Fugl-Meyer Assessment [FMA] of Physical Performance vs the Stroke Rehabilitation Assessment of Movement), and 2 balance measures (Berg Balance Scale vs the Activities-specific Balance Confidence Scale). The use of objective outcome measures allows therapists to quantify information that previously had been described in subjective terms. This allows the tracking of progress, and the comparison of effectiveness and costs across interventions, settings, providers, and patient characteristics.

Key words: *examination, outcome measures therapy, stroke*

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INTRODUCTION

Physical therapists (PTs) continually compare tests and measures to choose those most appropriate for each patient. The term *outcome measure* (OM) is often used to describe these tests since they are frequently used to determine whether there has been a change in patient status or outcome. Physical therapists also use measurement tools to diagnose or formulate a prognosis about a patient's future status. In this article, the term *outcome measure* will be used broadly—to describe those tools that are used to assess patient status, as well as tools that serve diagnostic or predictive purposes. Outcome measures help to guide the selection of appropriate interventions. For example, if a patient scores low on the Berg Balance Scale (BBS), interventions that target postural control would be important to include in the plan of care. The complexity and variability of patients seen in neurological physical therapy practice make selection of OMs challenging. In addition, time constraints in the clinical setting limit the number of OMs that one can reasonably administer.

Part I of this article series, "Outcome Measures in Neurological Clinical Practice: Part I. Making Sound Decisions,"[1] also in this journal issue, explores multiple factors involved in OM selection, including measurement psychometrics, measurement purpose, and clinical utility. The steps in selecting OMs are introduced in that article (see Figure 1, Potter et al[1]).

This article further explores the process for OM selection, and illustrates the application of that process for a patient with a diagnosis of stroke. A fully developed OM selection process is schematically represented in Figure 1. At the core of the process and represented in the center of the figure are the psychometric properties of the measure(s) under consideration. The key psychometric characteristics to examine before selecting an OM are that it:

- is appropriate to examine the desired constructs → *Validity*
- can be administered with minimal error → *Reliability*
- will help to determine if intervention produces a change in the patient's status → *Responsiveness*

Health Condition/Referral Question

The first step in the process (illustrated in Figure 1) is to gather information about a patient's health condition or reason for referral. This information prompts the therapist to consider the body structure/function issues common in that health condition. Knowledge of the health condition, combined with experience treating patients with that condition, allows a therapist to anticipate possible activity limitations and participation restrictions. A review of the medical record provides valuable

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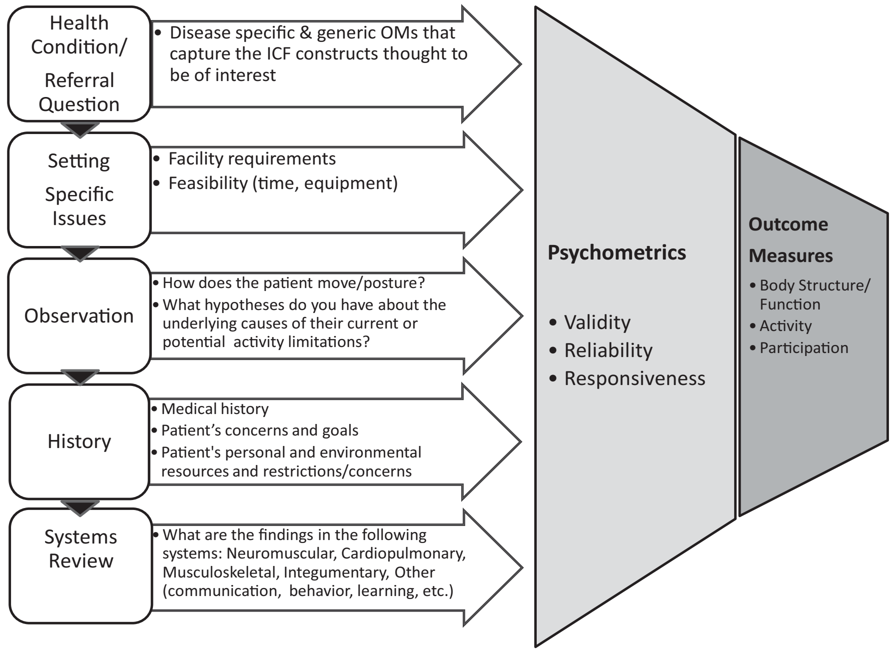
Figure 1. Schematic representing the outcome measurement selection process.



Abbreviations: ICF, International Classification of Functioning, Disability, and Health; OM, outcome measure.

preliminary information to help guide selection of OMs. In inpatient settings, nursing notes about the patient's activity level and assistance required for bed positioning and transfers may prompt the inclusion of specific activity-level measures. Combining information on the patient's health condition, medical record, and nursing notes allows the therapist to develop a tentative list of OMs prior to the therapist's initial evaluation of the patient. The list often includes measures that are specific to the patient's medical diagnosis or condition. Disease-specific measures may be particularly appropriate because they contain items designed to capture issues unique to individuals with that health condition. For example, stroke-specific OMs may include items about selective movement. Items about rigidity and tremor may be included in a Parkinson's disease–specific measure. Referral information may prompt the therapist to include measures, such as measures of balance for a patient who has been referred because of falls, that capture other constructs of interest. Each subsequent step of the examination process serves to tailor the list of OMs to a patient's unique circumstances and concerns.

Clinical Utility and Facility-Specific Issues

The next step in the process involves consideration of the clinical setting and facility-specific requirements and resources. Factors unique to each setting, including equipment and space available, as well as the time allotted for patient examination, affect the choice of measures. Facilities may require the use of specific OMs, like the Functional Independence Measure (FIM)[3] in inpatient rehabilitation, or the Minimum Data Set[4] in skilled nursing facilities. The choice of OMs occurs within the context of these resources and requirements.

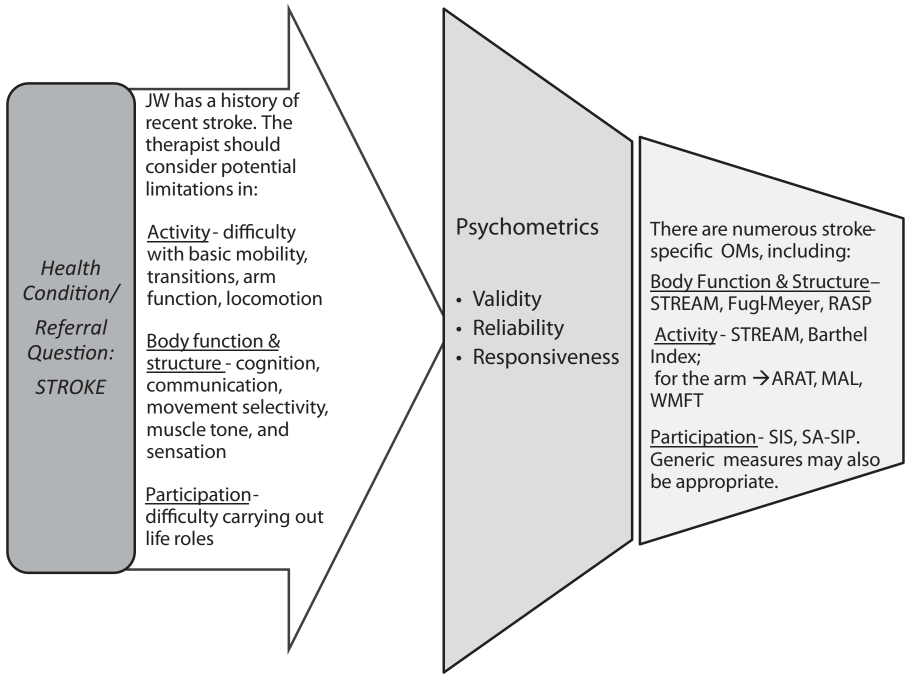
Observation

An initial observation of the patient is the next step in the process. The therapist observes the patient performing spontaneous movements and considers whether the movement is consistent with expectations given the health condition or reason for referral. Observations of posture and movement quality, excursion, and speed help the therapist generate hypotheses about the underlying causes of the activity limitations and participation restrictions. Comparing these hypotheses with the initial list of OMs leads the therapist to include additional OMs and/or reaffirm the appropriateness of the initial list. The potential list is further narrowed because OMs that may have either a ceiling or floor effect are ruled out. Floor and ceiling effects are indicative of failures of responsiveness at the 2 ends of the measurement scale: floor, minimum end, and ceiling, maximum end. For example, if the patient is having difficulty moving in bed, an OM that captures advanced balance activities, such as the HiMat,[2] may be associated with a floor effect, and therefore would be inappropriate for this patient.

Patient History and Goals

The therapist then explores the patient's history and identifies his or her concerns and goals. This provides information about the patient's past and current health situation, including medical and social history, and environment. Knowing the context in which the patient wishes to function, and his or her available resources and limitations, further helps to refine the potential list of OMs.

Figure 2. Outcome Measure considerations for J.W. given his health condition—stroke.



Abbreviations: STREAM, Stroke Rehabilitation Assessment of Movement; RASP, Rivermead Assessment of Somatosensory Performance; ARAT, Action Research Arm Test; MAL, Motor Activity Log; WFMT, Wolf Motor Function Test; SIS, Stroke Impact Scale; SA-SIP, Stroke-adapted Sickness Impact Scale.

Systems Review

The systems review follows and leads to the final OM selection. The systems review begins when the therapist first observes a patient, noting posture, movement, function, and so on. It continues with a more detailed review of the body systems. The *Guide to Physical Therapist Practice*[5] provides a comprehensive outline of this process. Anticipating the focus of treatment allows the therapist to choose OMs that will evaluate the success of those interventions. Following the examination, during evaluation, the therapist considers the OM findings and confirms or modifies initial hypotheses, leading to the development of the PT diagnosis, prognosis, and plan of care.

PATIENT CASE

Consider how this process helps guide the selection of OMs for J.W., a 73-year-old man having a diagnosis of a left cerebral vascular accident 1 week before being admitted to an inpatient rehabilitation unit. The first step in selecting OMs begins when the referral is received (Figure 1). Knowledge that J.W. had a stroke prompts the hypothesis of potential limitations at several levels of the International Classification of Functioning, Disability, and Health (ICF).[6] At the activity level, J.W. may have difficulty with bed mobility, transitions, arm function, and/or locomotion. At the body function/structure level, he may have limitations in the areas of cognition, communication, movement selectivity, muscle tone, and/or sensation. Therefore, OMs that capture these activity and body function/structure constructs should be considered. J.W. may also experience participation-level challenges such as limitations in being able to fully carry outfamily and employment roles. A participation measure, such as the Stroke Impact Scale,[7] might be appropriate if the patient has had the opportunity to experience the impact of the health condition in community living. Participation measures typically ask a patient for a "self-report" of their perceptions, for example, fear of falling or satisfaction with life roles. Because J.W. has been in the hospital since his stroke, this type of measure may not be appropriate at this point in the rehabilitation process.

J.W.'s diagnosis of stroke prompts the therapist to consider stroke-specific OMs. Stroke-specific measures are available to examine the patient's function at each level of the ICF.[6] An advantage of these measures is that they include items that examine many of the symptoms common with stroke, such as abnormal selectivity, spasticity, sensory loss, and cognitive change. Generic measures that target areas of interest such as balance and walking ability may also be included. Preliminary OM considerations for J.W. at this point in the process are illustrated in Figure 2.

The resources and requirements specific to the facility in which J.W. is being treated, including time available for the initial examination, equipment and space resources, and facility-specific OM requirements, are illustrated in Figure 3.

Armed with an awareness of the resources and requirements and a preliminary list of OMs, the therapist meets J.W. in his hospital room. J.W. responds to a knock on the door by saying, "Come in." Using his left hand, he uses the bed controls to move to a sitting position. When he reaches his left hand to

Figure 3. Setting-specific issues that the therapist must consider in planning J.W.'s examination.

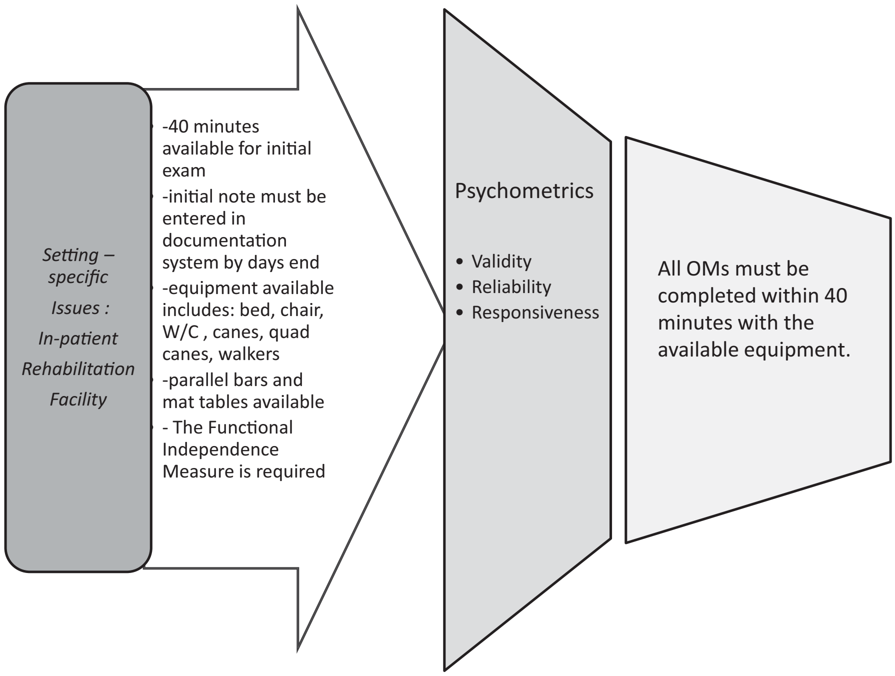
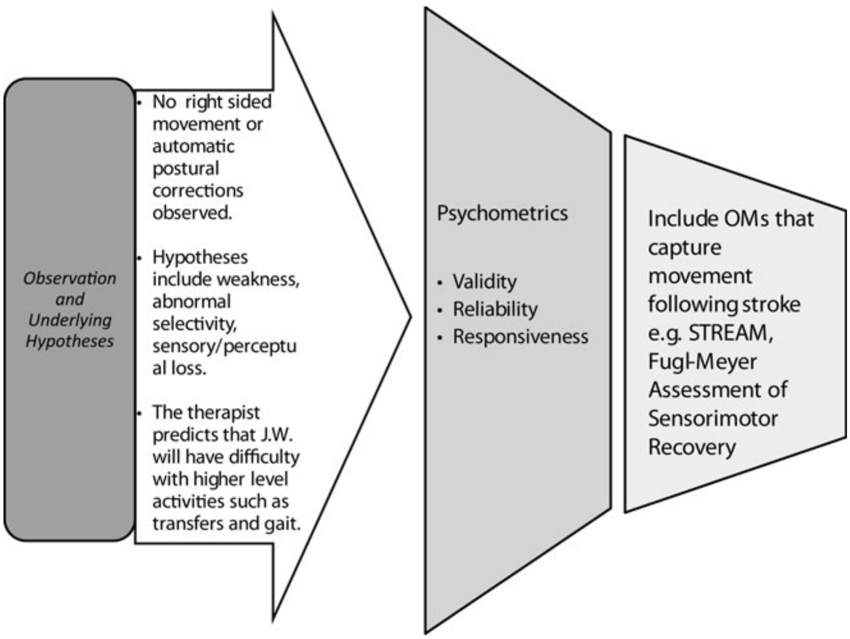


Figure 4. The initial observation and therapist's underlying hypotheses regarding the patient's movement problems.



Abbreviation: OMs, Outcome Measures; STREAM, Stroke Rehabilitation Assessment of Movement.

greet the therapist, J.W. falls slightly to the right. He is able to state his name, the name of the facility, and the reason he was hospitalized. The initial observation and therapist's underlying hypotheses regarding the patient's movement problems are illustrated in Figure 4.

During the history, J.W. reports that he lives with his daughter in a second floor walk-up apartment. He works part-time driving a boat. Prior to his stroke, J.W. was independent in all functional mobility and activities of daily living. He describes his health as "pretty good" before his stroke. J.W.'s medical history is significant for atrial fibrillation, hypertension, and hypercholesterolemia. His goals are to return home and to resume his premorbid life roles.

The systems review follows the history (Table 1). Each of the positive findings obtained during the systems review is compared with the initial hypotheses regarding body structure/function impairments, activity limitations, and participation restrictions resulting in a final list of constructs to examine. The findings also help to narrow the focus of the examination and eliminate those OMs that would result in ceiling or floor effects.

OUTCOME MEASURE SELECTION

The proposed process of selecting OMs can result in numerous possible OMs at each of the ICF levels.[6] It is inefficient and impractical to administer multiple OMs that examine the same construct. To illustrate how a therapist might choose between different measurement tools, 2 motor function measures, the Stroke Rehabilitation Assessment of Movement (STREAM)[8] and the FMA of sensorimotor function,[9] and 2 balance measures, the Berg Balance Scale (BBS)[10] and the Activities-specific Balance Confidence Scale (ABC)[11] will be considered. Comparing and contrasting these measures in the context of J.W.'s needs and goals helps to identify the best OM to select to examine each construct.

Information about the psychometrics of the FMA and STREAM is presented in Tables 2 to 4. The concepts of reliability, validity, and responsiveness are addressed at the center of the OM selection process. An OM's responsiveness and predictive validity are arguably the 2 most important characteristics to be considered when selecting among different tools. An OM that is responsive will allow the therapist to monitor change in a patient's status. Predictive validity will help the therapist to formulate a prognosis and make discharge recommendations. Numerous studies indicate that both the STREAM and FMA can be reliably administered to J.W.[8,9,12-16] The validity of these measures is similarly supported. Concurrent validity for the STREAM and FMA has been established by

Table 1. Information from J.W.'s Systems Review

Cardiopulmonary	
Resting HR	72 bpm
Resting BP	138/84 mm Hg
Resting RR	20/min
Resting O_2 saturation	98% on room air
Edema	Mild edema in R ankle and wrist
Musculoskeletal	
Gross symmetry	Depressed R shoulder and trunk flexed to R
Gross ROM	LUE and LE WFL; RUE and LE impaired
Gross strength	LUE and LE WFL; RUE and LE impaired
Height/weight	5′10″, 175 lb
Integumentary	
Skin color/pliability	Skin intact; no abnormalities of color
Neuromuscular	
Balance	Requires cues and supervision to maintain unsupported static sitting; unable to maintain unsupported standing; able to stand using a small base quad cane with assistance
Gait	Able to walk with small base quad cane and minimal assistance for 10′ with gait deviations present in stance and swing
Locomotion	Independent with wheelchair propulsion on level surfaces using L UE and LE
Transfers/transitions	Assistance required for bed mobility and transfers
Motor function	Unable to perform movements in R extremities
Sensory function	Impaired light touch R extremities
Other	
Communication	Able to speak clearly
Orientation	Alert and oriented 4×
Behavioral responses	Appropriate to situation
Learning barriers	None identified
Educational needs	Education about disease process, home safety, and fall risk
Learning preferences	Visual and reading

Abbreviations: bpm, beats per minute; L, left; LE, lower extremity; R, right; ROM, range of motion; UE, upper extremity; WFL, within functional limits; WNL, within normal limits.

Table 2. Reliability of the STREAM and FMA[a]

Stroke Rehabilitation Assessment of Movement (STREAM)	Fugl-Meyer Assessment (FMA) of Sensorimotor Recovery
Interrater reliability: Adequate to excellent for individual items[8,12] and excellent for arm, leg, gross motor subscales and total score[8,13]	*Interrater reliability*: Adequate to excellent for subscales[9,14-15] and excellent for total score [9,15] *Test-retest reliability*: Excellent for arm[9,15] and leg subscales[9] but not for the sensory subscale[16]
Test-retest reliability is excellent for the motor sections of both the FMA and STREAM.[12]	

[a]Excellent, >0.80; adequate, 0.40-0.79; and poor, <0.40.

Table 3. Validity of the STREAM and FMA

Stroke Rehabilitation Assessment of Movement	Fugl-Meyer Assessment of Sensorimotor Recovery
Total STREAM is moderately to highly related to motor function, balance, walking ability, and ADL function (FMA,[13] Box and Block Test, Berg Balance Scale, Timed Up and Go, and Gait Speed, Barthel Index,[17] and the Rivermead Mobility Index[18])	The FMA is the criterion standard to which many other sensorimotor measures have been compared including the Motor Assessment Scale,[19] Sensory Organization Test,[20] the Barthel Index,[21,22] the Action Research Arm Test.[23]
Predictive validity:	*Predictive validity*:
STREAM scores are predictive of discharge destination after acute care hospitalization[17]: Total STREAM < 63: probability of D/C to home = 0%	Admission motor FMA scores are predictive of discharge motor capacity and function.[24,25]
Total STREAM = 61-95: 55% home D/C	Admission LE FMA scores are predictive of discharge mobility and locomotion.[26]
Total STREAM = 95-100: 86% home D/C	Two authors[10,27] have used the FMA total motor score to classify clients by severity:
STREAM scores are predictive of gait speed and functional ability.[17]	*Gladstone et al*[27] Mild = 80/100; moderate = 56-79/100; moderately severe = 36-55/100; severe = 1-35/100
STREAM (total and subscale scores) are reported to correlate with stroke severity.[17]	*Berg et al*[10] Slight = 95-99; Moderate = 85-94; Marked = 50-84; Severe < 50 points

Abbreviations: ADL, activity of daily living; FMA, Fugl-Meyer Assessment; STREAM, Stroke Rehabilitation Assessment of Movement.

Table 4. Responsiveness of the STREAM and FMA

	STREAM	FMA of Sensorimotor Recovery
Responsiveness	In patients with acute stroke, total STREAM score as well as subscale scores were responsive to change.[17] In patients with severe stroke, the mobility and LE STREAM were responsive to change in gait speed, but less responsive to change than gait speed or the BBS.[18] In acute to subacute stroke, the mobility subscale of the STREAM was more responsive than the Rivermead Mobility Index (RMI) or Modified RMI.[19] The minimal detectable change (MDC) for UE-STREAM = 3 points.[20] The minimal clinical important difference (MCID) of the UE subscale = 2.2 points, LE subscale = 1.9 points, mobility subscale = 4.8 points.[22]	In patients with acute stroke the total FMA was moderately responsive to change.[23] Balance subscale: In acute and subacute stroke, there was a significant change in the modified FMA balance subscore.[24] The effect sizes were excellent between 14 and 30 d and decreased over time. The critical value of change on the balance scale is 4 points.[25] Sensation subscale: The FMA Sensation subscore was reported to have low to moderate responsiveness in acute to subacute stroke.[16] UE subscale: Responsiveness: standardized response mean (SRM) = 1.42 (SRM > 0.8 is considered large)[20] MDC = 5.2[20] Effect size (14-180 d poststroke) = 0.52 (moderate)[20] In patients with chronic stroke undergoing upper extremity forced-use treatment, a responsiveness ratio was used to determine that the Action Research Arm Test was more responsive than the FMA.[26] Lower extremity motor Effect size = 0.41 in patients during inpatient rehabilitation was small.[12] MDC is 5.[25]
	Both the FMA and STREAM showed small effect sizes (and their shortened versions a moderate effect size) between admission to discharge from a rehabilitation program.[12]	
Ceiling/ floor effects	No ceiling or floor effects from stroke onset to 180 d.[19] Compared with the Barthel Index and the Timed Up and Go Test, the STREAM had lowest ceiling effect in acute stroke; a ceiling effect was more significant at 3 mo poststroke. After 3 mo, less than 40% of individuals had reached the maximum score on the total STREAM, and less than 60% had reached the maximum score on the UE and LE subscales.[17] At admission, floor effects were reported on the UE/LE subscales, and ceiling effects were reported on the UE subscale.[12] The UE-STREAM had significant floor and ceiling effects (>21% of subjects) at various stages of recovery.[20]	There is a ceiling effect for both the upper and the lower extremity subscales.[27] Large floor effects were reported on the balance subsection of the FMA in acute stroke.[24]
	At discharge, a ceiling effect was reported for both FMA and STREAM motor subscales.[12]	

Abbreviations: FMA, Fugl-Meyer Assessment; LE, lower extremity; STREAM, Stroke Rehabilitation Assessment of Movement; UE, upper extremity.

comparisons with other measures of the same construct. Predictive validity information may help the therapist set goals related to motor capacity and functional activities, such as locomotion, as well as shape discharge recommendations.

J.W. is being seen in an inpatient rehabilitation setting. A primary role of the PT in this setting is to make discharge placement recommendations. The STREAM score is predictive of discharge destination (e.g., patients scoring < 63/100 on the total STREAM have 0% probability of being discharged to home). This information can assist the PT in making appropriate, evidence-based recommendations. The STREAM and FMA have been shown to be responsive to changes in motor function following stroke. While the FMA can be used to classify patients according to motor function severity, this information may be less useful in assisting with clinical decision making pertaining to discharge destination. Rather, this classification may be more useful to researchers wishing to stratify their subjects according to severity. Both the STREAM[20-22] and FMA[20-25] have published minimal detectable change (MDC) values, but only the STREAM has published minimal clinically important difference (MCID) values.[22] The MDC and MCID represent 2 different aspects of responsiveness, both of which are important in clinical practice.

Another element of responsiveness is the consideration of floor and ceiling effects. Choosing OMs in which J.W. scores at neither the minimum nor the maximum of the scale allows for optimal monitoring of his progress. Studies suggest that both floor and ceiling effects may be seen with the STREAM[12,17,20] and FMA[24,27] with someone like J.W., who has an acute stroke. However, initial observation of J.W. will allow the therapist to make a general prediction about where his scores might fall on these measures.[12-28] Although there is evidence of excellent psychometric date on both measures, the availability of MCID data offers an advantage in selecting the STREAM to provide more complete information about J.W.'s change or response to intervention.

As disease-specific OMs, both the FMA and the STREAM capture body function/structure constructs of interest following stroke, such as selective extremity movement. Both OMs have fairly good clinical utility. The equipment needed to perform the tests can be found in most clinics and is available in the facility where J.W. is being seen. Scoring

Table 5. Clinical Utility Comparison of the STREAM and FMA

Measure	STREAM	FMA of Sensorimotor Recovery
Instrument components and scoring	*Body function/structure level* → UE and LE motor function *Activity level* → Basic mobility 30 items in 3 areas: UE motor function, LE motor function, basic mobility. Each item is scored on a 3-point ordinal scale for motor function or a 4-point ordinal scale for mobility. The quality of motor function is examined although not reflected in total score. The maximum score = 70 points (UE motor function = 20; LE motor function = 20; basic mobility = 30) Scoring allows for omission of items if pain or limited passive range of motion.	*Body function/structure level* → UE and LE motor function, tactile sensation, joint position *Activity level* → balance 113 items in 6 areas: UE motor function, LE motor function, balance, sensation, range of motion, and pain. Each item is scored on a 3-point ordinal scale. The maximum score = 226 points (UE motor function = 66; LE motor function = 34; balance = 14; sensation = 24; ROM = 44; pain = 44)
Equipment required	Support surface (eg, mat or bed) Stop watch Sturdy stool Stairs with railing	Support surface (eg, mat or bed) Stop watch Goniometer Reflex hammer Cotton ball Cylindrical and spherical-shaped objects Pencil and paper (for patient to grab)
Administration time	15-20 min	20-30 min

Abbreviations: FMA, Fugl-Meyer Assessment; LE, lower extremity; ROM, range of motion; STREAM, Stroke Rehabilitation Assessment of Movement; UE, upper extremity.

for these OMs is on a 3-point ordinal scale. There are, however, differences between the measures. While the STREAM scoring system captures the concepts of movement excursion and quality (1a-c scores), total scores do not reflect this concept since all scores of 1 (a, b, or c) are tabulated as "1." The FMA items examine selective extremity movements; it also includes items on range of motion, pain, sensation, balance, and reflexes. The STREAM includes a gross mobility subscale composed of 10 mobility items assessing various aspects of bed mobility, transitions, and gait. The FIM,[3] a tool that is required in inpatient rehabilitation facilities, includes only 3 items pertaining to mobility. The FIM does not include items specific to bed mobility, which is an important skill for patients following stroke. In addition, the FIM is used to rate the burden of care, whereas the STREAM rates the patient's degree of independence and the degree to which the patient demonstrates a normal movement pattern during tasks. Hence, the information garnered from the STREAM and the FIM are complementary, rather than duplicative. Both provide useful information when determining the plan of care for patients following stroke. Finally, administration time for the tools differs; the STREAM takes 15 to 20 minutes to complete all 3 scales, while the FMA requires 20 to 30 minutes.

As described earlier, both FMA and the STREAM capture the construct of selective limb movement and have acceptable psychometrics that should allow the therapist to develop prognoses and measure change. Because of the greater clinical utility of the STREAM with its inclusion of gross mobility items, shorter administration time, ability to predict discharge destination, and published MCID values,[20,22] we believe that the STREAM is the more appropriate OM to use in this case.

The psychometric properties of the 2 balance measures, the ABC and BBS, are presented in Tables 6 to 8. The ABC is a self-report measure, where the BBS is a performance-based tool. Both the BBS and the ABC were developed as generic measures; however, excellent reliability has been reported for each measure when used following stroke.[10,28,29] The validity of both measures is similarly supported.[24,29,31-39] Concurrent validity for the BBS has been established by comparisons with other measures of balance.[24,28,30-38] Information on predictive validity is extremely helpful as it may contribute to the development of a prognosis about J.W.'s functional activities as well as discharge status.[32-38] The BBS has been studied in stroke across acuity levels,[30,32,35,36] while most studies of the ABC have involved stroke subjects in the chronic stage of recovery. Finally, the BBS has been shown to be responsive following stroke.[18,24,40-43]

Another element of responsiveness is the consideration of floor and ceiling effects. One study suggests that both floor and ceiling effects may be seen with the BBS in acute stroke.[24] No studies have examined the ABC in acute stroke and therefore the presence of floor or ceiling effects is unknown.

Table 6. Reliability of the Berg Balance Scale and Activities-specific Balance Confidence Scale[a]

Berg Balance Scale	Activities-specific Balance Confidence Scale
Test-retest reliability: Excellent in patients with stroke[10,28]	*Test-retest reliability*: Excellent in individuals with stroke who live in the community[25,29]

[a]Excellent, >0.80; adequate, 0.40–0.79; poor, <0.40.

Table 7. Validity of the Berg Balance Scale and Activities-specific Balance Confidence Scale

Berg Balance Scale	Activities-specific Balance Confidence Scale
Concurrent validity: Poststroke BBS scores have excellent correlations with the balance subscale of the FMA and Postural Assessment Scale for Stroke Patients,[24] Functional Reach,[30] and adequate association with dynamic Balance Master measures,[28] and sitting section of the Motor Assessment Scale and Rivermead Mobility Index.[31]	In stroke survivors, the ABC has good internal consistency.[29,39]
Predictive validity: BBS scores are associated with length of hospital stay and discharge destination,[32,33] ambulatory status,[34] and falls.[35-38]	*Predictive validity*: In community dwelling stroke survivors, ABC scores were associated with walking independence, use of an assistive device, and depression. An improvement on the ABC was predictive of physical function and health, and perceived health status.[39]

Abbreviations: ABC, Activities-specific Balance Confidence Scale; BBS, Berg Balance Scale.

However, after initial observation of J.W., the therapist may be able to generally predict where he might score on these OMs.

Clinical utility is good for both the BBS and the ABC, including reasonable equipment requirements, administration time, and ease of scoring. While the BBS and the ABC each address the construct of balance, the ABC specifically focuses on balance in community settings; for this reason the ABC can be eliminated from the list of potential OMs during J.W.'s short-term hospitalization. At a later point in his rehabilitation, in an outpatient or home care setting, the ABC may be very appropriate. The clinical utility for the BBS and the ABC is summarized in Table 9.

In summary, the therapist's initial observations of J.W. led to hypotheses about underlying issues with motor function, balance, and difficulty with basic and instrumental activities of daily living. These hypotheses supported initial inclusion of the STREAM and BBS. The psychometrics and clinical utility of both OMs support their selection. However, given the absence of observable movement in J.W.'s right arm and loss of balance in sitting, there may be concerns about floor effects on both the BBS and the upper extremity subscale of the STREAM. Yet, J.W. has several positive indicators including his relatively healthy premorbid status, recent onset of stroke, the ability to communicate his needs and goals, as well as some active movement of his right extremities that suggest that he will improve with rehabilitation. Thus, the selection of these measures seems appropriate. Furthermore, since both the STREAM and BBS are organized by position (supine, sitting, standing, and walking), the tests can be efficiently administered.

J.W. is anxious to return to his premorbid status as independent in daily activities. Right-sided movement and balance will contribute to achieving these goals. In the final step of the selection process, the systems review confirmed that J.W. has hemiparesis and requires assistance with transitions from supine to sitting to standing as well as gait. The choice of the STREAM and BBS will provide quantitative information on these issues that can be used to plan and evaluate the success of intervention strategies. Responsiveness data on these measures allow the therapist to conclude that these measures will capture meaningful changes during intervention.

DISCUSSION

The process presented in this article expands on the steps for OM selection outlined in "Outcome Measures in Neurological Physical Therapy Practice: Part I. Making Sound Decisions,"[1] and describes a comprehensive method for optimal OM choice. A step-by-step guide considering the critical elements related to the patient, therapist, facility, and available OMs is included. The challenge is to reconcile OM choice with the realities of the clinical environment.

One response to this challenge is the concept of "core sets" of OMs, which are batteries of OMs recommended for specific health conditions. Typically, core sets are developed by panels of experts using a process similar to that described in this article. An example of core set development is the recent effort by the American Physical Therapy Association—Neurology Section StrokEDGE Taskforce, which developed recommendations for the use of OMs following stroke. Consistent use of these core sets of recommended test batteries has multiple advantages including the ability to make comparison of treatment outcomes across facilities, clinicians, and patient characteristics. Perhaps most importantly, routine data collection using common metrics will facilitate the creation of a larger data set upon which to base clinical decisions and contribute to the evidence for best clinical practices. The use of these core sets of OMs does not preclude the use of additional measures that the therapist may find desirable, but will facilitate the collection of a uniform set of data.

Unfortunately, expert panel development of core sets is in its infancy. Using the process described in this article, individual therapists and clinical facilities have the opportunity to tailor test batteries for their settings and help to move forward the effort to develop core sets. Starting with patient populations most frequently treated in their settings, therapists can use resources such as in-services, journal clubs, and student projects to build their OM batteries. Numerous excellent Web sites are available with information about the psychometric properties and clinical utility of OMs used with several neurological populations (see Appendix, Supplemental Digital Content 1, for a list of these Web sites, http://links.lww.com/JNPT/A10).

However, until such time as there are core sets of OMs that are appropriate for the majority of patients seen in neurological PT practice, the process described in this article is designed to equip therapists to make optimal OM choices on a patient-specific basis.

CONCLUSIONS

Physical therapists have made strides in using standardized OMs to assess body structure/function, activity, and participation from the days where examination was documented primarily with subjective, narrative descriptors such as "poor balance, slow gait speed, and synergistic movement." The use of objective OMs allows therapists to quantify what was previously described only in subjective terms. This allows PTs

Table 8. Responsiveness of the Berg Balance Scale and Activities-specific Balance Confidence Scale

	Berg Balance Scale	Activities-specific Balance Confidence Scale
Responsiveness	The BBS was moderately responsive in detecting change in acute to subacute stroke, with decreasing effect as time since onset increased.[24] In acute to subacute stroke, an overall large effect size was reported for the BBS.[40] In patients with severe stroke, the BBS was the second most responsive measure of 5 measures tested (5- and 10-m walks, Barthel Index, STREAM, and Timed Up and Go). The 5-m walk was the most responsive.[18] In acute stroke, the BBS was sensitive to change and demonstrated large effect sizes.[41] The MDC of the BBS in acute stroke was reported to be 5-7 points.[42,43]	In chronic stroke, ABC Scale and Stroke Impact Scale-16 were most effective to identify individuals with a history of multiple falls.[44] Responsiveness of the ABC has been less frequently studied in stroke; however, the ABC has been found to be responsive in community dwelling seniors.[42,43]
Ceiling/floor effects	The BBS has a significant floor effect in patients 14 d after stroke onset. The BBS also had a significant ceiling effect at 90 and 180 d after stroke onset for those with higher-level function.[24]	No published data are available.

Abbreviations: ABC, Activities-specific Balance Confidence Scale; BBS, Berg Balance Scale; STREAM, Stroke Rehabilitation Assessment of Movement.

Table 9. Clinical Utility of the Berg Balance Scale and Activities-specific Balance Confidence Scale

Measure	Berg Balance Scale	Activities-specific Balance Confidence Scale
Instrument components and scoring	*Activity level* → tests balance in sitting and standing Each item is scored 0 (cannot perform) to 4 (normal performance) The total score ranges from 0 to 56	*Activity/ participation levels* → tests balance self-efficacy 16-item questionnaire rating balance confidence performing a variety of in home and community-based functional activities Each item is rated on a 0%-100% scale of confidence. The final score is the average of the item scores and ranges from 0% to 100%.
Equipment required	Stopwatch Ruler 2 standard height chairs (1 with, 1 w/o armrests) Footstool Object to pick up off the floor	Questionnaire
Administration time	15-20 min	5-10 min

to track progress and compare effectiveness and costs across interventions, settings, and providers, while considering patient characteristics such as severity, acuity, and lesion type or location. Comprehensive assessment across all components of the ICF model, including personal factors, the environment, and the patient's participation in life roles, enhances the focus on the patient's perspectives. Considerable information is available about what constructs are captured by specific measures, how the measures perform over time, and how scores can be used to predict change and plan care. In the future, consistent use of standardized OMs by therapists and collection of data across patients and settings can inform best clinical practice and the development of clinical prediction rules. Ultimately, consistent use of a core set of standardized OMs will allow therapists to determine, on a patient/situation basis, the optimal interventions needed to achieve the best possible outcomes.

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