Psychometric Evaluation of the Motivation and Energy Inventory – Short Form (MEI-SF)

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Overview

• Development of the MEI
• Item selection and preliminary evaluation of the MEI-SF
• Psychometric evaluation of the MEI-SF
• Conclusions and future directions
Development of the MEI: Objective

- Create a comprehensive patient-reported assessment of changes in energy and motivation due to treatment
  - Initially developed for use in antidepressant trials
Development of the MEI: Process

- Literature review and patient focus groups
- Four iterative sets of cognitive interviews
- Psychometric evaluation using data from two clinical trials
- Additional study to evaluate test-retest reliability and estimate minimal clinically important difference (MCID)
Development of the MEI: Example Items

During the past 4 weeks, how often did you feel satisfied with what you accomplished during the day?

- Never
- Less than 1 day a week
- 1 or 2 days a week
- 3 or 4 days a week
- 5 or 6 days a week
- Every day or nearly every day

During the past 4 weeks, to what extent were you interested in meeting new people?

- Not at all interested
- A little interested
- Somewhat interested
- Quite interested
- Extremely interested
Development of the MEI: Results

MEI

27 items

Physical Energy

7 items

Mental Energy

10 items

Social Motivation

10 items
Development of the MEI: Results

- Established test-retest reliability, internal consistency, construct and discriminant validity, and responsiveness of each subscale

Development of the MEI-SF: Objective

• Develop a short, acute form of the MEI
  • Minimize patient burden
  • Maximize responsiveness for use in trials of short duration
Development of the MEI-SF: Process

• Item Reduction
  • Responsiveness – ability to discriminate between responders and non-responders (50% reduction in HAM-D scores)
    • 4 behaviorally oriented items deleted
  • Inter-item correlations
    • 5 items deleted to minimize redundancy
• Reference period changed to “past 7 days”
Development of the MEI-SF: Results

• 18-item, acute form of the MEI
  • Original 3-factor structure not fully supported with remaining 18 items
  • Preliminary psychometric results for global score using MEI data from 3 previous studies were promising

Evaluation of the MEI-SF: Process

- Data obtained from two 8-week, double-blind, randomized trials comparing several antidepressants to placebo
  - 785 patients completed the MEI-SF
    - 388 in Trial 1 and 397 in Trial 2
- Investigated subscale structure
  - Exploratory factor analyses (Trial 1) and confirmatory factor analyses (Trial 2)
- Evaluated internal consistency, validity, MCID, responsiveness, and item characteristics
Evaluation of the MEI-SF: EFA Results (Trial 1)

- Exploratory results favorable for a 1-factor solution
  - All loadings .50 or greater
- 2 subsets of items consistently loaded together in multi-factor solutions
  - 6 items addressing cognitive or mental energy (concentration, decision-making)
  - 5 items addressing social motivation (prefer to be alone, interest in social activities)
- Considered possibility of a 3-factor solution
  - 1 general factor and 2 specific factors
1. Began day enthusiastic
2. Satisfied w/accomplishment
3. Trouble getting out of bed
4. Trouble finishing things
5. Felt overwhelmed
6. Procrastinated
7. Problems concentrating
8. Trouble making decision
9. Avoid social conversation
10. Prefer to be alone
11. Trouble keeping organized
12. Physically tired
13. Felt energetic
14. Felt motivated
15. Interested in new tasks
16. Interested in new people
17. Interested in talking
18. Interested in social activity

Evaluation of the MEI-SF: Scale Structure
Evaluation of the MEI-SF: CFA Results (Trial 2)

3-Factor Structure

GFI = 0.98
CFI = 0.99
RMSEA = 0.07
Loadings:
  0.49 to 0.79 (Total)
  0.38 to 0.54 (Cognitive)
  0.46 to 0.78 (Social)

1-Factor Structure

GFI = 0.95
CFI = 0.95
RMSEA = 0.13
Loadings:
  0.53 to 0.74 (Total)
# Evaluation of the MEI-SF: Internal Consistency

Cronbach’s Alpha at Baseline

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 1</td>
<td>.90</td>
<td>.84</td>
<td>.83</td>
</tr>
<tr>
<td>Trial 2</td>
<td>.88</td>
<td>.84</td>
<td>.81</td>
</tr>
</tbody>
</table>
## Evaluation of the MEI-SF: Construct Validity

### Correlations with Other Measures at Baseline

<table>
<thead>
<tr>
<th>Measure</th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAM-D</td>
<td>-0.32</td>
<td>-0.26</td>
<td>-0.25</td>
</tr>
<tr>
<td><strong>HADS-D</strong></td>
<td><strong>-0.67</strong></td>
<td><strong>-0.54</strong></td>
<td><strong>-0.51</strong></td>
</tr>
<tr>
<td>HADS-A</td>
<td>-0.36</td>
<td>-0.40</td>
<td>-0.22</td>
</tr>
<tr>
<td>CGI-S</td>
<td>-0.23</td>
<td>-0.26</td>
<td>-0.25</td>
</tr>
</tbody>
</table>

Note: HADS-D is patient-reported and assesses depression severity.
## Evaluation of the MEI-SF: Discriminant Validity

### Ability to Differentiate Between Known Groups Post-Treatment ($F$, $p$-value)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment</strong></td>
<td>14.6</td>
<td>14.8</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>($p= .0001$)</td>
<td>($p= .0001$)</td>
<td>($p= .0040$)</td>
</tr>
<tr>
<td><strong>CGI-S</strong></td>
<td>108.4</td>
<td>81.0</td>
<td>67.8</td>
</tr>
<tr>
<td></td>
<td>($p&lt;.0001$)</td>
<td>($p&lt;.0001$)</td>
<td>($p&lt;.0001$)</td>
</tr>
<tr>
<td><strong>CGI-I</strong></td>
<td>97.3</td>
<td>65.0</td>
<td>63.9</td>
</tr>
<tr>
<td></td>
<td>($p&lt;.0001$)</td>
<td>($p&lt;.0001$)</td>
<td>($p&lt;.0001$)</td>
</tr>
</tbody>
</table>
# Evaluation of the MEI-SF: Responsiveness

## Treated vs. Placebo Patients

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect Size</td>
<td>.33</td>
<td>.33</td>
<td>.25</td>
</tr>
</tbody>
</table>

- **mean change in treated patients** – **mean change in placebo patients**
- standard deviation of change in placebo patients
### Evaluation of the MEI-SF: Responsiveness

#### Responders vs. Non-Responders

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect Size</td>
<td>1.87</td>
<td>1.44</td>
<td>1.47</td>
</tr>
</tbody>
</table>

- **Mean change in responders** – **mean change in non-responders**
- **Standard deviation of change in non-responders**
## Evaluation of the MEI-SF: Estimating MCID

### Minimal Clinically Important Difference Estimates

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Cognitive</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEM</td>
<td>5.0</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>½ SD</td>
<td>7.5</td>
<td>3.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Anchor (CGI-I)</td>
<td>14.2</td>
<td>5.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>
Evaluation of the MEI-SF: Item Characteristics

Parameter Estimates Using Samejima’s Graded Response Model – Total Score

Slope ($a$)  
Range: 1.87 to 3.62

Threshold ($b$)  
Range: -2.56 to 1.95
Evaluation of the MEI-SF: Total Information

Test Information and Measurement Error

Information vs. Scale Score

Standard Error vs. Scale Score
Conclusions and Future Directions

• Results of present evaluation consistent with those of previous evaluations
• Strong evidence to support factor structure, reliability, validity, and responsiveness of MEI-SF within a depressed population
• More than 30 translations available – use in international trials anticipated
• Potential utility in additional therapeutic areas currently being explored
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