SAS PROC IRT

July 20, 2015 RCMAR/EXPORT Methods Seminar 3-4pm http://chime.med.ucla.edu/seminars/



Acknowledgements:

- Karen L. Spritzer
- NCI (1U2-CCA186878-01)

Ron D.Hays, Ph.D.

Patient-Reported Outcomes Measurement Information System (PROMIS®)

- Reduce response burden.
- Improve measurement precision.
- Compare or combine results from multiple studies.
- Use computer-based administration, scoring, and reporting.



PROI	PROMIS Adult Self-Reported Health—					
PROMIS Profile Domains	Physical Health Physical Function Pain Intensity Pain Interference Fatigue Sleep Disturbance		Mental Health Depression Anxiety		Social Health Ability to Participate in Social Roles & Activities	
PROMIS Additional Domains	Pain Behavior Pain Quality Sleep-related Impairment Sexual Function Gastro-Intestinal Symptoms Dyspnea		Anger Cognitive Function Alcohol Use, Consequences, & Expectancies Psychosocial Illness Impact Self-efficacy Smoking		Satisfaction with Social Roles & Activities Social Support Social Isolation Companionship	

The **PROMIS** <u>Global Health</u> item pool/scale assesses health in general (i.e. overall health). The global health items include global ratings of the five primary PROMIS domains (physical function, fatigue, pain, emotional distress, social health) as well as perceptions of general health that cut across domains. Global items allow respondents to weigh together different aspects of health to arrive at a "bottom-line" indicator of their health. Similar global health items have been found predictive of future health care utilization and mortality. The PROMIS Global Health items include the most widely used single self-rated health item ("In general, would you say your health is . . ."). Previous research has shown that this item taps physical and mental health about equally but reflects physical health more than mental health among respondents at lower income levels. PROMIS Global Health items include specific ratings of physical health and mental health, as well as a rating of overall quality of life. The remaining items provide global ratings of physical function, fatigue, pain, emotional distress, and social health. The PROMIS Global Health items can be administered as individual items or combined to produce separate physical and mental health summary scores (see Hays, Bjorner, Revicki, Spritzer, & Cella, 2009).

PROMIS Global Physical Health (alpha = 0.81)

- In general, how would you rate your physical health? (GlobalO3)
- To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair? (GlobalO6)
- How would you rate your pain on average? (Global07)
- How would you rate your fatigue on average? (Global08)

Graded Response Model

- Item "difficulty" and "discrimination" parameters
- Probability of item responses modeled as:

$$e^{D^*a (theta - b)}$$

1/(e^{-D*a (theta - b)})

1 + e ^{D*a} (theta - b)

- e = 2.718
- D = scaling constant, 1.7 = normal ogive
- a = discrimination
- **b** = difficulty

Global Physical Health Item Parameters

ltem	Α	B1	B2	B 3	B4
Global03	2.31	-2.11	-0.89	0.29	1.54
Global06	2.99	-2.80	-1.78	-1.04	-0.40
Global07	1.74	-3.87	-1.81	-0.67	1.00
Global08	1.90	-3.24	-1.88	-0.36	1.17

- 3. In general, how would you rate your physical health?
- 6. To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries or moving a chair?
- 7. How would you rate your pain on average?
- 8. How would you rate your fatigue on average?
- 3: Poor; Fair: Good; Very Good: Excellent
- 6: Not at all,; A Little; Moderately; Mostly; Completely
- 7: Worse pain imaginable (10) No pain (0)
- 8: Very Severe; Severe; Moderate; Mild; None

IRT Software

- IRTPRO 2.1 for Windows
 - Li Cai, David Thissen & Stephen du Toit
 - <u>http://www.ssicentral.com/irt/</u>
 - MULTILOG was predecessor
- WINSTEPS
 - <u>http://www.winsteps.com/index.htm</u>
 - <u>http://www.ati-online.com/pdfs/researchK12/RaschVsBirnbaum.pdf</u>
- *STATA 14*
 - <u>http://www.stata.com/stata14/irt/</u>
- SAS Version 9.4 (*TS1M2*)

PROC IRT

- Polychoric correlations between ordinal variables (Underlying normally distributed continuous latent variables)
- Eigenvalues and scree plots
- IRT model fit statistics
- IRT model parameter estimates
- Item characteristic and information curves

Test (scale) information curve

An, X., & Yung, Y-F. (2014). Item response theory: What it is and how you can use the IRT procedure to apply it. Paper SAS364-2014.

http://support.sas.com/resources/papers/proceedings14/SAS364-2014.pdf

PROC IRT Code

DATA PROMIS; INFILE "C:\PCAR\gh_orig_all.dat"; INPUT CASEID GLOBAL03 GLOBAL06 R_GLOBAL07 R_GLOBAL08;

RUN;

TITLE "PROC IRT EXAMPLE USING PROMIS GLOBAL PHYSICAL HEALTH SCALE";

PROC IRT DATA=PROMIS POLYCHORIC PLOTS=(ALL); VAR GLOBAL03 GLOBAL06 R_GLOBAL07 R_GLOBAL08; RUN;



PROC IRT Output



Ľ

 \square

0

ne	Tools	Document		Q	ᠿ ا€	7 / 10	Θ	÷	100% 🔻	IJ₽₽	 ×	Sign	In
				Item	Parameter	Estimate	Standard Error	Pr > t					
				GLOBAL03	Threshold 1	-2.11121	0.02384	<.0001					
					Threshold 2	-0.88984	0.01320	<.0001					
					Threshold 3	0.28662	0.01081	<.0001					
					Threshold 4	1.54106	0.01797	<.0001					
					Slope	2.31280	0.03529	<.0001					
				GLOBAL06	Threshold 1	-2.79487	0.03648	<.0001					
					Threshold 2	-1.77480	0.01897	<.0001					
					Threshold 3	-1.04318	0.01311	<.0001					
					Threshold 4	-0.39592	0.01024	<.0001					
					Slope	2.99310	0.05696	<.0001					4
				R_GLOBAL07	Threshold 1	-3.86475	0.06886	<.0001					
					Threshold 2	-1.80237	0.02297	<.0001				- 1	
					Threshold 3	-0.67350	0.01367	<.0001				- 1	
					Threshold 4	0.99278	0.01566	<.0001					
					Slope	1.74960	0.02632	<.0001					
				R_GLOBAL08	Threshold 1	-3.23345	0.04714	<.0001					
					Threshold 2	-1.87168	0.02260	<.0001					
					Threshold 3	-0.35798	0.01193	<.0001					
					Threshold 4	1.16464	0.01621	<.0001					
					Slope	1.90616	0.02835	<.0001					,
	8.50 x 11.00	0 in <										>	

8.50 x 11.00 in



8.50 x 11.00 in

<

--- 🔊 🔨 📻

.

> 9:58 A

8.50 x 11.00 in

<

Some PROC IRT Options

- RESFUNC = RASCH
- EQUALITY GLOBAL03 GLOBAL06
 R_GLOBAL07 R_GLOBAL08/parm=[slopes];
- LINK = PROBIT
 - LOGISTIC / 1.7
 - Camilli, G. (1994). Origin of the scaling constant
 d = 1.7 in item response theory. Journal of
 Educational and Behavioral Statistics, 19, 293-295.

Global Physical Health

- Five items
 - RMSEA = 0.220
- r = 0.29 between two items:
 - In general, how would you rate your health (1)
 - In general, how would you rate your physical health? (3)
 - RMSEA = 0.081
- Dropped general health item (1)

Local Independence Assumption

Items	a	a*
Global03	2.31	7.65
Global06	2.99	1.86
Global07	1.74	1.13
Global08	1.90	1.35

Global03: In general, how would you rate your physical health?

* Item discrimination parameters when also including "In general, would you say your health is:" item.

In general, how would you rate your health?

Excellent Very Good Good Fair

Fig. 1 Category Response Curves for PROMIS Global Health Item (global01) (Image file: Figure 1.tif).

In general, how would you rate your health?

62 = Excellent54 = Very Good47 = Good38 = Fair 29 = Poor

Reliability = 0.52 (compared to 0.81 for 4-item scale). $_{22}$

Suggested Readings

Hays, R. D., Bjorner, J., Revicki, D. A., Spritzer, K., & Cella, D. (2009). Development of physical and mental health summary scores from the Patient-Reported Outcomes Measurement Information System (PROMIS) global items. <u>Quality of Life Research</u>, 18, 873-80.

Hays, R. D., Morales, L. S., & Reise, S. P. (2000). Item Response Theory and Health Outcomes Measurement in the 21st Century. <u>Medical Care</u>, 38 (Suppl.), II-28-II-42.

Hays, R. D., Spritzer, K. L., Thompson, W. W., & Cella, D. (2015 epub). U.S. general population estimate for "excellent" to "poor" self-rated health item. <u>Journal</u> <u>of General Internal Medicine</u>.

Thank you.

<u>drhays@g.ucla.edu</u> @RonDHays (twitter)

Powerpoint file at: <u>http://gim.med.ucla.edu/FacultyPages/Hays/</u>