Psychometric Evaluation of the Diabetes Self-Management Instrument - Short Form (DSMI-20)

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Disclosure Slide

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Learner objectives
(1) The learners could learn the process of developing and testing an instrument
(2) The learners can utilize the instrument verified in this study to assess the self-management behaviors of people with diabetes

No conflict of interest

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# Outline

- Introduction & Purpose
- Methods
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  - Pilot Test
  - Data Collection
  - Psychometric Evaluation
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Introduction

- Diabetes is a life-long condition that cannot be cured, but can be controlled with medication and/or lifestyle modification.

- Because self-management of diabetes is the cornerstone of overall diabetes management, a valid and reliable instrument is required for an accurate assessment of the patient’s self-management efforts.
PURPOSE

- To revise and simplify the DSMI-35 in order to enhance its practicality in clinical settings.
- To evaluated the psychometric properties of the revised instrument.
METHODS

The short form instrument (DSMI-20) was created by revising our previous longer instrument (DSMI-35) through three phases:

**Phase 1: Process of items reforming**

**Phase 2: Pilot Test**

**Phase 3: Psychometric Evaluation**
DSMI-35

DSMI-35 was composed of 5 factors:

- Self-integration
- Self-regulation
- Interaction with health care providers and significant others
- Self-monitoring of blood glucose
- Adherence to the recommended regimen
Phase 1: Process of items reforming

- Small, in-depth group discussions
  - one group was comprised of 3 participants with diabetes who had university education level
  - one group was composed of 3 diabetes educators.

- Expert validity: 8 diabetes experts
  - 3 university professors who expertise in diabetes self-management and instrument development
  - 3 diabetes educators
  - 1 endocrinologist
  - 1 endocrinology nurse specialist
**Phase 2: Pilot Test**

- A convenience sample of 50 patients with T2DM was recruited.
- **Inclusion criteria**
  1. have a diagnosis of T2DM
  2. at least 18 years old
  3. able to communicate in Mandarin or Taiwanese
  4. willing to participate in the study

- On the basis of the item analysis results from the pilot study, 3 items with relevance less than 0.3 were removed.

- 35 items remained in the preliminary revised DSMI were scored on a 4-point Likert scale.
DATA COLLECTION

- Participants were recruited from the outpatient department and inpatient ward of a medical center and one outpatient clinic in southern Taiwan

- 237 patients with T2DM participated in the study
Phase 3: Psychometric Evaluation

Validity

- Construct Validity: exploratory factor analysis
- Convergent validity: correlating the DSMI-20 with the diabetes empowerment scale

Reliability

- Internal consistency: Cronbach's alpha coefficient
- Test-retest reliability
  30 volunteers with T2DM completed the questionnaire again 2 weeks after the first test
Results
PARTICIPANT DEMOGRAPHICS

- Mean age was 59.51 ± 12.55 years
- Mean diabetes duration was 9.10 ± 7.84 years
- 57.4% were women
- 78.9% married
- Education level
  - 29.5% elementary education
  - 22.8% senior high
  - 19.8% junior high.
- 59.4% had a family history of T2DM
- 64.6% had additional chronic illnesses
- 48.9% participants did not regularly self-monitor their blood sugar levels
RESULTS OF ITEM ANALYSIS

- 2 items were removed prior to the subsequent construct validity test
  - “Taking medications at the prescribed times”
  - “Taking the prescribed amount of medication”

- Reason for removing
  had low item discrimination (SD < 0.75) and had factor loadings of less than 0.5.
RESULTS OF CONSTRUCT VALIDITY

- After the EFA, the final version of the revised DSMI consist of 20 items
- Covering 4 factors
  - communication with HCPs
  - self-integration
  - self-monitoring of blood glucose
  - problem-solving
- Explained 57.1103% of the total variance
RESULTS OF CONVERGENT VALIDITY

Convergent validity

- The correlation of the DSMI-20 with the diabetes empowerment scale was 0.552 (p = .001)
RESULTS OF RELIABILITY

• The internal consistency (Cronbach’s α) was 0.925 for the total instrument ranged between 0.838 and 0.892 for the 4 factors

• The test-retest reliability with 2-week interval was $r = 0.790$ (p= 0.001)
## EFA Results and Cronbach’s Alpha

<table>
<thead>
<tr>
<th>Factor/Cronbach’s alpha</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1:</strong> Communication with HCPs /Cronbach’s alpha=0.892</td>
<td></td>
</tr>
<tr>
<td>- Comfortable telling HCPs about my struggles in managing diabetes</td>
<td>0.824</td>
</tr>
<tr>
<td>- Comfortable discussing degree of flexibility in treatment plan with HCPs</td>
<td>0.786</td>
</tr>
<tr>
<td>- Collaborating with HCPs to identify reasons for poor control</td>
<td>0.727</td>
</tr>
<tr>
<td>- Comfortable asking HCPs questions</td>
<td>0.709</td>
</tr>
<tr>
<td>- Comfortable discussing the modification treatment plan to fit lifestyle with HCPs</td>
<td>0.675</td>
</tr>
<tr>
<td>- Comfortable asking HCPs about diabetes care resources</td>
<td>0.547</td>
</tr>
<tr>
<td><strong>Factor 2:</strong> Self-integration /Cronbach’s alpha=0.874</td>
<td></td>
</tr>
<tr>
<td>- Considering effect on blood sugar when making food choices</td>
<td>0.907</td>
</tr>
<tr>
<td>- Managing food portions and choices when eating out</td>
<td>0.886</td>
</tr>
<tr>
<td>- Managing food choices to control blood sugar</td>
<td>0.769</td>
</tr>
<tr>
<td>- Managing diabetes and participating in social activity</td>
<td>0.737</td>
</tr>
<tr>
<td><strong>Factor 3:</strong> Self-monitoring of blood glucose /Cronbach’s alpha=0.858</td>
<td></td>
</tr>
<tr>
<td>- Monitoring A1c. to reach goals</td>
<td>0.750</td>
</tr>
<tr>
<td>- Monitoring blood sugar levels to reach goals</td>
<td>0.714</td>
</tr>
<tr>
<td>- Regularly testing my blood sugar levels</td>
<td>0.628</td>
</tr>
<tr>
<td>- Set goals for my blood sugar control</td>
<td>0.567</td>
</tr>
<tr>
<td>- Comparing differences between current and target blood sugar level</td>
<td>0.560</td>
</tr>
<tr>
<td><strong>Factor 4:</strong> Problem-solving /Cronbach’s alpha=0.838</td>
<td></td>
</tr>
<tr>
<td>- Acting in response to symptoms</td>
<td>-0.727</td>
</tr>
<tr>
<td>- Testing blood sugar when feeling sick</td>
<td>-0.691</td>
</tr>
<tr>
<td>- Increase the frequency of blood sugar tests when sick or under great stress</td>
<td>-0.678</td>
</tr>
<tr>
<td>- Making decisions based on experience</td>
<td>-0.637</td>
</tr>
<tr>
<td>- Recognize which signs and symptoms of high or low blood sugar</td>
<td>-0.535</td>
</tr>
</tbody>
</table>

\[a\] Total scale: variance(%) 57.110%; Cronbach’s alpha coefficients 0.925.

\[b\] Represents new items developed in the study.
Discussion and Conclusion
<table>
<thead>
<tr>
<th>DSMI-35 (original version)</th>
<th>DSMI-20 (short form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-integration</td>
<td>Self-integration</td>
</tr>
<tr>
<td>Interaction with health professionals and significant others</td>
<td>Communication with HCPs</td>
</tr>
<tr>
<td>Self-monitoring blood glucose</td>
<td>Self-monitoring blood glucose</td>
</tr>
<tr>
<td>Adherence to recommended regimen</td>
<td></td>
</tr>
<tr>
<td>Self-regulation</td>
<td>Problem solving</td>
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</tbody>
</table>
In the DSMI-20, the factors of “communication with HCPs”, “self-integration”, and “self-monitoring of blood glucose” were retained, but the factor of “adherence to the recommended regiment” was deleted according to the results of factor analysis.

The structures in the DSMI-20 verified by the EFA are same as those in the original DSMI-35 except one factor named “problem-solving” that actually was a result of “self-regulation” (Caltabiano, 2012) in the original DSMI-35.
The revised DSMI consist of 20 items, thus reducing the original DSMI-35 by 43%.

Based on our clinical testing, people with primary education level only spent 5 minutes to complete the instrument without requiring additional clarification.

The mean score of difficulty of the instrument on a 10-point scale (1 = very difficult and 10 = very easy) was 8.02 ± 2.21.
CONCLUSION

- The DSMI-20 is a valid and reliable instrument that is feasible for clinician adopting it to assess the self-management behavior of patient with diabetes.

- EFA is a data-oriented analysis. Confirmatory factor analysis (CFA) is theory-oriented analysis and can truly explore the possible underlying factor structure of a hypothesized measurement model.

- Next step:
  Utilize CFA to examine the construct validity of the DSMI-20 further.
Thank you for listening