Correspondence of Performance Based Physical Tests and PROMIS® Physical Function Scores in Community Dwelling Elderly

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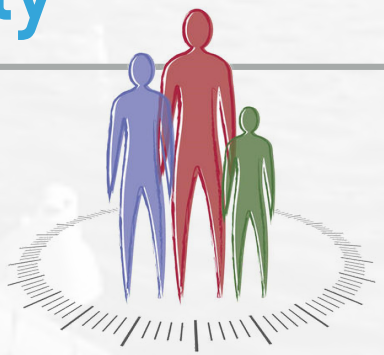

HealthMeasures
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[CLINICALLY MEANINGFUL]

- Generic patient-reported outcomes (PROs) [Hung 2014] & computer adaptive testing (CAT) [Lai 2011]
- PROMIS® Physical Function (PF) CAT
  - quicker to administer
  - minimizes floor/ceiling

  …vs. other disease-specific PROs [Hung 2014, Brodke 2017]
- PTs want patient-specific performance data
  - guide decision making & goal setting

"Ideal" = single generic scale of Physical Function
= applied across all patient diagnoses / levels of functioning

…and yields valuable performance information

DETERMINE CONVERGENT VALIDITY OF PATIENT REPORTED ABILITIES (PROMIS PF CAT T-SCORE) WITH PERFORMANCE-BASED TESTS

Central Questions:

1. How does a PROMIS PF CAT T-score correlate with performance-based tests of physical function?

2. How do IRT model parameters used in the PROMIS PF CAT (i.e. for patient responses no-, little- & some difficulty thresholds) match with measured performance (tested in this study) and normative data from previously published studies?

46 COMMUNITY-DWELLING OLDER ADULTS

- 60-95 yo
- stable chronic illness OK
- Mini Mental score ≥25
- Exclusion criteria:
  - inability to walk w/ or w/o AD
  - being treated for acute illness
  - intolerance to physical performance testing

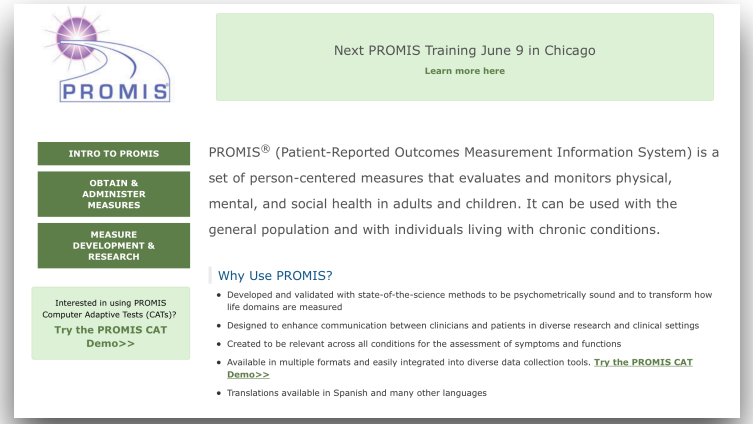
	N	Minimum	Maximum	Mean	Std. Dev.
Age	46	65.0	84.0	77.1	4.6
Height (in)	46	59.5	74.0	65.8	4.3
Weight (lbs)	45	83.0	275.0	162.9	38.8
BMI	45	14.7	39.5	26.2	5.0
# of Comorbidities	46	0	6	2.8	1.5
# of Meds	46	0	18.0	3.5	3.4
# of Falls in Past Year	46	0	2	0.3	0.6
0	36	78.3%			
1	7	15.2%			
2	3	6.5%			
Mini Mental	46	25	30	28.4	1.5
Modified Physical Performance Test	46	20	35	29.1	3.7
Not Frail	11	23.9%			
Minimal Frailty	30	65.2%			
Moderate Frailty	5	10.9%			
PROMIS PF T-score	45	41	62	49.4	5.1
PROMIS PF percentile*	45	24th	93rd	57th	

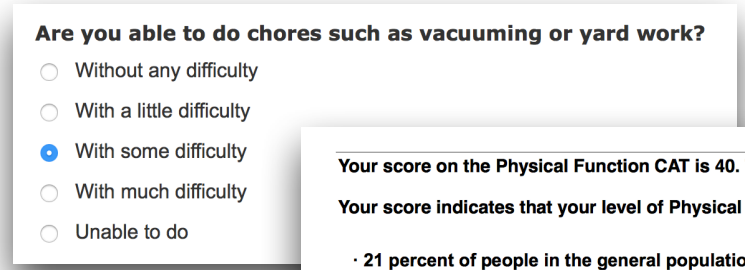
PROMIS PF = Patient Reported Outcome Instrumentation System Physical Function Scale

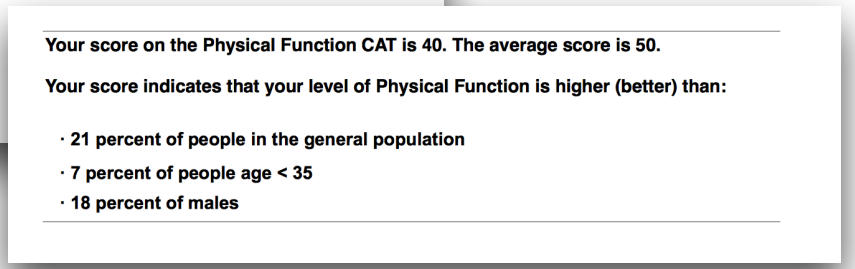
*Percentile of T-score compared to general US population

TESTING OF PARTICIPANTS

- PROMIS® Physical Function (PF) 1.2 [Cella 2007; Ader 2007; Rose 2014]







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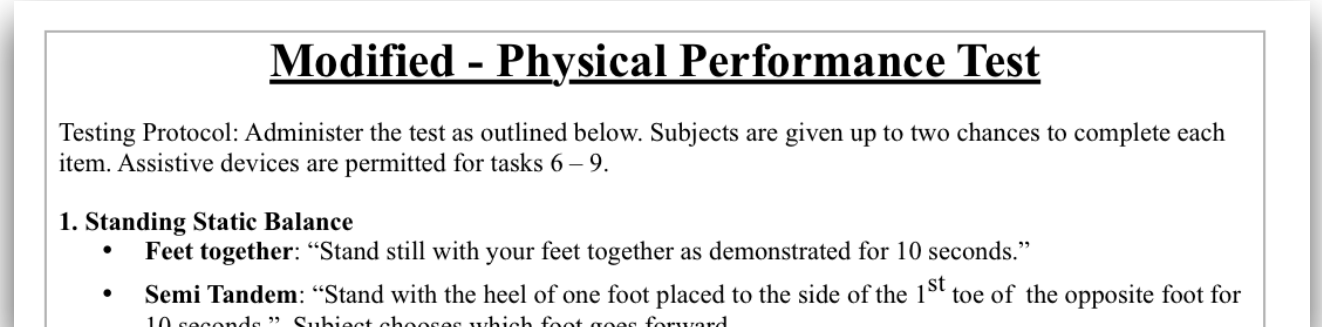
- Modified Physical Performance Test (mPPT) [Brown 2000; Addison 2017]



Modified - Physical Performance Test

Testing Protocol: Administer the test as outlined below. Subjects are given up to two chances to complete each item. Assistive devices are permitted for tasks 6 – 9.

1. Standing Static Balance

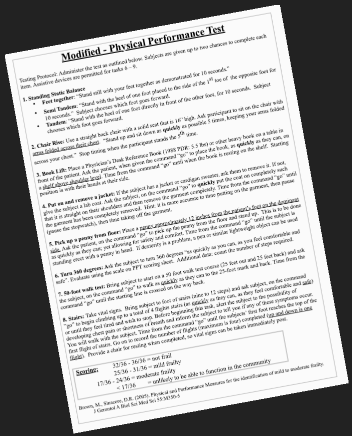
- **Feet together**: "Stand still with your feet together as demonstrated for 10 seconds."
- **Semi Tandem**: "Stand with the heel of one foot placed to the side of the 1st toe of the opposite foot for 10 seconds." Subject chooses which foot goes forward

MODIFIED PHYSICAL PERFORMANCE TEST mPPT

- **3** timed physical tasks **+1**

Gait Velocity [m/s]

Stair Ascent [sec]



Modified - Physical Performance Test

Testing Protocol: Administer the test as outlined below. Subjects are given up to two chances to complete each item. Assistive devices are permitted for tasks 6 – 9.

1. Standing Static Balance
- **Feet together**: "Stand still with your feet together as demonstrated for 10 seconds."
- **Semi Tandem**: "Stand with the heel of one foot placed to the side of the 1st toe of the opposite foot for 10 seconds." Subject chooses which foot goes forward.
- **Tandem**: "Stand with the heel of one foot directly in front of the other foot, for 10 seconds. Subject chooses which foot goes forward.

2. Chair Rise: Use a straight back chair with a solid seat that is 16" high. Ask participant to sit on the chair with arms folded across their chest. "Stand up and sit down as **quickly** as possible 5 times, keeping your arms folded across your chest." Stop timing when the participant stands the 5th time.

3. Book Lift: Place a Physician's Desk Reference Book (1988 PDR: 5.5 lbs) or other heavy book on a table in front of the patient. Ask the patient, when given the command "go" to place the book, as **quickly** as they can, on a shelf above shoulder level. Time from the command "go" until when the book is resting on the shelf. Starting position is with their hands at their side.

4. Put on and remove a jacket: If the subject has a jacket or cardigan sweater, ask them to remove it. If not, give the subject a lab coat. Ask the subject, on the command "go" to **quickly** put the coat on completely such that it is straight on their shoulders and then remove the garment completely. Time from the command "go" until the garment has been completely removed. Hint: it is more accurate to time putting on the garment, then pause (pause the stopwatch), then time taking off the garment.

5. Pick up a penny from floor: Place a penny approximately 12 inches from the patient's foot on the dominant side. Ask the patient, on the command "go" to pick up the penny from the floor and stand up. This is to be done as quickly as they can; yet allowing for safety and comfort. Time from the command "go" until the subject is standing erect with a penny in hand. If dexterity is a problem, a pen or similar lightweight object can be used

6. Turn 360 degrees: Ask the subject to turn 360 degrees "as quickly as you can, as you feel comfortable and safe". Evaluate using the scale on PPT scoring sheet. Additional data: count the number of steps required.

7. 50-foot walk test: Bring subject to start on a 50 foot walk test course (25 feet out and 25 feet back) and ask the subject, on the command "go" to walk as quickly as they can to the 25-foot mark and back. Time from the command "go" until the starting line is crossed on the way back.

8. Stairs: Take vital signs. Bring subject to foot of stairs (nine to 12 steps) and ask subject, on the command "go" to begin climbing up to a total of 4 flights stairs (as quickly as they can, as they feel comfortable and safe) or until they feel tired and wish to stop. Before beginning this task, alert the subject to the possibility of developing chest pain or shortness of breath and inform the subject to tell you if any of these symptoms occur. You will walk with the subject. Time from the command "go" until the subjects' first foot reaches the top of the first flight of stairs. Go on to record the number of flights (maximum is four) completed (up and down is one flight). Provide a chair for resting when completed, so vital signs can be taken immediately post.

Scoring:
32/36 - 36/36 = not frail
25/36 - 31/36 = mild frailty
17/36 - 24/36 = moderate frailty
< 17/36 = unlikely to be able to function in the community

Brown, M., Sinacore, D.R. (2005). Physical and Performance Measures for the identification of mild to moderate frailty. J Gerontol A Biol Sci Med Sci 55:M350-5

Total mPPT Score

5x Sit-to-Stand [sec]

ANALYSIS

- Linear regression: mPPT vs. PROMIS PF T-scores
  - Total mPPT score & individual performance items (e.g. stair ascent)

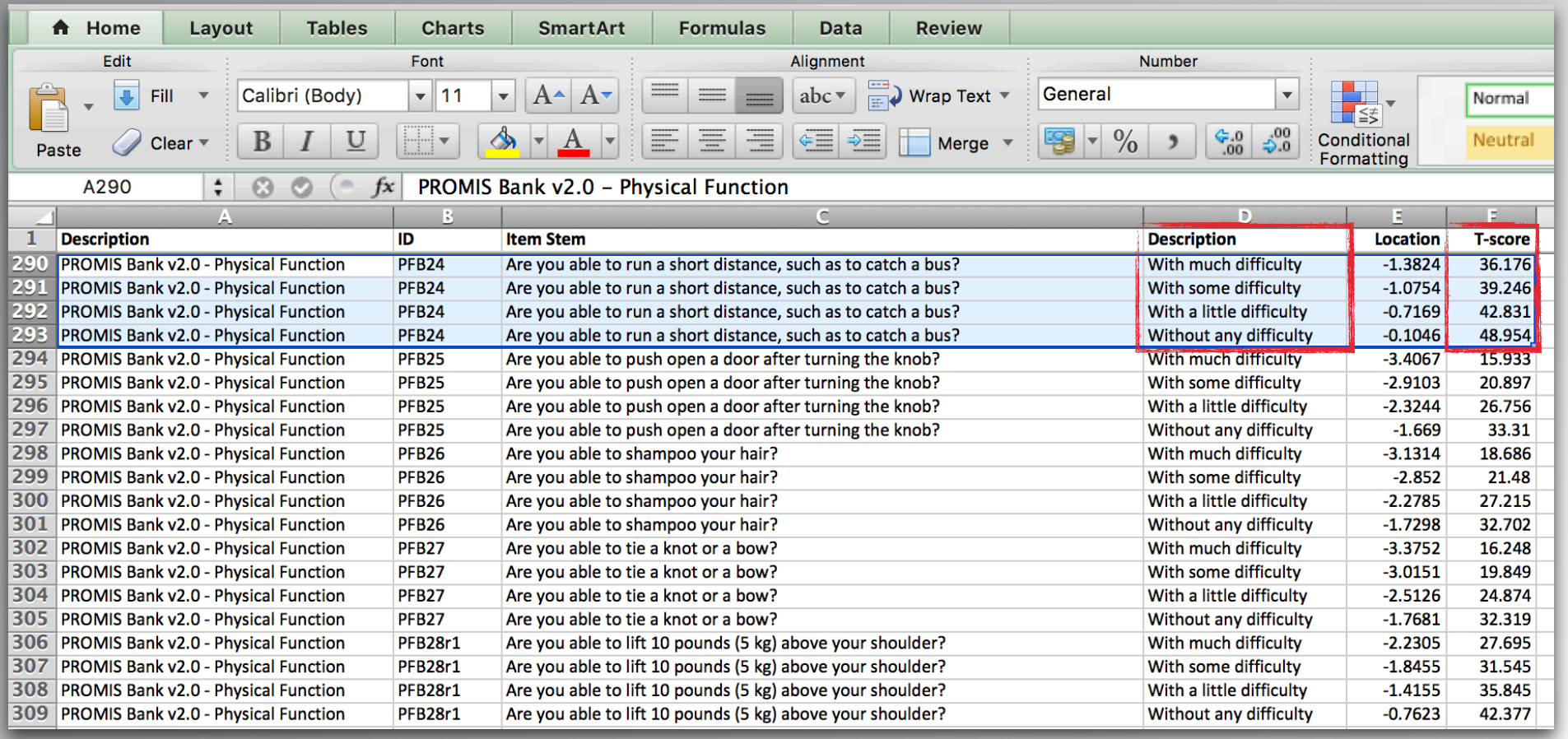
MATCHING PROMIS PF ITEMS

- Identified PROMIS PF items that best matched with the 3 mPPT tests
- Aligned items using IRT model parameter “cut-offs” with: 1) T-scores, 2) predicted mPPT values from data set (n=46), & 3) published norms

9 PROMIS PF ITEMS BEST MATCHED TO 3 mPPT ITEMS

- Gait Velocity
  - PFC38 - Are you able to walk at a normal speed?
  - PFM23 - Are you able to walk briskly for 20 minutes without stopping to rest?
  - PFB5r1 - Does your health now limit you in hiking a couple of miles (3 km) on uneven surfaces, including hills?
- Stair Ascent
  - PFA21 - Are you able to go up and down stairs at a normal pace?
  - PFC32 - Are you able to climb up 5 flights of stairs?
  - PFM21 - Are you able to climb the stairs of a 10-story building without stopping?
- 5x Sit-to-Stand
  - PFA15 - Are you able to stand up from an armless straight chair?
  - PFA41 - Are you able to sit down in and stand up from a low, soft couch?
  - PFC41 - Are you able to squat and get up?

MODEL PARAMETER "CUT-OFF" DATA



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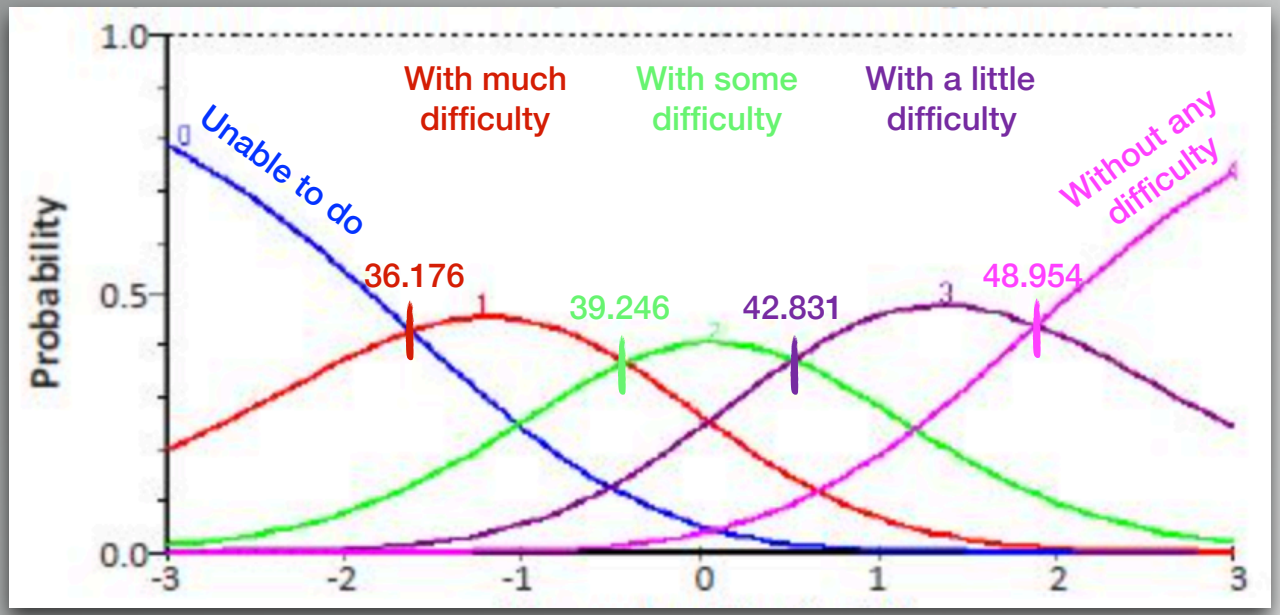
A290 | PROMIS Bank v2.0 – Physical Function

	A	B	C	D	E	F
1	**Description**	**ID**	**Item Stem**	**Description**	**Location**	**T-score**
290	PROMIS Bank v2.0 - Physical Function	PFB24	Are you able to run a short distance, such as to catch a bus?	With much difficulty	-1.3824	36.176
291	PROMIS Bank v2.0 - Physical Function	PFB24	Are you able to run a short distance, such as to catch a bus?	With some difficulty	-1.0754	39.246
292	PROMIS Bank v2.0 - Physical Function	PFB24	Are you able to run a short distance, such as to catch a bus?	With a little difficulty	-0.7169	42.831
293	PROMIS Bank v2.0 - Physical Function	PFB24	Are you able to run a short distance, such as to catch a bus?	Without any difficulty	-0.1046	48.954
294	PROMIS Bank v2.0 - Physical Function	PFB25	Are you able to push open a door after turning the knob?	With much difficulty	-3.4067	15.933
295	PROMIS Bank v2.0 - Physical Function	PFB25	Are you able to push open a door after turning the knob?	With some difficulty	-2.9103	20.897
296	PROMIS Bank v2.0 - Physical Function	PFB25	Are you able to push open a door after turning the knob?	With a little difficulty	-2.3244	26.756
297	PROMIS Bank v2.0 - Physical Function	PFB25	Are you able to push open a door after turning the knob?	Without any difficulty	-1.669	33.31
298	PROMIS Bank v2.0 - Physical Function	PFB26	Are you able to shampoo your hair?	With much difficulty	-3.1314	18.686
299	PROMIS Bank v2.0 - Physical Function	PFB26	Are you able to shampoo your hair?	With some difficulty	-2.852	21.48
300	PROMIS Bank v2.0 - Physical Function	PFB26	Are you able to shampoo your hair?	With a little difficulty	-2.2785	27.215
301	PROMIS Bank v2.0 - Physical Function	PFB26	Are you able to shampoo your hair?	Without any difficulty	-1.7298	32.702
302	PROMIS Bank v2.0 - Physical Function	PFB27	Are you able to tie a knot or a bow?	With much difficulty	-3.3752	16.248
303	PROMIS Bank v2.0 - Physical Function	PFB27	Are you able to tie a knot or a bow?	With some difficulty	-3.0151	19.849
304	PROMIS Bank v2.0 - Physical Function	PFB27	Are you able to tie a knot or a bow?	With a little difficulty	-2.5126	24.874
305	PROMIS Bank v2.0 - Physical Function	PFB27	Are you able to tie a knot or a bow?	Without any difficulty	-1.7681	32.319
306	PROMIS Bank v2.0 - Physical Function	PFB28r1	Are you able to lift 10 pounds (5 kg) above your shoulder?	With much difficulty	-2.2305	27.695
307	PROMIS Bank v2.0 - Physical Function	PFB28r1	Are you able to lift 10 pounds (5 kg) above your shoulder?	With some difficulty	-1.8455	31.545
308	PROMIS Bank v2.0 - Physical Function	PFB28r1	Are you able to lift 10 pounds (5 kg) above your shoulder?	With a little difficulty	-1.4155	35.845
309	PROMIS Bank v2.0 - Physical Function	PFB28r1	Are you able to lift 10 pounds (5 kg) above your shoulder?	Without any difficulty	-0.7623	42.377

MODEL PARAMETER "CUT-OFF" DATA



LOW Trait of Physical Function HIGH

Number

Normal

Neutral

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	D	E	F
	Description	Location	T-score
	With much difficulty	-1.3824	36.176
	With some difficulty	-1.0754	39.246
	With a little difficulty	-0.7169	42.831
	Without any difficulty	-0.1046	48.954
	With much difficulty	-3.4067	15.933
	With some difficulty	-2.9103	20.897
	With a little difficulty	-2.3244	26.756
	Without any difficulty	-1.669	33.31
	With much difficulty	-3.1314	18.686
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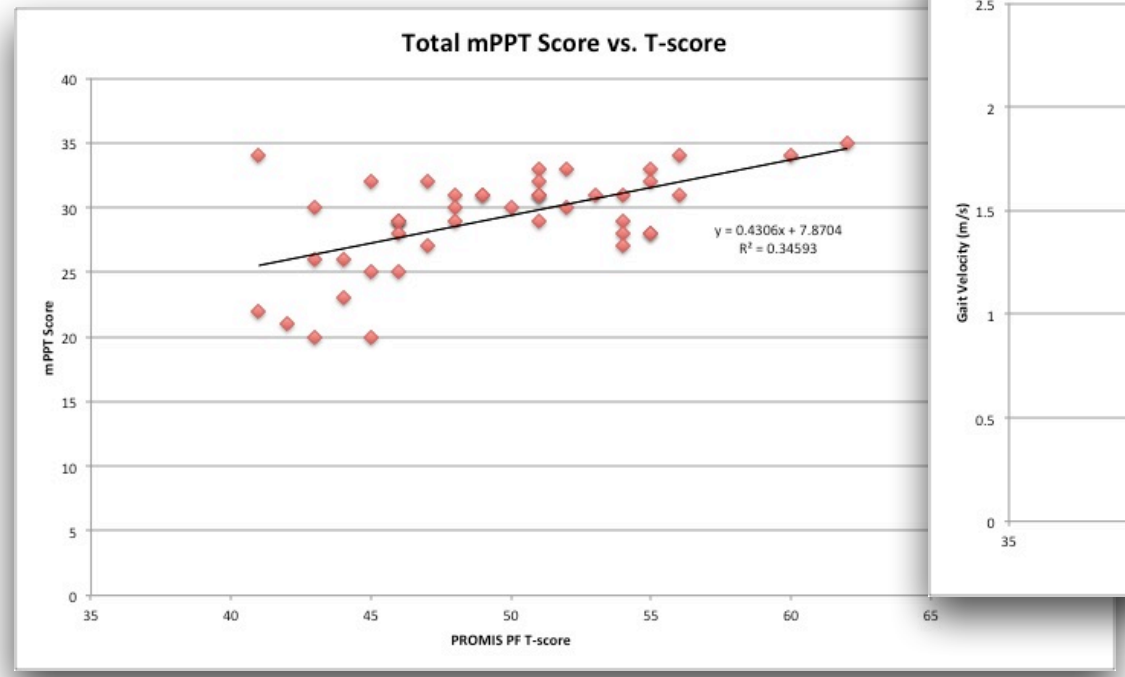
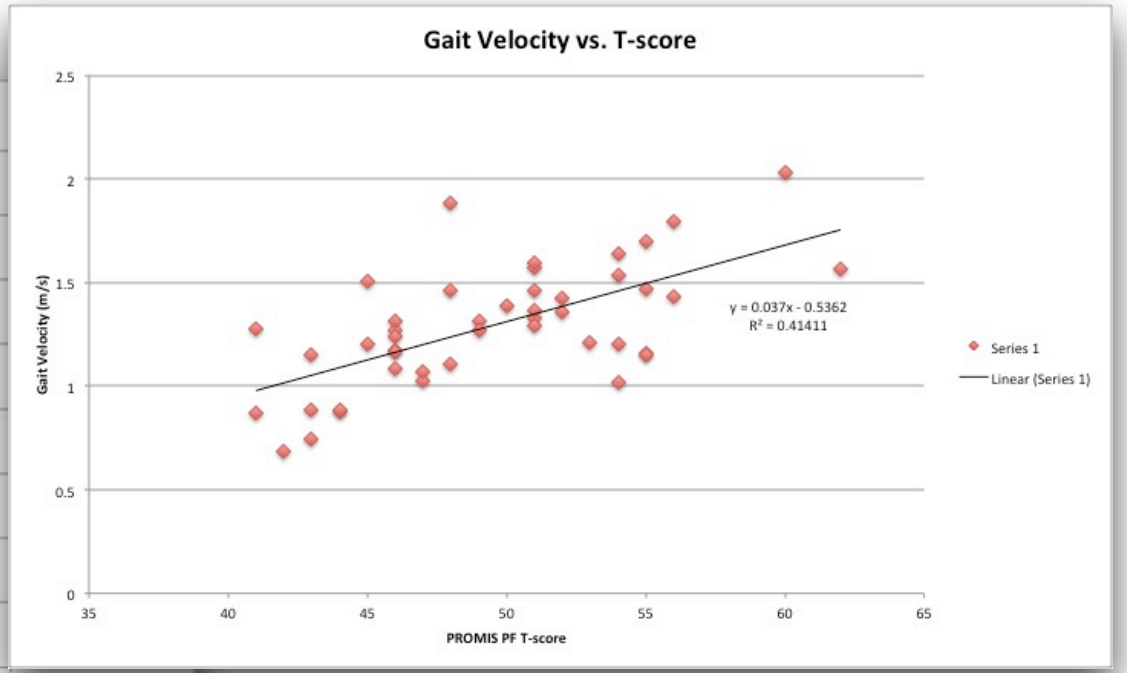
	With some difficulty	-1.8455	31.545
	With a little difficulty	-1.4155	35.845
	Without any difficulty	-0.7623	42.377

LINEAR REGRESSION

Performance Test	Mean Score	Std Deviation	Lowest Score (Low Function)	Highest Score (High Function)	R^2 (Linear Regression)	Std Error	R	*p*
mPPT Total	29	3.7	20	35	0.35	3.00	0.59	p<0.01
Gait Velocity (m/s)	1.3	0.3	0.7	2.0	0.41	0.22	0.64	p<0.01
Stair Ascent (s)	7.4	2.0	13.7	4.7	0.28	1.71	0.52	p<0.01
5 Times Sit-to-Stand (s)	14.5	3.5	26.7	9.0	0.22	3.11	0.46	p<0.01

mPPT: Modified Physical Performance Test *[Brown 2000].*





PROMIS T-score	PREDICTED mPPT Total Score	PREDICTED mPPT Frailty	PREDICTED Gait Velocity (m/s)[a]	PFB5r1	PFM23	PFC38	PREDICTED Stair Ascent (sec)[b]	PFM21	PFC32	PFA21	PREDICTED 5xSTS (sec)[c]	PFA41	PFC41	PFA15
41	26	mild	0.98	Much	Some	Little	9.19	Much Difficulty	Some Difficulty	Little Difficulty	17.23	Little Difficulty	Little Difficulty	Little
42	26	mild	1.02				8.98				16.90			
43	26	mild	1.05	Some Difficulty			8.77				16.57			
44	27	mild	1.09		Little Difficulty		8.56				16.25			
45	27	mild	1.13				8.35				**15.92**			
46	28	mild	1.17				8.14	Some Difficulty	Little Difficulty	No Difficulty	**15.60**			
47	28	mild	**1.20**				7.93				**15.27**		No Difficulty	
48	29	mild	**1.24**	Little Difficulty			7.72				**14.94**			
49	29	mild	**1.28**				**7.51**				**14.62**			
50	29	mild	**1.31**			No Difficulty	**7.30**				**14.29**	No Difficulty		
51	30	mild	**1.35**				**7.09**				**13.97**			
52	30	mild	**1.39**				**6.88**				**13.64**			
53	31	mild	1.42	No Difficulty	No Difficulty		**6.67**	Little Difficulty	No Difficulty	No Difficulty	**13.31**			
54	31	mild	1.46				**6.46**				**12.99**			
55	32	not frail	1.50				**6.25**				**12.66**			
56	32	not frail	1.54				**6.04**				**12.34**			
57	32	not frail	1.57				**5.83**				**12.01**			
58	33	not frail	1.61				**5.62**				**11.68**			
59	33	not frail	1.65				**5.40**				**11.36**			
60	34	not frail	1.68				**5.19**				**11.03**			
61	34	not frail	1.72				**4.98**	**No**			**10.71**			
62	35	not frail	1.76				4.77				10.38			

[a] **Gait Velocity Norms (95% CI in m/s):** 60-69yo (1.18-1.41) *[Lusardi 2010].* **PFB5r1** - hiking a couple of miles (3 km) on uneven surfaces, including hills? **PFM23** - walk briskly for 20 minutes without stopping to rest? **PFC38** - walk at a normal speed?

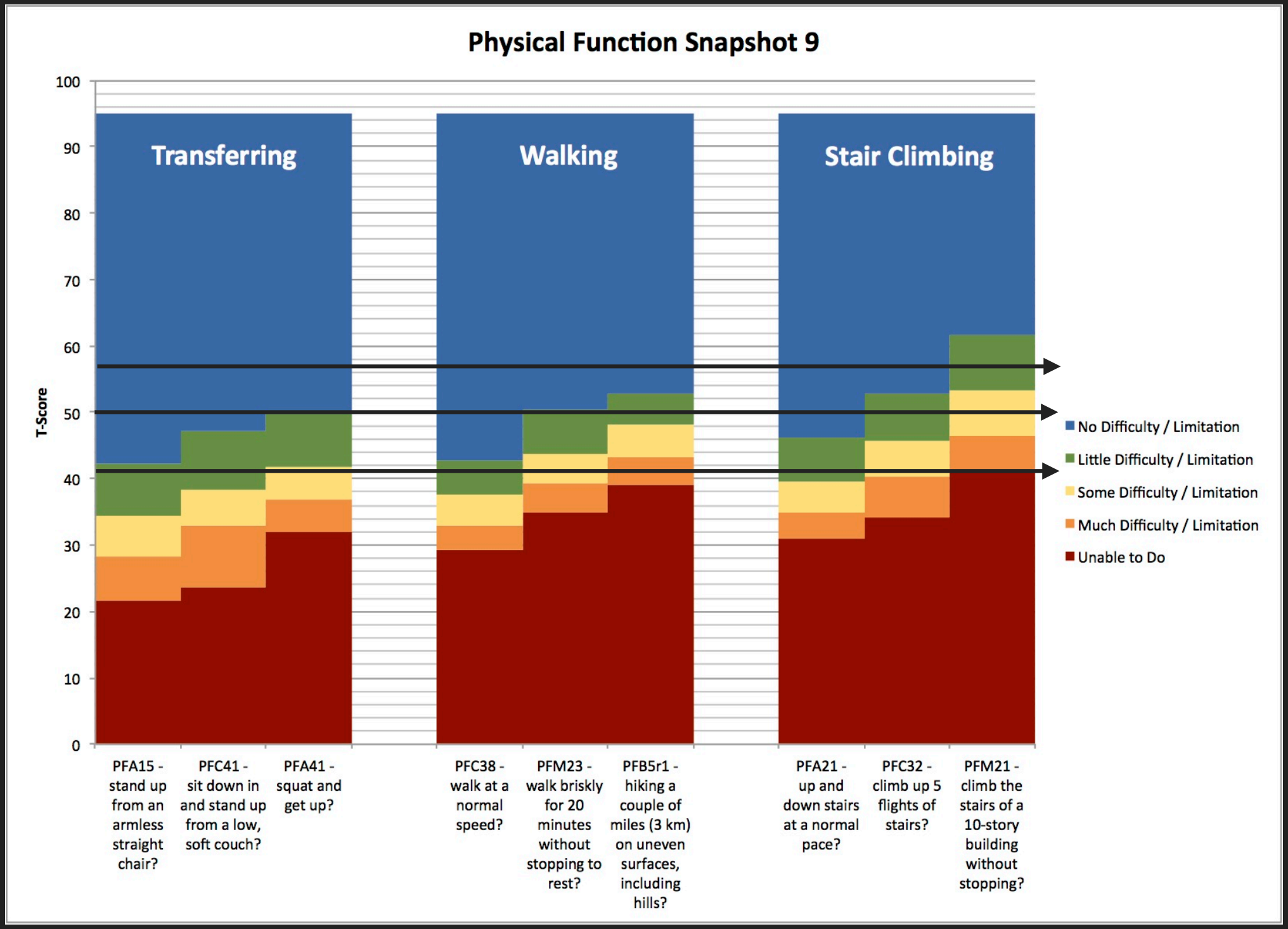
[b] **Stair Ascent Norms (range of means in sec):** 65yo+ (4.92-7.56 , 12 stairs) *[Nightingale 2014].* **PFM21** - climb the stairs of a 10-story building without stopping? **PFC32** - climb up 5 flights of stairs? **PFA21** - up and down stairs at a normal pace?

[c] **5xSTS Norms (mean ±SD in sec):** 63-84yo (13.4 ±2.8) *[Whitney 2005].* **PFA41** - squat and get up? **PFC41** - sit down in and stand up from a low, soft couch? **PFA15** - stand up from an armless straight chair?

[CLINICALLY MEANINGFUL]

- Convergent validity
- R^2 values in line with previous studies comparing disease-specific PROs with performance data [Adegoke 2012; Swinkels 2013] & comparing PROMIS PF vs. 6-minute walk test [Irwin 2015]
- *[Sheean 2017]* *Patients w/ hip impingement* PROMIS PF vs. self-selected gait velocity (R^2=0.23), stair ascent (R^2=0.49), 5xSTS (R^2=0.59)
- *[Our Data] community-dwelling older adults…*

R^2=.41				R^2=.28				R^2=.22			
PREDICTED Gait Velocity (m/s)[a]	PFB5r1	PFM23	PFC38	PREDICTED Stair Ascent (sec) [b]	PFM21	PFC32	PFA21	PREDICTED 5xSTS (sec) [c]	PFA41	PFC41	PFA15


Physical Function Snapshot 9
T-Score
100
90
80
70
60
50
40
30
20
10
0
Transferring
Walking
Stair Climbing
No Difficulty / Limitation
Little Difficulty / Limitation
Some Difficulty / Limitation
Much Difficulty / Limitation
Unable to Do
PFA15 - stand up from an armless straight chair?
PFC41 - sit down in and stand up from a low, soft couch?
PFA41 - squat and get up?
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PFB5r1 - hiking a couple of miles (3 km) on uneven surfaces, including hills?
PFA21 - up and down stairs at a normal pace?
PFC32 - climb up 5 flights of stairs?
PFM21 - climb the stairs of a 10-story building without stopping?

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