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Uniform Data System
for Medical Rehabilitation

The Functional Assessment Specialists

The FIM® Instrument: Its Background, Structure, and Usefulness

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Introduction

A gerontologist in Philadelphia, M. Powell Lawton, wrote in 1971 the first definition of functional assessment. He said that functional assessment was any systematic attempt to objectively measure the level at which a person is functioning in a variety of domains. Functional assessment, as a scientific endeavor, was slow to develop in rehabilitation. In fact, during the 1970s, most clinicians regarded functional assessment as an effort to measure the unmeasurable.[1]

Background

Although inpatient rehabilitation has been widely practiced since the 1950s, the field lacked an agreed-upon method of accounting for degrees of independence versus dependence in a person's performance of basic personal care activities. Thus, neither the outcomes nor the benefits of inpatient rehabilitation were objectively evaluated or measured. Consistently and predictably quantifying attributes of health beyond organ-based descriptors of physical manifestations and symptoms has been difficult. Early explorations were "extremely complex—being interrelated and difficult to separate while being value-laden and not easily quantified."[2]

Examples of early attempts to quantify what we now recognize as various expressions of "latent traits" include the PULSES profile[3] and the Barthel index.[4]

The Barthel index (BI) is used to gauge motor performance of rehabilitation inpatients in some centers, but it has one level for independence and only two levels for assistance. Thus, it is not sensitive to gradations between dependence and independence, and it does not relate to the extent of effort provided by the person who helps perform daily personal care activities (i.e., the burden of care, or BoC). Also, the BI does not address cognitive functioning. In traditional thinking, activities of daily living (ADLs) are mainly physical functions, but cognitive functions are necessary, even if less obvious.

In 1987, after three years of project development, a review of thirty-six published functional assessment instruments, and testing, the FIM® instrument was created. It was endorsed by the American Academy of Physical Medicine and Rehabilitation and the American Congress of Rehabilitation Medicine. The FIM® instrument was intended to address the challenges to neuroscience research with respect to the predictable relationship between the treatment or intervention afforded the person with disablement and the response of that person. It was necessary for the FIM® instrument to be criterion-referenced and administered by trained and tested clinicians in order for assessments of functioning to be uniform across different certified raters. The result is objective assessments that permit comparison of results between different sites and patients over time, whether treatment modalities are similar or different.

Patients are admitted to an inpatient rehabilitation facility because they are functionally dependent upon others to meet their daily personal care needs. The essential purpose of intensive (or acute) inpatient rehabilitation is to promote and achieve functional independence, primarily in personal care, and, within limitations imposed by disease or injury, to enable the person to regain normal or near-normal levels of participation in usual activities. The FIM® instrument is also used in selected skilled nursing facilities that emphasize rehabilitation and in a few long-term acute care hospitals. Use of the FIM® instrument enables the members of the interdisciplinary rehabilitation team to be continually aware of the progress being achieved by each team member and by the team as a whole. As a rule, most patients gain one or

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[1] Lawton M. The functional assessment of elderly people. *JAGS*. 1971;19(6):465–481.
[2] Granger CV, Gresham GE, eds. *Functional Assessment in Rehabilitation Medicine.* Baltimore: Williams & Wilkins;1984, page x.
[3] Moskowitz E, McCann CB. Classification of disability in the chronically ill and aging. *J Chronic Dis*. 1957; 5:342–346.
[4] Mahoney FI, Barthel DW. Functional evaluation: the Barthel index. *Md State Med J*. 1965;14:61-65.

two FIM® points per day. It is useful to compare the full FIM® rating at admission with ratings recorded ten days after admission. At that time, areas of greater need can be identified, and treatment can be adjusted. The attention given to the FIM® ratings is the qualifying difference when a patient is admitted to inpatient rehabilitation. Continuous improvement in a patient's function validates the team's effectiveness. We call using the FIM® instrument in this way "precision case management."

Knowing the effects of intensive rehabilitation in quantitative terms is essential to achieving evidence-based, or evidence-guided, practices targeted toward recovery of functional health. As well, functional assessment provides a means for compiling a database that meets the informational needs of both administrators and clinicians.[5] The diagnosis-related group (DRG) system had been recognized as suitable for prospective payment for acute hospital care, but it did not adequately adjust for severity at the level of patient functioning.

The FIM® instrument has been thoroughly tested for validity, reliability, responsiveness to change, feasibility for use, and meaningfulness in the clinical setting when administered by a trained and tested assessor. The instrument takes fifteen to twenty minutes to administer, and it can help rehabilitation clinicians set treatment goals and manage care. It has been incorporated into hundreds of research studies.

The FIM® instrument was the first of an array of functional assessments copyrighted by Uniform Data System for Medical Rehabilitation (UDSMR). UDSMR was created on October 1, 1987. Its core values, mission, and vision are presented below.

Core values:

- We believe that functional health deserves measurement that advances quality healthcare.
- We believe in our shared pursuit of excellence while operating with the highest degree of integrity in our relationships with our clients and our people.
- We believe in a fair and generous relationship with our people, and we expect the same in return.
- We believe in teamwork, defined as the state achieved by a group of people working together who trust one another, engage in healthy conflict, commit to decisions, hold one another accountable, and focus on productivity and collective results.
- We believe in a customer service focus that emphasizes satisfaction and quality.
- We believe that collaborative creativity with both our internal partners and our external partners leads to innovative processes and products that allow us to maintain our leadership position in the industry.

Mission:

- To enable healthcare providers and related entities to document and improve the outcomes, processes, and perceptions of care in uniform ways.

Vision:

- To be the internationally recognized expert in outcomes measurement by providing uniform and unbiased information that documents healthcare quality, including results, processes, and perceptions of care.

[5] Granger CV, Hamilton BB, Keith RA, Zielezny M, Sherwin F. Advances in functional assessment for medical rehabilitation. *Topics in Geriatric Rehabilitation*. 1986;1(3):59–74.

- To provide a common language for communication across disciplines and to provide a basis for benchmarking and comparing healthcare outcomes.
- To conduct and disseminate research that supports evidence-based healthcare practices in terms of meaningful assessments of the domains of human functioning and measurement of outcomes of care, especially for persons with disabilities, chronic health conditions, or both.
- To develop strategic partnerships that promote synergies within, and benefits to, healthcare organizations.
- To utilize our strengths and partnerships to work toward influencing policy and policy makers in support of the industries and persons that we serve, and to enhance quality-driven care.

Structure

In order to meet the assumptions necessary for the application of linear statistics to clinical measurement studies, Rasch analysis was used to transform ordinal scales into linear measures.[6] Rasch analysis allows one to evaluate the difficulty of items and the abilities of persons being tested, separately, on the same metric. The difficulty represented by each item may be arranged along a hierarchy from *easy* to *hard.* The hierarchies of functional ability items depend on the specific patterns of disability related to the underlying pathophysiology.

Studies of the FIM® instrument were performed on data from inpatient admission and discharge assessments. Analyses of the eighteen FIM® items demonstrated separate hierarchies for the thirteen motor items and the five cognitive items. There are five distinct patterns for the thirteen motor items: brain dysfunction, orthopaedic conditions, pain conditions (see figure 1, page 4), ambulatory spinal cord dysfunction, and wheelchair users with spinal cord dysfunction (see figure 2, page 4). Two patterns exist for the five cognitive items: stroke with right body hemiparesis (due to left hemisphere involvement causing aphasia), and all others. In the patients treated in inpatient rehabilitation, the following are expected of the motor item hierarchies:

1. Eating is the easiest task, and climbing stairs is hardest.
2. Dressing the upper body is easier than dressing the lower body.
3. For patients with spinal cord dysfunction, at the time of discharge, wheelchair locomotion may be relatively easier compared with several other items than walking locomotion is in comparison with other items.

Note that patients with dementia are seldom admitted to inpatient rehabilitation because of their difficulties in retaining instructions that have been presented to them. Interestingly, patients with dementia may present with more difficulty in eating than in walking. Thus, the hierarchy of difficulty reflects the impairments associated with the diagnostic condition.

[6] Granger CV, Linn RT. Biologic patterns of disability. *J Outcome Meas*. 2000;4(2):595–614.

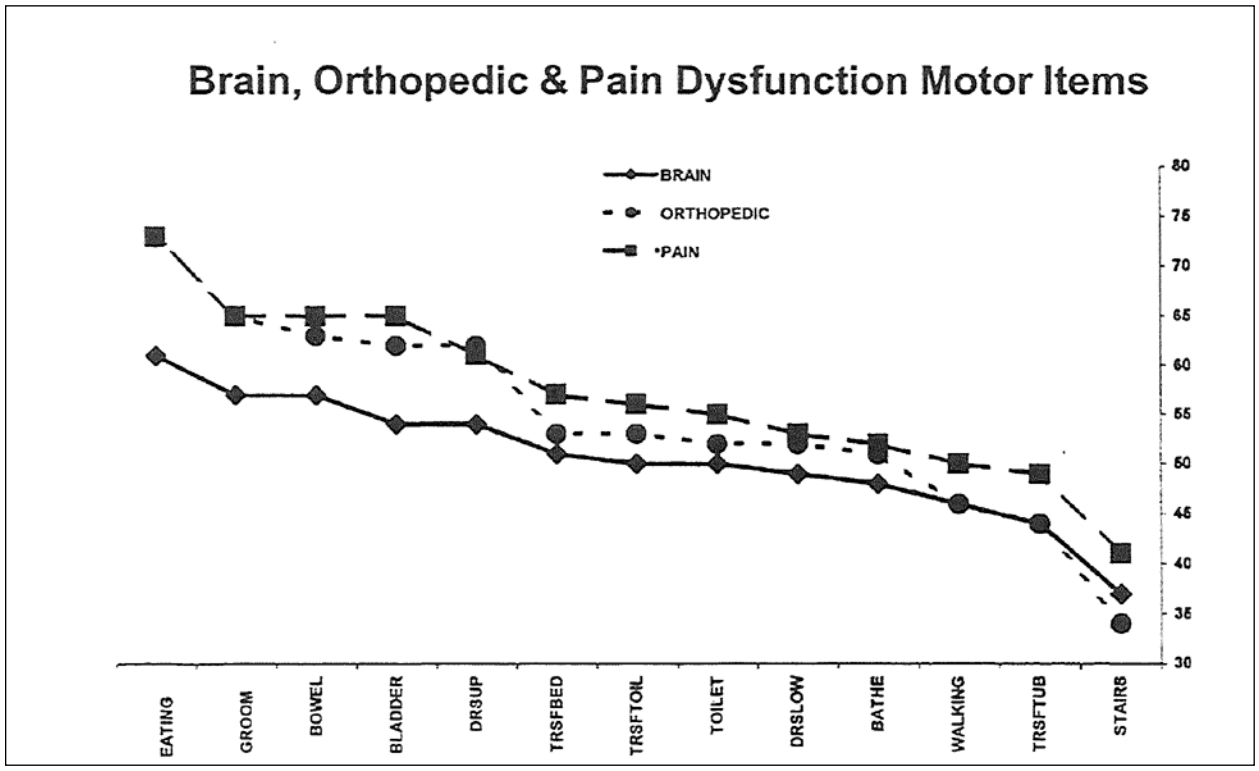

Figure 1. Rasch item difficulty hierarchies for items from the FIM® motor domain, comparing individuals with brain dysfunction, orthopaedic conditions, and pain conditions.

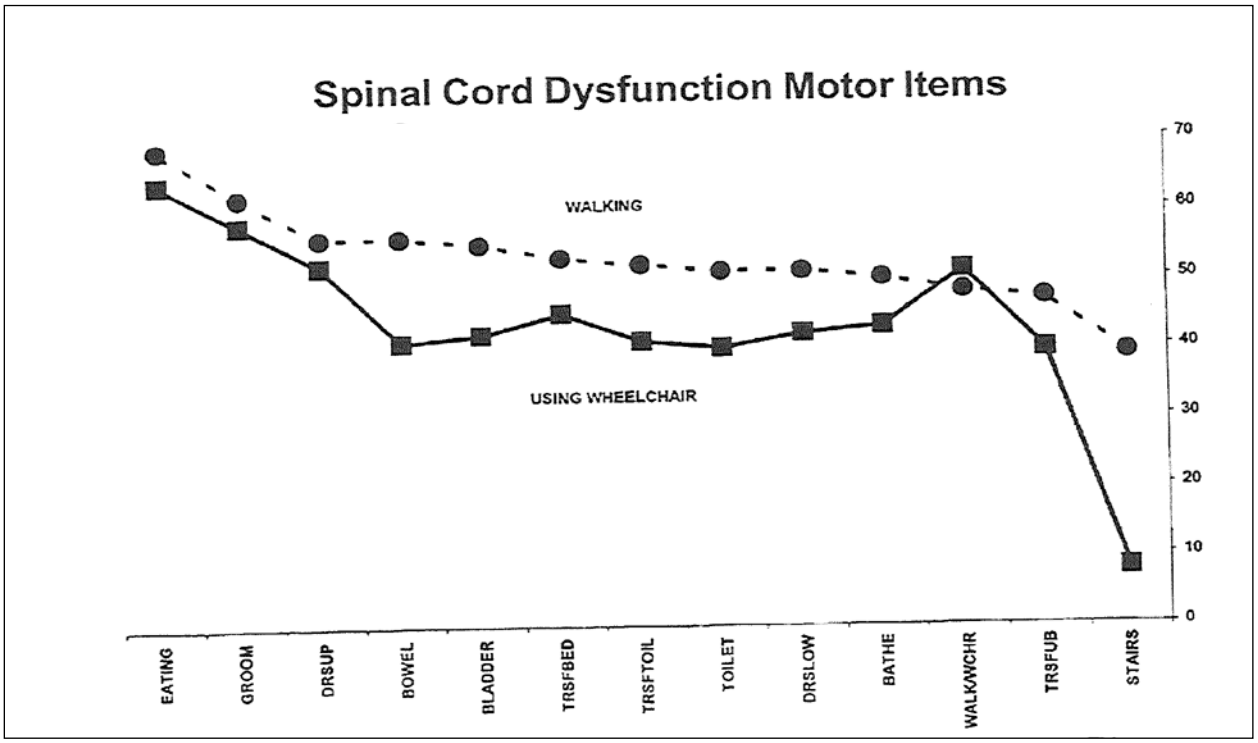

Figure 2. Rasch item difficulty hierarchies from the FIM® motor domain, comparing individuals with spinal cord dysfunction who walk at discharge to individuals with spinal cord dysfunction who use wheelchairs at discharge.

Using a map that shows the expected relationships between item ratings, a clinician can determine whether a particular patient matches the expected pattern. Such insights into the biology of disability may help clinicians monitor their patients' responses to treatment efforts.

Different rating hierarchies exist for the FIM® instrument's motor and cognitive items, and these hierarchies are specific to different types of clinical impairments. The hierarchical relationships of the thirteen motor ratings and five cognitive ratings are readily observed in the patient populations of inpatient rehabilitation facilities (IRFs). At both admission and discharge, ratings for individual FIM® items are expected to follow similar hierarchical patterns. In other words, the hierarchy of item difficulty depends on the particular clinical impairment. As patients with the same type of clinical impairments gain functional independence, they make gains in FIM® ratings. The expected rating gain for each item during the patient's IRF stay depends on the item's functional difficulty. For example, because climbing stairs is the most difficult of the motor tasks, the FIM® rating for Locomotion: Stairs is usually the lowest of the motor ratings at admission and at discharge. By contrast, eating tends to be the easiest motor task, and the FIM® rating for Eating is usually the highest of the motor ratings at admission and at discharge. As functional independence improves, all motor items tend to "cooperate" in maintaining the same rating relationships with each other. The same adherence to a hierarchical rating sequence applies to the cognitive items: Comprehension tends to have the highest rating, and Problem Solving tends to have the lowest.

An IRF's failure to maintain this hierarchy may indicate that its staff members are not rating the items correctly. Because admission FIM® ratings are an important component for determining an IRF's prospective payment, IRFs must be absolutely certain that their FIM® ratings are accurate.

UDSMR has processes in place to detect inconsistencies and test for FIM® rating accuracy at the IRF level. UDSMR's goals are to maintain the highest-possible data quality and to provide a fair and level opportunity for all participating facilities. By monitoring the accuracy of FIM® ratings, UDSMR provides an important service for the system of IRF effectiveness and costs.

UDSMR applies several statistical steps to identify outliers in the data submitted by IRFs:

1. UDSMR first assesses the FIM® gain of ten items—five motor items and five cognitive items—from admission to discharge. The five motor items are those CMS has identified as being most closely related to payment: Dressing – Lower Body; Transfers: Bed, Chair, Wheelchair; Transfers: Toilet; Locomotion: Walk, Wheelchair; and Locomotion: Stairs. All five cognitive items—Comprehension, Expression, Social Interaction, Problem Solving, and Memory—are included in the assessment.
2. UDSMR next examines IRFs whose FIM® gain is higher or lower than expected for two or more of the FIM® items identified in step 1. (Motor and cognitive items are assessed separately.) This is accomplished by comparing an IRF's actual FIM® item gain to the national expected gain (i.e., the gain expected by FIM® item at the national level if the nation had the facility's specific case-mix group distribution). This process produces an apples-to-apples comparison. UDSMR flags a facility's FIM® gain for a particular item when it is more than three standard deviations higher or lower than the national expected mean gain for that FIM® item.
3. Once an IRF is identified as having possible FIM® rating outliers, a group of clinicians and statisticians convene to scrutinize the facility's overall FIM® rating patterns. The goal is to determine whether the patterns follow the FIM® rating hierarchy for the particular types of clinical impairments. If the rating patterns are inconsistent with clinical expectations, UDSMR advises the IRF, works with the IRF's staff to help them conform with best practices for rating FIM® items, and offers specific FIM® training modules.

Discharge planning is a complex process involving many factors. The records of patients diagnosed with stroke were analyzed to determine the ideal cutoff point to distinguish between those likely to be discharged from rehabilitation to the community and those likely to be discharged to institutional settings. (See figure 3.) Both positive tests (FIM® rating ≥ 78) and negative tests (FIM® rating ≤ 77) correctly classified more than three-quarters of patients discharged to the community and institutional settings, respectively.[7]

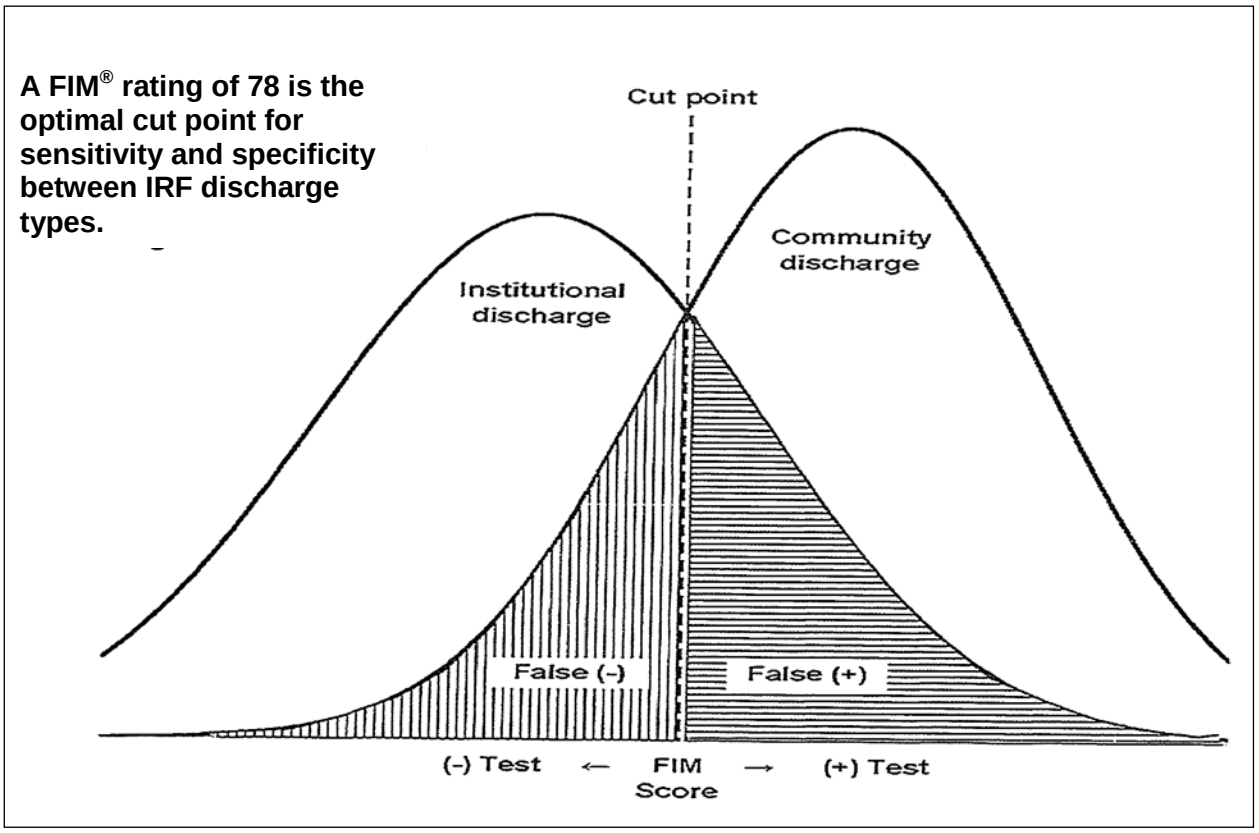

Figure 3. Probability density functions for total FIM® ratings from the two discharge groups. The cut point shown represents the optimal FIM® rating for differentiating positive and negative tests when errors in sensitivity and specificity are equally weighted. The graph also shows the tradeoff between these errors (false-negative and false-positive rates) when moving the cut point from its current value.

A study of stroke rehabilitation outcomes in Italy and the U.S. was conducted.[8] The participating clinicians in both countries were certified FIM® raters. Table 1 on page 7 presents the particulars of this study.

[7] Reistetter TA, Graham JE, Deutsch A, Granger CV, Markello S, Ottenbacher KJ. Utility of functional status for classifying community versus institutional discharges after inpatient rehabilitation for stroke. *Arch Phys Med Rehabil.* 2010;91:345–350.
[8] Tesio L, Granger CV, Perucca L, Franchinoni FP, Battaglia MA, Russell CF. The FIM® instrument in the United States and Italy. *Am J Phys Med Rehabil*. 2002;81:168–176.

Category	U.S.	Italy
Patients	29,444	801
Mean length of stay (days)	19.9	45.9
Discharge-to-community rate	74.4%	88.4%
Average admission FIM® rating	63.1	60.3
Average discharge FIM® rating	86.0	80.3

Table 1. The results of a study of left-body stroke patients in the United States and Italy.

Despite the apparent similarity of the summed admission and discharge FIM® ratings, an inspection of the FIM® motor item hierarchy showed important variations. As figure 4 demonstrates, ratings for walking and bed and toilet transfers were relatively higher compared to ratings of the other motor items. A hypothesis was proposed that occupational therapists in Italy were less "aggressive" than physical therapists. It turned out that Italy had not been training occupational therapists. This omission has been corrected.

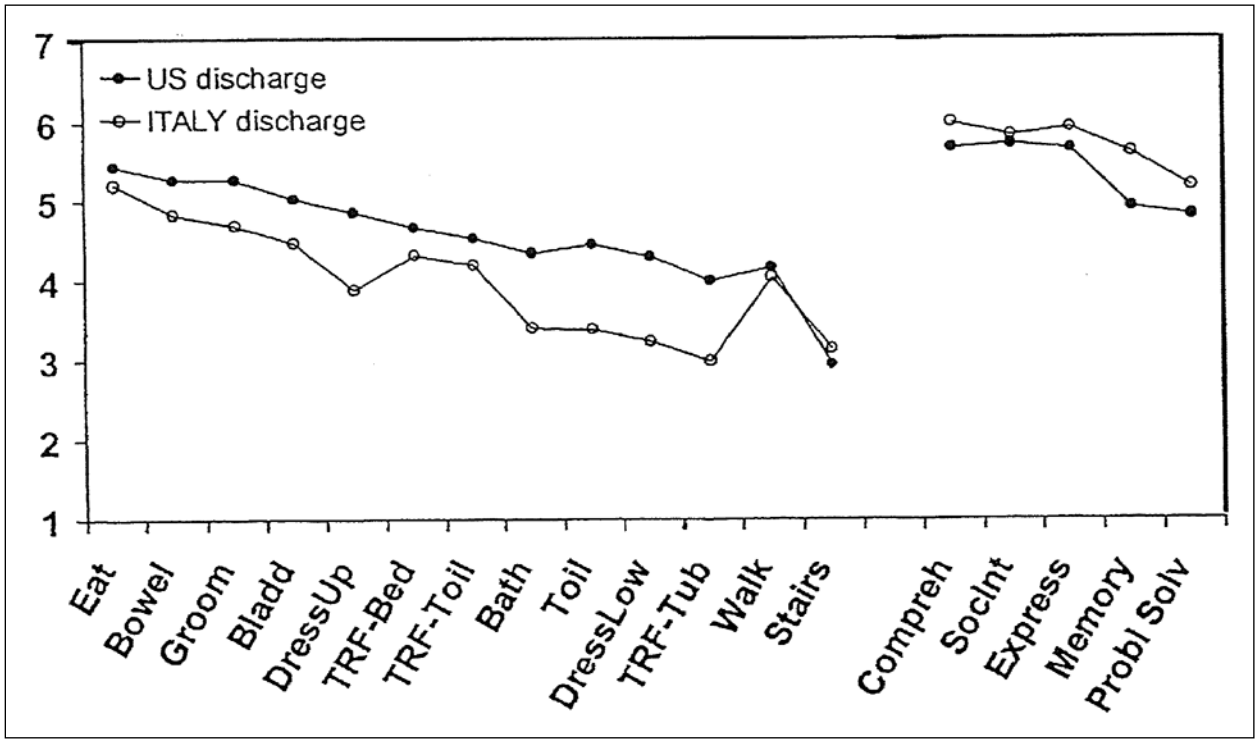

Figure 4. Results of a study conducted in the United States and Italy.

J Woo, SY Chan, MWC Sum, E Wong and YPM Chui authored "Inpatient Stroke Rehabilitation Efficiency: Influence of Organization of Service Delivery and Staff Numbers" in *BMC Health Services Research* (17 April 2008). The article compared FIM® efficiency scores (the gain in FIM® points between admission and discharge divided by the length of stay) from three hospitals in Hong Kong. One hospital was tracked over a ten-year period. In response to economic challenges, there was a progressive reduction in the number of staff members at this hospital. Concurrently, the patient care outcomes became less efficient, as evidenced by a reduction in the FIM® gain per day. This observation suggests that beneficial outcomes could be eroded by a relentless reduction in staff numbers even though a good process of care may be in place and that an optimum number of staff members in relation to best outcomes could be defined.

In preparation for January 1, 2002, UDSMR granted a royalty-free license to the Centers for Medicare and Medicaid Services (CMS) to incorporate the FIM® instrument into the new Inpatient Rehabilitation Facility Prospective Payment System (IRF PPS). A modified version of the FIM® instrument was included in the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI). A study was reported summarizing and showing the effect of modifications on FIM® data for stroke patients.[9]

Studies are being published covering the results of inpatient rehabilitation facility (IRF) practices over the years. An example is for stroke cases.[10] Due to a change in the definition of program interruption from thirty days to three days, the percentage of stroke patients who were discharged to acute care jumped from a range of 5.6% to 5.8% from 2000 to 2001 to a range of 8.5% to 10.3% from 2002 to 2008. Concurrently, program interruptions dropped from a range of 3.8% to 3.6% from 2000 to 2001 to a range of 1.6% to 1.1% from 2002 to 2008. Remarkably, the FIM® item ratings for admission and discharge across the years 2000–2008 maintained the expected hierarchies for motor items (figure 5, page 9, and figure 6, page 10) and cognitive items (figure 7, page 11), showing the expected differences between right-body stroke (left-brain stroke) and other forms of stroke.

[9] Granger CV, Deutsch A, Russell C, Black T, Ottenbacher KJ. Modifications of the FIM® instrument under the Inpatient Rehabilitation Facility Prospective Payment System. *Am J Phys Med Rehabil*. 2007; 86(11):883–892.

[10] Granger CV, Markello SJ, Graham JE, Deutsch A, Ottenbacher KJ. The Uniform Data System for Medical Rehabilitation: report of patients with stroke discharged from comprehensive medical programs in 2000-2007. *Am J Phys Med Rehabil.* 2009;88(12):961–972.

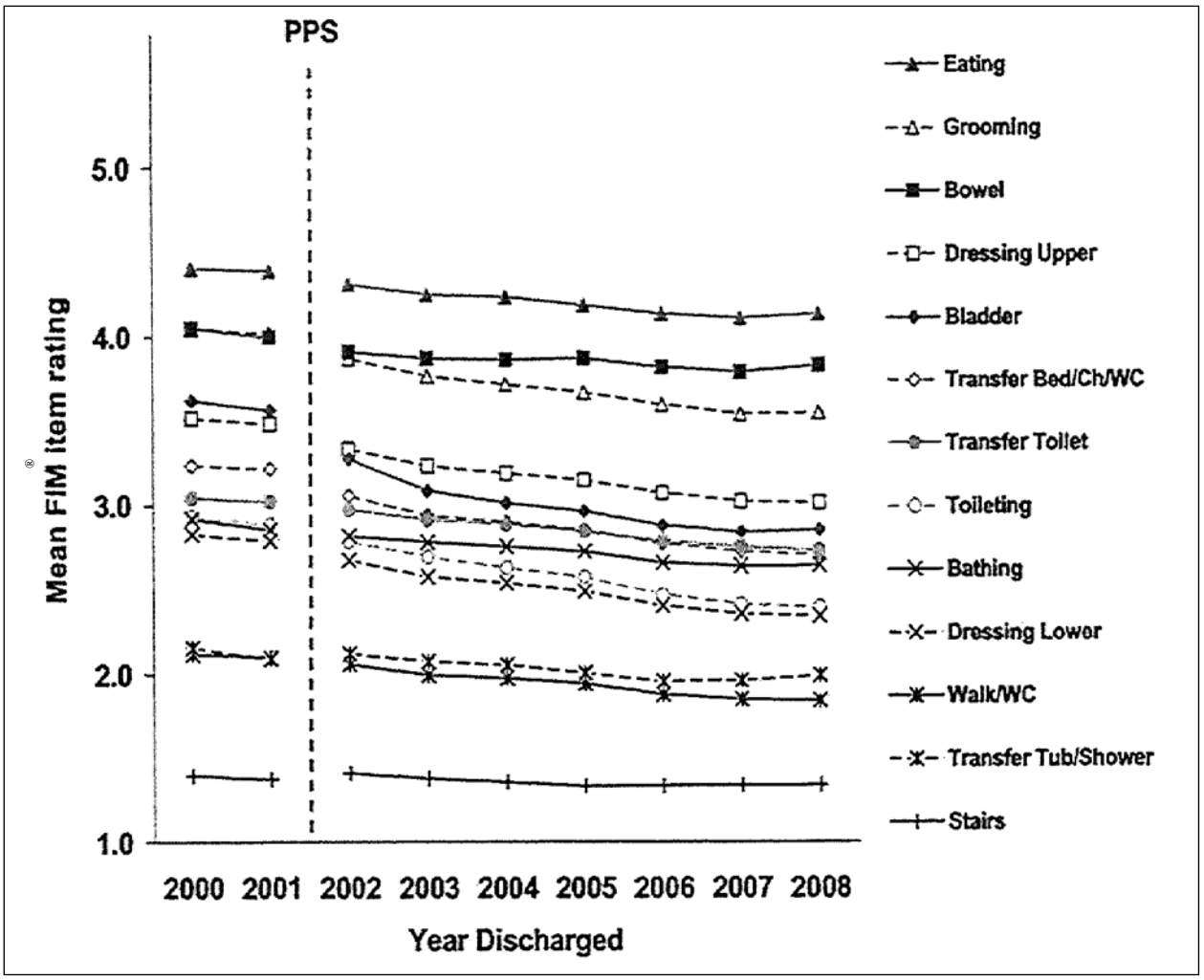

Figure 5. Mean ratings for individual FIM® motor items at admission to inpatient rehabilitation. Yearly summaries represent fiscal year periods (October 1 to September 30) from the Centers for Medicare and Medicaid Services. The dashed vertical line signifies the introduction of the prospective payment system (PPS), which resulted in substantial changes to functional evaluation and patient management processes.

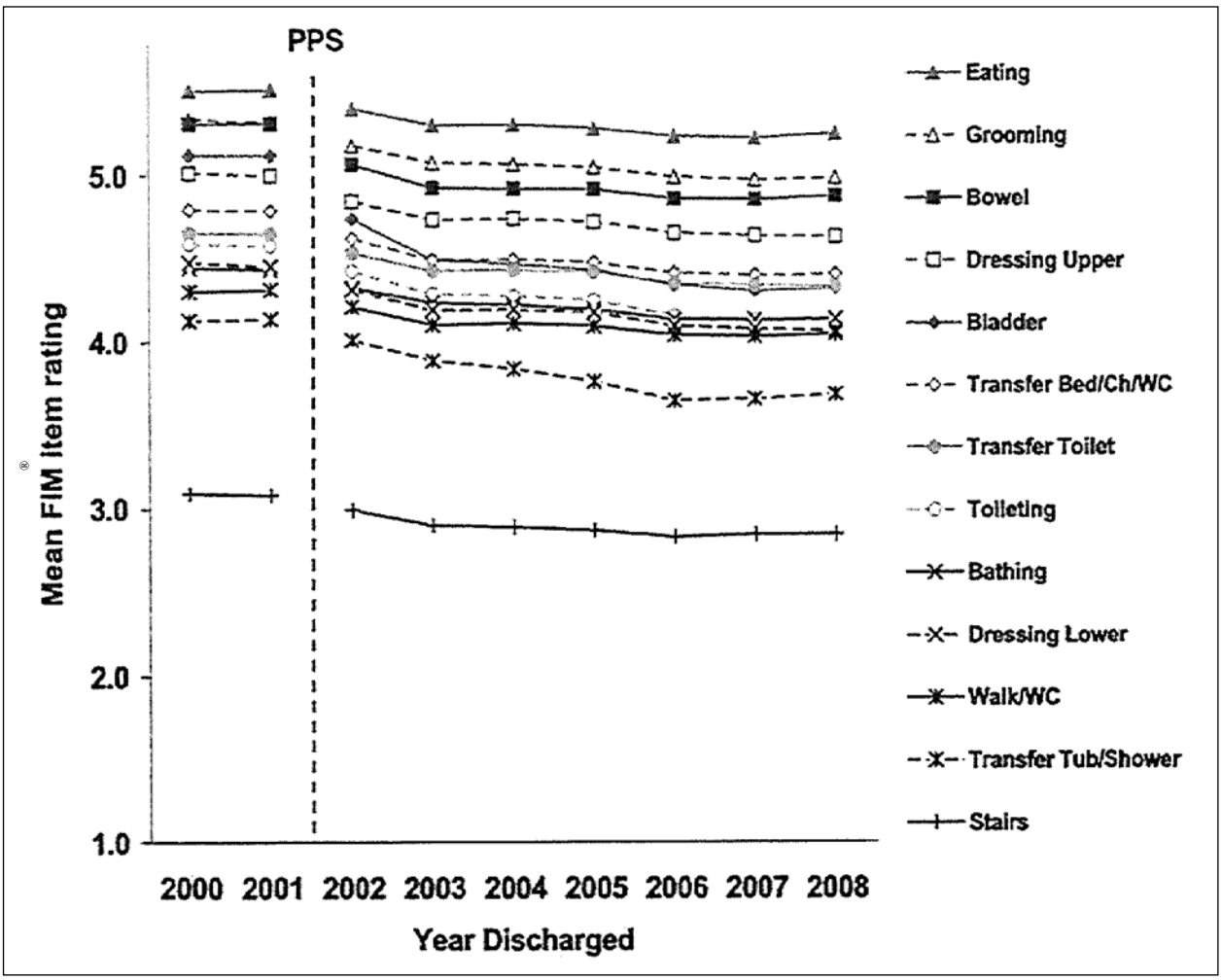

Figure 6. Mean ratings for individual FIM® motor items at discharge from inpatient rehabilitation. Yearly summaries represent fiscal year periods (October 1 to September 30) from the Centers for Medicare and Medicaid Services. The dashed vertical line signifies the introduction of the prospective payment system (PPS), which resulted in substantial changes to functional evaluation and patient management processes.

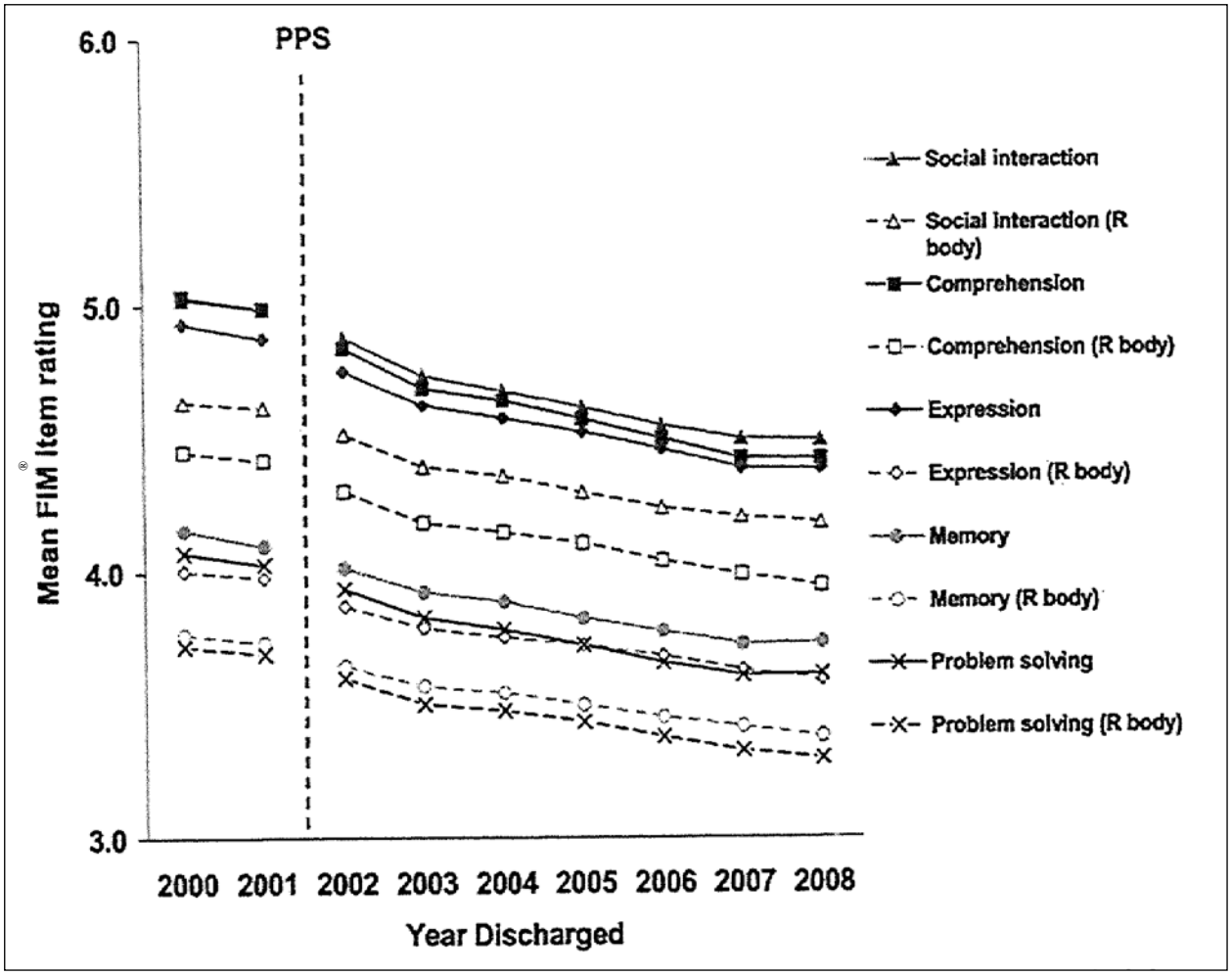

Figure 7. Mean ratings for individual FIM® cognitive items at admission to inpatient rehabilitation. Separate values are reported for patients with right-body (left-brain) impairments versus all others. Yearly summaries represent fiscal periods (October 1 to September 30) from the Centers for Medicare and Medicaid Services. The dashed vertical line signifies the introduction of the prospective payment system (PPS), which resulted in substantial changes to functional evaluation and patient management processes.

Observations of the intervals between the seven rating levels have identified minimal differences between the motor and cognitive scales.[11] The important point is that the intervals between levels 2 through 6, when transformed by Rasch analysis into a continuous interval measure with a range of 0 to 100, are approximately equal, but the intervals between levels 1 and 2 and between levels 6 and 7 are three times greater than the intervals between levels in the middle of the scales. Raw scores obtained from the FIM® instrument, which is an ordinal scale, do not meet the assumptions necessary for the application of linear statistical analyses, but the Rasch-transformed motor and cognitive measures do.[12]

[11] Granger CV, Linn RT, 2000.

[12] Cook KF, Gartsman GM, Roddey TS, Olson SL. The measurement level and trait-specific reliability of 4 scales of shoulder functioning: an empiric investigation. *Arch Phys Med Rehabil*. 2001;82(11):1558–1565.

Usefulness

The FIM® instrument has many uses, some of which are described in this section.

Program Evaluation Model (PEM)

The UDSMR® program evaluation model (PEM) came about as part of a proactive solution to the Institute of Medicine's (IOM) 2006 recommendation to Congress: namely, that every Medicare provider be reimbursed on a pay-for-performance basis. UDSMR worked toward constructing a PEM that utilized indicators that reflected the national goal put forth by IOM: improving healthcare quality. The goal of the PEM is to recognize high-performing facilities for their delivery of quality patient care that is effective, efficient, timely, and patient-centered. The FIM® instrument is central to the PEM.

Each IRF that subscribes to UDSMR receives reports on the outcomes of its medical rehabilitation services, which are compared with those of other IRFs in the United States. IRFs quickly identify strengths and opportunities for improvement; as a result, the performance of all facilities rises. The PEM model is based on five data points that reflect key patient care objectives and outcome measurements in the rehabilitation hospital setting. Measures 1, 2, and 3 are case-specific, and measures 4 and 5 are calculated at the facility-level.

1. Discharge FIM® rating
2. FIM® change
3. Length-of-stay (LOS) efficiency
4. Community discharge rate
5. Acute care hospital discharge rate

These five measures are appropriate because of the following factors:

- **Their importance to patients, caregivers, and administrators.** They are important to patients because they reflect significant elements of their outcomes; they are important to caregivers and administrators because the measure represents an outcome that might be altered with clinical focus and effort.
- **Their ready availability.** Because these measures are currently captured on the IRF-PAI as part of Medicare's IRF PPS, they do not require new or modified data reporting by participating hospitals. This data also is readily available to CMS and other payers through the standard IRF-PAI instrument.
- **Their acceptance by the rehabilitation field, payers, and accreditation bodies.** These measures have been accepted by both providers and researchers as valid and reliable outcomes for patient and program management, as well as intervention assessment. They have been accepted by payers for measuring patient functional status and predicting resource needs (cost) for rehabilitation, and they have been accepted by accreditation bodies, including (a) The Joint Commission, for use with its ORYX® measures, and (b) CARF, for monitoring quality assessment of effectiveness and efficiency.
- **Their comparability to stable benchmarks.** Expectations can be readily established from national benchmark data. Case-mix group–specific (CMG-specific) mean values can be used to set thresholds of patient-level indicators, and indirect standardization can be applied to generate case mix–adjusted and severity-adjusted hospital-level expectations (for community and acute care discharge rates).
- **Their ability to create a composite score.**

- **Their objectivity and consistency across sites in the methodology used to assign values and in the training and certification requirements for persons doing so.**

A letter from HealthSouth to Dr. Donald Berwick at the Centers for Medicare and Medicaid Services, dated June 21, 2011, included the following related to the PEM:

> These measures should be risk-adjusted to account for differences in impairment as well as medical and functional severity among patients. They should also focus on quantifiable treatment outcomes and meet TJC (The Joint Commission) requirements for performance measures reflecting care outcomes. Patients' functional improvements are effectively and efficiently evaluated using the functional items scored on the Inpatient Rehabilitation Facility-Patient Assessment Instrument, or "IRF-PAI," which incorporates the . . . FIM® instrument. Although other instruments are available to capture functional data for quality measures, the FIM® instrument is the most precise and relevant for patients treated in rehabilitation hospitals and hospital-based inpatient rehabilitation units, whose function is at the low end of the continuum.[13] [The FIM® instrument's] primary application is for evaluation and measurement of inpatient rehabilitation services. In addition to its patient-centric functional focus, advantages associated with using the FIM® tool include its long history of consistent use for clinical management and government reporting. This long history means that a huge investment supports the accuracy and consistency of FIM® measurements.
>
> We believe any quality framework developed for rehabilitation hospitals should be built around the following considerations when considering its specific elements:
>
> - The likelihood of the measurement's ability to help rehabilitation hospitals improve quality of care
> - The extent to which the measurement will provide clinicians with useful information
> - The extent to which the measurement will create an undue data collection burden, specifically, does a less complex means of capturing the data exist; and is the measurement already being tracked and/or reported in a way that would require modification of existing practices and/or systems?
> - Would implementing the measurement create exposure to unintended consequences?

Burden of Care (BoC)

FIM® ratings provide estimates of the burden of care, meaning the number of hours of assistance needed per day from another person for personal care on a daily basis in the home setting. (See table 2 on page 14.). This explains the seven ordinal levels for FIM® assessment, the corresponding total FIM® ratings,

[13] Jette A, Haley S, Ni P. Comparison of functional status tools used in post-acute care. *Health Care Financing Review*. 2003;24(3):13–24.

the equivalent Rasch-transformed ratings, the approximate minutes and hours of care required, and the expected level of assistance required in the home.

Level	Total	Rasch	Minutes	Hours	Description
1	18 24 30	2 10 20	498 456 419	> 8 7–8 6–7	Total Assistance
2	36 45	30 35	384 330	6–7 5–6	Maximal Assistance
3	54 63	40 45	276 222	4–5 3–4	Moderate Assistance
4	72 80	50 55	168 120	2–3 2–3	Minimal Assistance
5	90 100	60 65	60 < 60	1–2 < 1	Supervision/Setup
6	108 114 120	70 80 90	0 0 0	0 0 0	Modified Independence
7	126	100	0	0	Complete Independence

Table 2. FIM® instrument rating levels and the burden of care (BoC). The BoC ends at level 6.

The amount of change in the burden of care (BoC) associated with the change per FIM® point depends on whether the FIM® rating is high or low. Figure 8 provides a demonstration related to spinal cord injury. The relationship is similar for motor FIM® ratings (thirteen items) and total FIM® rating (eighteen items).

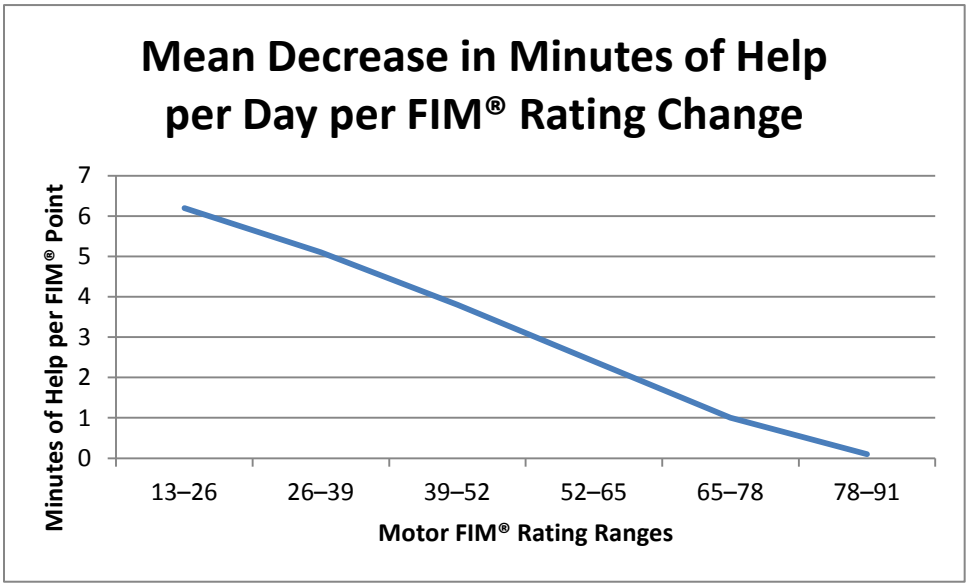

Figure 8. Change per FIM® point in various motor FIM® rating ranges. The change per FIM® point in lower FIM® motor ratings is associated with more minutes of help per day; conversely, the change per FIM® point in

higher FIM® ratings is associated with fewer minutes of help per day, as demonstrated in a study of patients with spinal cord injury.[14]

Explanation of Rasch Analysis

Jorge Rasch was a Danish mathematician who developed a theoretical construct that enables investigators to achieve actual measurement of quantities of constructs that are generally considered unmeasurable.

Rasch analysis, or Rasch modeling, is a statistical method based on a mathematical theory for converting raw scores for "latent traits" (concepts that cannot be measured with available tools such as a ruler, a thermometer, weight scales, etc.) into true "probabilistic" measures that have the same validity as other measuring tools. The concept of having data fit the Rasch model rather than using a model that fits the data is foreign to most researchers who have been trained in classical statistics. For Rasch analysis, test validity is achieved when the data follows the requirements of the Rasch model. Most analysts are satisfied to derive a number that represents the sum of item values without exploring the behavior of individual items that comprise the sum. Rasch modeling is unique in that it provides possibilities for uncovering information that should attract clinical attention on a case-by-case and item-by-item basis.

Analysts need to blend expertise in clinical, statistical, and Rasch measurement in order to successfully create useful and interesting measures of clinical phenomena. The biomedical model proposes that symptoms and behaviors are expected to be proportional to pathophysiology. Data from history and physical examinations, as well as laboratory data, even if thorough, may not sufficiently explain the observed symptoms and behaviors. When it is apparent that the relationships between pathophysiology and symptoms and behaviors are equivocal, then it is important to quantify and track both the phenomena and the appropriate Rasch measures. Thus, for patients with disablement, functional status that is measured reliably should be considered in conjunction with medial status when choosing a course of treatment and also used to help judge the effectiveness of the treatment rendered. It may develop that Rasch constructed measures from a person-self report (P-SR) may constitute the "evidence" from which treatment decisions may be made and the efficacy of treatment may be judged.

If you do not measure it, then you cannot manage it.

The purpose of Rasch modeling is to achieve the following attributes:

1. Linearity with equal-measurement unit intervals
2. Hierarchical arrangement of the items (to demonstrate gradations of difficulty)
3. Independent objectivity (the resulting tool can be used to measure samples other than the sample from which it was built)
4. Suitability of the choices for levels (ranging from agree to disagree or from important to not important)
5. Cooperation and calibration of items in forming a unidimensional and unidirectional concept
6. Identification of redundant items that tend to distort and dilute the sensitivity to change
7. Easy to apply for repeated measurements to create useful and meaningful results

[14] Hamilton BB, Deutsch A, Russell C, Fiedler RC, Granger CV. Cost of disability as measured by the FIM® instrument: spinal cord injury. Buffalo (NY): State University of New York at Buffalo, Department of Rehabilitation Medicine, Center for Functional Assessment Research; 1997 NIDRR Project H133G90157. Available through the National Rehabilitation Information Center: 1-800-346-2742 (accession no. 0-12553).

8. "Conjoint additivity" (the person's ability and the item difficulty are measured on the same metric)

Professors Jeremy Hobart and Stefan Cano offer the following observations:

> The FIM® instrument was developed, in part, because of the limitations of the Barthel index (BI) as a clinical measure of rehabilitation outcome. One of the BI's limitations, clearly apparent to rehabilitation clinicians, was the restricted ability of the BI to represent change in function as a change in score—a property known as *scale responsiveness.* This is not surprising. Most of the 10 items of the BI essentially grade "ability" on each item using either of the following scales:
>
> - 0 = unable, 1 = able
> - 0 = unable, 1 = partly able, 2 = able
>
> One way the developers of the FIM® instrument addressed this limited ability to detect change was by increasing the number of "response categories" for each item to seven. This change makes the FIM® instrument an inherently more precise measurement instrument. The developers also recognized that the instrument should be criterion-referenced, and they implemented a credentialing process in which raters must receive training from a class or the training manual and then pass a mastery test every 2 years. Rehabilitation clinicians noted the improved ability to detect change.
>
> The improved theoretical and clinically observable precision of the FIM® instrument ought to be demonstrable empirically. Specifically, the FIM® instrument should be notably more responsive to change than the BI. However, a number of studies comparing the responsiveness of the FIM® instrument and BI detected a consistent anomaly—the BI was marginally more responsive than the FIM® instrument!
>
> As this didn't make sense, we looked into it more deeply. Our findings are reported in two papers. In the first, we examined some basic statistics, including item score distributions, change scores, and effect sizes. We demonstrated that the FIM® instrument had more potential to detect change and that it detected change in more people. However, the standard indicator of scale responsiveness, the group effect size calculation, concluded that the two scales had similar responsiveness and, in fact, that the BI was marginally superior. We proposed a number of reasons for this anomaly, including that effect sizes may be inaccurate indicators of scale responsiveness.
>
> In the second piece, we used a more sophisticated, modern scale evaluation method—Rasch analysis.[15] Rasch analysis has three main advantages over more standard (traditional) methods of scale evaluation:
>
> 1. Rasch analysis enables equal interval (linear) measurements to be derived from non-equal-interval (ordinal) FIM® instrument and BI scores.

[15] Hobart JC, Cano SJ, Thompson AJ. Effect sizes can be misleading: is it time to change the way we measure change? *J Neurol Neurosurg Psychiatry.* 2010;81(9):1044–8.

2. Rasch analysis generates bespoke standard errors, for each person at each time point, thus enabling a legitimate study of change at the level of both the individual person and the group.[16]
3. Rasch analysis enables the comparison of the FIM® instrument and the BI on a common measurement metric.

Our analyses demonstrated that there was no difference between the responsiveness of the FIM® instrument and that of the BI at the group level. At the individual person level, however, the expected responsiveness superiority of the FIM® instrument was demonstrated clearly. These results show one of the added values Rasch analysis brings to our understanding of scale performance, and the misleading nature of group-level effect sizes as indicators of scale responsiveness.

Our studies of the FIM® instrument also provide a salutary lesson for us that we hope other rating scale–based researchers will benefit from: the need to be driven more frequently by experimental design, to test hypotheses, and to investigate anomalies. The FIM® instrument was developed in part to overcome the limited responsiveness of the BI. This is a hypothesis that required testing. Our initial results implied that this hypothesis was not supported. This was a clear anomaly because the FIM® instrument is obviously inherently better at detecting change. How can it not be? This should have stimulated immediately an investigation of the findings in order to provide an explanation for them. Part of the explanation is the limitation of effect-size calculations as indicators of scale responsiveness. There are also more subtle issues at play that will be reported in the next stages of our work. We have come to those conclusions more slowly than we should have.

But these issues are too easy to miss unless the paradigm in which rating scale research is conducted is one that emphasizes experimental design, hypothesis testing, and anomaly detection and explanation. This is nothing new for science—it reflects the scientific method, the teachings of Ronald Fisher, and the philosophies of science outlined by Thomas Kuhn and Karl Popper. Critically, it also reflects the paradigm in which Rasch expected his measurement model to be applied for the construction, evaluation, modification, and interpretation of measurement scales. Too little rating scale research takes advantage of these approaches. The FIM® instrument helped us learn this lesson.

[16] We use "bespoke" a bit out of context. In tailoring parlance, bespoke suits are made to measure for an individual. In this context, we use bespoke because each person gets an individualized standard error associated with the person's Rasch-derived measure that is determined in part by the person's location, the number of items completed, and the pattern of responses across those items. This is unlike classical test (summed score) theory, which assumes that the standard error is constant across the range of the scale. This is clinically curious because it means that the error of measurement associated with scores at the floor and ceiling is the same as at the center.

Continuum of Care

To foster a continuum of care from the acute-care hospital to the various post-acute settings, UDSMR developed the AlphaFIM® instrument. It consists of six relatively easy items—four motor items and two cognitive items from the full eighteen-item FIM® instrument—and is rated with the same seven-level ordinal scale.[17]

A patient's AlphaFIM® rating is also interpreted in terms of BoC. The purpose is to facilitate triaging patients into appropriate post-acute levels of care. To make it easier to obtain roughly equivalent estimates of independence versus dependence in basic personal care tasks, UDSMR developed two additional instruments: the ZetaFIM™ instrument, which replicates the AlphaFIM® instrument at three to four levels, and the SigmaFIM™ instrument, which uses three to four levels to represent the full eighteen-item FIM® instrument.

Pharmaceutical Research Trial

For persons with multiple sclerosis, disability, as measured by the FIM® instrument, was slowed by treatment with interferon B-1a, compared with placebo. The treatment effect determined using the FIM® instrument, with its motor and cognitive components, showed a response to therapy for patients with mild to moderate multiple sclerosis.[18]

Precision Case Management

Research has demonstrated that intensive and comprehensive inpatient rehabilitation produces predictable results. The **UDSMR® Precision Case Management Tool** identifies FIM® rating thresholds that clinicians can use when setting goals for patients who will be discharged to the community. The research performed to determine the threshold values was based on studies of the UDSMR® database, which contains more than six million IRF cases gathered over twenty years. The item thresholds that have been established are for the 50th percentile of patients in a specific CMG who were discharged to the community.

Precision case management urges members of the rehabilitation team to advance specific FIM® item functions that are consistent with returning the patient to the community. Table 3 on page 19 shows the expected discharge FIM® ratings for ten CMGs for stroke, each of which is a prospective payment category.

[17] Stillman G, Granger C, Niewczyk P. Projecting function in stroke patients in rehabilitation using the AlphaFIM® instrument in acute care. *PM&R*. 2009;1(3):234–239.
[18] Granger CV, Gilewski M, Carlin M. Measures of functional performance. In: Mpofu E, Oakland T, eds. *Rehabilitation and Health Assessment*. New York: Springer; 2009:547–568.

CMG	101	102	103	104	105	106	107	108	109	110
Eating	7	7	6	6	6	6	6	5	5	5
Grooming	7	6	6	6	6	6	5	5	5	5
Bathing	6	6	5	5	5	5	5	4	4	4
Dressing – Upper Body	7	6	6	6	5	5	5	4	5	4
Dressing – Lower Body	6	6	5	5	5	5	5	3	4	3
Toileting	6	6	6	6	6	5	5	4	4	4
Bladder Management	7	6	7	6	6	5	5	3	5	4
Bowel Management	6	6	6	6	6	6	6	5	6	5
Transfers: Bed, Chair, Wheelchair	6	6	6	6	6	5	5	4	5	4
Transfers: Toilet	6	6	6	6	5	5	5	4	5	4
Transfers: Tub, Shower	6	5	5	5	5	5	4	4	4	4
Locomotion: Walk, Wheelchair	6	6	5	5	5	5	5	4	5	4
Locomotion: Stairs	6	5	5	5	4	4	2	1	2	1
Total motor rating	*82*	*77*	*74*	*73*	*68*	*67*	*63*	*50*	*59*	*51*
Comprehension	6	6	6	6	6	6	6	5	6	5
Expression	6	6	4	6	6	6	6	5	6	5
Social Interaction	6	6	5	6	6	6	6	5	6	5
Problem Solving	6	6	4	5	5	5	5	4	5	4
Memory	6	6	4	5	5	5	5	4	5	5
Total cognitive rating	*30*	*30*	*22*	*28*	*28*	*28*	*28*	*23*	*28*	*24*
Total rating (motor and cognitive)	*112*	*107*	*96*	*101*	*96*	*95*	*91*	*73*	*87*	*75*
FIM® gain	19	23	28	26	28	30	31	28	33	34
Estimated length of stay	7	9	11	11	13	15	17	20	20	25
Gain per day	2.7	2.6	2.4	2.4	2.2	2.0	1.8	1.4	1.7	1.4

Table 3. CMGs and expected 50th percentile data for FIM® items, FIM® gain, estimated length of stay, and FIM® gain per day. The yellow shading highlights the values for CMG 105.

Precision case management is based on the FIM® ratings of stroke patients with IGCs 01.1, 01.3, 01.4, and 01.9 for the 50th percentile of patients who were discharged to the community. Table 4 on page 20 compares FIM® ratings (admission, interim, and discharge) with the highlighted thresholds/goals for CMG 105.

FIM® Items	**Admission FIM® Rating (12/17/2008)**	**Interim FIM® Rating (1/2/2009)**	**Discharge FIM® Rating (1/7/2009)**	**Discharge Goals for CMG 105**
Eating	6	6	6	6
Grooming	3	5	6	6
Bathing	3	4	6	5
Dressing – Upper Body	4	6	6	5
Dressing – Lower Body	2	5	6	5
Toileting	2	5	6	6
Bladder Management	4	6	6	6
Bowel Management	6	6	6	6
Transfers: Bed, Chair, Wheelchair	3	5	6	6
Transfers: Toilet	3	5	6	5
Transfers: Tub, Shower	1	4	6	5
Locomotion: Walk, Wheelchair	4	5	6	5
Locomotion: Stairs	1	5	5	4
Total motor rating	*41*	*67*	*77*	*68*
Comprehension	5	5	5	6
Expression	5	5	5	6
Social Interaction	4	5	5	6
Problem Solving	4	4	5	5
Memory	5	5	5	5
Total cognitive rating	*23*	*24*	*25*	*28*
Total rating (motor and cognitive)	*64*	*91*	*102*	*96*
FIM® gain	-	27	38	28
Length of stay (actual and estimated)	-	16	21	13
Gain per day	-	1.7	1.8	2.2
Rasch-transformed rating	46	61	68	63
Burden of care (hours/day)	3–4	1–2	< 1	≈ 1

Table 4. A comparison of FIM® ratings at admission, interim, and discharge with CMG-appropriate goals. The patient is expected to progress from a total rating of 64 at admission to a total rating of 96 at discharge. Values shaded in gray do not meet the thresholds.

Table 4 compares the admission FIM® ratings with an interim rating collected 16 days after admission and the discharge rating, which was collected on the twenty-first day. The LOS was purposefully extended beyond the expected thirteen days in order to reduce the burden of care on the patient's spouse, whose physical limitations prevented her from providing more than minimal assistance. Table 2 on page 14 shows the relationship between the total FIM® rating and BoC in terms of the number of hours a helper might have to spend each day at home to care for the patient. In this case, the total discharge FIM® rating of 102 indicates a BoC of less than an hour, which was agreeable to both the patient and the patient's spouse. Values that are shaded do not meet the thresholds.

Precision case management is designed to facilitate compliance with CMS's expectations for "significant benefit, measurable improvement, and predetermined and reasonable period of time."

The FIM® instrument can be used in many ways for precision case management in inpatient settings:

1. It is a criterion-referenced tool that has been carefully crafted to provide a common language among IRFs for two purposes:
    a. Measuring independence versus dependence in performing personal care activities
    b. Quantifying the BoC in terms of the number of hours of care a helper must provide in the home or a community setting
2. It is administered by trained clinicians who must pass an exam to renew their credentialing status every two years.
3. The FIM® ratings collected at admission contribute to the CMG that determines the federal prospective payment for the case.
4. The FIM® ratings collected at discharge have many uses.
    a. The difference between the eighteen-item ratings at admission and discharge measure the patient's gain in personal care functioning and the reduction in BoC, thereby reflecting the effectiveness of the rehabilitation team.
    b. The efficiency of the rehabilitation team's efforts is reflected in the FIM® gain, which is the eighteen-item gain divided by the length of stay. A gain of 1 point per day is minimal; a gain of 2.5 is exceptional.
    c. The eighteen-item discharge FIM® rating can be compared to the previously determined, statistically expected rating according to a level consistent with being discharged to the home or a community setting. (This typically requires a discharge rating of 80 or more, which represents a BoC of less than two hours per day.)
    d. The eighteen-item discharge FIM® rating determines the impact of a one-point change on the BoC:
        i. In the middle range of total FIM® rating, a change of one point is equivalent to three to five minutes of BoC.
        ii. In the upper range of total FIM® rating, a change of one point is equivalent to less than three minutes of BoC.
        iii. In the lower range of total FIM® rating, a change of one point is equivalent to more than five minutes of BoC.
5. The FIM® motor items can be arranged in an expected hierarchy from easy to difficult. The exact hierarchy varies by impairment. Similarly, the hierarchy for the cognitive items varies in stroke patients, depending on whether the brain lesion is right- or left-sided. The rank order of item ratings can be monitored as part of efforts to ensure program quality.
6. The PEM allows an inpatient program to compare its total rehabilitation effectiveness with its own efforts from year to year and with other facilities across the nation.

The FIM® instrument also can be used in acute and post-acute settings to promote the continuum of care. In these settings, abbreviated versions of the complete instrument are typically used:

- The AlphaFIM® instrument, a six-item, seven-level version

- The AcuteFIM™ instrument, a six-item, three-level version used for acute discharge planning
- The SigmaFIM™ instrument, an eighteen-item, three-level version used for most community or institutional settings, either pre-acute or post-acute

The WeeFIM® Instrument and the WeeFIM® Instrument: 0–3 Module

The WeeFIM® instrument is a direct derivative of the FIM® instrument.[19,20] It was developed from observation or parental report to measure the need for assistance and the severity of disability in children between the ages of six months and seven years. The WeeFIM® instrument consists of a minimal data set of eighteen items that measure functional performance in three domains: self-care, mobility, and cognition. It can be used with children above the age of seven years provided that their functional abilities, as measured by the WeeFIM® instrument, are below those expected of children aged seven who do not have disabilities.

The WeeFIM® Instrument: 0–3 Module is a questionnaire for parental interview or parental report that measures precursors to function in children zero to three years old, regardless of disability. It is useful across many settings, including early intervention and preschool.

The WeeFIM II® System allows clinicians to measure and document functional performance in a consistent manner for infants (zero to three years old), children, and adolescents with acquired or congenital disorders. The WeeFIM® instrument reliably measures outcomes and can be applied uniformly across inpatient, outpatient, and community-based settings to track clinical, managerial, and functional performance improvement efforts and initiatives. The WeeFIM II® System is a criterion-referenced outcomes management system that provides a method of evaluating outcomes for patients, groups of patients (population-based), and overall medical rehabilitation programs.

[19] Deutsch A, Braun S, Granger CV. The Functional Independence Measure (FIM™ Instrument) and the Functional Independence Measure for Children (WeeFIM® Instrument): ten years of development. *Crit Rev Phys Med Rehabil.* 1996;8(4):167–281.
[20] Uniform Data System for Medical Rehabilitation. 2006. *The WeeFIM II® Clinical Guide, Version 6.0.* Buffalo: UDSMR.

Summary Overview for Teaching Purposes: Use of the FIM® Instrument in Practice

- The FIM® instrument is designed to measure the "burden of care," meaning an approximation of the number of minutes or hours another person must spend providing personal care assistance to a person in a home setting with disability in order to accomplish the common daily tasks of personal care: mobility, self-care, sphincter management, communication, and social cognition. These tasks do not include (a) household tasks such as laundry, cleaning, shopping; (b) medically related tasks such as medication or wound dressings; or (c) supervision related to mental insufficiency or behavioral management.
- The concept of burden of care is important in placement in post-acute venues because it is a principal reason why individuals with disability remain in inpatient settings, such as IRFs, SNFs, and, to some degree, LTCHs and home care programs.
- The seven-level assessment categories apply to all eighteen items, which comprise the thirteen-item motor measure and the five-item cognitive measure. The levels are labeled 1–7 to indicate increasing personal care independence and a lower burden of care. The minimum total rating is 18, and the maximum total rating is 126. The lowest levels (1–5) indicate degrees of need for assistance from another person (from total assistance to supervision), and the highest levels (6 and 7) indicate modified independence and complete independence, respectively. Accurate assignment of the seven categories, especially of levels 1–5, is extremely important for correct scientific and clinical interpretation of the results of functional assessment. UDSMR requires that those who use the FIM® instrument to rate patients be trained and pass a mastery test at least every two years, thereby becoming certified raters.
- As commonly used, the FIM® instrument is a scale of "raw" numbers in which higher-numbered labels indicate "more" independence (a lesser burden of care) and lower-numbered labels indicate "less" independence (a greater burden of care). Studies conducted in the home setting of persons with disabilities, using a stopwatch, have shown that the average relationship between a total FIM® rating and minutes of care from another person is three to five minutes for each point in raw FIM® ratings. In other words, an increase of one point within the midrange (approximately a total FIM® rating of 40 to 90) reduces the burden of care by three to five minutes. At lower FIM® ratings, the change in rating per FIM® point is greater than five minutes; at higher FIM® ratings, the change in rating per FIM® point is less than three minutes.
- A rule of thumb is that a FIM® rating of 60 is equivalent to about four hours of personal care assistance and that a FIM® rating of 80 is equivalent to about two hours of personal care assistance. A FIM® rating of 80 or higher is compatible with the ability of family members, if available, to provide care in the home. A FIM® rating of 100 to 110 indicates no burden in personal care.
- The FIM® instrument has been the subject of many scientific investigations. Over six hundred peer-reviewed publications and book chapters have been written about it.
- The structural integrity of the FIM® instrument has been studied using Rasch analysis. (See http://www.udsmr.org/Documents/UDSMR_What_Is_Measurement_Article.pdf.) Rasch analysis is the only method by which a scale depicting a "latent trait" is transformed into a measure. A latent trait is a quality or experience—for example, pain or emotional state—for which no objective physical quantification exists. Despite being "real," this quality or experience cannot be described in terms of weight, height, width, length, or energy manifestations. Rasch analysis uses mathematical modeling. Accordingly, measures consist of several items, which cooperate with each other (i.e.,

have been tested for fit) to form a hierarchical staircase from easy to difficult. Redundant items may be identified and subsequently deleted, category levels must function in the expected order, intervals between categories and items are known, and persons and items are on the same metric (conjoint additivity). Rasch transformation of scales into measures is a theoretical and technological advancement. Rasch analysis has demonstrated that the intervals between each FIM® level from 2 through 6 are approximately equal and that the intervals between levels 1 and 2 and between levels 6 and 7 are approximately three times greater.

- For over twenty years, UDSMR has provided subscribing facilities with many services, including program evaluation, training, credentialing/mastery testing, and consultation. Because the FIM® instrument is criterion-referenced, raters who receive training and pass credentialing/mastery testing are crucial for securing accurate FIM® ratings that can be used to correctly interpret program evaluation efforts.
- Program evaluation reports provide feedback to subscribing facilities—initially on a quarterly basis, and now on demand via the Internet. Program evaluation has three goals:
    1. To explain to service providers the outcomes of each site in comparison with the whole
    2. To use differences between sites constructively in order to optimize service provision and achieve optimal outcomes effectively and efficiently through evidence-based practices
    3. To educate providers with respect to outcomes so that providers may be assured that they are utilizing best practices based on evidence derived from outcome measurement
- Indicators of disease/impairment and functional status measures are to be used in concert to monitor and augment care processes for evidence-guided care and precision case management.
- Compare the measured status of patients against optimal benchmark values for quality of daily living in order to contribute to evidence-based and evidence-guided care and to facilitate evaluation of the effects of treatment on patients over time. Functional status contributes to quality of daily living and refers to the skills included in performing tasks necessary for daily living, leisure activities, vocational pursuits, social interactions, role participation, and other required behaviors.
- The FIM® instrument does not have a ceiling effect in terms of the construct that the tool is designed to measure. The specific intent of the FIM® instrument is to determine whether a person needs assistance from another person (i.e., whether a "burden of care" exists and, if so, how much assistance the person requires) or can function independently without such assistance in terms of the basic eighteen personal care items measured by the instrument. The definition of two levels of independence—modified and complete—avoids ceiling effects by allowing the person to attain freedom from need for assistance from another person before reaching the upper limits of the scale. The validity of the FIM® instrument is directly related to assistance from another person in terms of hours (or minutes) of help per day. This subtlety may be missed by clinicians who attempt to use the FIM® instrument for measuring more than it is intended to measure. For example, instrumental activities of daily living and psychosocial competence use different constructs of independence and should be measured appropriately, as should walking speed and endurance.
- **"Outcome-optimizing research** is a systematic effort that starts with the desired human health outcome and works backward, implementing and coordinating multiple interventions by diverse

groups to maximally improve outcomes and evaluating their impact on patients, setting research agendas to fill in knowledge gaps."[21]

- The following list identifies reasons for assessing and measuring functional status:
  - To provide consistent descriptions of functional status and quality of daily living at given points in time
  - To detect changes in functional status through serial repetition
  - To monitor and guide treatment over time
  - To enhance communication among medical team members and with referring agencies
  - To provide observations compatible with answering research questions
  - To support optimal management and care by reducing uncertainty
- Longitudinal tracking of patients with chronic disease is effective and efficient using the LIFEware℠ System because of the following factors:
  - Patient-centered reporting of quality of daily living data is accumulated.
  - Over time, summed values of measures are tracked, as are item values.
  - Acquired data is actionable.
  - Interventions may be initiated based on symptoms, disease burden, quality of daily living, or a combination thereof.
  - Feedback is rapid for current and past data.
  - Interactions of functional status and impairment condition may be studied.
  - Long-term coordination of care is facilitated.
  - Unexpected comorbidities may be recognized and addressed early.
  - Children with continuing disabilities may be measured and tracked into adulthood using the WeeFIM® instrument, followed by the FIM® instrument.

  Additional information is available at http://emedicine.medscape.com/article/317865-overview.
- Table 5 identifies international UDSMR® product lines and the countries of subscribing facilities.

Product and Description	International Subscribers
AlphaFIM® Instrument *Acute care hospitals*	Canada
WeeFIM II® System *Pediatric inpatient and outpatient programs*	Canada, Chile, Columbia, El Salvador, Guatemala, Hong Kong, Italy, Lithuania, Mexico, Nicaragua, Paraguay, Qatar, Saudi Arabia, South Africa, Switzerland, Uruguay

[21] Pronovost PJ, Goeschel CA. Time to take health delivery research seriously. *JAMA*. 2011;306(3):310–311.

The FIM System® *Inpatient rehabilitation programs*	Canada, Chile, Czech Republic, Estonia, Finland, Hong Kong, Iceland, Israel, Italy, Norway, Qatar, Saudi Arabia, Singapore, South Africa, South Korea, Spain, United Kingdom

Table 5. International UDSMR® product lines.

"As we function, so shall we live."
—Carl V. Granger, MD

Additional Reading

Information in this document was compiled from published and unpublished documents from UDSMR and CFAR, including:

- Granger CV, Black T, Braun SL. Quality and outcome measures for medical rehabilitation. In: Braddom RL, ed. *Physical Medicine & Rehabilitation.* 3rd ed. Elsevier; 2007.
- Granger CV. Rehabilitation medicine and Medicare postacute care policies. *Arch Phys Med Rehabil.* 2008;89(4):793–794. Comment on *Arch Phys Med Rehabil.* 2007;88(12):1737–1739.
- Granger CV, Harper C, Duffey E. The FIM-SR (self-report) is not the FIM® instrument. *Arch Phys Med Rehabil.* 2007;88(2), 265–266.

For more detailed reading related to the FIM® instrument, UDSMR suggests the following:

- Ottenbacher KJ, Hsu Y, Granger CV, Fiedler RC. The reliability of the Functional Independence Measure: A quantitative review. *Arch Phys Med Rehabil.* 1996;77(12):1226–1232.
- Linacre JM, Heinemann AW, Wright BD, Granger CV, Hamilton BB. The structure and stability of the Functional Independence Measure. *Arch Phys Med Rehabil.* 1994;75(2):127–132.
- Heinemann AW, Kirk P, Hastie BA, Semik P, Hamilton BB, Linacre JM, Wright BD, Granger, C. Relationships between disability measures and nursing effort during medical rehabilitation for patients with traumatic brain and spinal cord injury. *Arch Phys Med Rehabil.* 1997;78(2):143–149.
- Granger CV, Cotter AC, Hamilton BB, Fiedler RC. Functional assessment scales: a study of persons after stroke. *Arch Phys Med Rehabil.* 1993;74(2):133–138.
- Granger CV, Cotter AC, Hamilton BB, Fiedler RC, Hens MM. Functional assessment scales: a study of persons with multiple sclerosis. *Arch Phys Med Rehabil.* 1993;71(11):870–875.
- Granger CV, Divan N, Fiedler RC. Functional assessment scales: a study of persons after traumatic brain injury. *Am J Phys Med Rehabil.* 1995;74(2):107–113.
- Disler PB, Roy CW, Smith BP. Predicting hours of care needed. *Arch Phys Med Rehabil*. 1993; 74(2):139–143.