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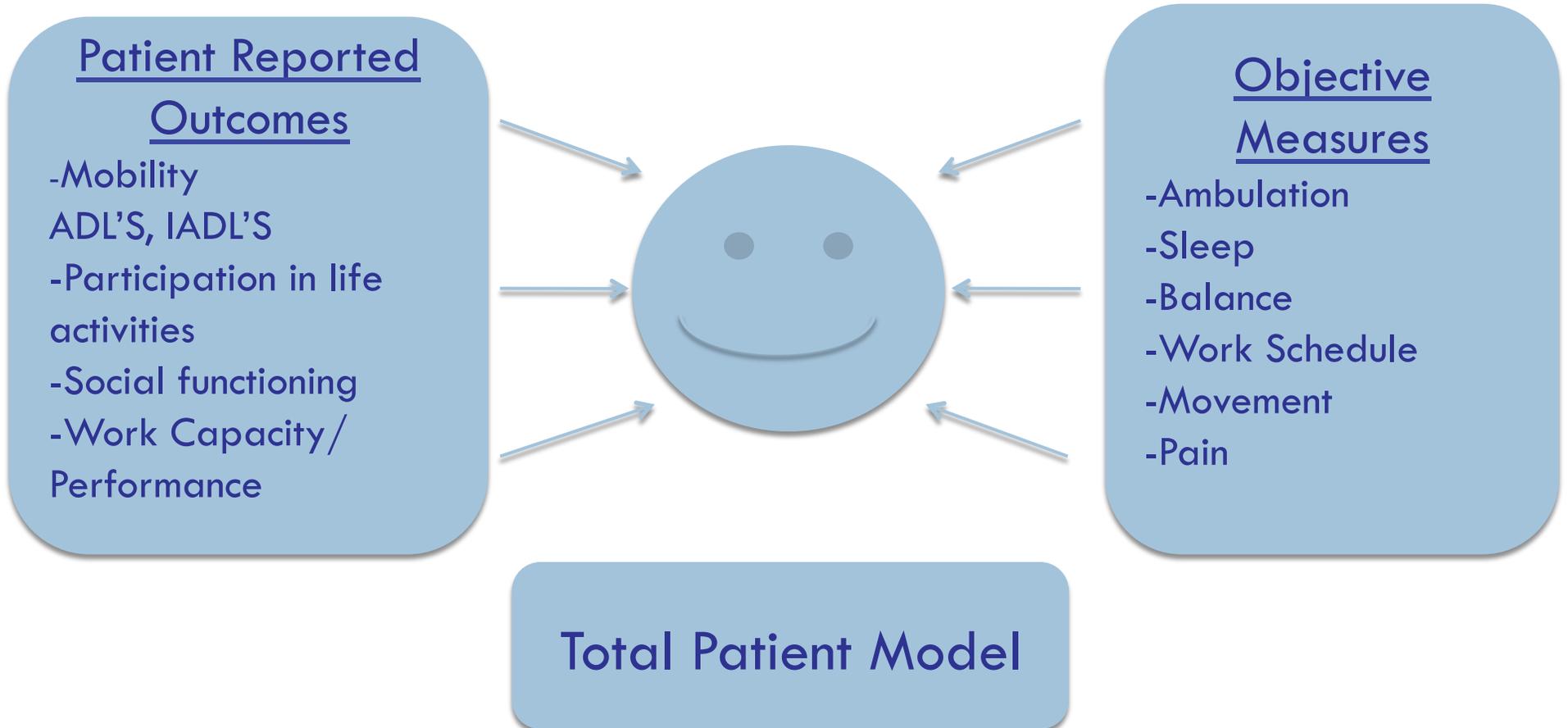
CANCER REHABILITATION SYMPOSIUM JUNE 8-9, 2015

Work groups 2 & 3: *MEASURES OF FUNCTION*

Measurement fundamental to research and clinical practice

- Categorizing
- Ordering
- Comparing

Focus on the **totality of function** of the patient



What are we measuring and why?

- Stakeholders
 - Clinicians
 - Rehabilitation
 - Primary care providers
 - Specialty care providers
 - Researchers
 - Epidemiologists
 - Trialists
 - Payers

Function is a broad, complex construct

- Span
 - ▣ Multiple domains
 - ▣ Wide performance range
- Subjective and objective dimensions



Measure challenges unique to cancer

- ▣ Symptom burden
- ▣ Dynamism – fluctuations due to treatment, disease regression/progression
- ▣ Number of concurrent impairment processes / affected systems
- ▣ Common, severe treatment toxicities
- ▣ Existential distress & mood issues

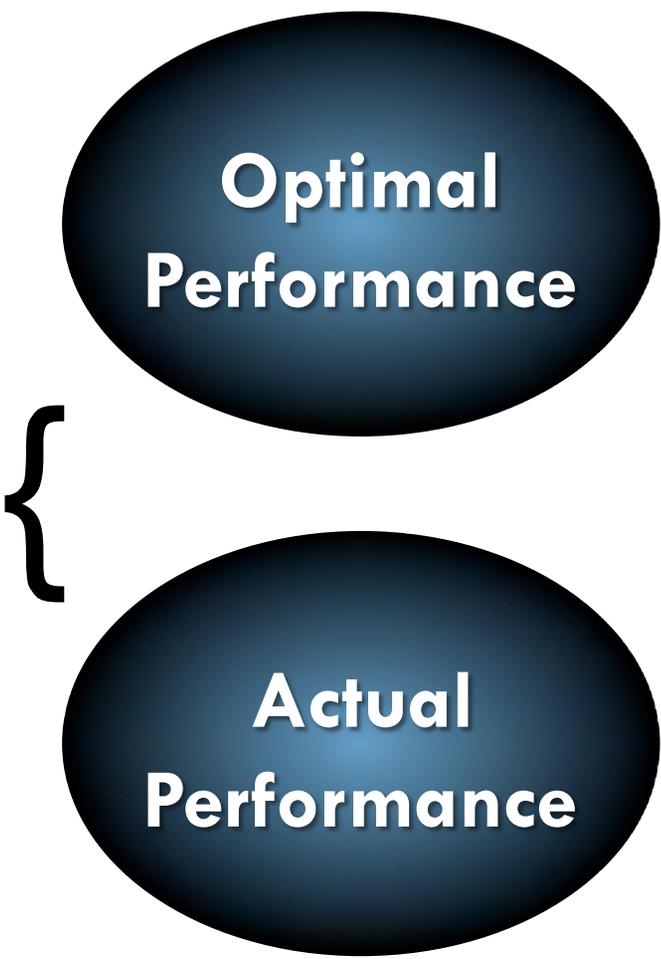
“Truth” in functional measurement

**Optimal
Performance**

- Invariant
- Theoretical
 - ▣ Ascertainable with repeated sampling?



“Truth” in functional measurement

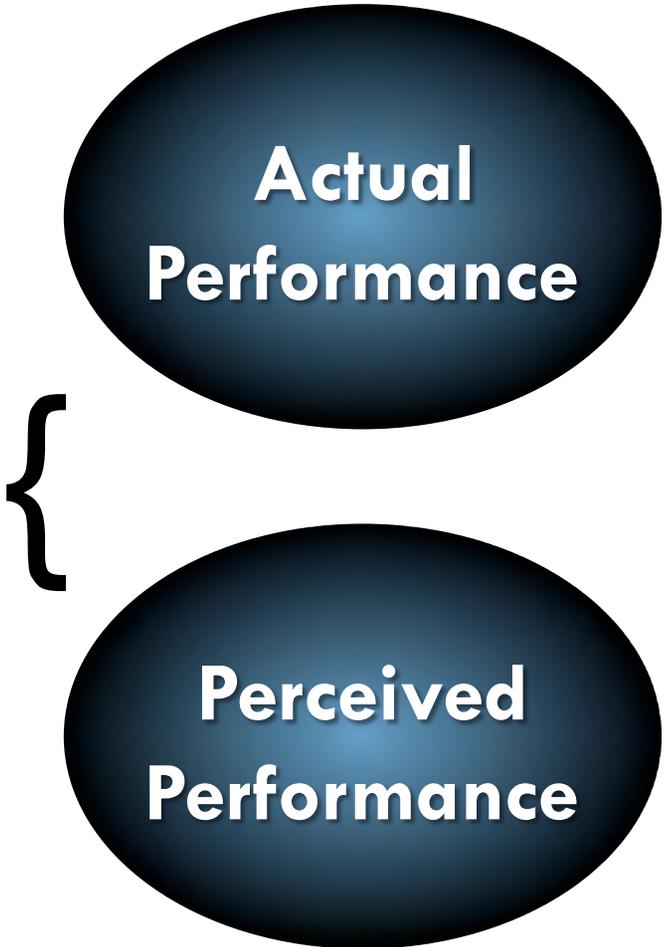


**Optimal
Performance**

**Actual
Performance**

- Variant
- Impacted by known factors
 - Mood
 - Symptom-burden
 - Motivation
 - Time of day
- Impacted by unknown factors
- Measured with:
 - Objective performance measures & batteries
 - Activity monitors
 - Physiological parameters

“Truth” in functional measurement



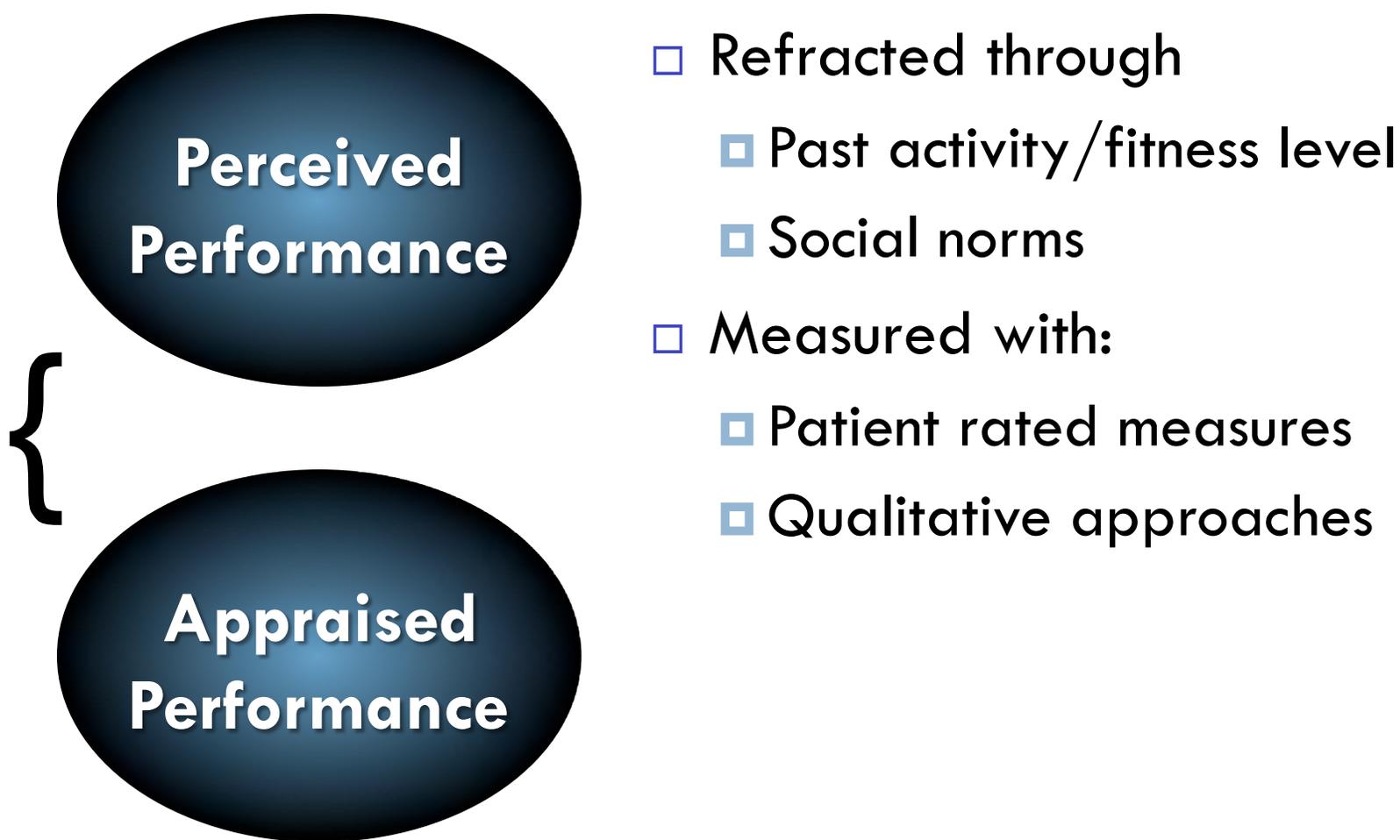
**Actual
Performance**

**Perceived
Performance**

- Refracted
 - Knowledge of disease status
 - Attribution
 - Social acceptability
- Extent of gap contextual¹
- Measured with:
 - Patient rated measures
 - Clinician rated measures
 - “Other” rated measures

1. Aadahl M, Kjaer M, Kristensen JH, Mollerup B, Jorgensen T. Self-reported physical activity compared with maximal oxygen uptake in adults. *Eur J Cardiovasc Prev Rehabil* 2007;14:422-8.

“Truth” in functional measurement



**Perceived
Performance**

**Appraised
Performance**

- Refracted through
 - ▣ Past activity/fitness level
 - ▣ Social norms
- Measured with:
 - ▣ Patient rated measures
 - ▣ Qualitative approaches

1. Heiwe S, Clyne N, Dahlgren MA. Living with chronic renal failure: patients' experiences of their physical and functional capacity. *Physiother Res Int* 2003;8:167-77.

Scope and granularity of measurement

- Global vs. system-level performance
- Activity vs. impairment
- Surrogates and proxies
 - ROM
 - VO2 max

Patient Rating

Clinician Rating & Objective Performance

- Inexpensive
- Site agnostic
 - Mail
 - Telephone
 - Internet
- Summative assessment
- Many measures
- Costly
- Point of care
 - Hospital
 - Clinic
 - Lab
- Limited assessment
 - What is acutely observed
- Relatively fewer measures

PRO Work Group:



□ Objectives:

1. Characterize potential use of functional PROs in cancer care and rehabilitation
2. Identify gaps in the current available PRO instruments and barriers to implementation
3. Opportunities and recommendations

PROs in Cancer Populations



Use of PROs in cancer

- ▣ Cancer impacts many dimensions of functioning, thus screening, assessment, and treatment are central to comprehensive care
 - Inexpensive, easily administered, patient voice/perspective of their experience

- ▣ What is the purpose of measuring function with PRO?
 - Screen for disablement
 - Estimate the effectiveness of rehabilitation interventions
 - Incorporation into treatment trials for function-based end-points

- ▣ Current instruments are generic and disease-specific

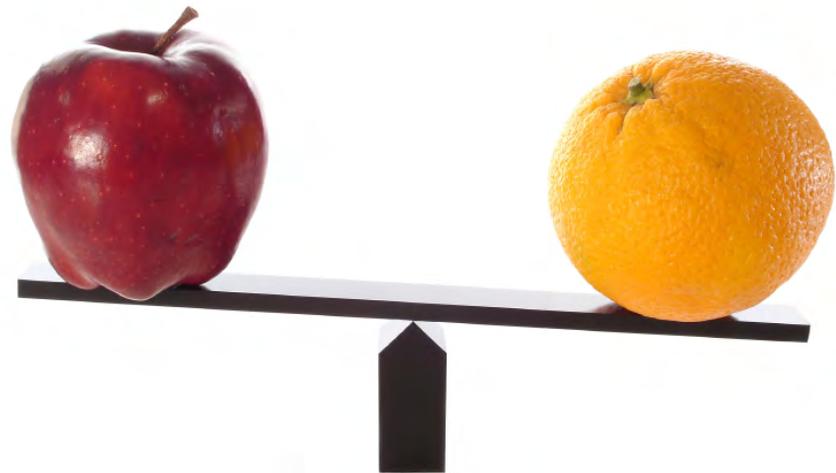
Patient reported outcomes - limitations

- Floor and ceiling effects
- Checks on veracity/accuracy
- Refracted
 - ▣ Frame of reference
 - ▣ Conception of activity
 - ▣ Respondent characteristics
 - Mood
 - Cognition
 - Symptoms¹
 - Demographics²

1. Cheville AL, Basford JR, Dos Santos K, Kroenke K. Symptom burden and comorbidities impact the consistency of responses on patient-reported functional outcomes. Arch Phys Med Rehabil 2014;95:79-86.
2. Cheville AL, Wang C, Ni P, Jette AM, Basford JR. Age, Sex, and Symptom Intensity Influence Test Taking Parameters on Functional Patient-Reported Outcomes. Am J Phys Med Rehabil 2014.

Why item Response Theory (IRT)?

- ↑ Precision
- ↓ Respondent burden
- Minimize ceiling and floor effects
 - ▣ Scores from 0 to ∞
- Comparable scores
 - ▣ Apples to apples



Latent Trait

- These latent traits (constructs, variables, θ) are measured on a continuum of severity.

I can climb stairs

Low

False

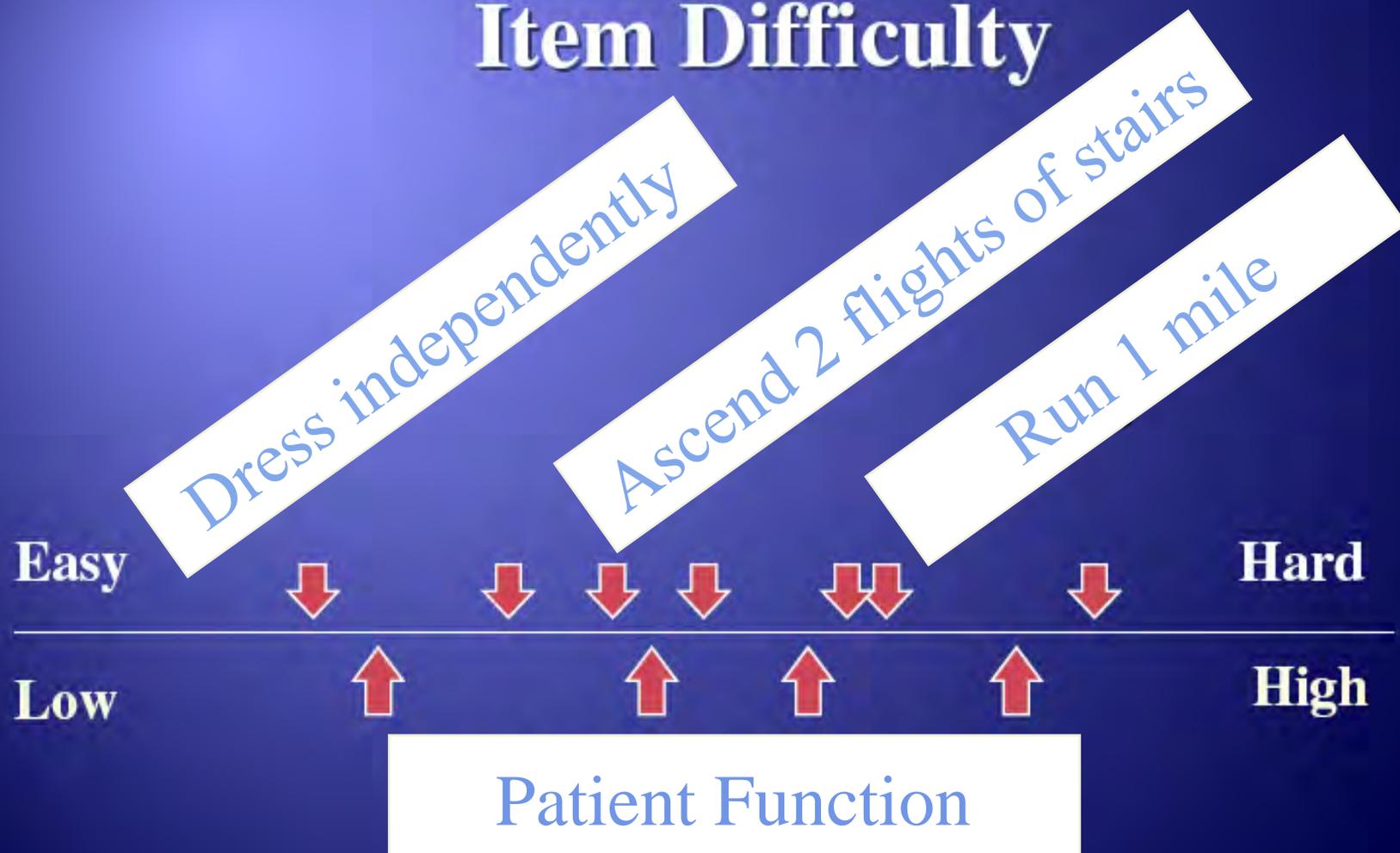
True

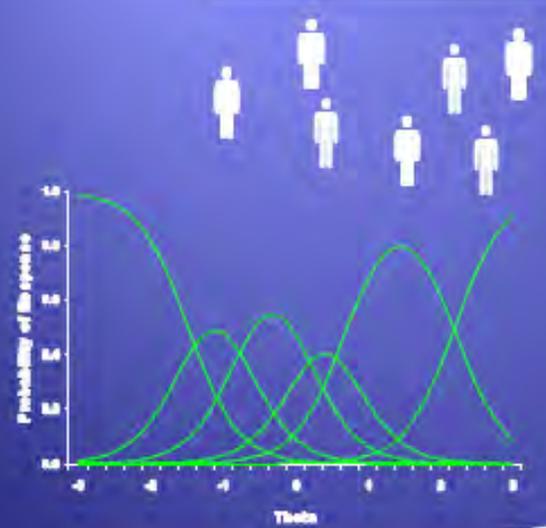
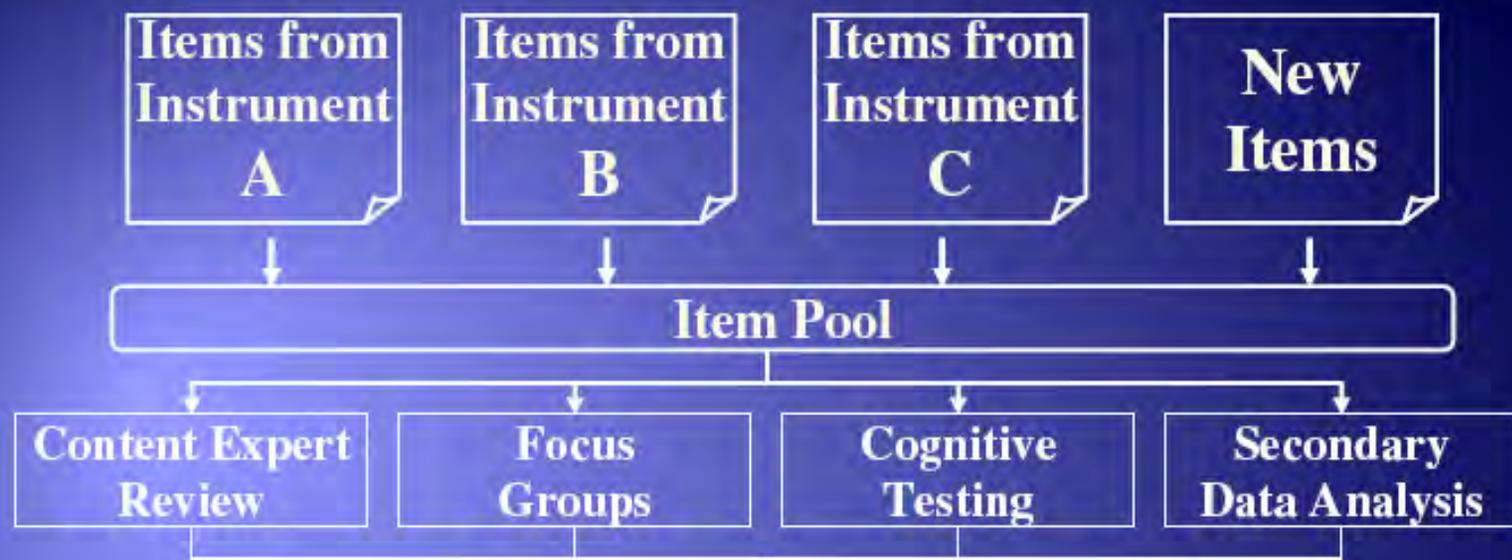
High

Function

Respondents and items are on
the same Scale

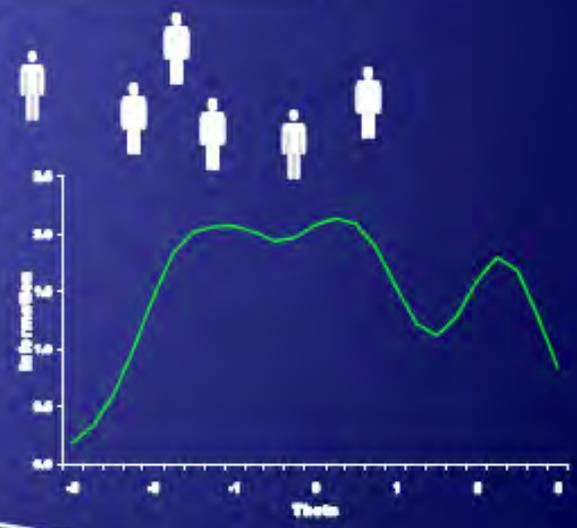
Item Difficulty





Questionnaire administered to large representative sample

Item Response Theory (IRT)



Item Bank
 (IRT-calibrated items reviewed for reliability, validity, and sensitivity)

Short Form Instruments



Progressions through a CAT



IRT modeled banks for functional assessment

- PROMIS Physical Function(PF)¹
- Cancer PROMIS Supplement PF²
- AM-PAC-CAT
- NeuroQOL³
- SCI – QOL⁴
- TBI – QOL⁵

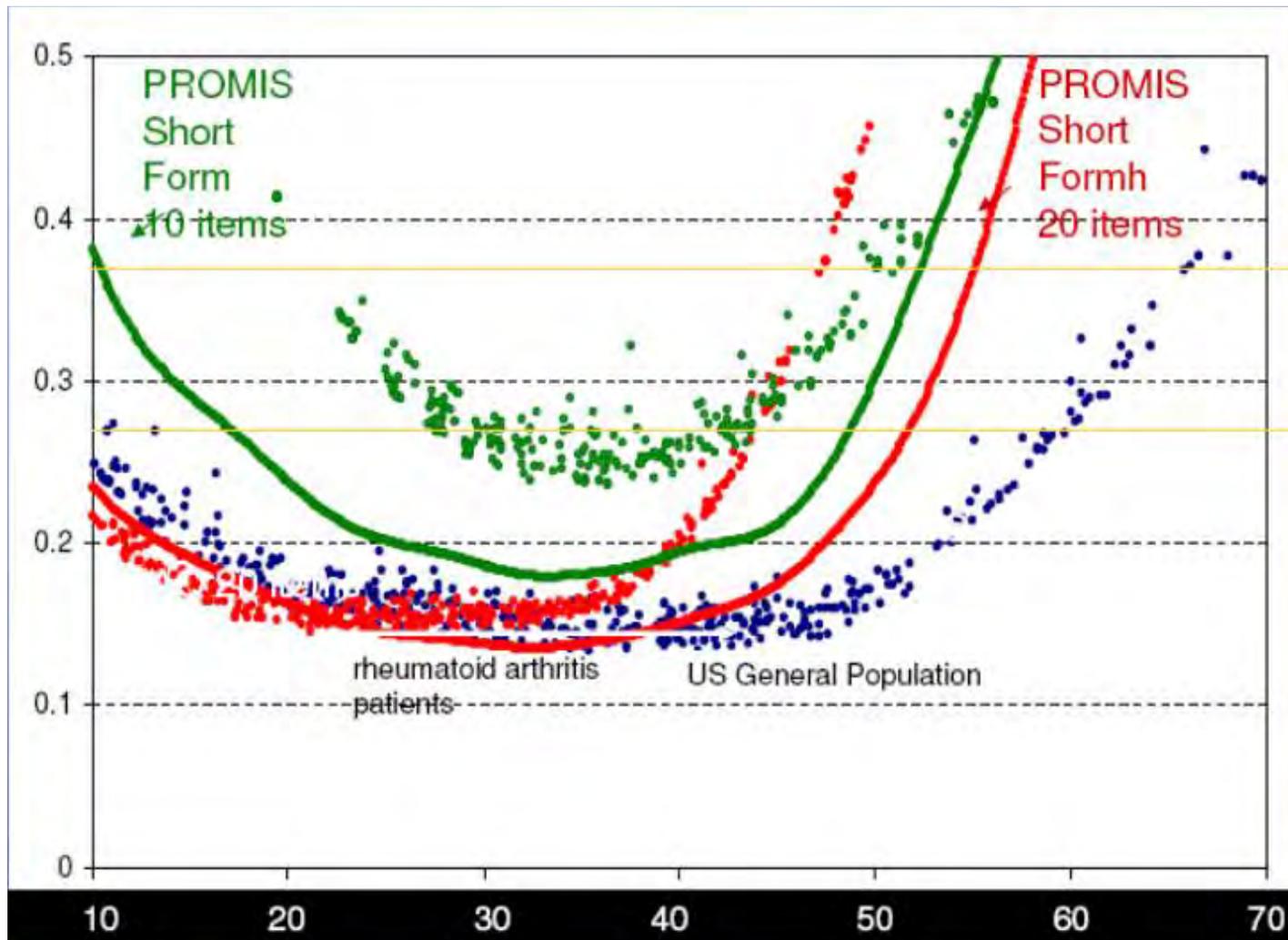
1. Fries JF, Witter J, Rose M, Cella D, Khanna D, Morgan-DeWitt E. Item response theory, computerized adaptive testing, and PROMIS: assessment of physical function. *J Rheumatol* 2014;41:153-8.
2. Garcia SF, Cella D, Clauser SB, et al. Standardizing patient-reported outcomes assessment in cancer clinical trials: a patient-reported outcomes measurement information system initiative. *J Clin Oncol* 2007;25:5106-12.
3. Gershon RC, Lai JS, Bode R, et al. Neuro-QOL: quality of life item banks for adults with neurological disorders: item development and calibrations based upon clinical and general population testing. *Qual Life Res* 2012;21:475-86
4. Tulskey DS, Jette AM, Kisala PA, et al. Spinal cord injury-functional index: item banks to measure physical functioning in individuals with spinal cord injury. *Arch Phys Med Rehabil* 2012;93:1722-32.
5. Tulskey DS, Kisala PA, Victorson D, et al. TBI-QOL: Development and Calibration of Item Banks to Measure Patient Reported Outcomes Following Traumatic Brain Injury. *J Head Trauma Rehabil* 2015.

IRT benefits in functional assessment - limited empirical validation

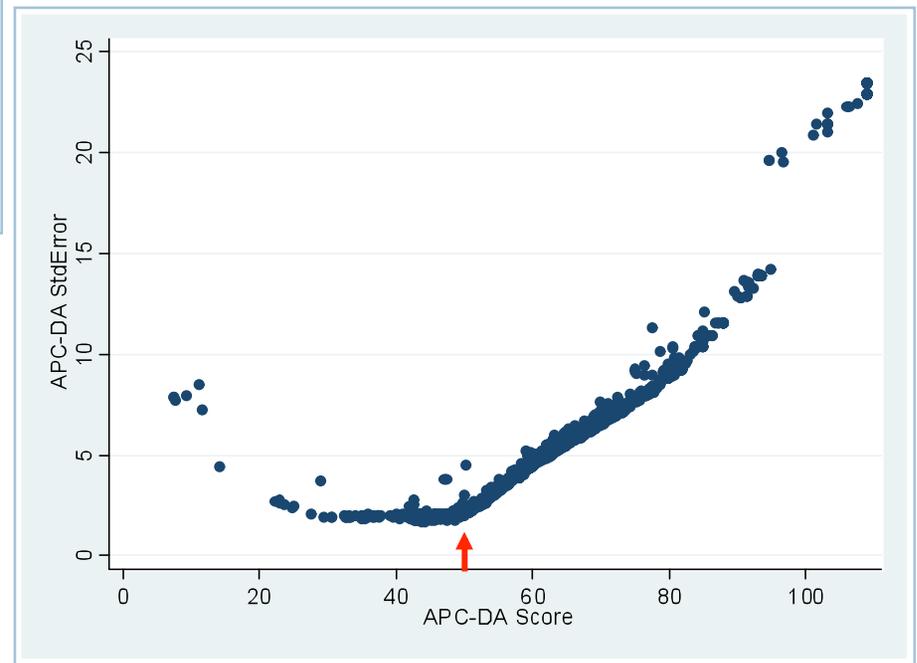
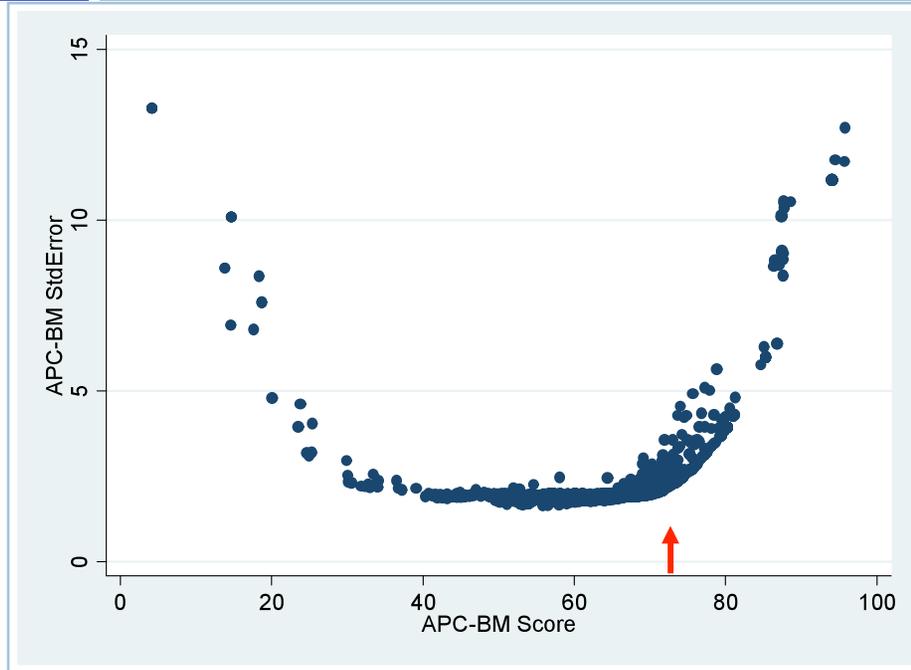
- Cherry picking
- Cross-walking
- Disease agnostic
 - ▣ Inconsistent performance across subgroups¹
 - Model fit
 - Calibration
 - Differential item functioning
- Ceiling and floor effects

1. Kratz AL, Slavin MD, Mulcahey MJ, Jette AM, Tulskey DS, Haley SM. An examination of the PROMIS((R)) pediatric instruments to assess mobility in children with cerebral palsy. Qual Life Res 2013;22:2865-76.

Trait versus standard error of measurement



AM PAC Mobility and Daily Activity scores plotted against standard error



Disease specific versus generic instruments

- No empirical basis to guide selection of cancer specific vs. generic measures
- Cause for:
 - ▣ Reassurance – PROMIS PF and PROMIS Cancer PF similar
 - ▣ Concern – poor fit in clinically important subgroups
 - Cerebral palsy
 - Fibromyalgia¹
- What are markers for a potentially poor fit in cancer populations?

1. Yost, K. J. (2013, October). Dimensionality of the PROMIS fatigue item bank in patients with fibromyalgia. Presented at ISOQOL 20th Annual Conference, Miami, FL.

Breadth of content



Scoping content review of existing function-based PROs

- Current instruments initially evaluated against ICF categories of activity and participation
- Selected instruments reviewed as exemplars of current state
- Review of measurement properties

Functional Trait



- Patients treated for cancer have wide variations in functional capacity and expectations

- Function (Activity and Participation) is a complex interaction between:
 - Symptoms
 - Cancer-based and co-morbid physiologic
 - Psycho-social factors
 - Personal factors
 - Environmental factors

- While we used the ICF model as a taxonomy, it has some limitations when understanding function in patients with cancer

Activity and Participation Domains of ICF



- Learning and Applying Knowledge
- General Tasks and Demands
- Communication
- Mobility
- Self-Care
- Domestic Life
- Interpersonal Interactions and Relationships
- Major Life Areas
- Community, Social and Civic Life

Scales rated against ICF Domains

- ECOG-Performance Status (ECOG-PS)
- Functional Independence Measure (FIM)
- PROMIS:
 - Physical Function & Mobility (PF)
 - Cancer Bank – Physical Function (CA-PF)
 - Applied Cognitive Abilities (ACA) & General Concerns
 - Ability to Participate in Social Roles and Activities (PRSA)
 - Upper Extremity Function (UEF)
- NeuroQOL
 - Upper Extremity Function (UEF)
 - Lower Extremity Function (LEF)
 - Cognitive Function (COG)
 - Ability to Participate in Social Roles and Activities (PRSA)
- Activity Measure – Post Acute Care, Computer Adapted Testing (AM-PAC CAT)
 - Basic Mobility (BM), Daily Activities (DA), Applied Cognitive (COG)
- Return to Normal Living Index (RNL)

Ratings

- Work Group Members examined item banks for items directly measuring construct
 - Items directly cover most or all constructs in domain
 - ◐ Items partially cover constructs in domain
 - Less than 30% of constructs covered in domain

Gap Analysis: Learning & General Tasks

Learning applying Knowledge	CROs		PROs			
	ECOG-PS	FIM™	PROMIS	Neuro-QOL	AM-PAC CAT	RNL
Purposeful Sensory Experiences	○	○	○	○	○	○
Basic Learning	○	○	○	○	○	○
Applying Knowledge	○	◐	◐	●	◐	◐
General Tasks and Demands	◐	○	◐	◐	◐	◐

PRSA
ACA

COG
UIFF

COG

PRSA

CA-PF/PF
PRSA
ACA

COG
PRSA

COG

Communication

Communication	CROs		PROs			
	ECOG-PS	FIM™	PROMIS	Neuro-QOL	AM-PAC CAT	RNL
Receiving	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/> COG	<input type="radio"/>
Producing	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> ACA	<input type="radio"/>	<input checked="" type="radio"/> COG	<input type="radio"/>
Conversation	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/> ACA	<input checked="" type="radio"/> PRSA	<input checked="" type="radio"/> COG	<input checked="" type="radio"/>

Mobility

Mobility	CROs		PROs			
	ECOG-PS	FIM TM	PROMIS	Neuro-QOL	AM-PAC CAT	RNL
Changing/ Maintaining Position			PF CA-PF	PRSA LEF	BM	
Carrying/ Moving/ Handling			PF CA-PF	LEF UEF	BM	
Walking/ Moving			PF CA-PF	LEF	BM	
Moving using Transportation			PF CA-PF	COG PRSA LEF	BM	

Self-Care and Domestic Life

	CROs		PROs			
	ECOG-PS	FIM TM	PROMIS	Neuro-QOL	AM-PAC CAT	RNL
Self-Care			PF CA-PF ACA	PRSA	DA	
Housework			PF CA-PF	PRSA		
Acquisition of Necessities			PF CA-PF	PRSA	DA	
Household Tasks			PF CA-PF	PRSA	DA	
Caring for objects and others			PF CA-PF	PRSA		

Major Life Areas and Community Social and Civic Life

Major Life Areas	CROs		PROs			
	ECOG-PS	FIM™	PROMIS	Neuro-QOL	AM-PAC CAT	RNL
Education	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work and Employment	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/> PRSA	<input checked="" type="radio"/> PRSA	<input type="radio"/>	<input checked="" type="radio"/>
Economic Life	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/> ACA	<input checked="" type="radio"/> CF	<input checked="" type="radio"/> COG	<input type="radio"/>
Community, Social, Civic Life	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/> PRSA CA-PF PF	<input checked="" type="radio"/> PRSA	<input type="radio"/>	<input checked="" type="radio"/>

Functional Content in PROs

- Some PROs have a limited view of function
 - ▣ Mobility and self-care usually covered
 - ▣ Communication, learning, work/employment, and community and social participation domains were more limited in representation
 - ▣ May contribute to inadequate or inaccurate assessments of global functioning
- If wide view of function is possible often spread across multiple questionnaires
- Many more PROs could be assessed

Application specific measurement properties

- Different PRO applications require different coverage and psychometric properties
 - Screening vs. Outcome Measure
 - Cut-Points for referral vs. MCIDs and Responsiveness

Gaps and Barriers in Use of PROs



- Granular functional data needed by rehabilitation specialists is not practical to collect in busy clinical work flows.
- Current measures may not discriminate in the functional domains and at the trait levels that are relevant to survivors.
- ICF offers limited dimensionality to include cancer-related symptoms that impact functioning

What are pressing measurement needs?



- Survivorship
 - Global
 - Activity- / impairment-specific
- Identify and address gaps
 - Detection of subtle deficits in high functioning patients
- Systematic, longitudinal functional measurement
 - Epidemiological studies
- Empirical basis for:
 - Generalizing across populations
 - Selecting measures
- Clinical performance: Responsiveness, MCIDs, and ROCs
- Potential application of e-PROs

Work Group 3

Objective #3: Recommendations

- Identify and address barriers to consensus regarding “gold-standard” functional measures specific to different cancer populations and applications.
- Create a centralized electronic interface/clearing house (similar to Assessment Center)

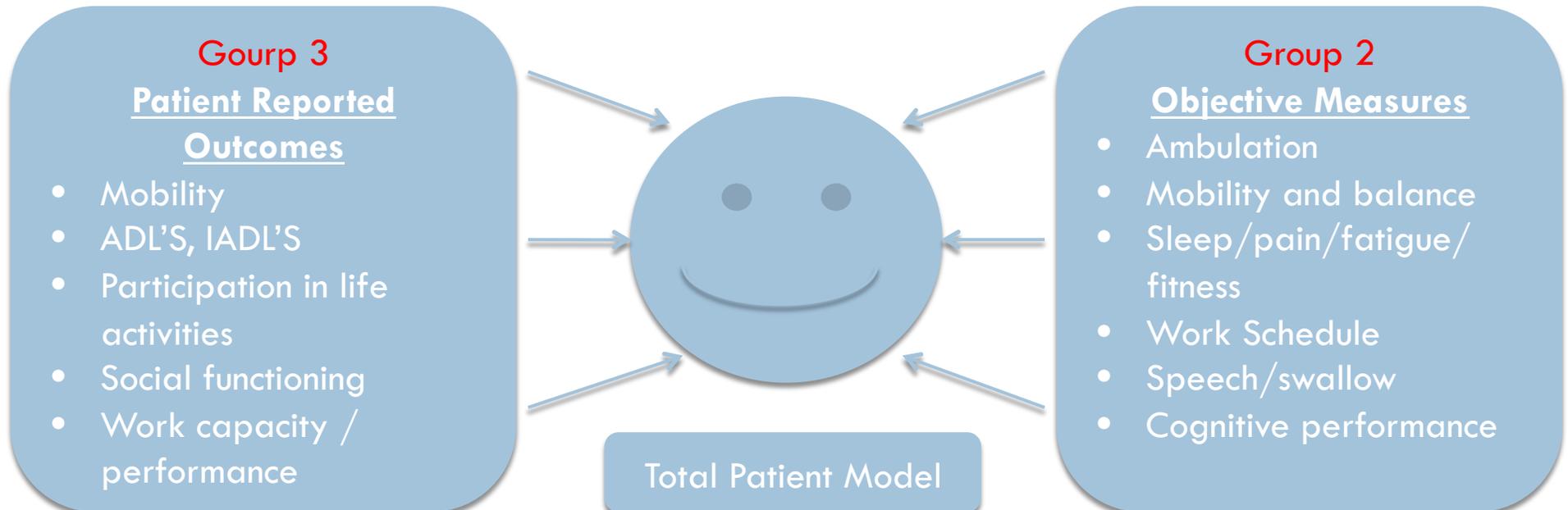
Work Group 3:

Members and role/expertise

Member; Affiliation	Role/ Expertise
Andrea Cheville, MD, MSCE Mayo Clinic, Rochester, MN	Co-Chair; Leveraging of item response theory-based banks and electronic administration to address critical gaps in clinical measurement
Laura Gilchrist PhD, PT St. Catherine University, Childrens Hospitals and Clinics of Minnesota	Co-Chair; Neuromuscular side effects of cancer treatment in children and adolescents, pediatric oncology physical therapy
Mary Vining Radomski PhD, OTR/L Courage Kenny Research Center, part of Allina Health	Member; Assessment and intervention methods for mild cognitive impairment, including cancer-related cognitive dysfunction
Kerri Winters-Stone PhD Oregon Health Sciences University Portland, OR	Member; Musculoskeletal/Neurologic side effects of cancer treatment in adult survivors; Prescriptive exercise programs to improve QOL/independence/survival

Work Group 2 – Objective/task

- Evaluate the literature to identify appropriate **OBJECTIVE** measures that focus on **totality of function** in persons with cancer



Work Group 2: Outline



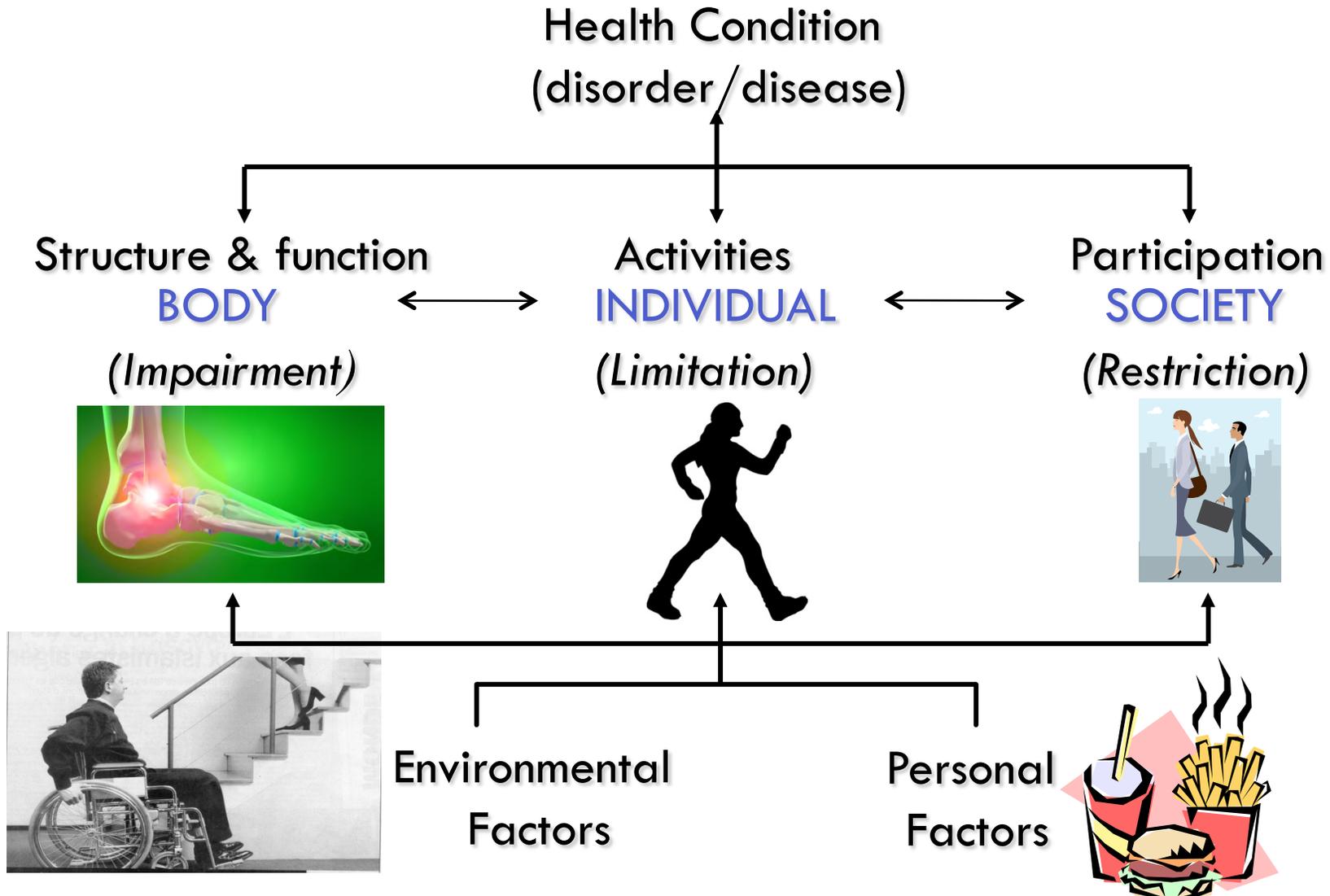
- Identify objective clinical tools for screening and assessment of the totality of function in persons with cancer
- Evaluate evidence to support the use of identified objective tools (on the basis of the activity participation dimensions of ICF) in persons with cancer
- Identify gaps in the literature/availability/use of objective measures
- Determine key questions that address identified gaps in the literature/availability/use of objective measures

Work Group 2:

Members and topics / assignments

Member	Topic / Assignment
Lynn Gerber, MD; George Mason University	Co-chair
Lee Jones, PhD; Memorial Sloan Kettering Cancer Ctr	Co-Chair
Kiri Ness, PT, PhD; St. Jude Children's Research Hospital	Physical performance/fitness
Tim Wolf OTD, OTR/L; Washington University in St. Louis	Cognition
Zavera Brandon MPT,DPT, CBIS; NIH Rehabilitation Medicine Department	Functional performance/mobility
Schuyler Cunningham, LSW; NIH Department of Social Work	Communication

Work Group 2: Totality of Function



Work Group 2: Evidence Evaluation

- Instrument properties
 - Totality of function – was the instrument designed to characterize activities/participation?
 - Cancer specific – has the instrument been used in patients with cancer/what types of cancer?
 - Rehabilitation specific – has the instrument been used to evaluate the response to a rehabilitation intervention (and in patients with cancer)?
 - Psychometrics – is the instrument reliable, valid, responsive?
 - Normative data?
 - Clinical utility – patient, rehabilitation professional, cost

Group 2: Examples

- Physical performance/fitness
 - ▣ Cardiopulmonary exercise testing (CPET)
- Cognitive performance
 - ▣ Complex task performance assessment (CPTA)
- Functional performance/mobility
 - ▣ Six minute walk test (6MWT)
- Communication
 - ▣ Boston diagnostic aphasia examination (BDAE)

Group 2: Cardiopulmonary exercise testing

- A performance based measure of exercise capacity
 - ▣ Primary outcome is peak oxygen uptake
 - ▣ Other measures are included that provide information about cardiac function, pulmonary status, oxygen delivery to muscles
 - ▣ Can be done on a treadmill, bike, arm ergometer
- Has been used to evaluate capacity in multiple cancer types
- Normative data available

Group 2: Complex task performance assessment

- A performance based measure of executive function that simulates a work situation
 - ▣ Multi-tasking (simulation library)
 - Primary task – inventory control
 - Secondary task – phone messages
 - Delayed intentions – time and message
 - No immediate feedback
 - ▣ Validity and reliability data available in a small sample of community controls and persons with mild-stroke

Group 2: Six minute walk test

- A performance based measure of exercise capacity
 - Requires walking
- Validity and reliability data available in cancer patients of varied diagnoses
- Normative data available

Group 2: Boston diagnostic aphasia examination

- Evaluates language skills based on auditory, visual and gestural modalities, processing functions (comprehension, analysis, problem solving), and response modalities (writing, articulation and manipulation)
- Designed for use in persons with organic brain syndromes
- Reliable, valid, normative data available

Utility to assess totality of function

Learning and applying knowledge

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
Purposeful sensory experiences	Watching		X		X
	Listening		X		X
Basic learning	Copying				
	Rehearsing				
	Learning to read				X
	Learning to write				X
	Learning to calculate				
	Acquiring skills				
Applying knowledge	Focusing attention		X		
	Thinking		X		X
	Reading		X		X
	Writing		X		X
	Calculating		X		
	Solving problems		X		X
	Making decisions		X		

Utility to assess totality of function

General tasks and demands

Domain	CPET	CPTA	6MWT	Boston Aphasia Battery
Undertaking a single task	X	X	X	X
Multitasking		X		
Carrying out a daily routine		X	X	
Handling stress and other psychological demands		X		

Utility to assess totality of function

Communication

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
Communicating – receiving	With spoken messages		X		X
	With non-verbal messages		X		X
	With written messages		X		X
Communicating - producing	Speaking		X		X
	Producing non-verbal messages		X		X
	Writing messages		X		X
Conversation	Conversation				X
	Discussion		X		
	Using communication devices and techniques (phone)		X		

Utility to assess totality of function

Mobility

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
Changing and maintaining a body position	Changing basic body positions		X		
	Maintaining a body position	X		X	
	Transferring oneself		X		
Carrying, moving and handling objects	Lifting and carrying objects				
	Moving objects with lower extremities				
	Fine hand use		X		
	Arm and hand use		X		
Walking and moving	Walking		X	X	
	Moving around		X	X	
	Moving around in different locations			X	
	Moving around using equipment				
Moving around using transportation	Using transportation (public)				
	Driving				

Utility to assess totality of function - Self-care

Domain	CPET	CPTA	6MWT	Boston Aphasia Battery
Washing oneself				
Caring for body parts				
Toileting				
Dressing				
Eating				
Drinking				
Looking after one's health				

Utility to assess totality of function - Domestic life

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
Acquisition of necessities	Acquiring a place to live				
	Acquisition of goods and services				
Household tasks	Preparing meals				
	Doing housework				
Caring for household objects and assisting others	Caring for household objects				
	Assisting others				

Utility to assess totality of function - Interpersonal interactions and relationships

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
General interpersonal interactions	Basic interpersonal interactions (socially appropriate interactions)		X		
	Complex interpersonal interactions (forming, terminating relationships)				
Particular interpersonal relationships	Relating to strangers		X		
	Formal relationships (related to work, etc.)		X		
	Informal social relationships (friendships)				
	Family relationships (including parenting)				
	Intimate relationships (spousal, sexual)				

Utility to assess totality of function - Major life areas

Domain		CPET	CPTA	6MWT	Boston Aphasia Battery
Education	Informal education				
	School education				
	Vocational training				
	Higher education				
Work and employment	Apprenticeship				
	Acquiring, keeping and terminating a job				
	Remunerative employment				
	Non-remunerative employment				
Economic life	Basic economic transactions		X		
	Complex economic transactions (maintaining bank account)				
	Economic self-sufficiency				

Utility to assess totality of function - Community, social and civic life

Domain	CPET	CPTA	6MWT	Boston Aphasia Battery
Community life				
Recreation and leisure				
Religion and spirituality				
Human Rights				
Political life and citizenship				

Group 2: Knowledge gaps – cognition

- Instruments have not been thoroughly evaluated in individuals with cancer
- Instruments require additional training and experience to administer
- The psychometric properties of the instruments have been evaluated but not always with a high level of rigor

Group 2: Knowledge gaps – function/ mobility

- Therapists lack of knowledge of measurement tools (including education and training)
- Decreased accessibility in the clinic; tools not readily available
- Limited time in busy clinics
- Lack of research to support use of these measurement tools in the cancer population

Group 2: Knowledge gaps – communication

- Standard battery, administered by Speech Pathologist
- Interpretation for impact on function requires trained professional

Work Group 2: Key questions

- How can we use impairment based measures effectively with activity/participation measures?
- When should these measures be recommended for cancer patients (issues of sensitivity, validity, ease of use, etc.). Should this be something for which we would recommend further study?
- Do objective measures significantly enhance data we are able to obtain from PROs? Does this need further study?

Work Group 2: Key questions

- Are rehab professionals knowledgeable about these measures? Do they need education in order to increase the likelihood of use?
- Which objective measures would we think are “must” have? Which are “not needed”? Do we know this? Is this something we could answer with a Delphi process?
- Are there systematic reviews that look carefully at utility of these measures in cancer rehab management?