Measurement Issues of Health Literacy in the Context of Chronic Disease Management: examples of linguistically isolated immigrant populations:

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Conflict of Interest

- None
Objectives

- Briefly review the major HL measurement issue related with intervention research and practice
- Discuss the process of developing and validating disease specific health literacy measurement tool using real study examples
Health literacy! What’s really about?

Individual
- Language
- Transportation
- Fear or being intimidated
- by main health care system

Psychological
- Feeling of marginalization
- Loss of self-confidence
- Role conflict/dependency on others
- “Do not want to be a burden to family”
- Depression

Environmental/financial
- Safety
- Cost of medication
- Access to health care

Extent of Limited Health Literacy by Race/Ethnicity

- Ethnic minorities have a higher percentage of *below basic* health literacy than Whites

- Hispanics, American Indians/Alaskan Natives and Blacks most affected

Source: NAAL, 2003
Adults who learn English at a later age have lower literacy scores than those who learn English at an earlier age.
Major Barriers to Adequate Health Care for Immigrant populations in US (Korean and Vietnamese Americans)

Individual
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- Safety
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**Intervention Strategies**

- Health literacy
- Structured psycho-behavioral DM education delivered over 6 weeks
- Home glucose monitoring with a telephone transmission system (HGDM) over 24 weeks
- Culturally tailored comprehensive behavioral intervention over 24 weeks

Health literacy focused Telephone counseling with a bilingual nurse case manager over 24 weeks

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**Intervention Strategies**

- **Health literacy**
  - Structured psycho-behavioral HBP education delivered
  - 6 weeks

- **Home HBP** with telephone transmission system (HGMT)
  - 24 weeks

- **Health literacy** focused Telephone counseling with a bilingual nurse case manager
  - 24 weeks

**Culturally tailored comprehensive behavioral intervention**

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Kim MT et al. (2011) *Journal of Clinical Hypertension*, 13, 605–612. PMID:21806771
Intervention Materials for Health Literacy

Health literacy word slides

Diabetes
- 다이아비티스 (당뇨병)

Medication
- 메디케이션 (약)

Calorie
- 캘로리 (열량)

Insulin
- 인슐린 (인슐린)

Obesity
- 오비세리 (비만)

Cholesterol
- 콜레스테롤
Dialogue (대화)

Doctor (의사):
Hello, Mrs. Kim.
Hello, 미세스 김.
How are you?
하우 아 유?
Mrs. Kim (미세스 김):
I am OK in general.
이이 엠 오케이 인 제너럴.

Doctor (의사):
We have to run some tests to see how your diabetes is doing.
위 해브 두런 셸 테스츠 두 씩 하우 유어 다이아비타스 이즈 두잉.
Major barriers to implement HL focused intervention

- Limitation on outcome measurement
  * Sensitivity to capture the intervention effect
  * Global measure vs. disease specific instrument

- Researcher skepticism:

  “Can Health Literacy be improved by a short-term intervention?”
Major methodological contributors of false “non-significant” findings in intervention research

- Randomization method may not yield comparable treatment & control groups in terms of attributes.
- The treatment (independent variable) may not be powerful enough to produce a change.
- Measurement of the independent variables may not be sufficiently specific or sensitive to detect change.
- The timing (interval) of the test and measurements of data may not allow for detection of effect of the independent variable.
- Uncontrolled extraneous variables have a dominant effect on the dependent variables or independent variable.
High Blood Pressure Health Literacy Scale (HBP-HLS) Kim et al, 2011

- 43-Item HBP-HLS
  - 30 print items
  - 13-functional items

- Development & validation of scale was guided by several principles:
  - The use of simple word recognition test would be appropriate
  - The addition of functional items would ensure the assessment of comprehension
  - Making it content specific to HBP will reduce the shame and stigma of limited HL, and make it more relevant for targeted clinical interventions
  - Inclusion of community member input was necessary

- Wanted to further support its utility in other ethnic populations such as Vietnamese American
  - Create a shorten scale that was more applicable in clinical settings

Instrumentation Process

Develop Health Literacy Tool

Pilot and Refine Tool

Korean American

Exploratory Factor Analysis

Reliability & Validity

Item Response Theory Analysis

Assess relationships with HBP-HLS

Vietnamese American

Exploratory Factor Analysis

Reliability & Validity

Aim 1

Aim 2
State of Science of HL Measures

- 59 existing instruments; 29 general, 30 content/context-specific
- None of the disease specific measures were related to HBP
- Evidence supporting use of disease specific HL measures was not clear, but strong arguments were made regarding their usefulness in reducing the shame and stigma of limited HL.
- Most were validated with White (n=33), Black (n=29), and/or Hispanic (n=14) Americans samples
Measurement Framework:

**Item Response Theory (IRT)**

- General statistical theory that uses logistic models to describe the relationship between an individual’s ability and how they respond to an *item*.

- This relationship is described by the *item characteristic curve (ICC)*:
  - *Interpreted by its*
    - Difficulty parameter, $b$
    - Discrimination parameter, $a$

- Information function curves

\[
P(\theta) = \frac{1}{1 + e^{-L}} = \frac{1}{1 + e^{-a(\theta-b)}}
\]
IRT Process

- Test for Differential Item Functioning (DIF)
  - Development sample (n=323)
  - Validation sample (n=317)
  - Assess model fit
  - Calibrate items using best model
  - Items Trimming
  - Preliminary validity assessment
  - Correlate & Reassess Relationships

Methods:
- MLE
- EFA
- Nested Models
- S-X²
- LD X²
- ICC
- Information Functions
- IRTPRO®
## Study Demographics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Korean American (n=440)</th>
<th>Vietnamese American (n=200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>n(%) or mean±SD</td>
<td>n(%) or mean±SD</td>
</tr>
<tr>
<td>18-29</td>
<td>70.9±5.5</td>
<td>57.0±14.6</td>
</tr>
<tr>
<td>30-44</td>
<td>12 (6.0%)</td>
<td>22 (11.0%)</td>
</tr>
<tr>
<td>45-59</td>
<td>22 (11.0%)</td>
<td>72 (36.0%)</td>
</tr>
<tr>
<td>60-69</td>
<td>186 (42.3%)</td>
<td>56 (28.0%)</td>
</tr>
<tr>
<td>70-79</td>
<td>223 (50.7%)</td>
<td>29 (14.5%)</td>
</tr>
<tr>
<td>≥80</td>
<td>31 (7.0%)</td>
<td>9 (4.5%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>134 (30.5%)</td>
<td>97 (48.5%)</td>
</tr>
<tr>
<td>Female</td>
<td>306 (69.5%)</td>
<td>103 (51.5%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ Middle school</td>
<td>165 (37.5%)</td>
<td>71 (35.5%)</td>
</tr>
<tr>
<td>High school</td>
<td>126 (28.6%)</td>
<td>55 (27.5%)</td>
</tr>
<tr>
<td>≥Some College</td>
<td>149 (33.9%)</td>
<td>74 (37.0%)</td>
</tr>
<tr>
<td>Year in U.S.</td>
<td>24.2±11.3</td>
<td>19.0±11.5</td>
</tr>
<tr>
<td>Observed HBP-HL Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-10</td>
<td>202 (46%)</td>
<td>31 (16%)</td>
</tr>
<tr>
<td>11-20</td>
<td>47 (11%)</td>
<td>10 (5%)</td>
</tr>
<tr>
<td>21-30</td>
<td>61 (14%)</td>
<td>25 (13%)</td>
</tr>
<tr>
<td>31-43</td>
<td>130 (30%)</td>
<td>134 (67%)</td>
</tr>
</tbody>
</table>
Results:

Differential Item Functioning (DIF)

35-items, (-) DIF

8-items, (+) DIF
Results:

Item Trimming (Interval 1)

ICC

Information Functions
Results:

ICCs of 43 versus 10-item HBP-HLS
Results:

Standard Error of Measurement Functions

![Graph showing Standard Error of Measurement Functions](image-url)
Conclusions

- The HBP-HLS was effectively shorten by over 75% to 10-item (7 print, 3 functional) while retaining optimal precision, content coverage and preliminary evidence of validity.

- Measurement equivalence was achieved in two ethnic groups whose native language is vastly different.

- This has tremendous implications for participant burden, feasibility of use in clinical settings, and cost.
Future HL instrumentation Research
direction

- Contribute to NIH Patient Reported Outcome Measurement Information System (PROMIS) health literacy item bank
Implication on Health Disparity Research

- Given the growing health disparity gap in chronic disease management among those special populations, researchers and clinicians should consider an educational intervention that directly influences health literacy as a viable option to address this important issue.