Difference in Self-Reported Adherence on Different Recall Intervals over Time between Males and Females in MACH14 Study

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Li Cai, UCLA
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Outline

- Background
- IRT model
- Results
- Discussion/Limitation
Background

- Item Response Theory (IRT) for Health Outcome
- MACH14 project
- Self-Reported Adherence
Item Response Theory (IRT)

- IRT was first proposed in psychometrics
  - Widely used in education
  - Relate latent trait(s) to the probability of responses

- IRT-based models have become increasingly popular in
  - Health outcomes
  - Quality-of-life research
  - Clinical research

- Item residuals when using the same instruments over time
**MACH14** study----a Multi-site Adherence Collaboration in HIV among 14 universities/institutes in the U.S.
Self-reported adherence

- Self-reported adherence with different recall intervals
  - One day
  - Two days
  - Three days

- Ordinal response created at baseline and exit:
  - 0 – with less than 50%
  - 1 – 50% - 85%
  - 2 - >85% - perfect adherence
Method

• Two-tier Item Factor Analysis Model
  • Missing observations
  • Clustering observations
  • By gender
Two-tier model for longitudinal data
Additional problems

- Missing is coded as “-9”
- Clustered observations within each study
- Compare the difference between genders
Assumptions of the model

- The latent variables are normally distributed.
- Primary latent variables can be correlated.
- The components of specific dimensions (adherence at different recall intervals) are mutually orthogonal.
- The primary dimension and the specific dimensions are orthogonal.
- The item responses are independent after the influence of latent variables are removed.
Results

• Latent trait estimation
• flexMIRT
Some basic characteristics of the sample

**Male**
- N = 1108
- Mean Age = 41.3 ± 8.3

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean ± Std</th>
<th>Mean ± Std</th>
<th>N</th>
<th>Mean ± Std</th>
<th>Mean ± Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS item 1</td>
<td>1067</td>
<td>0.93 ± 0.23</td>
<td>1.84 ± 0.5</td>
<td>478</td>
<td>0.89 ± 0.27</td>
<td>1.75 ± 0.59</td>
</tr>
<tr>
<td>BS item 2</td>
<td>1003</td>
<td>0.93 ± 0.23</td>
<td>1.83 ± 0.5</td>
<td>426</td>
<td>0.9 ± 0.27</td>
<td>1.76 ± 0.59</td>
</tr>
<tr>
<td>BS item 3</td>
<td>998</td>
<td>0.92 ± 0.24</td>
<td>1.82 ± 0.52</td>
<td>424</td>
<td>0.89 ± 0.28</td>
<td>1.76 ± 0.59</td>
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<tr>
<td>Ex item 1</td>
<td>1052</td>
<td>0.91 ± 0.26</td>
<td>1.8 ± 0.56</td>
<td>470</td>
<td>0.86 ± 0.31</td>
<td>1.68 ± 0.67</td>
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<tr>
<td>Ex item 2</td>
<td>986</td>
<td>0.91 ± 0.26</td>
<td>1.79 ± 0.56</td>
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<td>0.89 ± 0.29</td>
<td>1.74 ± 0.62</td>
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<tr>
<td>Ex item 3</td>
<td>987</td>
<td>0.91 ± 0.26</td>
<td>1.81 ± 0.54</td>
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<td>0.89 ± 0.28</td>
<td>1.76 ± 0.6</td>
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</tbody>
</table>

**Female**
- N = 484
- Mean Age = 41.2 ± 7.7
## Overall estimation

<table>
<thead>
<tr>
<th>Item</th>
<th>a1</th>
<th>a2</th>
<th>a3</th>
<th>a4</th>
<th>a5</th>
<th>c1</th>
<th>c2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.28</td>
<td>0</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>10.57</td>
<td>8.02</td>
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<tr>
<td>2</td>
<td><strong>30.35</strong></td>
<td>0</td>
<td>0</td>
<td><strong>12.28</strong></td>
<td>0</td>
<td><strong>45.49</strong></td>
<td><strong>35.82</strong></td>
</tr>
<tr>
<td>3</td>
<td>7.62</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.99</td>
<td>12.01</td>
<td>9.45</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>6.28</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>10.57</td>
<td>8.02</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>30.35</td>
<td>0</td>
<td>12.28</td>
<td>0</td>
<td><strong>45.49</strong></td>
<td><strong>35.82</strong></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>7.62</td>
<td>0</td>
<td>0</td>
<td>2.99</td>
<td>12.01</td>
<td>9.45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>mu1</th>
<th>mu2</th>
<th>mu3</th>
<th>mu4</th>
<th>mu5</th>
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<table>
<thead>
<tr>
<th>Theta1</th>
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<th>Theta4</th>
<th>Theta5</th>
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![Graph](image)

June 30, 2015

UCLA
Clustered within study

Latent Site Estimation by Gender

M=Male  F=Female
By gender estimation – latent adherence

**Graded Items for Group 1: M**  \[ \theta_1 = 0, \theta_2 = 1.07, Var(\theta_2) = 1.7, COV(\theta_1, \theta_2) \approx 0 \]

<table>
<thead>
<tr>
<th>Item</th>
<th>a 1</th>
<th>a 2</th>
<th>a 3</th>
<th>a 4</th>
<th>a 5</th>
<th>c 1</th>
<th>c 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>5.36</td>
<td>3.73</td>
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<tr>
<td>3</td>
<td>32.23</td>
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<td>42.66</td>
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<td>0</td>
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<td>3.73</td>
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<td>0</td>
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<tr>
<td>6</td>
<td>0</td>
<td>32.23</td>
<td>0</td>
<td>0</td>
<td>38.7</td>
<td>42.66</td>
<td>36.04</td>
</tr>
</tbody>
</table>

**Graded Items for Group 2: F**  \[ \theta_1 = 0, \theta_2 = 1, Var(\theta_2) = 1.95, COV(\theta_1, \theta_2) \approx 0 \]

<table>
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<tr>
<th>Item</th>
<th>a 1</th>
<th>a 2</th>
<th>a 3</th>
<th>a 4</th>
<th>a 5</th>
<th>c 1</th>
<th>c 2</th>
</tr>
</thead>
<tbody>
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<tr>
<td>4</td>
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<td>0</td>
<td>4.09</td>
<td>5.09</td>
<td>3.25</td>
</tr>
</tbody>
</table>
Conclusion

- The **difficulty** on report adherence based on different recall intervals between male and female
  - Male – 3 days recall
  - Female – 1 or 2 days recall

- Males have advantages in short-term memory
Discussion and Limitation

- Discussion
- Limitation
- Future work
Compare with traditional analysis
Discussion

- The computation speed
  - With and without cluster
  - Different OS
- Assumptions
Limitation

- Missing is not at random
- No inference about the other covariates
  - Age
  - Substance abuse
  - Ethnicity
Possible Future Work

- MEMS data verification
- Continuous outcome vs Ordinal response
- More than two longitudinal time points
- Multiple imputation techniques
- Violation of the assumptions
Key references

Acknowledgements

We would like to express our great appreciation to MACH14 investigators for their contribution to the rich data set.