Module 3: Understanding Measurement Properties

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Learning objectives

Learners should be able to answer following the questions after completing this module:

- In your clinic, what aspects of clinical utility will affect use of
  - A patient-reported instrument administered electronically?
  - A clinician-rated instrument that takes about 20 minutes for a typical patient?
- What is inter-rater reliability?
- What is internal consistency?
- What is test-retest reliability?
- How can a clinician ensure valid application of instruments?
- What are potential sources of error or bias?
  - For patient-reported instruments?
  - For clinician-rated instruments?

Learning objectives, continued

- What can you do in the clinic to reduce measurement error and the potential for bias?
- What measurement properties should clinical outcome instruments demonstrate?
  - For interpreting a score at a single point in time?
  - For prediction of a future event?
  - For interpreting change over two or more time points?
- How are minimally clinically important difference (MCID) indices of value to clinicians?
- How do MCIDs differ from minimal detectable change (MDC) indices?

Identify Measures for YOUR Case

•ACTIVITY: Identify measures for your case based on:

Clinical Utility

- Cost
- Equipment
- Time to administer / score
- Burden to patient / clinician
- Scoring complexity

Psychometric Information

- Reliability
- Validity
- Floor / ceiling Effects
- Normative Values
- Indices of Change

•Record the information on the worksheet provided

•Report back to group: your case, measures you considered, why you chose the one you selected

Clinical Utility

Clinical utility

- Cost of Instrument
- Training Required
- Time to administer
- Type of Measure
  - Patient-reported
  - Clinician-rated
- Burden of measure
  - To the clinician
  - To the patient
- Resources required?
  - Clinical space and equipment
  - Instrument-specific requirements
- Organizational constraints

Understanding differences

- Discriminate states: (presence or absence of a condition)
  - Screening
  - Plan intervention
- Predicting future events: (ex. Fall risk)
- Evaluating change over time
  - Significant improvement: upgrade plan
  - Significant deterioration: reassess
  - Trajectory of change: gradual or rapid?
  - Goal attainment: on track, exceeding expectations, or lagging?

Clinical utility

	Clinician Rated Performance Instruments	Patient Reported Outcome (PRO) Instruments
Pros	• Qualitatively rich • Conceptually related to functioning constructs • Primarily physical functioning constructs of Body Structures, Body Functions, and Activity levels	• Inexpensive • Reduced burden on clinician • Little or no rater error • Can be administered electronically • Body Structures, Body Functions, Activity, Participation, satisfaction, health related quality of life, and other constructs
Cons	• Clinician burden • Rater error • Potential for rater drift, bias	• Fixed item sets can be lengthy (computer adaptive tests are shorter) • May be perceived as less clinically relevant

Case Example: Parkinson Disease

Frank

- 72 year old male, lives with 70 year old wife
- Diagnosis:
  - Parkinson Disease, 7 years post dx
  - Hoehn and Yahr scale stage 3
- Being assessed in a PD clinic (60 min eval period) for potential admission into inpatient rehabilitation secondary to:
  - **Frequent falls that occur while standing and ambulating**
  - Decreased mobility
  - Gait instability
  - Greater dependence in ADLs/IADLs
- Patient goals are to reduce his fall risk, increase stability and independence in mobility and daily activities.

Case application: Selected Instruments

- Five balance instruments
  - Berg Balance Test (BBS)
  - Dynamic Gait Index (DGI)
  - Timed Up and Go (TUG)
  - Activities-Specific Balance Confidence Scale (ABC)
  - Functional Reach Test (FRT)

Comparing instruments: Clinical Utility for Case 1

	BBS	FRT	DGI	TUG	ABC
Constructs	Static and Dynamic Balance, falls risk	Stability in a fixed position	Dynamic balance, falls risk	Dynamic balance, falls risk	Balance Confidence
Instrument Type*	CR	CR	CR	CR	PR
Equipment	Stop watch Chair Ruler Slipper Step stool	Ruler	Shoe box Two obstacles Stairs	Chair Stopwatch	Instrument and pen
Length of Test	14 items	1 item	8 items	1 item, 2 trials	16 items
Time required	15 – 20 min	< 5 min	10 min	< 5 min	10 – 20 min
Cost	Free	Free	Free	Free	Free

* Clinician Rated = CR, Patient Reported = PR

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Clinical Bottom Line: Clinical Utility

- Match instrument with purpose
- Consider organizational barriers / facilitators
- An instrument that has good clinical utility in one setting, doesn't mean clinical utility is good in another

Classroom Activity: Clinical Utility

- ACTIVITY: Use online resources to identify important aspects of clinical utility for the instruments you have chosen
  - Record the information on the worksheet provided
  - Determine whether there are specific considerations for your situation
  - The group will report back interesting findings

Reliability

Reliability = Consistency

- Reliability coefficients are…
  - Derived from samples
  - NOT attributes of the instrument
  - Based on the sample context
    - Study methods
    - Sample demographics
    - Condition(s) of interest
    - Instrument
- Clinical considerations
  - How precise will this instrument measure the construct with my patient?
  - What sources of error are relevant to use of this instrument with patients in my clinic?
  - Best you can expect: clinical settings less rigorous than research settings

Types of Reliability

- Internal consistency: Multi-item measures summarized to single score (unidimensional)
- Intra- and inter-rater: raters are part of the measurement process
- Test-retest
  - Repeat assessments at different times
  - Assume no change of construct over time interval
- Correlation coefficient: has no unit
  - Intra-class correlation coefficient (ICC)
  - Pearson or Spearman
- Standard error of measurement (SEM): in scale units

Clinical bottom line: Comparing instruments' reliability

- Reliability is based on how rigorous the standardization procedure was in a research study
  - Critical to standardize instruments for clinical care
  - .9 in the research is at best .9 in the clinic
  - Re-standardization NEEDS to occur
    - Minimizes "drift"
    - Increases clinician reliability

- For clinical application, instruments should have
  - A reliability coefficient > .9
  - Internal consistency of > .7, <.9

Comparing instruments: Reliability for Case 1

Reliability	BBS	FRT	DGI	TUG	ABC
Test-retest* in Elderly	**.91**	NA	NA	.97	.7 to .92
Test-retest* in PD	**.94 to .8**	NA	.84	.8	.94
Interrater* in Elderly	**.88**	.98	†.82 to .92	.91	NA
Interrater* in PD	**.95**	.74 to .87	NA	On meds: .99 Off meds: .87 to .99	NA
Intrarater* in Elderly	**.98**	NA	*.89 to .9	.85 to .92	NA
Intrarater* in PD	**NA**	**.64**	.84	NA	NA
Internal consistency in Elderly	**.96**	NA	NA	NA	.96
Internal consistency in PD	**.95**	NA	NA	NA	.92

* Reliability should be > .9 for a clinical instrument
Internal consistency should be > .7 & < .9 for clinical instrument
†Danish version of DGI used for test
References for the data can be found in the Rehabilitation Measures Database

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Clinical Bottom Line: Comparing Instruments for Reliability

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- For clinical application, instruments should have:
  - A reliability coefficient > .9
  - Internal consistency of > .7, <.9

Classroom Activity: Reliability

ACTIVITY: Use online resources to identify reliability and internal consistency of the measures that you chose

- Record the information on the worksheet provided
- Determine whether there are specific considerations for your situation
- The group will report back interesting findings

Valid application of instruments

Validity

Extent to which a measure assesses what it is intended to measure

- Validity is an attribute of the application of a measure, to a sample, in a context, and *not an attribute of the measure itself*
- Reliability is a prerequisite
- Reliability defines the upper limit of validity

Validity

Extent to which a measure assesses what it is intended to measure

Would you

Measure body weight …

… with a postage meter?

Measure BP on a child…

… with a large cuff?

Measure body temperature…

… with a turkey thermometer?

Validity

- How meaningful and trustworthy is the interpretation of

- A given score
- From a given measure
- For a given person/sample
- Under a given context

Valid measurement: The right instrument for the situation

Select the best instrument for

- The construct(s) of interest
- A specific patient
- A known set of circumstances
  - Clinical setting
  - Clinical application
  - Time frame
  - Burden
- Scores within a valid range
- One or more clinical decisions
  - Discrimination
  - Prediction
  - Evaluation

Validation coefficients

- Other instruments correlate
  - High, if comparable
  - Low, if different
- Cross-sectional
  - one point in time
- Predictive
  - Associated with future event
- Longitudinal
  - Subjects are stable over time
  - Subjects who change over time

Validity: Types

Validation Methods

- Face
- Content
  - Dimensionality
- Criterion
  - Gold standard
  - Concurrent
  - Predictive
- Construct
  - Latency

Unified concept

Messick's Six aspects of Validity

- Content
- Substantive
- Structural
- Generalizability
- External
- Consequential

Validity

- **Content:** relevance, representativeness, and technical of the measure to the construct
- **Substantive:** empirical evidence for the theoretical construct of interest.
- **Structural:** fidelity of the scoring structure to the structure of the construct domain
- **Generalizability:** extent scores generalize across populations, settings, and tasks.

Validity

- **External:** convergent, discriminant, and criterion-based evidence for the measure. How does this measure perform in comparison to other similar or different measures?

- **Consequential:** positive or negative, and intentional or unintentional consequences of use of the measure.

(Messick 1995)

Validation methods

- Content
  - Include relevant
  - Exclude irrelevant
  - Sufficient range
- Criterion
  - Alternate test
- Construct
  - Better test

- Convergent
- Discriminant
- Known/extreme groups
- Cross-sectional
- Longitudinal
  - Sensitivity to change
  - Responsiveness
- Predictive

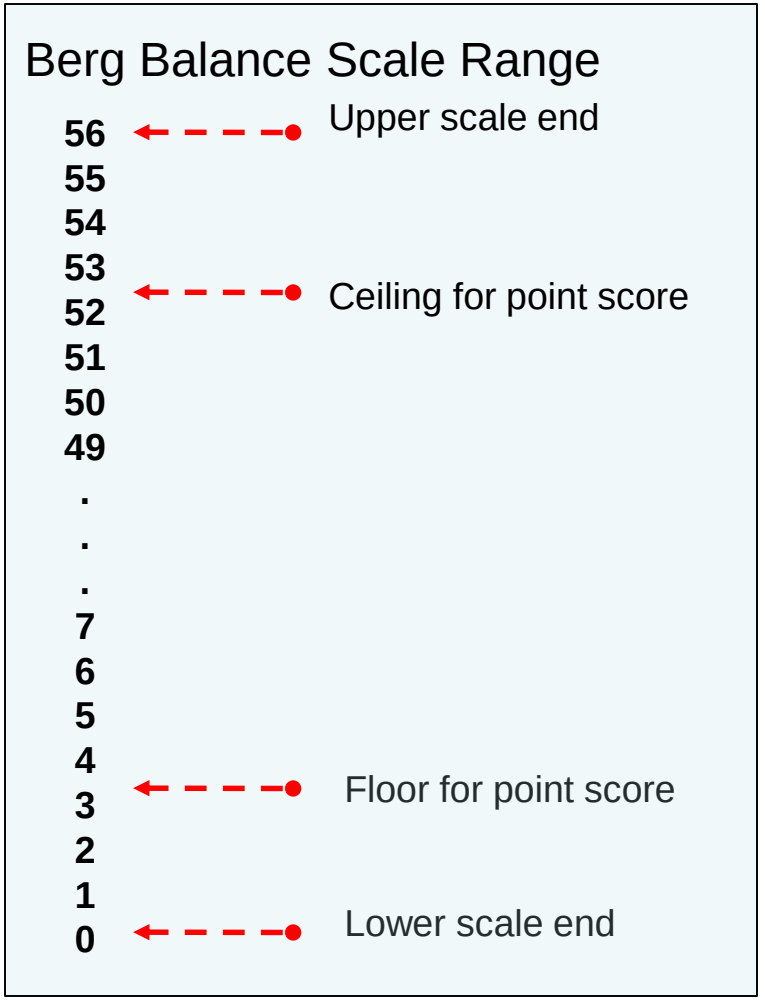
Validity: Floor and ceiling effects

Scores at scale ends can be invalid

- Floor effects occur for scores at or near the low end
- Ceiling effects occur for scores at or near the high end

A baseline score could be out of range, or invalid, if it lies within a margin of error of either scale end.

- The true score for a floor effect could be lower than the lowest scale score
- The true score for a ceiling effect could be higher than the highest scale score



Clinical bottom line: Valid measurement

- Ensure the construct the instrument measures is valid for the patient and your purposes
  - Correlation of >.6 with instruments that measure construct of interest
  - Low correlations with instruments measuring different constructs
- Ensure that study sample is similar to your patient
- Determine if patient's score falls outside of the margin of error at either end of the scale

Comparing instruments: Validity for Case 1

	BBS	ABC	DGI	TUG
Elderly	.50 with ABC .67 with DGI .84 with FGA	.50 with BBS .39 with TUG .88 with FES .53 with FGA	.67 with BBS .94 with FGA	.39 with ABC .17 with FRT .76 with 10 MWT -.84 with FGA
Parkinson's Disease	-.67 with FFM .51 with FRT .64 with ABC .78 with FGA .87 with BesTest	.64 with BBS -.44 with TUG	NA	-.36 with FRT .55 with Tinetti .58 with FFM

FES = Falls Efficacy Scale
FFM = Fear of Falling Measure
FRT = Functional Reach Test
10 MWT = 10 Meter Walk Test
FGA = Functional Gait Assessment
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Comparing instruments: Floor and ceiling effects for Case 1

- Floor / Ceiling effects:
  - Berg (in PD): not established
  - ABC (in PD): Initial scores > 80 unlikely to improve

- After initial assessment:
  - Determine whether initial score is within the margin of error for either test end
  - If the patient is within this range, will likely encounter a floor/ceiling effect

Clinical Bottom Line: Valid measurement

- Ensure the construct the instrument measures is valid for the patient and your purposes
  - Correlation of >.6 with instruments that measure construct of interest
  - Low correlations with instruments measuring other constructs
- Ensure that study sample is similar to the patient
- Does the patient's score fall outside of the margin of error for either end of the scale

Classroom Activity: Validity

- ACTIVITY: Use online resources to identify validity information for the instruments you chose

  - Record the information on the worksheet provided

  - Determine whether there are specific considerations for your situation

  - The group will report back interesting findings

Interpreting scores

Measurement error and bias

Measurements have error due to the
- Instrument
- Patient
- Environment
- Clinician

- Error is an unavoidable part of measurement
- Can be substantial

Some measures are vulnerable to bias

- Instrument
  - Calibration that drafts
- Patient
  - Social response
  - ‘faking bad’
  - Recall
- Clinician
  - Social response
  - Special interests

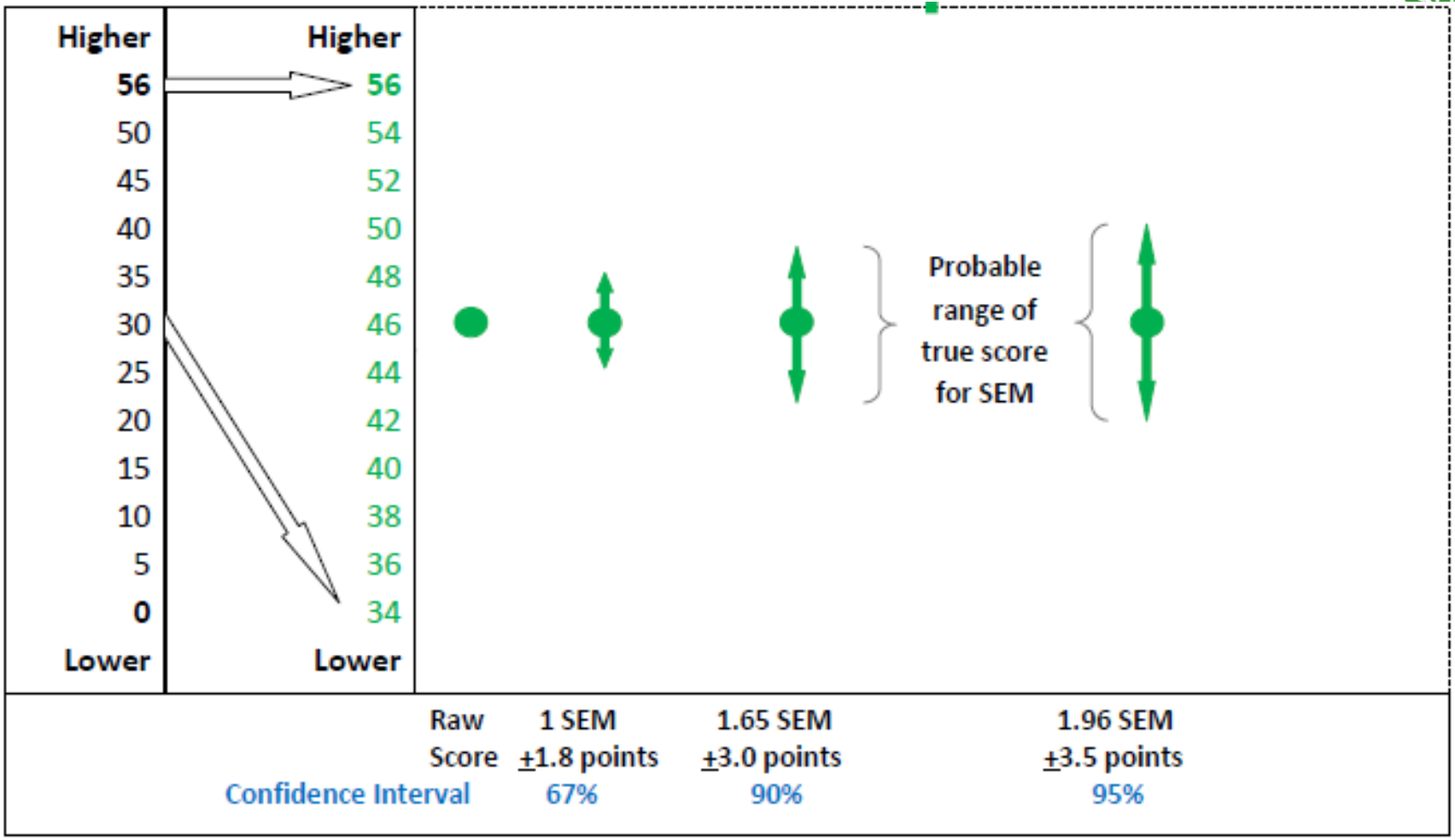
Score: Point estimate and margin of error

- An observed score is an estimate at a point in time
- The true score could fall within a range above or below the estimate (margin of error)
- This range can be described by the standard error of measurement (SEM)

$$\mathbf{SEM = (SD_{baseline})*\sqrt{(1-ICC)}}$$

- SEM is like a standard deviation

Measurement of a single time point



Interpretation of Results: Clinical Example

Standard Error of Measurement (SEM):

- Clinical scenario: Pt. scores a 46 on the BBS
  - SEM for the BBS ranges from 1.2 to 2.3 points for elderly, cut-off for fall-risk is < 45
  - BBS score on eval is 46 (out of 56), what is the range the true score lies?
  - Accounting for the SEM, the patient's true score on the BBS is between 43.7 and 48.3
  - Is this patient at risk of falls?
  - Although the score is above the cut-off for fall-risk, considering the SEM may indicate the patient is actually at risk for falls.

Interpretation of Results: Clinical Example

- Clinical scenario: Box and Blocks Test
  - SEM for the Box and Blocks Test in Chronic Stroke is 3.7 block per minute
  - On evaluation, the patient is able to move 7 block in 1 minute
  - After 4 weeks of treatment, the patient moves 10 blocks in 1 minute
  - *Did the patient make a change that is beyond measurement error?*
    - No, you cannot be confident the patient improved.
    - The score would have to be >10.7 blocks per minute to indicate a change beyond measurement error

Conditional standard error of measurement (CSEM)

Conditional SEM for Berg Balance Scale with elderly subjects (Donoghue 2009)		
Scale Range	**1 CSEM (67% CI*)**	**1.96 CSEM (95% CI*)**
0-24	1.7	3.3
25-34	2.3	4.5
35-44	1.8	3.5
45-56	1.2	2.4

*CI=Confidence Interval

Interpreting score for prediction

Prediction

- Some measures have been validated to predict future events
- Prediction is defined by
  - a cut point or threshold for a probability level at which a patient is at risk for the occurrence of the future event
  - A time frame in which the event occurrence is probable.
  - The characteristics of the sample and the conditions of the study

Falls prediction from the Berg Balance Scale

- Maximum score of 56 indicates functional balance
- Falls risk for elderly 2.7 times greater over 3 months for scores <45 (2+ falls compared to 0 or 1 fall)

[Berg 1992]

- Falls risk for elderly over 6 months
  - 50% probability for scores ≤49
  - 75% probability for scores ≤45
  - 90% probability for scores ≤41
  - 99% probability for scores ≤33

[Shumway-Cook 1997]

SEM and prediction: Case Application

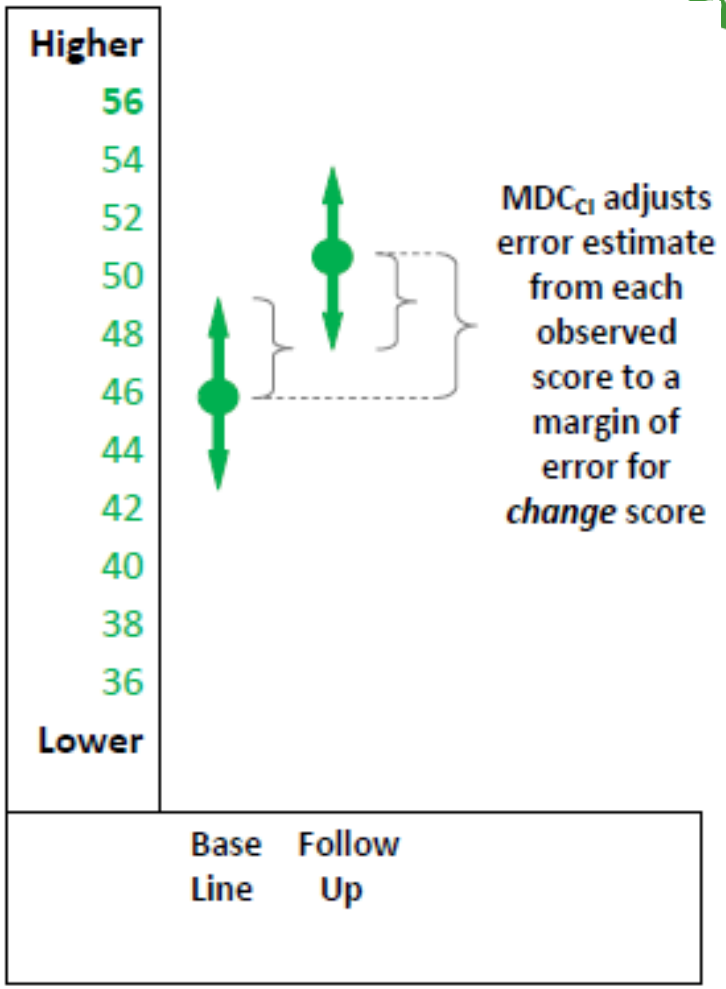
- If the BBS is chosen:
  - $SEM_{(95)}$ for the BBS is 3.5 for PD
  - Cut-off for fall-risk is < 45

- BBS score on admission is 46 (out of 56)
  - Accounting for the $SEM_{(95)}$, the patient's true score on the BBS is between 42.5 and 49.5 points
  - Although the observed score is above the cut-off for fall-risk, considering the margin of error for the true score, our patient has more than twice the risk of falling in the next 3 months than a non-faller

Interpreting change over time

Measuring change

- Baseline and follow-up scores both have error
- Minimal detectable change (MDC) provides margin of error for true change
- $MDC_{CI} = SEM_{CI} * \sqrt{2}$
- $MDC_{(95)} = SEM * 1.96 * \sqrt{2}$
- Berg $MDC_{(95)}$ = 5 points for Parkinson's Disease (Steffen and Seney, 2008)



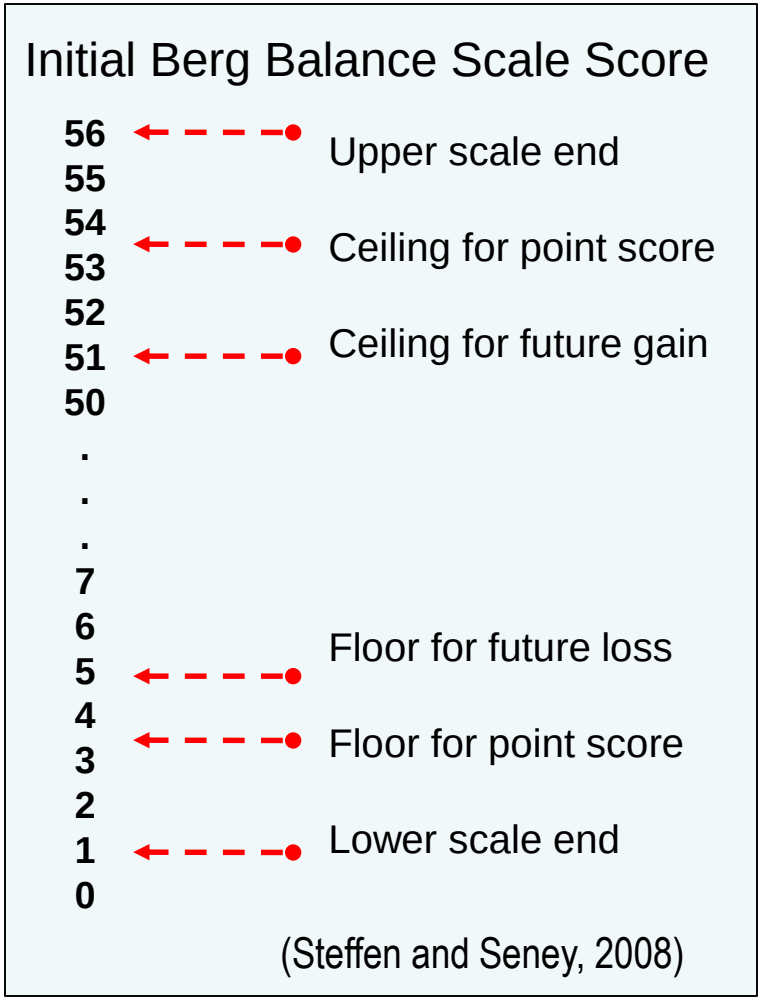
Validity: Floor and ceiling effects

Scores at scale ends could be invalid

- Floor effect at or near the low end
- Ceiling at or near the high end

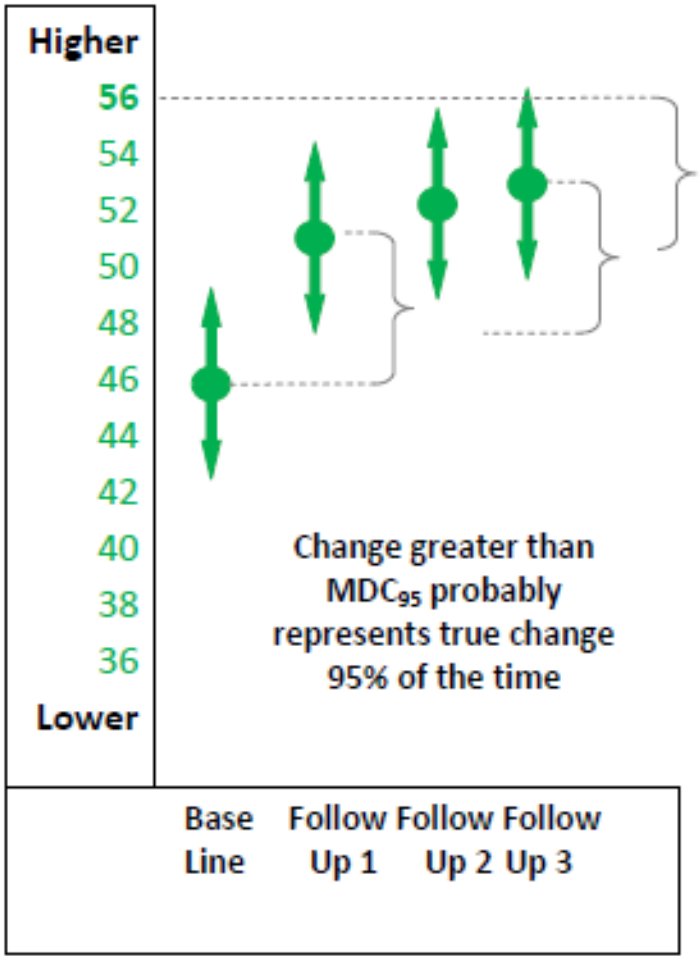
A baseline score could be

- Out of range if within $SEM_{(95)}$ = 3.5 of the scale ends
- Insufficient to measure future change within $MDC_{(95)}$ = 5.0 of scale ends
  - Effective floor for deterioration = 5
  - Effective ceiling for improvement = 51



Measuring change over multiple time points

- Change from baseline to follow-up 1
- Change from follow-up 1 to follow-up 3
- Pattern of observed scores
- Change in risk of falls
- Implications on decision-making
  - Ceiling effect
  - Intervention or discharge planning



MDC: Impact on clinical decision-making

- The time period in which a MDC should be achieved is unknown
  - Look for trends toward achieving MDC
  - Should be within a reasonable time period (how long does it take to achieve similar results in similar patients in the research literature?)

- Slowing in progress could indicate:
  - Approaching plateau, discharge should be considered
  - Intervention, frequency, intensity should be changed to maximize outcomes

Interpretation of Results: Clinical Example

Minimal Detectable Change (MDC):

- Clinical scenario:
  - MDC in Parkinson's Disease for comfortable gait speed is .18 m/s
  - Gait speed on initial evaluation is .4 m/s, at re-evaluation is .53 m/s
  - *Did this patient make a true change in speed?*
  - Although change was demonstrated in gait speed, the change was not sufficient to demonstrate a true change

Interpretation of Results: Clinical Example

MDC Clinical Scenario: Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)

- The MDC on the DASH in athletes is 10 points.
- A patient scores 67 out of 100 on the instrument

- What is the minimum score a patient must achieve at the follow-up test to be confident a change has occurred?
  - 77 out of 100

- If the patient does NOT score a 77 at the next test, what information would help you decide whether a change (although not substantial change) has occurred?
  - The SEM – if the patient increases the score beyond the SEM, you can assume a change has been made (although not a substantial/meaningful change)
  - SEM in athletes is 3.61 points

Measuring change over three or more time points

- When to re-administer
  - Discharge only: no information during intervention
  - Expect change to exceed MDC_{CI}
  - Critical decision points: e.g., team meetings

- Time trade off
  - more assessments provide more information
  - more burden, particularly for clinician-rated instruments

Interpreting important change

Measuring important change

- Minimal detectable change (MDC) provides the margin of error for true change
  - Calculated from test-retest reliability sample
- Minimal clinically important difference (MCID) provides an index of important change
  - Anchored to patient, clinician, or other threshold for important change
  - Estimated in many ways from different research studies
- Change must be detectable to be important
  - Cannot have important change that cannot be detected
  - MCID for instrument and sample similar to your patient must meet or exceed MDC

Interpretation of Results: Clinical Example

Minimally Clinically Important Difference (MCID):

- Clinical Scenario:
  - MCID for 6 MWT for geriatrics and acute stroke is 50m (164 feet)
  - 6 MWT on initial evaluation was 380 feet, at re-evaluation it was 570 feet
  - Considering the MCID, this change in 6 MWT likely enabled the patient to experience a noticeable change in function

Interpretation of Results: Clinical Example

MCID Clinical Scenario: Action Research Arm Test (ARAT)

- MCID for ARAT in acute stroke is 12 points (if dominant arm is impaired)
- ARAT on initial evaluation was 17 points, at re-evaluation it was 35 points
- Considering the MCID, this change in ARAT likely enabled the patient to experience a noticeable change in function

Interpretation of Results: Clinical Example

MCID Clinical Scenario: Functional Independence Measure (FIM)

- MCID for the FIM motor subscale in acute stroke is 17 points
- FIM motor on initial evaluation was 39 points, at re-evaluation it was 52 points
- Considering the MCID, this change (13 points) in the FIM does NOT indicate a meaningful change has been made, and the patient probably would NOT report a noticeable change in function

Classroom Activity: Interpretation of Results

- ACTIVITY: Use online resources to identify any information available to assist in interpretation of the test results

  •Record the information on the worksheet provided

  •Determine whether there are specific considerations for your situation

  •The group will report back interesting findings

Predicting outcomes

Predicting outcomes

- Instruments validated to measure change can be used to predict outcomes and plan treatment
  - Expected scores at key time points during intervention
  - Expected score at discharge
  - Set specific dates for expected scores, not ranges
- Measurable change must be detectable with the instrument used with a sample similar to your patient
  - Plan to reassess when change greater than MDC is expected
  - Can reassess at set times (e.g., for weekly team meetings) even if change is not expected
  - Change greater than MCID is clinically important
- Series of scores at specific dates can plot a recovery curve

Case 2: Community Dwelling Elderly

Lucille

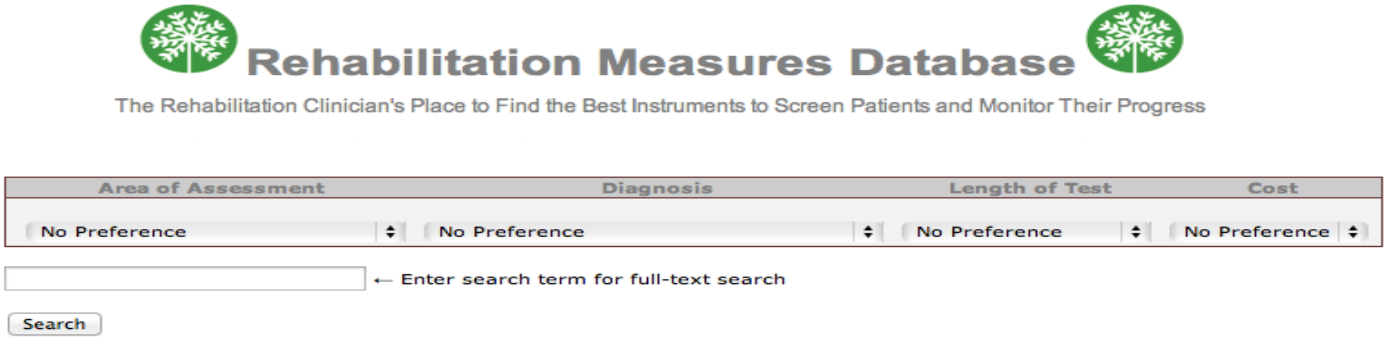
- 79 year old female
- Lives alone in a two-story home
- Referred for outpatient occupational and speech therapy because of noticeable deficits in executive function. Complaints include:
  - Increasing forgetfulness (per daughter)
  - Frequent errors with bill-paying
  - Difficulty preparing meals
  - Concerns of potential medication errors
- Daughter reports that she is thinking of having the patient move in with her, but she works full-time. Is also considering assistive living if more supervision is needed.
- Patient goals: understand current deficits and impact on function/living situation, improve independence in above areas

Potential assessment areas

Case 2: Community Dwelling Elderly

- Establish current status & understand extent of deficits (discriminate and screen)
- Determine assistance required for daily living
- Monitor improvements or decline in cognitive functioning (change over time)

Search results: the Rehabilitation Measures Database



- www.rehabmeasures.org
- Area:
  - Cognition
  - Executive Function
- Diagnosis: Geriatrics
- Length: No preference
- Cost: No preference

Search results: Rehabilitation Measures Database

- Four cognition instruments
  - Mini-Mental State Exam (MMSE)
  - Kettle Test* (KT)
  - Short Orientation-Memory-Concentration Test of Cognitive Impairment* (OMC)
  - Executive Function Performance Test* (EFPT)

- Three executive function instruments
  - Kettle Test*
  - Short Orientation-Memory-Concentration Test of Cognitive Impairment*
  - Executive Function Performance Test*

*in both domains

- Review the information gathered about the instruments
  - Select the best instrument for your situation
  - Determine appropriate testing times (initial eval, every 2 weeks, DC, etc)
  - Describe any limitations to using the selected instrument

- Report back to the group
  - Rationale for selected instrument
  - Limitations to using the instrument

Classroom Activity: Instrument Selection and Utilization

- ACTIVITY: Review the information gathered about the instruments

  - Select the best instrument for your situation

  - Determine appropriate testing times (initial eval, every 2 weeks, DC, etc)

  - Describe any limitations to using the selected instrument

  - Report back to group: your case, measures you considered, why you chose the one you selected

Summary and review

- What is inter-rater reliability?
- What is internal consistency?
- What is test-retest reliability?
- What measurement properties should clinical outcome instruments demonstrate?
  - For interpreting a score at a single point in time?
  - For prediction of a future event?
  - For interpreting change over two or more time points?
- How are minimally clinically important differences (MCID) of value to clinicians?
- How are MCIDs different from minimal detectable change (MDC)?

Summary and review, continued

- What sources of error exist in rehabilitation measures?
  - For patient-reported instruments?
  - For clinician-rated instruments?
- What are potential sources of bias?
  - For patient-reported instruments?
  - For clinician-rated instruments?
- What can you do to reduce measurement error and the potential for bias?
- What aspects of clinical utility will affect the use of
  - A patient-reported instrument administered electronically?
  - A clinician-rated instrument that takes about 20 minutes for a typical patient?

Review of Case 2 Application: Cognition

Comparing instruments: Clinical utility for case 2

	MMSE	KT	OMC	EFPT
Constructs	Screening tool cognitive impairment	Cognitive functional performance	Screening tool cognitive impairment	Cognitive functional performance
Instrument type*	PR	CR	PR	CR
Equipment	None	Kettle Dishes Ingredients for beverages	None	Several items routinely found in homes and clinics
Length of Test	11 items	1 activity	6 items	4 activities
Time required	<10 min	<10 to 20 min	5 to 10 min	30 to 45 min
Cost	$75+	Free	Free	Free
*Clinician Rated = CR, Patient Reported = PR				

Comparing instruments: Clinical utility for case 2

	MMSE	KT	OMC	EFPT
Constructs	**Screening tool cognitive impairment**	Cognitive functional performance	**Screening tool cognitive impairment**	Cognitive functional performance
Instrument type*	**PR**	CR	**PR**	CR
Equipment	**None**	Kettle Dishes Ingredients for beverages	**None**	Several items routinely found in homes and clinics
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Time required	**<10 min**	<10 to 20 min	**5 to 10 min**	30 to 45 min
Cost	**$75+**	Free	**Free**	Free

*Clinician Rated = CR, Patient Reported = PR

Comparing instruments: Reliability for case 2

	KT	EFPT
Test-retest reliability	Acute Stroke = .85	NA
Interrater reliability	NA	Chronic Stroke = .91
Intrarater reliability	NA	NA – can only be administered once
Internal consistency	NA	Chronic Stroke = .94

*Reliability should be > .9 for a clinical instrument
Internal consistency should be > .7 for clinical instrument
†Tested in Alzheimer's patients

Comparing instruments: Reliability for case 2

	KT	EFPT
Test-retest reliability	Acute Stroke = .85	NA
Interrater reliability	NA	**Chronic Stroke = .91**
Intrarater reliability	NA	NA – can only be administered once
Internal consistency	NA	**Chronic Stroke = .94**

*Reliability should be > .9 for a clinical instrument
Internal consistency should be > .7 for clinical instrument
†Tested in Alzheimer's patients

Comparing instruments: Validity for Case 2

	KT	EFPT
Validity	**Elderly:** **-MMSE: .56** **-Clock Drawing Test: .59** **-Star Cancellation : .32** **-Caregiver ratings of ALDS = .53**	Acute Stroke: -DKEFS Sorting: .511 -DKEFS Verbal Fluency: .474 -DKEFS Color-word interference: .566 -Short Blessed: .548 Chronic Stroke: -Digits forward: -.26 Digits backward: -.49 Trails A: .21 Trails B: .39 Story Recall: -.59 Animal Fluency: -.47 Short Blessed: .39

DKEFS = Delis-Kaplan Executive Function System

Comparing instruments: Validity for Case 2

	KT	EFPT
Validity	Elderly: -MMSE: .56 -Clock Drawing Test: .59 -Star Cancellation : .32 -Caregiver ratings of ALDS = .53	Acute Stroke: -DKEFS Sorting: .511 -DKEFS Verbal Fluency: .474 -DKEFS Color-word interference: .566 -Short Blessed: .548 **Chronic Stroke:** **-Digits forward: -.26** **Digits backward: -.49** **Trails A: .21** **Trails B: .39** **Story Recall: -.59** **Animal Fluency: -.47** **Short Blessed: .39**

DKEFS = Delis-Kaplan Executive Function System

Comparing instruments: Indices of change for case 2

- Error of measurement has not been established because the tests can only be administered once

- Floor and ceiling effects have not been assessed for either test

Questions and Discussion

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