Differential Item Functioning Between English- and Spanish-Language on the Patient-Reported Outcomes **Measurement Information System** (PROMIS®) Physical Functioning Items for Children and Adolescents

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In the past 7 days ...

0 = Not able to do; 1 = With a lot of trouble; 2 = With some trouble; 3 = With a little trouble; 4 = With no trouble

- <u>29 upper extremity items</u>
 - I could button my shirt or pants.
 - I could open a jar by myself.
- 23 mobility items
 - I could run a mile.
 - I could ride a bike.
 - DeWitt et al., J Clin Epid, 2011, 64 (7), 794-804
- 21% of those 6-17 years old in U.S. speak language other than English at home.
 - American Community Survey (2007)

Differential Item Functioning (DIF)

- Controlling for underlying upper extremity (mobility),
- Probability of picking a particular response (e.g., "not able to do")
- Differs when item is administered in

English versus Spanish.



Samples

- English-language
 - 5,091 children and adolescents from medical clinics in North Carolina and Texas and community schools in North Carolina.
- Spanish-language
 - 605 children and adolescents of adults who are members of an internet panel.
 - Hays, R. D., Liu, H., & Kapteyn, A. (2015). Use of internet panels to conduct surveys. <u>Behavior Research Methods</u>, 47 (3), 685-690.
 - Adults completed demographic questions about child and then passed computer to child.

Spanish-Language Sample

- Hispanic Spanish-speaking adults
 - Members of the Greenfield/Toluna internet panel (<u>http://us.toluna.com</u>)
- Average score on 4-item Short Acculturation Scale for Hispanics (SASH) was 2.6 for children.
 - What language(s) do you read and speak?
 - What language(s) do you usually speak at home?
 - What language(s) do you usually speak with your friends?
 - In which language(s) do you usually think?

1 = Only Spanish; 2 = Spanish better than English; 3 = Both equally; 4 = English better than Spanish; 5 = Only English

Spanish Translation

Iterative process of forward translations, reconciliation, back translation, multiple reviews, and pre-test with cognitive debriefing (FACIT Translation Methodology).

Each translated item pre-tested and debriefed in the US with 5 Spanish-speaking subjects from the general population to try to make sure translation is well understood and conceptually equivalent to the source.



Sample Demographics

	English (n = 5,091)	Spanish (n = 605)
% Female	52%	45%
% Hispanic	18%	96%
Age		
8-12 years old	53%	50%
13-17 years old	47%	50%

Confirmatory Factor Analysis Fit Indices

 $\chi_{null} - \chi_{model}$

 χ_{null}

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• Normed fit index:

• Non-normed fit index:





Comparative fit index:

 $1 - \left(\frac{\chi_{model}^{2} - df_{model}}{\chi_{null}^{2} - df_{null}}\right)$

RMSEA = SQRT ($\lambda^2 - df$)/SQRT (df (N - 1))

Confirmatory Factor Analysis

 One-factor model fit the data well in the Spanish (n = 605) sample for upper extremity and mobility, respectively

➤ CFIs = 0.998 and 0.996

➢ RMSEAs=0.036 and 0.054

- Range of standardized factor loadings
 > 0.824--0.962 (29 upper extremity items)
 - 0.815—0.967 (23 mobility items)

CFI>0.95; RMSEA = 0.05 (good)

Ordinal Logistic Regression

http://CRAN.R-project.org/package=lordif

Model 1 : logit $P(u_i \ge k) = \alpha_k + \beta_1 * mobility$

Model 2 : logit P($u_i >= k$) = $\alpha_k + \beta_1 *$ mobility + $\beta_2 *$ language

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Model 3 : logit P(u<sub>i</sub> >= k) = \alpha_k + \beta_1 * mobility + \beta_2 * language +
\beta_3 * mobility * language
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<u>DIF assessment</u> (log likelihood values and McFadden's pseudo $R^2 >= 0.02$):

- Overall: Model 3 versus Model 1

-Non-uniform: Model 3 versus Model 2

-Uniform: Model 2 versus Model 1

Note: Purified IRT score used for mobility (conditioning variable).

Upper extremity (4/29 dif) Mobility (7/23 dif)

- Upper extremity
 - I could hold an empty cup. (harder for Spanish)
 - I could pull open heavy doors.
 - I could pour a drink from a full pitcher.
 - I could open a jar by myself. (non-uniform)
- Mobility
 - I could ride a bike.
 - I could do sports and exercise that other kids my age could do.
 - I could run a mile.
 - I could walk upstairs without holding on to anything.
 - I could keep up when I played with other kids.
 - I used a walker, cane or crutches to get around. (non-uniform)
 - I could turn my head all the way to the side. (non-uniform)

Impact of DIF (4 items) on Test Characteristic Curves: Upper Extremity

All Items

DIF Items



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Impact of DIF at Individual Level: Upper Extremity



CAT-based Theta Estimates Using English (x-axis) and Spanish (y-axis) Parameters for 29 Upper Extremity Items (n = 605)

English vs Spanish (29 items, r=0.985)



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Impact of DIF (7 items) on Test Characteristic Curves: Mobility



Impact of DIF at Individual Level: Mobility



initial theta

CAT-based Theta Estimates Using English (x-axis) and Spanish (y-axis) Parameters for 23 Mobility Items (n = 605)

English vs Spanish (23 items, r=0.99)



English Parameter

Questions?



Stocking-Lord Linking Constants

- Spanish calibrations transformed linearly so that their TCC most closely matches English TCC.
- $a^* = a/A$ and $b^* = A * b + B$
- Optimal values of A (slope) and B (intercept) transformation constants found through multivariate search to minimize weighted sum of squared distances between TCCs of English and Spanish transformed parameters
 - Stocking, M.L., & Lord, F.M. (1983). Developing a common metric in item response theory. Applied Psychological Measurement, 7, 201-210.