

Introduction to the PROMIS-Preference (PROPr) Summary Score

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- Mark Roberts – University of Pittsburgh
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Why Make A Preference-Based Score?

- Descriptive health systems cannot indicate our preferences
- Preference is a common metric to compare disparate domains of health
- Health utility scores can be integrated with life expectancy to generate Quality Adjusted Life Years (QALY)

The problem of too many riches

Treatment A

- Anxiety
- Depression -10
- Cognition
- Fatigue
- Sleep Disturbance
- Social Roles

Treatment B

- Anxiety
- Depression -10
- Cognition
- Fatigue
- Sleep Disturbance
- Social Roles

The problem of too many riches

Treatment A

- Anxiety +5
- Depression -10
- Cognition 0
- Fatigue 0
- Sleep Disturbance +10
- Social Roles 0

Treatment B

- Anxiety -5
- Depression -10
- Cognition -10
- Fatigue -5
- Sleep Disturbance -5
- Social Roles +5

The problem of too many riches

Treatment A

- Anxiety +5
- Depression -10
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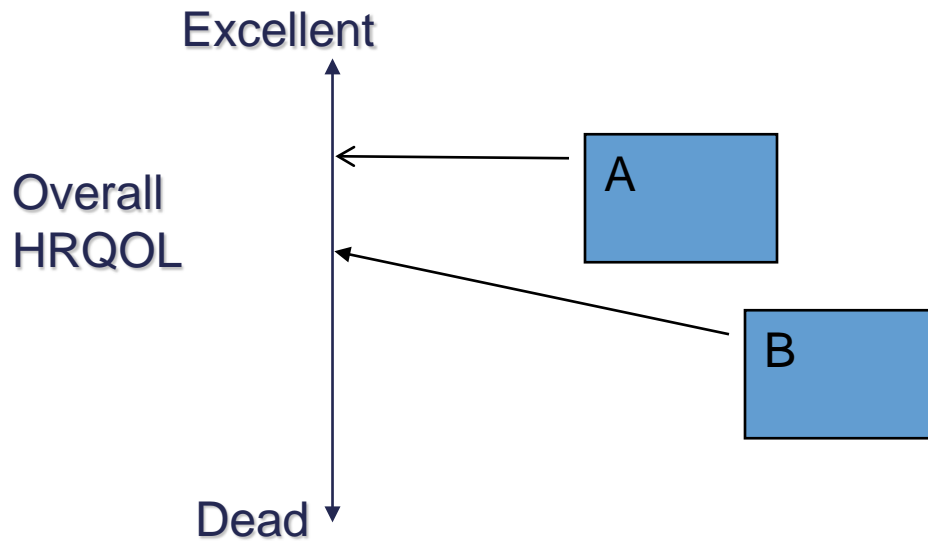
- Value = ??

Treatment B

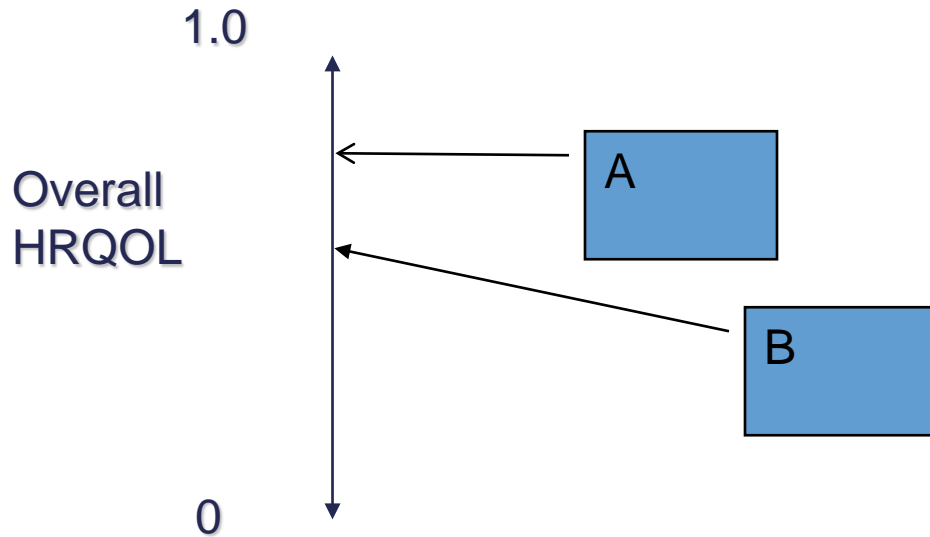
- Anxiety -5
- Depression -10
- Cognition -10
- Fatigue -5
- Sleep Disturbance -5
- Social Roles +5

- Value = ??

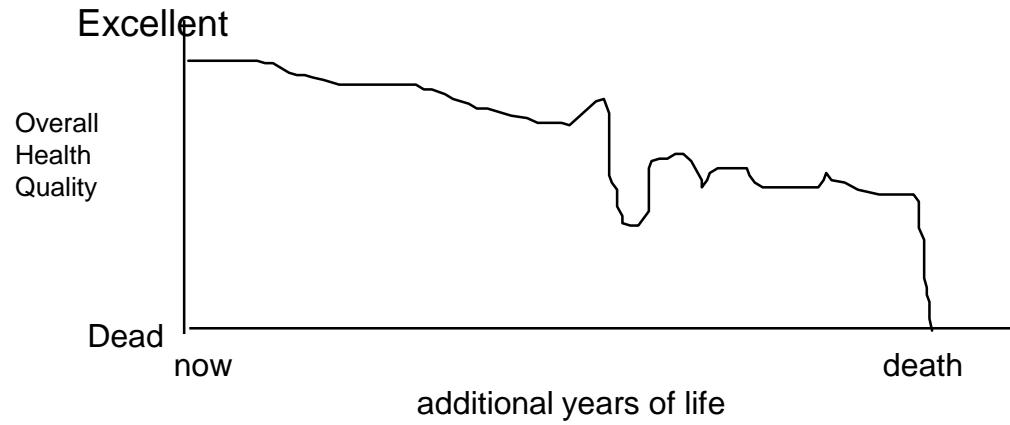
Is Person A healthier than Person B?



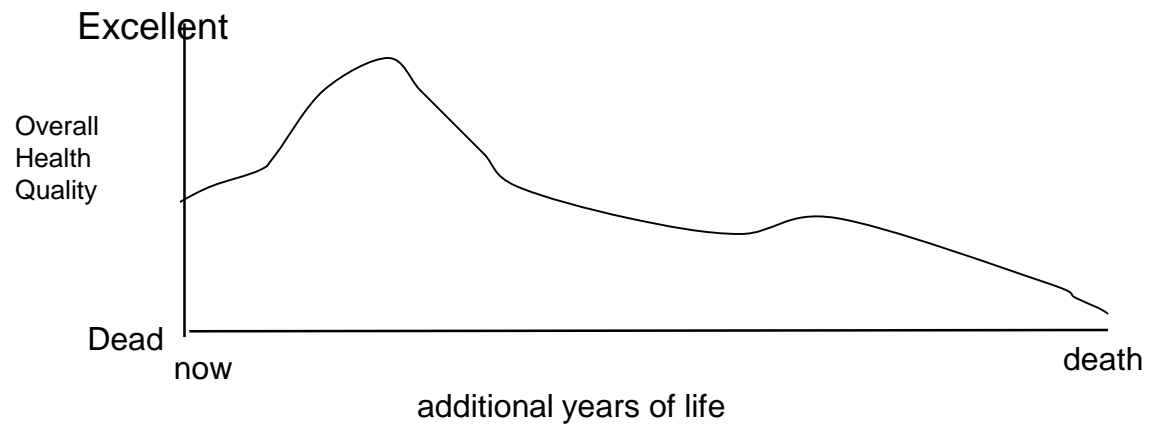
Is Person A healthier than Person B?



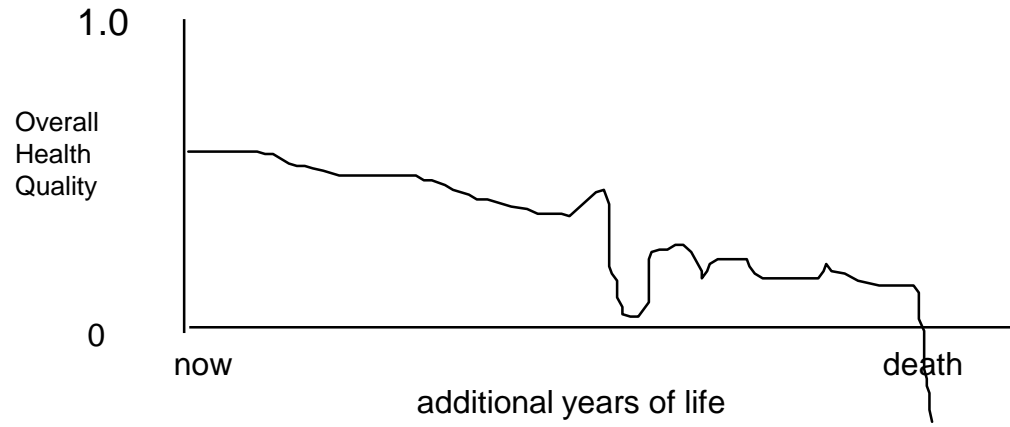
A



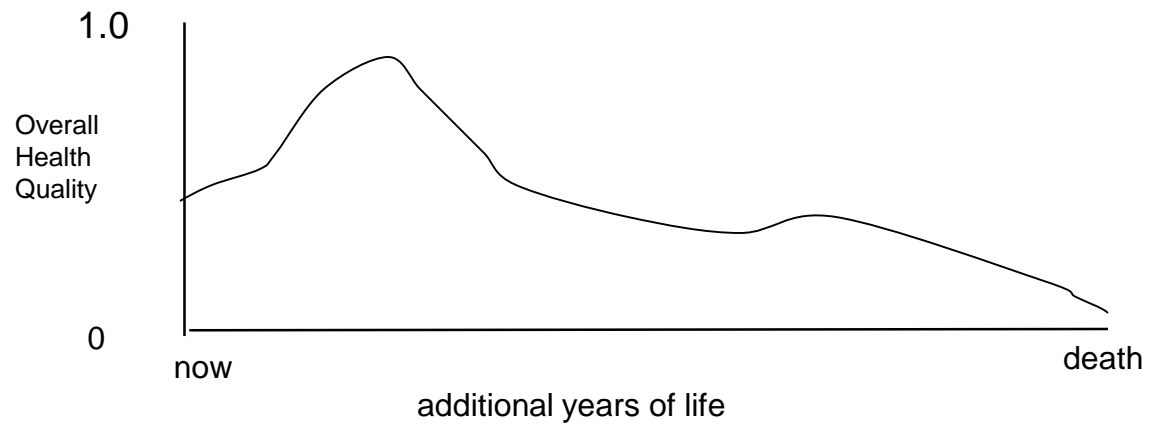
B



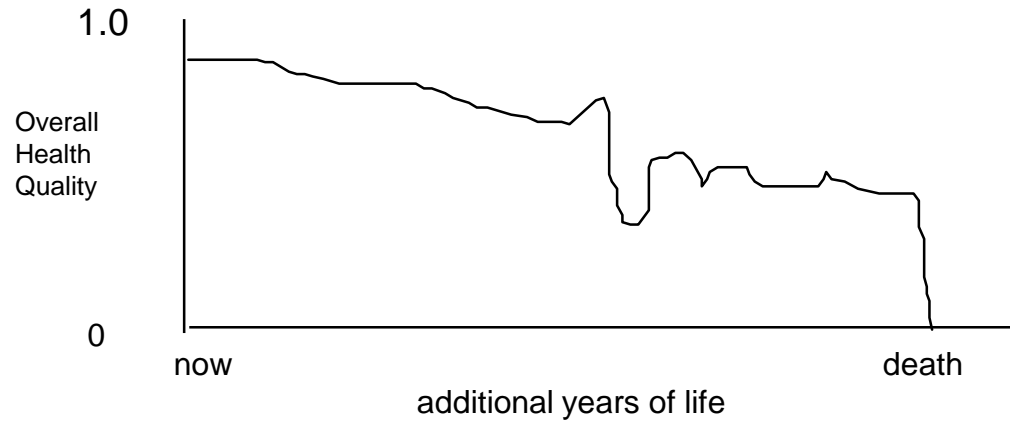
A



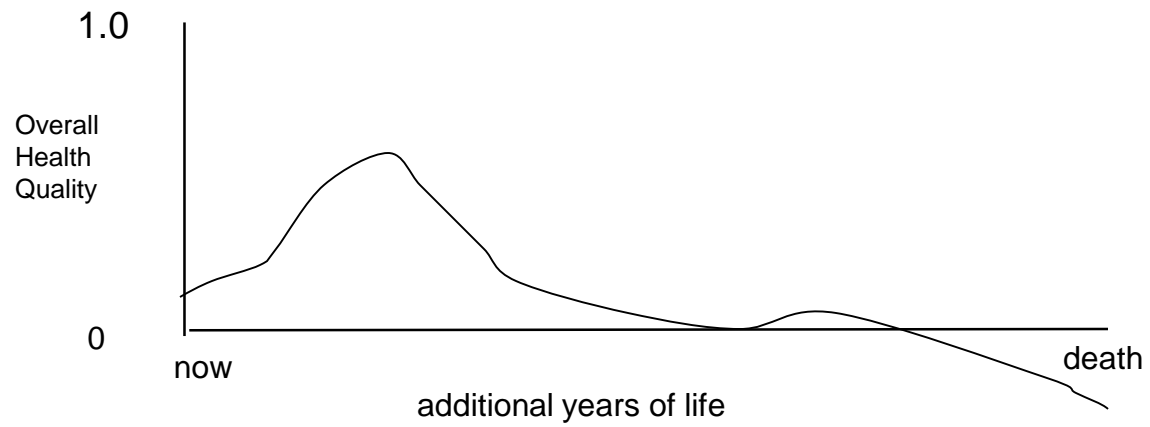
B



A



B



Historical Health Utility Construction

- Create a basic, discrete descriptive system
- Value specific combinations of responses
 - Standard Gamble
 - Time Trade-off
 - Visual Analog Scale

EQ-5D

By placing a tick in one box in each group below, please indicate which statement best describes your own health state today.

Do not tick more than one box in each group.

Mobility

I have no problems in walking about

I have some problems in walking about

I am confined to bed

Self-Care

I have no problems with self-care

I have some problems washing and dressing myself

I am unable to wash or dress myself

Usual Activities (eg. work, study, housework, family or leisure activities)

I have no problems with performing my usual activities

I have some problems with performing my usual activities

I am unable to perform my usual activities

Pain/Discomfort

I have no pain or discomfort

I have moderate pain or discomfort

I have extreme pain or discomfort

Anxiety/Depression

I am not anxious or depressed

I am moderately anxious or depressed

I am extremely anxious or depressed

Is that actually useful??

- Vast literature showing these measures capture movement in the same direction as more complex measures.
- No one thinks this is the only thing you should pay attention to.
- We use lots of useful coarse measures:
 - There are about 5,000 public companies in the US
 - The Dow Jones average uses 30

Problems with Prior Utility Measures

- Ceiling and floor effects
- Too coarse for individual tracking or decision making
- Some with poorly constructed questions
- Some were proprietary
- Difficult to combine results from different measures

Problems Solved with PROMIS[®]

- **Ceiling and floor effects**
- **Too coarse for individual tracking or decision making**
- **Some with poorly constructed questions**
- **Some were proprietary**
- **Difficult to combine results from different measures**
- So, we just need to put a utility measure on it . . .

PROMIS maps to preference-based scores, but the problems aren't solved

- Regression Based Mapping Algorithms:
 - PROMIS-domains to EQ-5D (R^2 0.57)
 - PROMIS-Global to EQ-5D (R^2 0.65)
 - PROMIS-domains to HUI3 (R^2 0.61)
 - PROMIS-Global to HUI3 (R^2 0.48)
- PROMIS-29 to DCE-based valuation

Our Solution?

- Use PROMIS item banks as the descriptive underpinnings for a preference-based score
- This will allow simultaneous collection of descriptive scores *and* a preference-based summary score
- Value the function using a sample of the US

A preference-based score in 5 simple steps

1. Select domains
2. Figure out how to display domains
3. Collect valuation data
4. Create single-attribute scores
5. Create a multi-attribute score

Step 1 – select domains

- Applied Cognition – Abilities
- Depression*
- Fatigue*
- Pain Interference*
- Physical Function*
- Satisfaction with Social Roles and Activities*
- Sleep Disturbance*

Step 2 –Display Domains

Cognition	I have been able to concentrate. . .	Not at all	A little bit	Somewhat	Quite a bit	Very much
	I have been able to remember to do things, like take medicine or buy something I needed . . .	Not at all	A little bit	Somewhat	Quite a bit	Very much
Depression	I felt unhappy . . .	Always	Often	Sometimes	Rarely	Never
	I felt that nothing was interesting . . .	Always	Often	Sometimes	Rarely	Never
Fatigue	How often were you too tired to take a bath or shower? . . .	Always	Often	Sometimes	Rarely	Never
	How often did you feel tired?	Always	Often	Sometimes	Rarely	Never
Pain	How often was your pain so severe you could think of nothing else? . . .	Always	Often	Sometimes	Rarely	Never
	How often was pain distressing to you? . . .	Always	Often	Sometimes	Rarely	Never
Physical Function	Are you able to dress yourself, including tying shoelaces and buttoning up your clothes? . . .	Unable to do	With much difficulty	With some difficulty	With a little difficulty	Without any difficulty
	Are you able to run 100 yards (100 m)? . . .	Unable to do	With much difficulty	With some difficulty	With a little difficulty	Without any difficulty
Sleep	I got enough sleep . . .	Never	Rarely	Sometimes	Often	Always
	I woke up too early and could not fall back to sleep . . .	Always	Often	Sometimes	Rarely	Never
Social Roles	I have trouble taking care of my regular personal responsibilities . . .	Always	Usually	Sometimes	Rarely	Never
	I have trouble participating in recreational activities with others. . .	Always	Usually	Sometimes	Rarely	Never

Step 3 – Collect Valuation Data

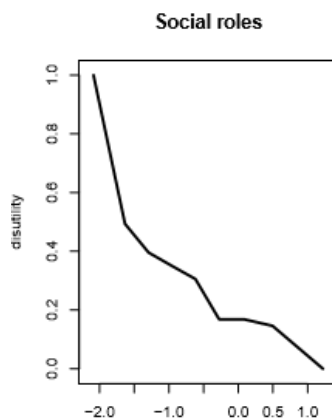
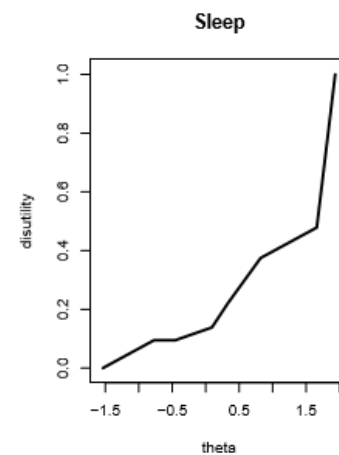
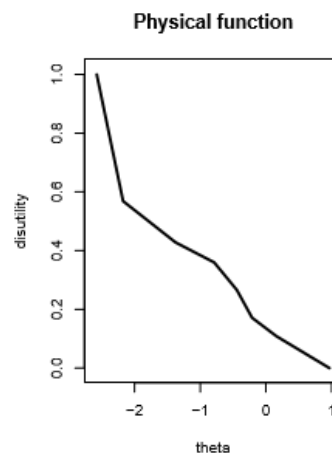
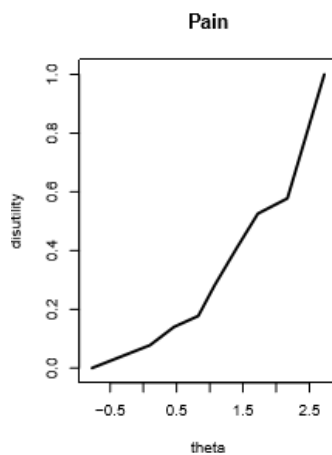
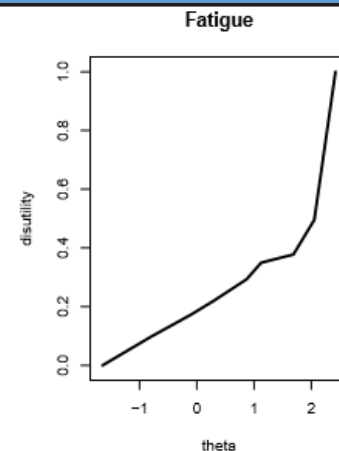
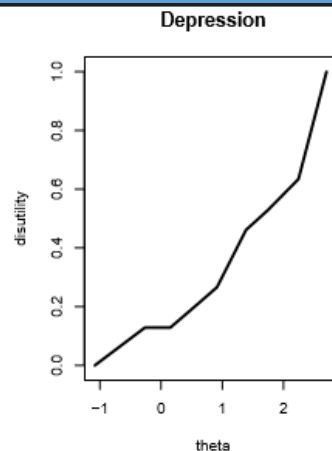
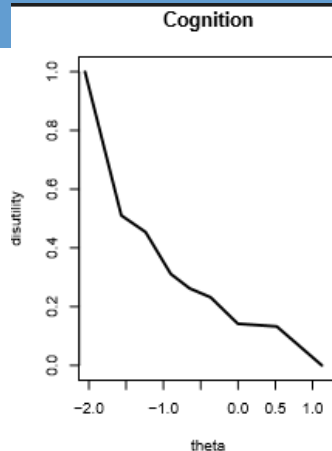
- US Nationally Representative Panel
 - Each participant was assigned one domain and several corner states using standard gamble
 - Each participant completed a variety of other measures
-
- 1164 completed surveys, 983 used in scoring

WARNING

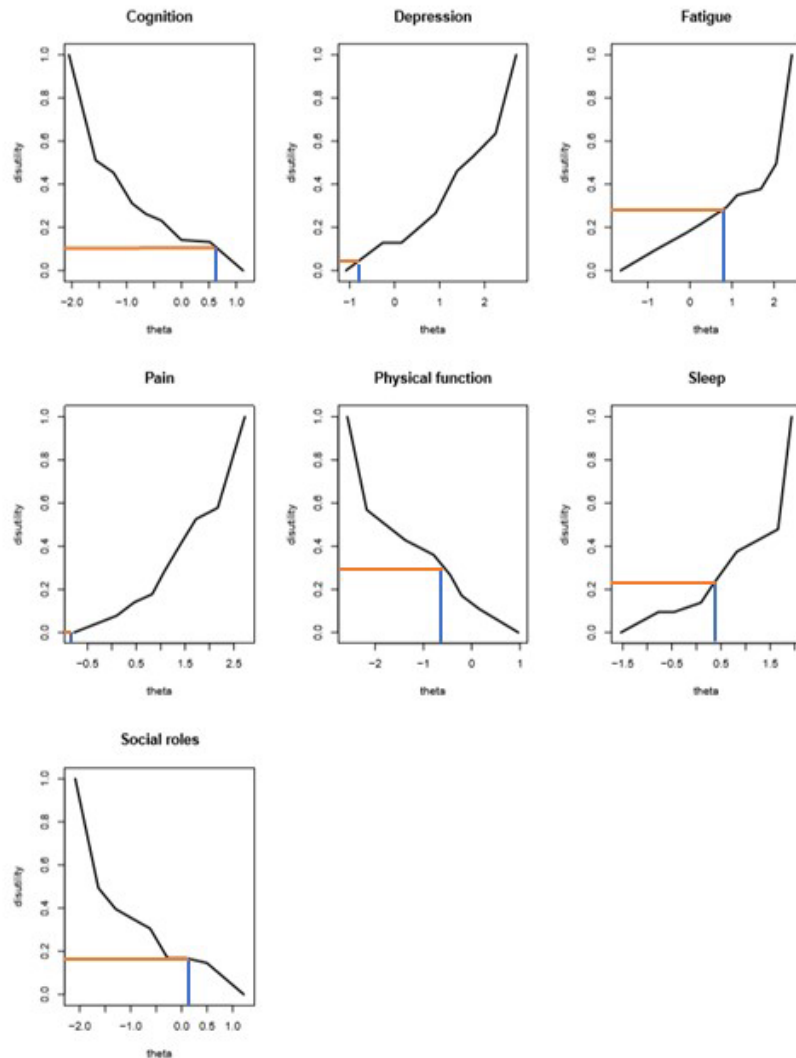
These scores represent average societal preferences
NOT the preferences of individuals

DO NOT USE FOR INDIVIDUAL DECISION MAKING

Step 4: Create Single-Attribute Scores



Step 5: Create Multi-Attribute Scores

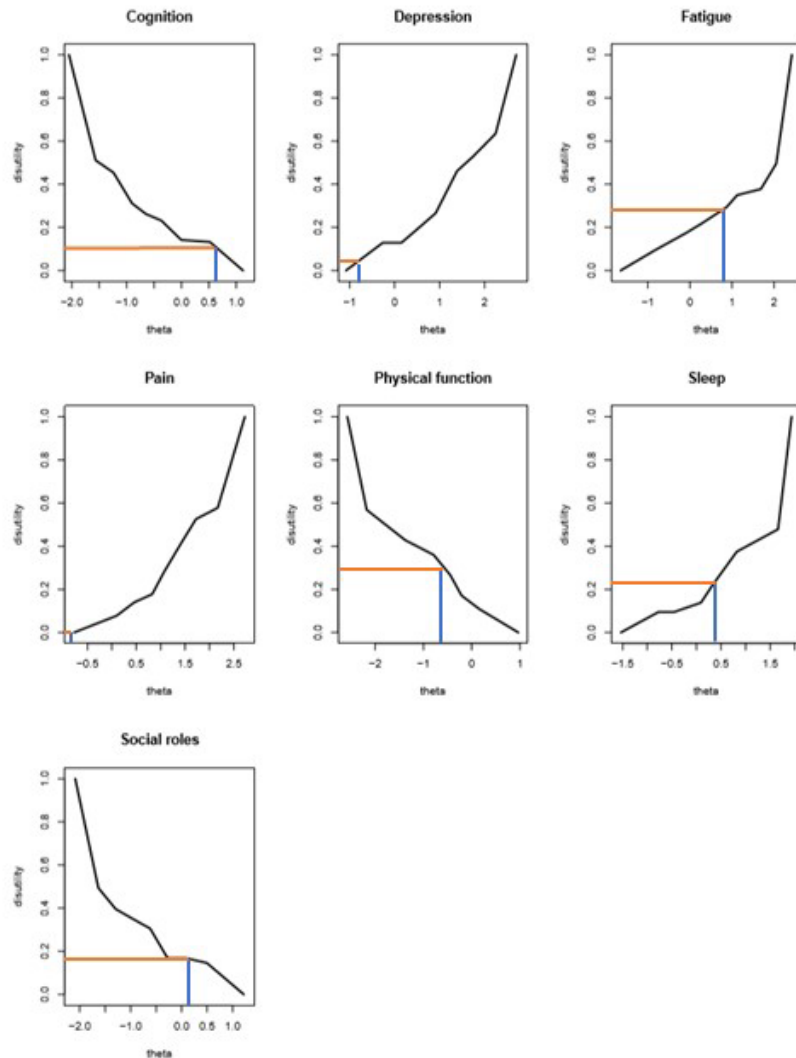


$$u(\Theta) = 1 - \frac{\bar{u}(\Theta)}{\bar{u}(dead)},$$

where

$$\bar{u}(\Theta) = \frac{1}{c} \prod_{i=1}^7 (1 + c \cdot c_i \cdot \bar{u}_i(\theta_i))$$

Step 5: Create Multi-Attribute Scores



1. Find the relative value of each domain using corner states.
2. Solve for the global interaction constant.
3. Rescale so 1=full health, 0=dead.

$$\begin{aligned}
 PROPr &= 1 - 1.0219 \left(\frac{1}{-0.99918} \right) \\
 &\times (1 + -0.99918 \times 0.63504 \times CognitiveDisutility) \\
 &\times (1 + -0.99918 \times 0.66616 \times DepressionDisutility) \\
 &\times (1 + -0.99918 \times 0.63861 \times FatigueDisutility) \\
 &\times (1 + -0.99918 \times 0.65296 \times PainDisutility) \\
 &\times (1 + -0.99918 \times 0.68835 \times PhysicalDisutility) \\
 &\times (1 + -0.99918 \times 0.56296 \times SleepDisutility)
 \end{aligned}$$

Wait, what?

It is simpler than it sounds

Step 1 – Get domain scores

Step 2 – Plug in to available code

Step 1: Get PROMIS Domain Estimates

Domain	T-score	Theta score
Cognitive Function		
Depression		
Fatigue		
Pain Interference		
Physical Function		
Sleep Disturbance		
Ability to Participate in Social Roles and Activities		

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CAT administration

Short form administration

PROMIS-29 + Cognitive Function short form

PROMIS-31 is coming

Note: there is currently no support for missing domains

Step 1: Get PROMIS Domain Estimates

Domain	T-score	Theta score
Cognitive Function	56.1	0.61
Depression	41	-0.9
Fatigue	33.7	-1.63
Pain Interference	41.6	-0.84
Physical Function	57	0.7
Sleep Disturbance	41.2	-0.88
Ability to Participate in Social Roles and Activites	51.8	0.18

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Step 2: Plug them in

Domain	T-score	Theta score	Disutility Estimate	Single-attribute Utility Estimate	Multiattribute Utility Estimate
Cognitive Function	56.1	0.61	0.1062	0.8937	0.757
Depression	41	-0.9	0.0304	0.9695	
Fatigue	33.7	-1.63	0.0814	0.9185	
Pain Interference	41.6	-0.84	0	1	
Physical Function	57	0.7	0.0615	0.9384	
Sleep Disturbance	41.2	-0.88	0.1246	0.8753	
Ability to Participate in Social Roles and Activites	51.8	0.18	0.1833	0.8166	

Standardized R code

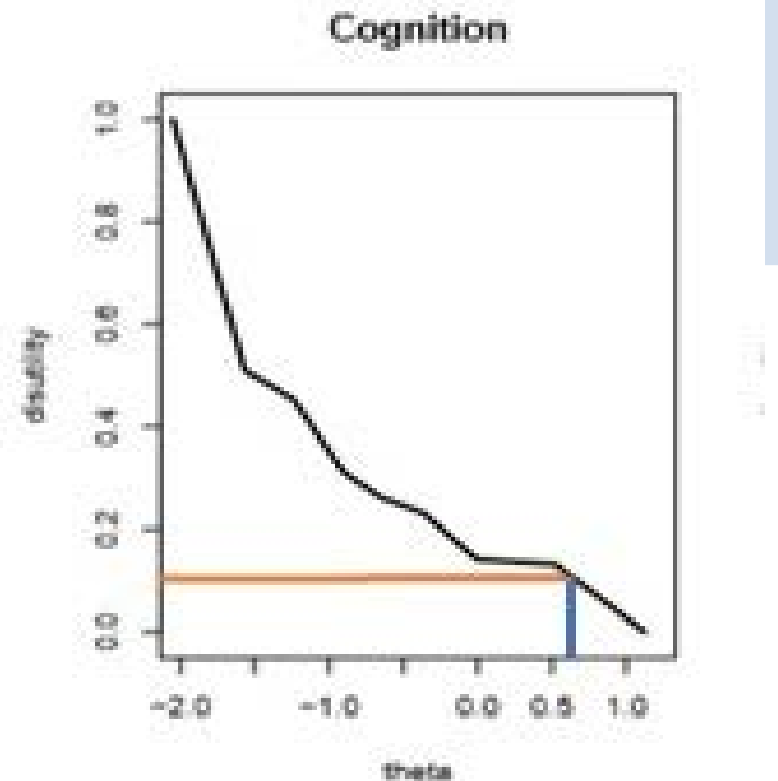
Standardized SAS code

<https://github.com/janelhanmer/PROPr>

API implementation is coming

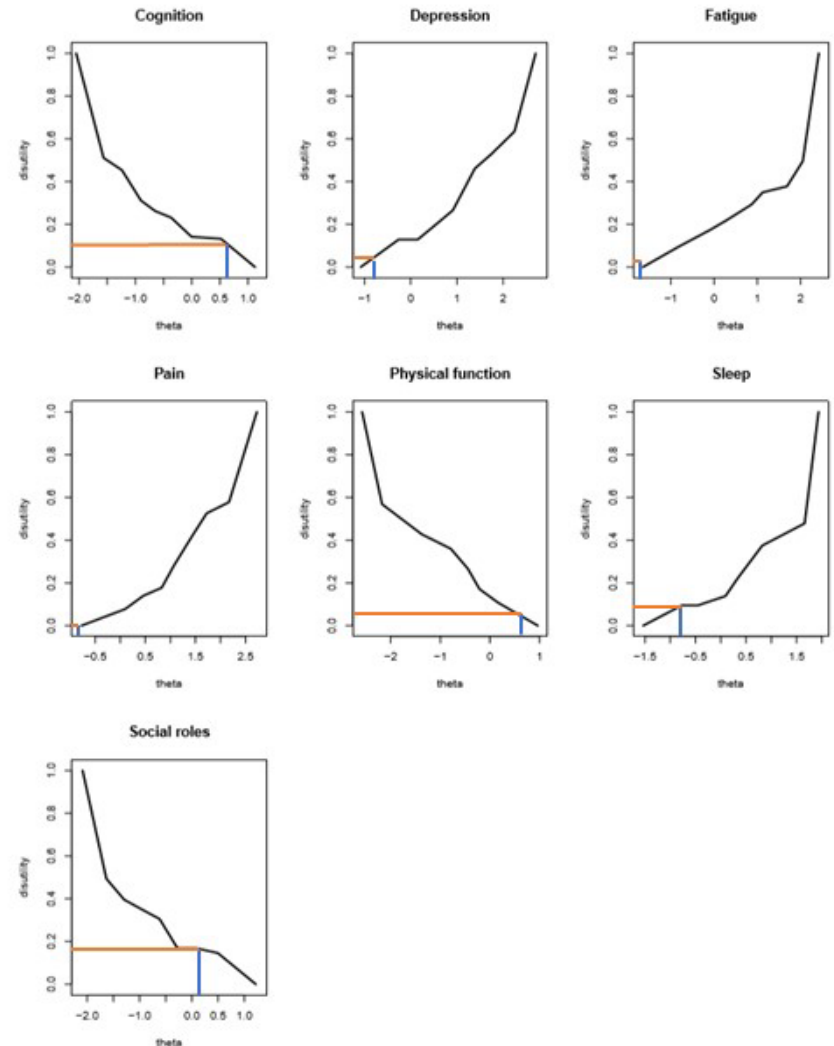
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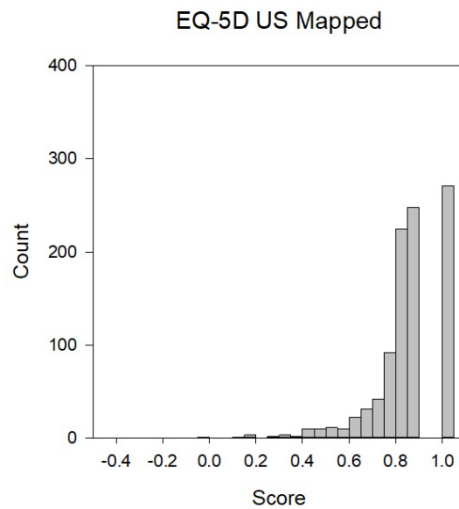
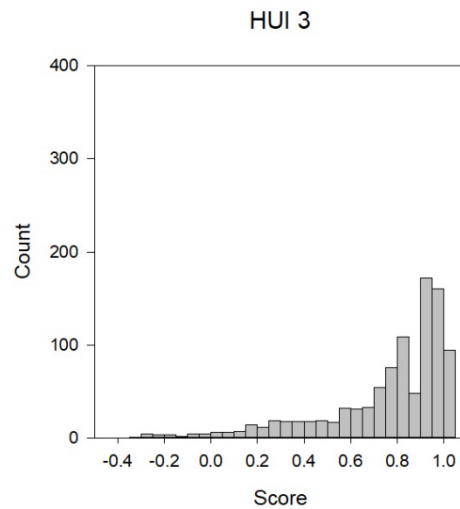
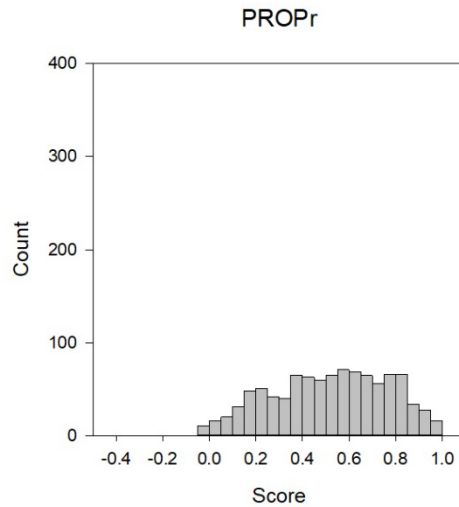
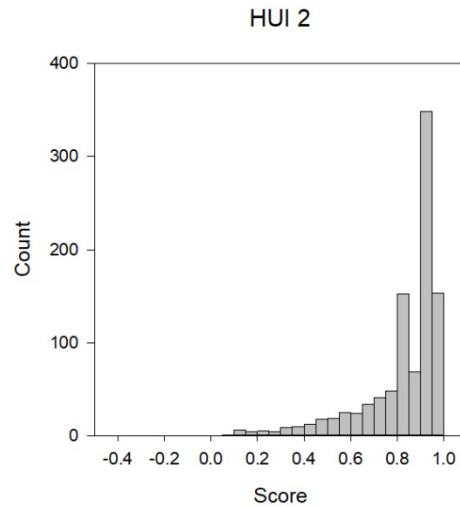
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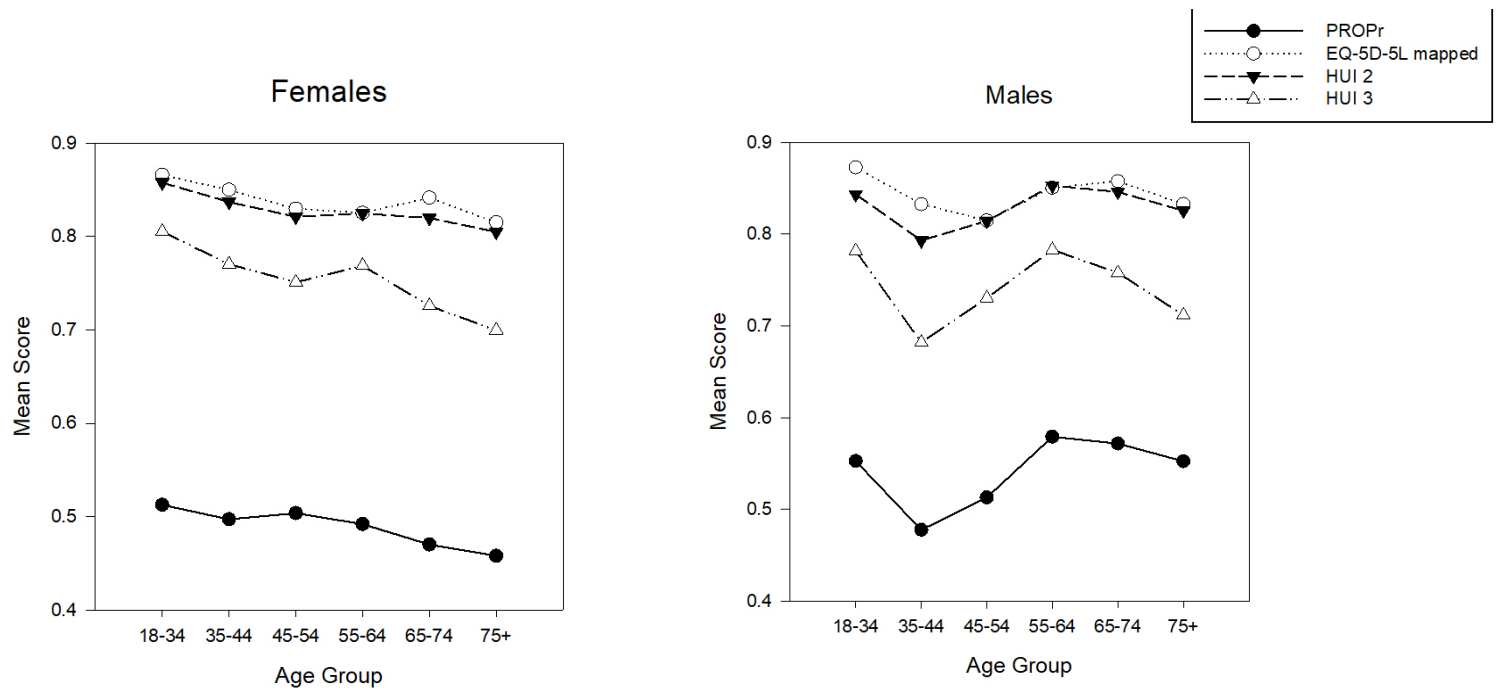
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Comparison to Other Measures

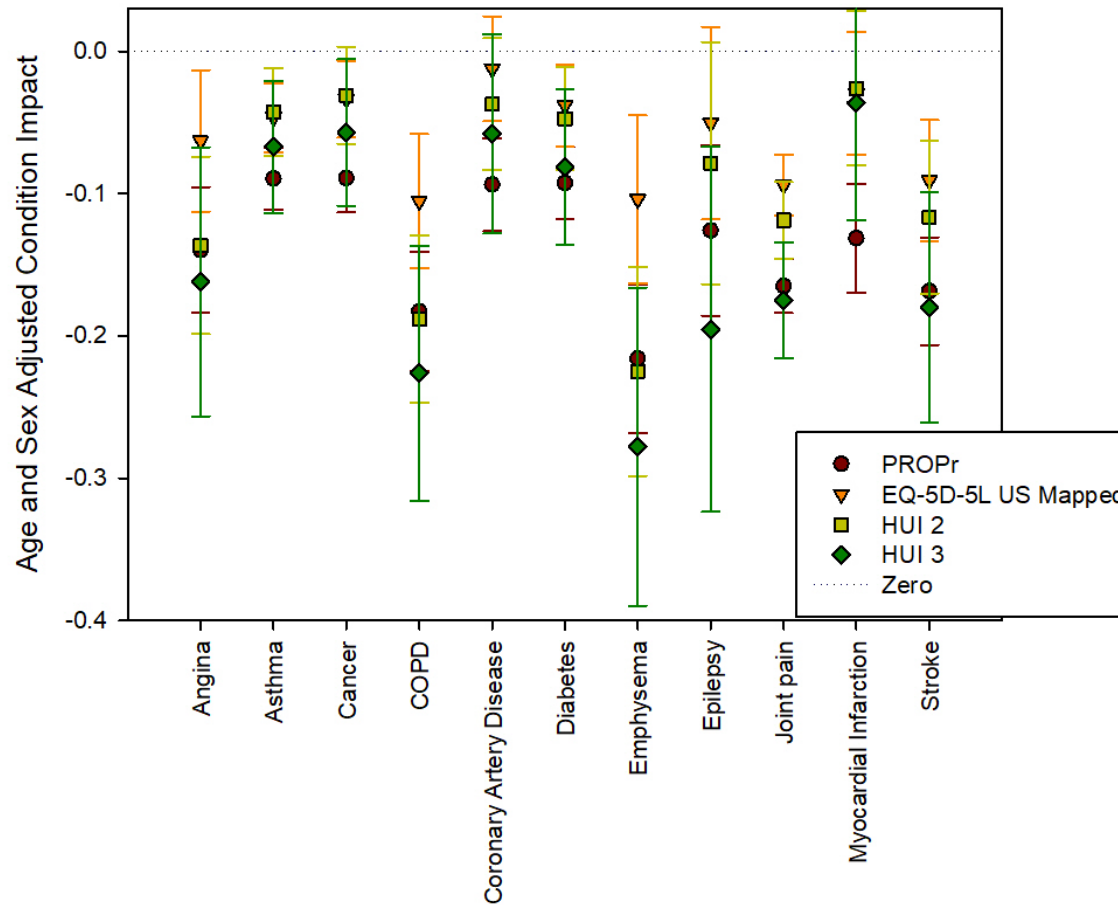


Comparison to Other Measures



Comparison to Other Measures

Condition Impact Estimate and 95% CI



Interpreting PROPr Scores

- Minimally Important Differences have not been established
 - In legacy measures, MID between 0.3 and 0.5
 - A conservative estimate would be $\frac{1}{2}$ SD ~ 0.8
- These scores represent the average value for the health state in the US general population
 - THIS DOES NOT REPRESENT AN INDIVIDUAL'S VALUE

A PROMIS[®]-Preference (PROPr) score

A score for any version of PROMIS[®] banks that includes scores equivalent to:

- Applied Cognition – Abilities v2.0
 - Applied Cognition v2.0
- Depression v1.0
- Fatigue v1.0
- Pain Interference v1.1
 - Pain Interference v1.0
- Physical Function v1.2
 - Physical Function v1.0, v1.1, v2.0
- Satisfaction with Social Roles and Activities v2.0
- Sleep Disturbance v1.0

Thank you!

Contact:

- hanmerjz@upmc.edu
- <http://janelhanmer.pitt.edu/PROPr>
- <https://github.com/janelhanmer/PROPr>