Reliability and Validity of Spinal Cord Independence Measure of Mongolian Version (mSCIM)

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Abstract

Aims: To evaluate the reliability and validity of the Mongolian Version of the Spinal Cord Independence Measure (mSCIM).

Methods: Spinal cord independence measure III (SCIM III) was translated into Mongolian and data collected from 40 patients with spinal cord injury (SCI) were analysed. Reliability and validity were analysed in 30 patients, and the responsiveness was tested in 10 patients at admission to rehabilitation and discharge.

Results: Percent agreement and Kappa values between two raters were 83–100% and 0.70–1.00, respectively, in all mSCIM items. Intraclass correlations were shown to be above 0.99 within subscales and total score, and Cronbach’s alpha was above 0.75 aside from the respiration and sphincter subscale. The correlation between mSCIM and motor parts of the Functional Independence Measure (mFIM) was above 0.86 in each rater. The mSCIM showed more responsiveness to functional changes for patients at discharge than mFIM.

Conclusions: The SCIM III scale was translated into Mongolian, high inter-rater reliability and validity was shown. In addition, more sensitive to changes in function compared with mFIM. Furthermore, we justified the use of mSCIM in the field of rehabilitation, which might be easier for rehabilitation staff to use, because it is in their mother language.

I. Introduction

Mongolia is a country with ancient and nomadic traditions. Mongolian health care and human resources have been developing well since the 1990s, with a ratio of 3.94 doctors per 1,000 population in Ulaanbaatar (capital city). However, the number of rehabilitation staff is inadequate compared with the population, such as only over 200 rehabilitation doctors by the Mongolian Society of Physical Medicine and Rehabilitation,¹ and 198 physical therapists in Mongolia.² Moreover, Dorjbal et al. reported that people with spinal cord injury (SCI) had limited activities, community restrictions, and a lack of rehabilitation services in Mongolia.³ Although, there is no definite statistical data has been observed for SCI patients. The disability prevalence rate is 3.9% in the population (108,071 individuals), and physical disability is more prevalent than mental disability.⁴ SCI is a severe disease, leads to long-term disability. Before returning to community, prolonged stay in hospital and continued rehabilitation is necessary. However, the hospitalisation period in Mongolia is short, with an average of 8.7 and 7.6 days in urban and rural areas, respectively.⁵ In addition, Mongolian version of activities of daily life (ADL) scales are few. Functional independence measure (FIM) and modified Barthel Index (MBI) are commonly used for SCI patients. However, the previous study reported that the MBI has been used in non-SCI populations and little validation in patients with
SCI. The FIM was developed in 1980, since that it has been widely used including SCI patients. Validity and reliability of the FIM for measuring the burden of care is more and lack in evaluation of sphincter management and does not evaluate the respiratory management. currently, the Spinal Cord Independence Measure (SCIM) is a highly recommended to specialised functional scale for patients with SCI. Anderson K et al. reported that the SCIM represented the more sensitive than FIM scale and valid measure for individuals with SCI. Revisited two times, the last version of SCIM III is composed of 19 items in three subscales: self-care, respiration and sphincter management, and mobility. This scale has been translated into many languages such as Italian, Turkish, Brazil, Spanish, Thai, and Japanese. Also, those versions were studied reliability and validity, shown high results. In the present study, we assessed the reliability and validity of the Mongolian version of the SCIM (mSCIM).

II. Materials and Methods

Ethical approval for this study was obtained from the Research Ethics Board of the Mongolian National University of Medical Sciences (No. 2019/5-06). We got permission from the copyright holder to reprint before translations.

Translation and cross-cultural adaptation of mSCIM followed a previous study. Translation into Mongolian: The English version of the SCIM III was translated into Mongolian by two physicians (D.Z and B.B) who were native Mongolian speakers and were fluent in English with many experiences that could be preferably translated into Mongolian. Translation was independently performed, and the results were then compared and discussed to final version was reached. Back translation from Mongolian to English: The original and backward-translated versions were reviewed and compared by rehabilitation doctors, nurses, and physical therapists, which were not familiar with the scale. None of the items were excluded. Review of the Mongolian translation: The original and backward-translated versions were reviewed and compared by rehabilitation doctors, nurses, and physical therapists, which were not familiar with the scale. None of the items required changes. Finally, the scale was refined before data collection (Fig. 1).

2.1. Subjects

In the present study, data were collected from four venues (two rehabilitation departments, the National Traumatology and Orthopaedics Centre and National Rehabilitation Centre; two non-government organisations, the Universal Progress Independent Living Centre and Mongolian National Wheelchair Users Association). Data collection was performed from June to October 2020. A total of 40 patients with SCI participated in this study. Eligible participants had any level of SCI, traumatic or non-traumatic origin, over 16 years of age, and did not have any cognitive impairment. Concomitant neurological diseases may alter the functional level previously established by SCI. Before assessment, the evaluators were explained about the study, and asked to participation in study. Then, participant or family member signed the consent form.

2.2. Procedure

First author of present study explained about the mSCIM scale to all evaluators before data collection. All evaluations were performed by three physical therapists. The reliability and validity were examined by two physical therapists in 30 patients with SCI (Group A). The evaluators have over 6 to 8 years of clinical experience. The evaluators made assessment independently within a day and blinded to the result of other assessment. Participants were assessed with mSCIM, and FIM as measured by observation and interviews with general information. The responsiveness was assessed by one of the three physical therapists at admission and discharge of the rehabilitation in 10 patients with SCI (Group B). As well, she has about 8 years’ experience and who has mainly worked with orthopaedic patients.

2.3. Data analysis

Inter-rater reliability was evaluated by following methods: a) total agreement, kappa coefficient between two raters concerning each item, which confirm that the result is independent of the rater and correlates with the patient’s situation. To obtain total agreement, calculated the difference between raters then counted the number of zeros in the first. Secondly, dividing the number of zeros by number of items. The result is directly interpreted as the percent of data that are correct. Interpreted to Cohen’s Kappa, 0.21–0.40 indicate fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 substantial agreement, and 0.81–1.00 almost perfect agreement. b) intraclass correlation coefficient (ICC (3,1)), which estimated the proportion of variability between the participants within the total score variability. An ICC of excellent reliability above 0.90, high reliability 0.70–0.90, moderate reliability 0.50–0.70 and low reliability below 0.50. Internal consistency was analysed using Cronbach’s alpha. The desired Cronbach’s alpha is above 0.70. Validity was tested using the Spearman’s correlation coefficient calculated by matching each mSCIM subscale with FIM motor subscale (mFIM). The self-care, sphincter control, transfers and locomotion subscales are included in motor part of FIM. In detail by items in subscale, the eating, grooming, bathing, dressing-upper body, dressing-lower body, toileting items are in self-care subscale; the bladder and bowel management items are in sphincter control subscale; the bed/chair/wheelchair transfer, toilet transfer, tub/shower transfer items are in transfer subscale; walk/wheelchair, stairs items are in locomotion subscale. When correlation between mSCIM and mFIM was matched self-care of mSCIM to self-care of mFIM, respiration and sphincter management of
Өгөгдөл арчилх
1. Хонолол (хөрх, сав онгоц, элэх, хоолно амд, хуш, шигээ нүүртэй, вис барих)

2. Усанд ором (гавсанд, утас, хашдын бөгөөр, хүн нөх, хоол)

3. Хувцаслал (хүч, гула, байгын ор, оле, их, хаш, дугаар)

4. Арнан цээвэр (ээр нүүр нүүр, нүүр нүүр, гүй нүүр, нүүр нүүр, нүүр нүүр)

5. Амсагал

6. Давсгүүл, гэдэсний менежмент

7. Гэдэсний менежмент

Fig. 1
8. Бие засах ороо оңгоолж (умуу, босоо эрэгтэй аримаан цэцэрлэг, овогларын уед хуучина ангилаа, аримаан цэцэрлэг шааны, зөөлөг шааны)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, умээ, босоо эрэгтэй оромгоо барилга жишээ бийгүй
 2. Хос нэгийг жолоо шаардагт, босоо эрэгтэй оромгоо бийгүй оролцогч босоо
 3. Хөндий болон хоногийн бие засч чадна, тэгээд ордонд зөөлөг уснаас хөргөлзөгч ашиглан
 4. Ямчар чоногдоо уснаас хөргөл зөөлөгч ашиглагын дагуул гяхт хөөгөн чадна

ХӨСГИЙН ОННОО (0-40)

9. Орон дээр хөлбөх болол бие засах ороо
 0. Бүх үйл ажиллахад тусламж хүртэл бийрмэл хэлэлцээгээр оролцоо дээр өгөгдөл, бүхий дээд хоёр оролцоо дээр өгөгдөл, бэлэн баригч бусдас бүрэн хамагийт
 1. Бүх үйл ажиллахад бусдас бүрэн туслахчид оролцогч бийгүй
 2. Хөндий болон хоногийн бие засч чадна, бүх үйл ажиллахад бийгүй оролцогч бийгүй

10. Шилжих: орноос-таржсалаа (таржсалаа түлхүү, хэлнээ танилцуулыг өгөгч, гарын таны идэг, анхааралтай зөөлөг давтагч, гяхт хөөгөн дагуул)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, зөөлөг давтагч, идэг давтагч (гяхт хөөгөн дагуул)
 2. Бие дээр өгөгдөг (зөөлөг таарлагч хөргөлгөн)

11. Шилжих: таарлагч-суулуул (таржсалаа бусдас болон би оролцогч, хэлнээ танилцуулыг өгөгч, гарын таны идэг, анхааралтай зөөлөг давтагч, гяхт хөөгөн дагуул)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, зөөлөг давтагч, идэг давтагч (гяхт хөөгөн дагуул)
 2. Бие дээр өгөгдөг (зөөлөг таарлагч хөргөлгөн)

Алхах ордонд (байшин дотор, гадаад өрөн, зөөлөг гадаадууд алхах)

12. Байшины дотор алхах
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, зөөлөг давтагч, идэг давтагч (гяхт хөөгөн дагуул)
 2. Бие дээр өгөгдөг (зөөлөг таарлагч хөргөлгөн)

13. Дунд зэрэгийн зайд алхах (10-100 метр)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, зөөлөг давтагч, идэг давтагч (гяхт хөөгөн дагуул)
 2. Бие дээр өгөгдөг (зөөлөг таарлагч хөргөлгөн)
 3. Алхах уед зөөлөг дээр шаардагт, зөөлөг давтагч (гяхт хөөгөн дагуул)
 4. Алхах уед зөөлөг дээр шаардагт, зөөлөг давтагч (гяхт хөөгөн дагуул)
 5. Сүүлээ таарлагч зөөлөг 3 гар тантай ахлаж (гяхт хөөгөн дагуул)
 6. Бие дээр таарлагч зөөлөг 3 гар тантай ахлаж (гяхт хөөгөн дагуул)

14. Гадаад өрөн алхах (100 метрээс дээд зайд)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, зөөлөг давтагч, идэг давтагч (гяхт хөөгөн дагуул)
 2. Бие дээр өгөгдөг (зөөлөг таарлагч хөргөлгөн)
 3. Алхах уед зөөлөг дээр шаардагт, зөөлөг давтагч (гяхт хөөгөн дагуул)
 4. Алхах уед зөөлөг дээр шаардагт, зөөлөг давтагч (гяхт хөөгөн дагуул)
 5. Сүүлээ таарлагч зөөлөг 2 гар тантай ахлаж (гяхт хөөгөн дагуул)
 6. Бие дээр таарлагч зөөлөг 2 гар тантай ахлаж (гяхт хөөгөн дагуул)

15. Шатарга орсоо, уруулаа
 0. Шатарга орсоо, уруулаа (таржсалаа)
 1. Бусдас бүрэн хамагийт
 2. Бие дээр таны идэг, анхааралтай зөөлөг давтагч (гяхт хөөгөн дагуул)
 3. Бие дээр таны идэг, анхааралтай зөөлөг давтагч (гяхт хөөгөн дагуул)

16. Шилжих: таарлагч-маанз (маанз бусдас түлхүү, гарын таны идэг, анхааралтай зөөлөг давтагч)
 0. Бусдас бүрэн хамагийт
 1. Хос нэгийг жолоо шаардагт, бусдас бүрэн зөөлөг давтагч, таарлагч орсон (гяхт хөөгөн дагуул)

17. Шилжих: гадаад-таржсалаа
 0. Туслахчид шаардагт
 1. Бие дээр таны идэг, анхааралтай зөөлөг давтагч (гяхт хөөгөн дагуул)

ХӨСГИЙН ОННОО (0-40)

НИЙТ ОННОО (0-100)
mSCIM with sphincter control of mFIM, mobility (room and toilet) of mSCIM with transfers of mFIM, and mobility (indoors and outdoors) of mSCIM with locomotion of mFIM. 6,19 

Responsiveness to change estimated by McNemar test comparing mSCIM subscales score to FIM items that match those subscales. The statistical analysis was performed with SPSS 25 for Mac OSX. The level of significant differences was set at $P < 0.05$.

### III. Results

#### 3.1. Participants’ characteristics

A total of 40 patients with SCI comprised the study participants (Table 1). The mean age was 38.2 and 35.4 years in each group, respectively. With respect to gender, males were more than females in each group, and 60% and 90% of groups A and B, respectively. Traumatic injury was the most leading cause of injury in both groups (76.7% and 100%, respectively). With respect to the level of injury, paraplegia (73.3%) was more than tetraplegia in the group A, and the same proportion was in the group B (Table 1). The mean days of hospitalisation and rehabilitation were 15.1 in the group A and 9.9 days in the group B, respectively.

#### 3.2. Reliability, validity, and responsiveness

Inter-rater reliability was evaluated in 30 patients and was analysed using percent agreement and kappa values between raters. The total agreement values ranged from 83 to 100%, and kappa values ranged between 0.70 and 1.00 for all mSCIM items. The full agreement (100%) and kappa values (1.00) were shown in respiration, mobility indoors, mobility moderate distance, mobility outdoors, and stair management of mSCIM items (Table 2). ICC values were above 0.991 for the total score and for all subscales of mSCIM (Table 3).

Internal consistency was evaluated using Cron-

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### Table 1 Participants’ characteristics

| Items                        | Group A | Group B |
|------------------------------|---------|---------|
| Number                       | 30      | 10      |
| Age (years)                  | 38.2 ± 8.2 | 35.4 ± 13.1 |
| Gender (n, %)                | Male    | 18 (60.0) | 9 (90.0) |
|                              | Female  | 12 (40.0) | 1 (10.0) |
| Cause of injury (n, %)       | Traumatic | 23 (76.7) | 10 (100.0) |
|                              | Non-traumatic | 7 (23.3) | —        |
| Level of injury (n, %)       | Paraplegia | 22 (73.3) | 5 (50.0) |
|                              | Tetraplegia | 8 (26.7) | 5 (50.0) |

Group A: Reliability and validity were assessed; Group B: Responsiveness was assessed; n: number

### Table 2 Total agreement and kappa coefficient between raters (n = 30)

| Items                                | Total agreement (%) | Kappa values |
|--------------------------------------|---------------------|--------------|
| Self-care                            |                     |              |
| Feeding                              | 93                  | 0.83         |
| Bathing upper body                   | 87                  | 0.77         |
| Bathing lower body                   | 83                  | 0.70         |
| Dressing upper body                  | 87                  | 0.80         |
| Dressing lower body                  | 83                  | 0.74         |
| Grooming                             | 90                  | 0.80         |
| Respiration and Sphincter management |                     |              |
| Respiration                          | 100                 | —            |
| Bladder management                   | 90                  | 0.85         |
| Bowel management                     | 90                  | 0.86         |
| Use of toilet                        | 83                  | 0.78         |
| Mobility (room and toilet)           |                     |              |
| Mobility in bed                      | 93                  | 0.86         |
| Transfer from bed to wheelchair      | 93                  | 0.89         |
| Transfer from wheelchair to toilet   | 97                  | 0.95         |
| Mobility (indoors and outdoors)      |                     |              |
| Mobility indoors                     | 100                 | 1.00         |
| Mobility moderate distance           | 100                 | 1.00         |
| Mobility outdoors                    | 100                 | 1.00         |
| Stair management                     | 100                 | 1.00         |
| Transfer from wheelchair to car      | 87                  | 0.80         |
| Transfer from ground to wheelchair   | 93                  | 0.86         |

### Table 3 Intraclass correlation coefficient within mSCIM subscales and total scores (n = 30)

| mSCIM subscales                  | ICC      | 95% CI |
|----------------------------------|----------|-------|
| Self-care                        | 0.993    | 0.984-0.996 |
| Respiration and sphincter manage| 0.996    | 0.991-0.998 |
| Mobility (room and toilet)       | 0.991    | 0.981-0.996 |
| Mobility (indoors and outdoors)  | 0.999    | 0.999-1.000 |
| Total                            | 0.998    | 0.997-0.999 |

mSCIM: Mongolian version of the spinal cord independence measure; ICC: intra-class correlation coefficient; CI: confidence interval

### Table 4 Internal consistency (Cronbach’s α coefficient) within subscales (n = 30)

| mSCIM subscales                  | Rater 1 | Rater 2 |
|----------------------------------|---------|---------|
| Self-care                        | 0.92    | 0.91    |
| Respiration and sphincter manage| 0.57    | 0.59    |
| Mobility (room and toilet)       | 0.75    | 0.78    |
| Mobility (indoors and outdoors)  | 0.91    | 0.91    |
| Total                            | 0.75    | 0.76    |
Spinal Cord Independence Measure of Mongolian

Table 5  mSCIM and mFIM scores and the validity of mSCIM and mFIM subscales by Spearman correlation by each rater  \((n=30)\)

| Subscales                              | mSCIM score | mFIM score | Spearman | P value |
|---------------------------------------|-------------|------------|----------|---------|
| Self-care 1                           | 13.87 ± 5.78| 31.17 ± 10.64| 0.94    | p<0.01 |
| Self-care 2                           | 13.97 ± 5.77| 32.00 ± 10.75| 0.84    | p<0.01 |
| Respiration and sphincter management 1| 26.00 ± 10.57| 7.40 ± 4.26| 0.91    | p<0.01 |
| Respiration and sphincter management 2| 25.57 ± 10.53| 6.77 ± 4.17| 0.86    | p<0.01 |
| Mobility (room and toilet) 1          | 7.20 ± 3.54| 13.13 ± 6.89| 0.87    | p<0.01 |
| Mobility (room and toilet) 2          | 7.30 ± 3.47| 13.37 ± 6.85| 0.91    | p<0.01 |
| Mobility (indoors and outdoors) 1     | 6.27 ± 7.75| 3.77 ± 2.60| 0.86    | p<0.01 |
| Mobility (indoors and outdoors) 2     | 6.20 ± 7.76| 3.80 ± 2.91| 0.84    | p<0.01 |
| Total score 1                         | 53.33 ± 22.34| 55.47 ± 21.40| 0.94    | p<0.01 |
| Total score 2                         | 53.03 ± 22.42| 55.93 ± 21.65| 0.95    | p<0.01 |

\(\text{Mean} \pm \text{SD}; \text{mFIM}: \text{motor parts of the functional independence measure}; 1: \text{first rater}; 2: \text{second rater}\)

Table 6  Sensitivity to functional changes between admission and discharge, of mFIM and mSCIM within subscales  \((n=10)\)

| Changes identified by mFIM | No | Yes | Total |
|---------------------------|----|-----|-------|
| **Self-care**             | No | 6   | 6     |
|                           | Yes| 0   | 4     |
|                           | Total| 6 | 4 | 10 |
| McNemar’s test            | P = 1.00 |
| **Respiration and sphincter management** | No | 6   | 4     |
|                           | Yes| 0   | 10    |
|                           | Total| 6 | 4 | 10 |
| McNemar’s test            | P = 0.13 |
| **Mobility (room and toilet)** | No | 7   | 1     |
|                            | Yes| 0   | 2     |
|                            | Total| 7 | 3 | 10 |
| McNemar’s test            | P = 1.00 |

bach's \(\alpha\) coefficient. Each subscale indicated above 0.75 and 0.78 by the first and second rater. On the other hand, the respiration and sphincter management subscales were 0.57 and 0.59, respectively (Table 4). The mSCIM and mFIM correlations were measured using Spearman rho correlation coefficient to determine the validity. The results by each subscale were 0.86-0.94 and 0.84-0.91 for the first and second rater, respectively. In addition, total score correlation was 0.94 and 0.95 in first and second rater. By the score of each scale, mSCIM were 13.87 and 13.97, and the mFIM were 31.17 to 32.00 in the self-care subscale by each rater. In the respiration and sphincter management subscale, mSCIM were 26.00 and 25.57, and the mFIM were 7.40 and 6.77 by each rater. In the mobility (room and toilet) subscale, mSCIM were 7.20 and 7.30, and mFIM were 3.77 and 3.80 by each rater. The total scores were 53.33 and 53.03 in mSCIM, and the mFIM were 55.47 and 55.93 by each rater (Table 5).

Further, Responsiveness to functional changes at admission to rehabilitation and discharge were analysed in 10 patients using McNemar's test. In the result, the mSCIM was found to be more sensitive than mFIM to changes in function for SCI patients. For example, mFIM showed changes in self-care, and mobility (room and toilet) whereas the mSCIM determined improvement in self-care, respiration, and sphincter management, and mobility (room and toilet) (Table 6).

Table 6  Sensitivity to functional changes between admission and discharge, of mFIM and mSCIM within subscales  \((n=10)\)

| Changes identified by mFIM | No | Yes | Total |
|---------------------------|----|-----|-------|
| **Self-care**             | No | 6   | 6     |
|                           | Yes| 0   | 4     |
|                           | Total| 6 | 4 | 10 |
| McNemar’s test            | P = 1.00 |
| **Respiration and sphincter management** | No | 6   | 4     |
|                           | Yes| 0   | 10    |
|                           | Total| 6 | 4 | 10 |
| McNemar’s test            | P = 0.13 |
| **Mobility (room and toilet)** | No | 7   | 1     |
|                            | Yes| 0   | 2     |
|                            | Total| 7 | 3 | 10 |
| McNemar’s test            | P = 1.00 |

IV. Discussion

In Mongolia, medical care has been improving; however, the rehabilitation field has some complications that require more rehabilitation services for patients with SCI. The SCIM III, a specialised scale for SCI patients, was translated into Mongolian, and the final Mongolian version (mSCIM) was reviewed by the rehabilitation staff. Moreover, the reliability and validity for participants with SCI injury were evaluated. In the result, the total agreement and kappa values ranged between 83-100% and 0.70-1.00 for all items of the mSCIM between raters. Based on Cohen’s kappa guideline, present study results were acceptable.17 In the present study, all evaluators were physiotherapists. However, Catz A et al., Itzkovich M et al., and Anderson KD et al. selected the evaluators by various professions such as physicians, occupational therapists, nurses, and the physiotherapists. In the comparison of total agreement result with those studies. Above 80% agreement was for 12 of the 16 items in the SCIM I, 13 of the 19 items in the SCIM III, 8 of the 19 items in the US multi-center study.20 Our study indicated higher agreement compared with previous studies. Thai version reported that physical therapist might have difficulty in assessing respiration and sphincter management.14

The subjects of group A who had no problem of respiration received a full score for mSCIM. It might be related to result in the present study. As well, this scale
presented high reliability when used by health professionals with different levels of experience and backgrounds.\textsuperscript{12}

Regarding the ICC result, it was above 0.991 (0.981–0.996, 95% CI) within subscales and total scores. In the previous study of SCIM III,\textsuperscript{9} Thai,\textsuperscript{9} Spanish,\textsuperscript{11} Italian (at discharge),\textsuperscript{10} and Brazilian\textsuperscript{12} versions showed high ICC values greater than 0.91 for all subscales and total score. Morrow et al. reported that a small sample size has a large standard error and indicates an unacceptable level of measurement error.\textsuperscript{21} Regarding to small sample size with previous studies, Thai version was shown higher than 0.92 (0.815–0.970, 95% CI, n = 16),\textsuperscript{14} the Spanish version was ranged between 0.7–0.94 (n = 35) at admission to rehabilitation and discharge,\textsuperscript{13} and Japanese\textsuperscript{11} version was higher than 0.79 (n = 12) in all subscales and total score.\textsuperscript{19} From this, our study was higher than previously reported small sampled study.

In present study, each subscale of internal consistency resulted in over 0.75 Cronbach’s alpha and approved accepted limit. Besides the respiration and sphincter management subscales, which had poor internal consistency 0.57 and 0.59 reported by each rater. Result of similar studies on internal consistency, the original study (SCIM III) demonstrated more than 0.70 Cronbach’s alpha and other versions were ranged (Cronbach’s alpha = 0.50–0.65).\textsuperscript{9,11,14,19} Thai\textsuperscript{12} and Turkish\textsuperscript{11} versions ranged between 0.50 to 0.57, and Japanese\textsuperscript{11} version was shown 0.63 to 0.65, respectively. It explained that despite the relevance of respiration assessment in patients with SCI, the results show that this item is not clearly related to the sphincter management subscale.\textsuperscript{9,22}

Regarding the validity result, mSCIM and mFIM showed high correlation. The similar result was shown with the previous studies.\textsuperscript{10,11,19} The Italian and Spanish versions indicated the validity of FIM at admission to rehabilitation and discharge. The results ranged between 0.81 to 0.98 in Italian version, and 0.81 to 0.94 in Spanish version in each subscale.\textsuperscript{10,11} In the present study, validity method was supported by previous study of Japanese version. The Japanese version showed correlation above 0.90 with mFIM in each subscale. In addition, correlation between mSCIM and mFIM subscale’s score was reported to be widely different.\textsuperscript{19} In the present study, self-care, and mobility (indoors and toilet) scores had observable differences between mFIM and mSCIM, too.

Secondly, the original version (SCIM III) showed high correlation with FIM suggesting that both FIM and SCIM could be appropriate for evaluation of SCI patients.\textsuperscript{9} Nevertheless, there were differences in respiration and sphincter management and mobility indoors and outdoors subscales it illustrated by responsiveness. We could not demonstrate this because validity and responsiveness targets were different in this study. In addition, most of the participants had paraplegia and period was long after injury. They had no problems in mobility in bed, and respiration management and did not use electronic wheelchairs.

Responsiveness was assessed in 10 patients with SCI. The results showed that the mSCIM had more changes in the respiration and sphincter management, and mobility in bed items than FIM. Moreover, most patients in this group had no changes in the function of mobility indoors and outdoors. The previous study, the original version (SCIM III) demonstrated responsiveness in the sphincter and mobility indoors/outdoors. US multi-center study reported that SCIM is more responsive to changes in respiration and sphincter management than FIM.\textsuperscript{20} The sphincter and mobility indoor/outdoor areas might be high relative to in everyday tasks in functional areas for SCI patients.\textsuperscript{9} The mean days of hospitalisation and rehabilitation were 15.1 and 9.9 days, respectively. Baast et al. reported that the mean day of hospitalisation in urban areas was 8.7 days,\textsuperscript{7} whereas this study had a longer hospitalisation period, although the mean day of rehabilitation was 9.9 days, including weekdays. In addition, Mongolians had shorter hospitalisation period than other countries,\textsuperscript{23} even in patients with SCI. For this reason, monitoring the significant changes in the function of mobility (indoors and outdoors) was not possible in the present study.

This study has a few limitations. In the translation procedure, there were no differences in content comparison between back translation of mSCIM and original version of SCIM III. Furthermore, reviewed by rehabilitation staffs but back translated mSCIM was not checked by copyright holder. Owing to the spread of COVID–19, data collection was delayed and impacted the sample size. Following the reduction in the number of contact patients, responsiveness was evaluated by one rater in acutely injured patients with SCI. The evaluators were physical therapists, who further cooperated with other staff, such as nurses and rehabilitation physicians.

V. Conclusions

Good agreement and high inter-rater correlation was shown between raters. Additionally, mSCIM demonstrated its superior sensitivity to changes in function compared with FIM for SCI patients with short period hospitalisation. The findings of the present study supported the validity and reliability of mSCIM and justified the use of mSCIM in the rehabilitation field, which might be easier for rehabilitation staff to use, because it is in their mother language.

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Declaration of Interest Statement

The authors report no conflicts of interest.
Spinal Cord Independence Measure of Mongolian

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