Assessment of psychometric properties, cross-cultural adaptation, and translation of the Turkish version of ICU Mobility Scale

Abstract

Background/aim: To carry out the cultural adaptation and translation the ICU Mobility Scale (IMS) into Turkish and research the psychometric properties.

Materials and methods: This study was methodological design. The IMS was translated from English to the Turkish language in a regularised translation process. Two physiotherapists assessed patients independently in coronary intensive care unit. It was assessed that construct validity, intra-rater and inter-rater reliability, and internal consistency of the IMS Turkish version.

Results: A total of 70 intensive care patients were included in the study. The intra-rater and inter-rater reliability of the IMS was excellent. The weighted Kappa value was 0.92 (0.87 – 0.96) for the intra-rater reliability, and 0.87 (0.80 – 0.93) for the inter-rater reliability. There was a significant correlations between the IMS and Functional Status Score for the Intensive Care Unit (r=0.83), Perme Intensive Care Unit Mobility Score (r=0.84), Katz Activities of Daily Living (r=0.73), handgrip strength (r=0.62), knee extension strength (r=0.46) and age (r=-0.44).

Conclusions: This study suggests the IMS Turkish version is reliable and valid scale for assessing functional status and mobility level in ICU patients.

Key words: ICU mobility scale, functional status, intensive care unit
1. Introduction

The intensive care unit (ICU) is special units where close follow-up and treatment of patients are performed in the presence of a life-threatening critical illness [1]. Early mobilization has been established as an important, feasible and safe method to reduce the incidence of ICU-acquired weakness, increase functional capacity, and reduce hospital and ICU stay [2]. Early mobilization is a step by step process from rolling to independently walking to improve recovery and outcomes [3]. Therefore, it is crucial to define the mobility levels of intensive care patients in a way that all healthcare professionals can use [4].

A systematic review demonstrated that a few instruments such as Functional Status Score for the ICU (FSS-ICU), Perme ICU mobility Score, and ICU Mobility Scale (IMS) assess functional status in ICU [4]. However the IMS is the initial instrument that has declared feasibility and interrater reliability for assessing the maximum mobility level of functional status in ICU survivors and the IMS is the most practical scale to evaluate functional status over other scales. [5].

The IMS is a quick and simple method to assess functional status in ICU survivors [5]. It was developed by a multidisciplinary team of researchers and clinicians [5]. Studies support validity, inter-rater reliability and responsiveness of the IMS as a measure of functional status in ICU survivors [5, 6]. The use of IMS in international studies has been increased day by day and translated into different languages [7, 8]. However, there is no Turkish translation of the IMS. It is vital to know the level of early mobilization in the management of intensive care patients. To improve early mobilization of ICU survivors, there is a need for instruments in Turkish. Having an instrument to measure functional
status will increase functional capacity, improve early deficiencies and reduce hospital
and ICU stay. Therefore, the study aimed to carry out the translation and cultural
adaptation of the IMS into Turkish and research the psychometric properties.

2. Materials and methods

2.1 Study design and participant

This study was methodological design. The study was carried out in a 16-bed adult
coronary ICU in Dokuz Eylül University Hospital. Patients who were 18 years old and
over, awake, and had independent activities of daily living before ICU were included in
the study. We excluded participants if they had baseline cognitive or physical impairment
or hemodynamic instability preventing mobility. The study was approved by the
Noninvasive Research Ethics Board of Dokuz Eylül University (No: 3526-GOA,
2017/21-17) and performed following the ethical standards as laid down in the 1964
Declaration of Helsinki (as revised in Brazil 2013). All the participants gave written
informed consent before participation in the study.

2.2 Translation and cross-cultural adaptation

According to a proposed guide, cross-cultural adaptation and translation of the IMS
into the Turkish process were carried out [9]. The process mentioned below has been
followed.

2.2.1 Initial translation

Two forward translations were made of the instrument from the English to the
Turkish by two translators. One of the translators were bilingual (having Turkish as their
mother tongue). While one of the translator was not aware of the study, the other translators was aware of study concepts.

2.2.2 Synthesis of the translations

A synthesis of the two translators' versions were conducted. A written report was prepared.

2.2.3 Backward translation

To be sure that the translation was expressing the same item content as the English version, back translation was performed by two independent translators. They were native English speakers and fluent in Turkish.

2.2.4 Expert committee

The expert committee’s role was to consolidate all the versions of the questionnaire. While forming the expert committee, care was taken to bring together competent people from different area. The expert committee consisted of 14 people in total. These were health professionals (two medical doctors and six physiotherapists), the translators (two forward and two back translators), one Turkish language teacher and one primary school teacher. Pre-final version was prepared by this committee.

2.2.5 Pre-final version

The last stage of adaptation procedure was the pre-test. The pre-final translated version was tested to recommend items for modification or deletion. Recent arrangements have been made.

2.2.6 Final version
The final version was developed by the expert committee. Some minor changes were conducted to make use more understandable. The final Turkish version of the IMS was created.

2.3 Data Collection

Two physiotherapists (>five years of experience in ICU) participating in assessment process received training and instructions on how to assess the Turkish version of the IMS prior to initiation of assessment process. All evaluations were carried out at the third day during the ICU stay. Two physiotherapists evaluated same patients separately for the inter-rater reliability of the IMS on the same day. The IMS were scored by two physiotherapists who blinded to each other. The same patient was assessed by one of the physiotherapists after one hour later if the clinical condition of the patient is similar to the first evaluation for the intra-rater reliability.

The demographic characteristics were recorded. Before the assessments, vital and hemodynamic signs were observed on ICU monitor.

2.3.1 The ICU mobility scale

The IMS is a simple, quick and ordinal scale. It consists of 11 different mobility levels in total. It ranges from passive mobilization (0=lying in bed) to independent mobilization (10= ambulation independently without help). As the IMS score increases, the level of mobility also increases [5].

2.3.2 Functional status score for the intensive care unit

The FSS-ICU has five mobility level (from rolling to walking). Each section is scored between 0 and 7, and the total score is a maximum of 35. As the score increases,
the patient's mobility level also increases. [10]. It has been demonstrated that Turkish version of the FSS-ICU for the Intensive Care Unit instrument is a valid and reliable scale [11].

2.3.3 Perme intensive care unit mobility score

The Perme ICU mobility score contains seven categories and 15 items. It scored from 0 to 32 and a high total score indicates better mobility level [12]. It has been showed that Turkish version of the Perme ICU mobility score is a valid and reliable scale [13].

2.3.4 Peripheral muscle strength

An electronic hand-held dynamometer (Lafayette Instrument Company, Lafayette, Indiana, USA) was used to measure knee extensor muscle strength [14]. The Jamar® hand dynamometer (Patterson Medical, Warrenville, Illinois, USA) was used to assess the handgrip strength [15]. Measurements were three times and average values were recorded.

2.3.5 Katz activities of daily living (The KATZ ADL)

It has six items. Each item is scored as 0 or 1 and the total score range from 0 to 6. As the Katz ADL score increases, the independence of activities of daily living also increases [16]. It has been showed that Turkish version of the Katz ADL is a valid and reliable scale [17].

2.4 Sample Size

The minimum required sample size was calculated as 70 patients in this study. There is no generally acceptable consensus in the literature to calculate the minimum
required sample size for validation studies. It is usually recommended that 2–20 subjects per item are usually recommended [8].

2.5 Statistical analysis

The intra-rater and inter-rater reliability was investigated using the weighted Kappa statistic which was qualitatively interpreted as excellent (>0.8), strong (0.7–0.8), and good (0.6–0.7) [18].

Thirteen pre-defined hypotheses were determined to evaluate the construct validity, including convergent and discriminant. For testing the convergent validity, the following hypotheses were constructed: significant and high correlations between the IMS and (1) the FSS-ICU, (2) Perme ICU mobility, (3) Katz ADL, (4) handgrip strength-right, (5) handgrip strength-left; significant and moderate correlations with (6) knee extension strength-right, (7) knee extension strength-left, and (8) age. For testing the divergent validity, noncorrelations were expected between the IMS and (9) body mass index, (10) respiratory rate, (11) heart rate, (12) systolic blood pressure, and (13) diastolic blood pressure. These hypotheses were based on our clinical observations also supported by the previous studies [6, 11]. The Spearman's rank correlation coefficients (rs) were calculated since the IMS is an ordinal variable. The correlation coefficients were interpreted as low correlation rs<0.30, moderate correlation rs=0.30–0.59, and high correlation rs≥0.60 [19]. Statistical significance was set at p<0.05. Data were analyzed using IBM® SPSS® (Version 22.0. Armonk, NY: IBM Corp.).

3. Results

A total of 70 intensive care patients were included in the study. Most of the participants were male (60%). Table 1 presents the patients’ characteristics and outcomes.
It found that the inter-rater and intra-rater reliability of the IMS was excellent. The weighted Kappa value was 0.92 (0.87 – 0.96) for the intra-rater reliability, and 0.87 (0.80 – 0.93) for the inter-rater reliability (Table 2).

Significant and high correlations were observed between the IMS and the FSS-ICU, Perme ICU mobility, Katz ADL, handgrip strength-right, handgrip strength-left (rs≥0.60, p<0.05). Significant and moderate correlations were observed between the IMS and knee extension strength-right, knee extension strength-left, and age (rs=0.30–0.59, p<0.05).

Nonsignificant correlations between the IMS and body mass index, respiratory rate, diastolic blood pressure, and systolic blood pressure (p>0.05). The IMS and heart rate was significantly and moderately correlated (rs=−0.37, p=0.002). Twelve out of 13 predefined hypotheses were confirmed (92%) indicating that the construct validity of the IMS was good. Table 3 shows the predetermined hypotheses, correlation coefficients of the IMS with other measurements.

4. Discussion

The present study demonstrates the initial report of psychometric properties, cross-cultural adaptation and translation of the IMS in Turkish language. The results of this study showed that the IMS Turkish version has excellent inter-rater and intra-rater reliability, construct validity, and internal consistency.

The IMS is a simple and quick bedside instrument to measure mobility in critically ill patients. In rehabilitation studies in the ICU, mobility milestones (e.g., first time to stand or walk) are commonly used as intermediate, functional endpoints. However, the IMS is a feasible tool with a sensitive 11-point ordinal scale, ranging from lying/passive exercises in bed (score of 0) to independent ambulation (score of 10) [6]. Evidence to support the reliability and face and content validity of the IMS is reported [5]. According
to a previous study investigating the validity and responsiveness of various instruments, the IMS had criterion validity, could predict discharge destination, and could detect change over time from awakening to ICU discharge [20]. Furthermore, the predictive validity of the IMS in relation to 90-day mortality is also reported [1]. It takes less than 1 minute to complete the IMS [5]. Hodgson et al demonstrated that the IMS has high inter-rater reliability with a weighted Kappa (95% confidence interval) of 0.83 (0.76-0.90) among junior and senior physiotherapists in surgical/trauma/medical ICU survivors [5]. Kawaguchi et al showed that the IMS has excellent inter-rater reliability (Cronbach’s alpha coefficient (95% confidence interval) of 0.99) during the evaluation of survivors in one surgical ICU (20 beds) and two clinical ICUs (10 beds) [7]. A recent Spanish validation study of the IMS also showed that the Kappa index demonstrated values excellent for the IMS (Kappa index higher than 0.95) [8]. The Turkish version of the IMS has showed excellent inter-rater reliability in our study. Additionally, to the best our knowledge this is the first study to examine intra-rater reliability of the IMS. The Turkish version of the IMS has showed excellent intra-rater reliability in our study. These results has demonstrated the IMS has excellent inter-rater (agreement between different researchers) and intra-rater reliability (reproducibility of a practical evaluation) in addition to the other psychometric properties [21].

The present study showed that the Turkish version of the IMS demonstrates a good concurrent construct validity with divergent and convergent validity. Twelve out of 13 pre-defined hypotheses were confirmed (92%) indicating that the construct validity of the IMS was good. Tipping et al demonstrated that the IMS has proof of construct validity including convergent (there was a correlation between the IMS and muscle strength, and there was statistically difference in a difference in the IMS score between with and
without ICU-acquired weakness) divergent (there is no correlation between the IMS and weight, and there is no significant difference between male and female) validity [6]. In accordance with the literature, the Turkish version of the IMS demonstrates a good concurrent construct validity.

This study had some limitations. First, although we had enough the minimum required sample size, this study was a single center (coronary ICU) study. Therefore, generalization of results for all patients is reduced. Second, there was a short time interval to evaluate intra-rater reliability. This short time interval between evaluations may affect intra-rater reliability results.

In conclusion, the present study presents the IMS Turkish version is suitable to use in Turkey. This study suggests the IMS Turkish version is reliable and valid scale for assessing functional status and mobility level in ICU patients.

Acknowledgement/disclaimers/conflict of interest

All authors report no conflict of interest that may have influenced either the conduct or the presentation of the research.

Informed Consent

The study was approved by the Noninvasive Research Ethics Board of Dokuz Eylül University (No: 3526-GOA, 2017/21-17) and performed following the ethical standards as laid down in the 1964 Declaration of Helsinki (as revised in Brazil 2013). All the participants gave written informed consent before participation in the study.
1 References


7. Söyler DE. Validity and Reliability Study of the Turkish Version of Perme Intensive Care Unit Mobility Scale. MSc, Mugla Sitki Kocman University, Mugla, TR, 2019


Table 1. Characteristics of participants (n = 70)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>69.65± 10.73</td>
</tr>
<tr>
<td>Sex (male, %)</td>
<td>42 (60)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>26.65± 3.84</td>
</tr>
<tr>
<td>Admission diagnosis (%)</td>
<td></td>
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<tr>
<td>Acute coronary syndrome</td>
<td>38 (54.3)</td>
</tr>
<tr>
<td>Heart failure</td>
<td>11 (15.7)</td>
</tr>
<tr>
<td>Transcatheter aortic valve replacement</td>
<td>11 (15.7)</td>
</tr>
<tr>
<td>Implantable cardiac defibrillator implantation</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>3 (4.3)</td>
</tr>
<tr>
<td>Respiratory rate (breathes/minute)</td>
<td>19.59±3.88</td>
</tr>
<tr>
<td>Heart rate (beats/minute)</td>
<td>81.23±22.06</td>
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<tr>
<td>SBP (mmHg)</td>
<td>117.37±22.40</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>67.68±11.57</td>
</tr>
<tr>
<td>Handgrip strength-right (kg)</td>
<td>23.55±10.46</td>
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<tr>
<td>Handgrip strength-left (kg)</td>
<td>22.80±10.53</td>
</tr>
<tr>
<td>Knee extension strength-right (kg)</td>
<td>14.87±4.63</td>
</tr>
<tr>
<td>Knee extension strength-left (kg)</td>
<td>14.18±4.21</td>
</tr>
<tr>
<td>Perme ICU mobility (score)</td>
<td>21.32±5.09</td>
</tr>
<tr>
<td>Katz activities of daily living (score)</td>
<td>3.74±1.53</td>
</tr>
<tr>
<td>Functional status score for the ICU (score)</td>
<td>24.27±8.04</td>
</tr>
<tr>
<td>ICU Mobility Scale (score)</td>
<td>7.81±2.04</td>
</tr>
</tbody>
</table>
Table 2. Intra-rater and inter-rater reliability of the ICU Mobility Scale

<table>
<thead>
<tr>
<th></th>
<th>Intra-rater reliability [Kappa (95%CI)]</th>
<th>Inter-rater reliability [Kappa (95%CI)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICU Mobility Scale</td>
<td>0.92 (0.87 – 0.96)</td>
<td>0.87 (0.80 – 0.93)</td>
</tr>
</tbody>
</table>

ICU: intensive care unit; ICC: intra-class correlation coefficient; CI: confidence interval.
Table 3. Predetermined hypotheses, correlation coefficients of the ICU Mobility Scale with other measurements

<table>
<thead>
<tr>
<th>Type of validity</th>
<th>Variable</th>
<th>Hypothesis</th>
<th>Result</th>
<th>Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convergent</td>
<td>Functional status score for the ICU</td>
<td>Significant and high correlation</td>
<td>0.83 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Perme ICU mobility</td>
<td>Significant and high correlation</td>
<td>0.84 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Katz ADL</td>
<td>Significant and high correlation</td>
<td>0.73 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Handgrip strength-right</td>
<td>Significant and high correlation</td>
<td>0.62 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Handgrip strength-left</td>
<td>Significant and high correlation</td>
<td>0.62 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Knee extension strength-right</td>
<td>Significant and moderate correlation</td>
<td>0.46 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Knee extension strength-left</td>
<td>Significant and moderate correlation</td>
<td>0.46 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Convergent</td>
<td>Age</td>
<td>Significant and moderate correlation</td>
<td>-0.44 (&lt;0.001*)</td>
<td>Yes</td>
</tr>
<tr>
<td>Divergent</td>
<td>Body mass index</td>
<td>Nonsignificant correlation</td>
<td>0.05 (0.664)</td>
<td>Yes</td>
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<tr>
<td>Divergent</td>
<td>Respiratory rate</td>
<td>Nonsignificant correlation</td>
<td>-0.04 (0.755)</td>
<td>Yes</td>
</tr>
<tr>
<td>Divergent</td>
<td>Heart rate</td>
<td>Nonsignificant correlation</td>
<td>-0.37 (0.002*)</td>
<td>No</td>
</tr>
<tr>
<td>Divergent</td>
<td>Systolic blood pressure</td>
<td>Nonsignificant correlation</td>
<td>0.16 (0.187)</td>
<td>Yes</td>
</tr>
<tr>
<td>Divergent</td>
<td>Diastolic blood pressure</td>
<td>Nonsignificant correlation</td>
<td>0.02 (0.851)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Statistically significant.

ADL: activities of daily living; ICU: intensive care unit.