Research Article

Lack of knowledge and training are the major obstacles in application of the Spinal Cord Independence Measure (SCIM) in China

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Objective: To investigate the use of functional outcome measurements after spinal cord injury (SCI) in current clinical practice and to explore the knowledge about the Spinal Cord Independence Measure (SCIM) among SCI physicians in China, and to find facilitators for a broader utilization of SCIM.

Design: A survey-based study.

Setting: SCI workshops at Peking University.

Participants: 125 Chinese SCI physicians attending annual workshops in two consecutive years.

Interventions: Not applicable.

Outcome measures: A questionnaire was administered. The following items were included: whether functional outcome measurement for SCI individuals was performed and with which assessment tool(s); what items should be included in the assessment; whether they knew about the SCIM, its latest version, the Chinese translation, and if so from what source; the possible reasons why SCIM was not implemented in clinical practice; and whether training before using the SCIM was needed, and the training method preferred.

Results: Among these physicians, 84.8% performed functional outcome measurement for individuals with SCI, but only 29.6% of attendees were aware of the SCIM and 20.8% had used it. Lack of training was the major reason why SCIM was not used in clinical practice. Furthermore, 74.4% of the physicians felt they needed formal training before using the SCIM.

Conclusion: The use of SCIM is limited in clinical practice in China, which is mainly attributed to lack of knowledge and training. Formal training on the use of the SCIM is essential for its dissemination and will improve functional SCI outcome measurement in China.

Keywords: Spinal cord injury, Functional outcome measurement, Survey, Spinal Cord Independence Measure (SCIM)

Introduction

The assessment of functional capacity is of high relevance in persons with spinal cord injury (SCI) as it provides information on the person's ability to perform activities of daily living and his/her mobility.¹⁻³ Several specific tools have been used to assess functional capacity and disability in individuals with SCI in both clinical practice and scientific research,^{1,2} such as Functional Independence Measure (FIM), Spinal Cord Independence Measure (SCIM), Walking Index for Spinal Cord Injury (WISCI), Quadriplegia Index of

Function (QIF), Modified Barthel Index (MBI), Timed Up & Go (TUG), 6-min walk test (6MWT), and 10-m walk test (10MWT). Among these measures, SCIM is one of the most widely accepted scales that is specifically designed for the SCI population to reflect the general status of functional independence in daily living.

SCIM was developed in 1997 and revised in 2002.^{4,5} The latest version, SCIM III, was updated and published in 2007.⁶ After its introduction into clinical practice SCIM III has been investigated in several studies not only for its validity and reliability,⁷⁻⁹ but also for the determination of minimal clinically important difference (MCID).¹⁰ The results indicated that SCIM III is reliable and valid for assessment of functional outcome in individuals with SCI. Hence, it has also

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become one of the most frequently used research tools for assessing response to treatments in individuals with SCI around the world. As SCIM is more and more widely used, the standardized data collection will hopefully lead to comparability of information that enables better communication between health professionals from different settings.

While SCIM III was originally published in English,⁶ it has already been translated into several other languages. Reliability and validity of these translated versions have been evaluated.^{11–15} The self-report version of SCIM has also been developed and translated into several languages.^{16,17} However, although the Chinese version has been available since October 2007,¹⁸ it has not been well used. Information regarding the knowledge and attitude toward SCIM among Chinese SCI physicians is still limited. To promote the dissemination of SCIM and to finally contribute to a standardized assessment of functional outcomes of individuals with SCI in China, it is of interest to find possible reasons that impede the use of SCIM in China.

In this study, the knowledge and attitude toward SCIM, as well as the current utilization of functional outcome measurement in clinical practice were investigated with a questionnaire among Chinese SCI physicians. The necessity of formal training before using SCIM was explored. The results of the study are expected to reveal the current obstacles for application of SCIM, and to provide possible ways for bridging the gaps in the utilization of SCIM and functional outcome measurement of individuals with SCI in China.

Methods

A questionnaire on the use of functional outcome measurement in individuals with SCI was completed by all 125 Chinese physicians who attended one of the two independent national SCI workshops in Beijing

Table 1 The current clinical practice regarding use of functional outcome measurement for individuals with SCI (n = 125).

Functional outcome measurement used for individuals with SCI	n (%)
NO	19 (15.2%)
YES	106 (84.8%)
<i>If YES, Measures (Multiple choices, n = 106)</i>	
Modified Barthel Index (MBI)	73 (68.9%)
Functional Independence Measure (FIM)	70 (66.0%)
Spinal Cord Independence Measure (SCIM)	22 (20.8%)
10-meter walk test (10MWT)	20 (18.9%)
6-min walk test (6MWT)	13 (12.3%)
Timed Up and Go test (TUG)	8 (7.6%)
Walking Index for Spinal Cord Injury (WISCI)	8 (7.6%)
Other	1 (0.9%)

SCI, spinal cord injury.

(Sept 2015 and July 2016). These physicians all worked in specialized SCI inpatient rehabilitation centers in urban settings, which represented the more populated provinces.

The questionnaire (Appendix 1) was developed to investigate the following aspects with regard to SCIM application and functional outcome measurement after SCI: (i) the situation regarding current practice; (ii) the knowledge about the SCIM; and (iii) the attitudes to training before using the SCIM.

Q1 and Q2 are designed to investigate whether the clinicians perform functional outcome measurement for individuals with SCI (Q1) and the measures they used (Q2). Considering that more than one tool may be used in the clinical practice, Q2 was allowed for multiple choices. The purpose of Q3 is to investigate which of the 19 SCIM item(s) are considered necessary for the assessment of functional capacity.

Q4 to Q8 aim to explore the knowledge about SCIM among Chinese physicians. The following details regarding knowledge about SCIM are included: the source for knowledge of SCIM (Q5), the latest version used (Q6), the possible reasons why SCIM is not implemented in clinical practice (Q7), and knowledge of the Chinese translation of SCIM (Q8).

Q9 and Q10 are related to the attitudes towards training before using the SCIM, and the preferred training method.

Table 2 The opinion on items used in the functional outcome measurement (n = 125).

Items	Necessary n (%)	Unnecessary n (%)
Feeding	118 (94.4%)	7 (5.6%)
Bathing - upper body	101 (80.8%)	24 (19.2%)
Bathing - lower body	94 (75.2%)	31 (24.8%)
Dressing - upper body	116 (92.8%)	9 (7.2%)
Dressing - lower body	113 (90.4%)	12 (9.6%)
Grooming	116 (92.8%)	9 (7.2%)
Respiration	88 (70.4%)	37 (29.6%)
Sphincter management – bladder	110 (88.0%)	15 (12.0%)
Sphincter management – bowel	100 (80.0%)	25 (20.0%)
Use of toilet	110 (88.0%)	15 (12.0%)
Mobility in bed	112 (89.6%)	13 (10.4%)
Transfers: bed - wheelchair	115 (92.0%)	10 (8.0%)
Transfers: wheelchair - toilet - tub	108 (86.4%)	17 (13.6%)
Mobility indoors	109 (87.2%)	16 (12.8%)
Mobility moderate distance (10-100 meters)	98 (78.4%)	27 (21.6%)
Mobility outdoors (more than 100 meters)	83 (66.4%)	42 (33.6%)
Stair management	98 (78.4%)	27 (21.6%)
Transfers: wheelchair - car	73 (58.4%)	52 (41.6%)
Transfers: ground - wheelchair	100 (80.0%)	25 (20.0%)

After the survey, the number of answers to each question was counted. For the questions that all attendees should answer (Q1, Q3, Q4, and Q9), the percentage distribution among the options was calculated on the basis of the total number of physicians ($n = 125$). For the questions that may not be answered by all of the attendees (Q2, Q5, Q6, Q7, Q8, and Q10), the percentage distribution among the options was calculated with the number of physicians who responded to the specific question as the denominator.

Results

The survey showed that 84.8% of the attendees performed functional outcome measurement regularly for individuals with SCI (Table 1). However, the rate of SCIM utilization was only 20.8%. The utilization rates of different measurement tools are shown in Table 1. MBI was the most popular tool with a utilization rate of 68.9%, followed by FIM (66.0%). SCIM was the third on the list with 20.8% only.

The opinion regarding which items should be included for assessment of functional outcome in individuals with SCI varied (Table 2). Sixteen of the 19 items were considered necessary by more than 75% of the physicians, with the lowest score being 50.8% for transfers from wheelchair to car.

The results regarding knowledge about the SCIM (Table 3) indicated that only 37 (29.6%) of the physicians had heard about SCIM. More than half of the

37 physicians knew this tool from peer recommendation, whereas published articles were the second most common source. However, only 16.2% of the physicians who knew SCIM were aware on the latest version. 48.6% were aware of the Chinese translation of SCIM.

The potential reason(s) why SCIM was not well used in clinical practice is summarized in Table 3. Lack of training was the most frequently reported reason. Not being confident with the interpretation of the original English version and time needed to perform the measurement were other common reasons given. None considered SCIM not to be helpful for patient care.

The attitudes toward training before using the SCIM among Chinese physicians are illustrated in Table 4. Up to 74.4% of the attendees reported they needed formal training before using the SCIM. The most preferred method of training was hands-on workshop (63.4%), then online course and manuals.

Discussion

This study reveals that the necessity of functional outcome measurement for individuals with SCI was acknowledged by Chinese physicians, as the majority of the attendees had performed such assessments in their clinical practice. Unfortunately, the use of SCIM was limited in China, i.e. only about one-fifth of SCI physicians had used it. This may not be a surprise because more than 70% of the attendees have never heard about SCIM.

According to previous systematic reviews,¹⁻³ the outcome measures that were used to assess the activity domain in individuals with SCI can be divided into two categories: (i) global instruments assessing the general status of functioning in daily life such as FIM, SCIM, QIF and MBI; (ii) ambulation instruments focusing on the mobility, including WISCI, TUG, 6MWT and 10MWT. When considering the proper outcome measures for SCI individuals, we know that the ambulation instruments can only be applied for incomplete SCI with some preserved walking. The

Table 3 The knowledge about the SCIM ($n = 125$).

Be aware of the SCIM	n (%)
NO	88 (70.4%)
YES	37 (29.6%)
<i>If YES, source to learn about SCIM ($n = 37$)</i>	
Published articles	14 (37.8%)
Lectures	2 (5.4%)
Peer recommendation	20 (54.1%)
Other	1 (2.7%)
<i>If YES, knowledge of the latest version ($n = 37$)</i>	
Version I	0 (0.0%)
Version II	2 (5.4%)
Version III	6 (16.2%)
Version IV	1 (2.7%)
Not sure	28 (75.7%)
<i>If YES, knowledge of Chinese version ($n = 37$)</i>	
Yes	18 (48.6%)
No	19 (51.4%)
<i>If YES, reason(s) why SCIM is not well used in clinical practice (Multiple choices, $n = 37$)</i>	
Not confident in interpreting the English language	13 (35.1%)
Need more training before using it	23 (62.2%)
Take too long to use	13 (35.1%)
Too complicated	10 (27.0%)
Not helpful for patient care	0 (0.0%)
Other(s)	0 (0.0%)

SCIM, Spinal Cord Independence Measure.

Table 4 The attitudes toward training before using SCIM ($n = 125$).

Necessity of training before using SCIM	n (%)
NO	32 (25.6%)
YES	93 (74.4%)
<i>If YES, preferred methods of training ($n = 93$)</i>	
Online courses	23 (24.7%)
Hands-on workshop	59 (63.4%)
Manuals	10 (10.8%)
Other	1 (1.1%)

SCIM, Spinal Cord Independence Measure.

global instruments have a broader scope of application. But some of them are not very appropriate for the SCI population.

MBI was the most frequently used tool among the Chinese physicians in our study, but its validity in the SCI population still remains controversial.² In addition, it is not originally developed for the SCI population¹; hence, it seems inappropriate to consider MBI as the first choice for functional outcome measurement in individuals with SCI. The situation for FIM is more complicated. Although FIM is widely used in the United States for assessment of individuals with SCI,¹⁹ it was originally developed for stroke patients.¹ FIM scores are more related to the burden of care rather than the functional recovery.²⁰ It is reported that the cognition domain of FIM could not detect changes over time following SCI.²¹ In addition, the FIM is copyrighted²² and is not authorized for use in China. Although QIF is specially designed for the SCI population, it focuses on the upper extremity function and thus only useful in individuals with tetraplegia.¹ Accordingly, SCIM are recommended as the primary measure for functional recovery following SCI,^{1,2,20} but lack of knowledge about SCIM seriously impedes its application in the clinical practice.

In addition to the low rate of utilization and knowledge of SCIM among the Chinese physicians, our results further revealed some potential weaknesses from those who knew SCIM when investigating the details of their knowledge. It is supposed that learning from lectures is the most efficient method to promote knowledge, i.e. where one presenter can introduce SCIM to a large audience. However, peer recommendation was the primary source for dissemination of the SCIM among the Chinese physicians. Less than 20% of the physicians knew that the latest version is SCIM III, and more than 75% of those who knew about SCIM chose the option "Not sure". The problem is, if using an older version the results will be less comparable with those using the newest version. These results highlight the necessity to introduce SCIM more broadly among SCI physicians in China.

In order to investigate the physicians' potential acceptance of SCIM, we asked whether the 19 items in the SCIM III were necessary for a functional outcome measure of SCI individuals. The majority (16 out of 19) of the items were considered necessary for assessment by more than 75% of the attendees. The other three items including transfer from wheelchair to car, mobility outdoors, and respiration were found necessary by less than 71% of the physicians. Although private cars are more and more common in China, it is still

not the regular means of transport; therefore, more than 40% choose not to include it in the assessment. Surprisingly, mobility outdoors got the second lowest of acceptance among the 19 items, although mobility indoors and mobility for moderate distance were well appreciated. It should be emphasized to the physicians that these three items are included in a group to reflect three different functional levels of mobility (i.e. within the room, around the house, and in the community) rather than the simple increase of the distance to move. Respiration was the item with the third lowest acceptance, which is lower than sphincter management for bladder and bowel that are listed in the same domain. One potential reason is that none of the two most frequently used tools (FIM and MBI) refers to respiration, making the physicians less aware of performing respiratory function measurement. The incidence of severe respiratory dysfunction requiring tracheostomy and ventilator support is most commonly seen in individuals with high complete cervical SCI.²³ Therefore, the physicians may pay less attention to this aspect when the survey focused on the general situation after SCI. Actually, respiratory complications in individuals with thoracic injuries should not be overlooked.²⁴ In summary, the points mentioned above should be clarified to the physicians before introducing the SCIM into clinical practice.

Lack of confidence in interpreting the English language version of the original SCIM is a significant obstacle for Chinese physicians. This highlights the importance of translating and validating the Chinese version of the SCIM. Even though a Chinese translation of SCIM III has been published in a Chinese journal,¹⁸ the knowledge about it was limited, as only 18 out of 125 attendees had heard about it. Unlike the well-validated SCIM III translations in to other languages,¹¹⁻¹⁷ the authors¹⁸ did not describe the translation process, thus the reader cannot know if the translation is in accordance with the recommendations.²⁵ The authors also investigated the validity and reliability of the Chinese SCIM III,²⁶ but several limitations were obvious in their study. Firstly, patients with non-traumatic SCI, T1-T9 injury, and AIS D injury were not included, thus the representativeness was limited. Secondly, the responsiveness to change from admission to discharge was not tested. Lastly, although FIM was used for the analysis of criterion validity, the description related to the authorization details was ambiguous. We have to acknowledge that a study reported in a Chinese journal is much easier to read and understand for most Chinese colleagues. But it is also important to have it reviewed and recognized by the international

academic society. Thus, it is essential for the Chinese version of SCIM III to be translated in accordance with the recommendations and to be validated to ensure that the translation is correct. A better-designed study published in an international journal is warranted to ensure the appropriateness of the Chinese version and to improve the knowledge and utilization of SCIM III in China.

Regarding training, approximately 75% of the physicians considered it necessary to receive training before using the SCIM. Even among the attendees who already knew about the SCIM, lack of training was the major reason that SCIM was not used in clinical practice to a greater extent. Therefore, training may play an important role in facilitating the use of SCIM in China. In contrast with the current situation that the primary source to learn about SCIM is peer recommendation, hands-on workshop including lecture and practice was proposed as the most preferred training method. It is suggested that a validated Chinese translation as well as a group of qualified and experienced trainers is required to meet this demand. Interestingly, online courses were the second most favored method. Along with the evolution of e-Learning programs such as InStEP (<https://lms3.learnshare.com/home.aspx>) and elearnSCI (<http://www.elearnsci.org/>), it is worth considering a SCIM online course in the future.

We also have to acknowledge several limitations of our study. First of all, most survey respondents were from the major hospitals with SCI inpatient rehabilitation in the relatively developed areas of China, so their responses may not reflect the actual overall situation; hence, the results of this study can only provide a preliminary conclusion. Secondly, the SCIM IV is now under development and testing. The content of SCIM IV should be included into the questionnaire in further studies.

Conclusion

Most of the Chinese SCI physicians performed functional outcome measures on individuals with SCI; however, the tools they usually used are not optimal. Although SCIM III is recommended as the primary measure for SCI individuals, its use seems limited in China due to lack of knowledge and training. Therefore, in order to facilitate the dissemination of SCIM in China, formal training, especially hands-on workshop in the use of SCIM III is warranted. Meanwhile, it is essential to translate the SCIM into Chinese in accordance with the translation recommendations and characterize the psychometric properties of the Chinese version. Once the Chinese version of

SCIM III is well validated and is established as the gold standard to assess functional outcomes in individuals with SCI, it will not only improve the functional outcome measurement following SCI in China, but also facilitate the communication between health professionals from different settings for the better continuity of medical care.

Disclaimer statements

Contributors None.

Funding None.

Conflicts of interest The authors declare no conflict of interests.

Ethics approval None.

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Appendix 1

Spinal Cord Injury Functional Outcome Measurement Survey

Please choose your opinion on the questions listed below, by checking the response:

1. In your clinical practice, do you perform the functional outcome measurement for individuals with spinal cord injury (SCI)?
 - ☐ Yes
 - ☐ No
2. If you have performed the functional outcome measurement, which measure(s) you have used? (Multiple choices)
 - ☐ Modified Barthel Index (MBI)
 - ☐ Functional Independence Measure (FIM)
 - ☐ Spinal Cord Independence Measure (SCIM)
 - ☐ 10-meter walk test (10MWT)
 - ☐ 6-min walk test (6MWT)
 - ☐ Timed Up and Go test (TUG)
 - ☐ Walking Index for Spinal Cord Injury (WISCI)
 - ☐ Quadriplegia Index of Function (QIF)
 - ☐ Other, specify____
3. If you want to assess functional outcome for individuals with spinal cord injury (SCI), which of the following item (s) are considered to be used?

Item	Yes	No
Feeding	☐	☐
Bathing - upper body	☐	☐
Bathing - lower body	☐	☐
Dressing - upper body	☐	☐
Dressing - lower body	☐	☐
Grooming	☐	☐
Respiration	☐	☐
Sphincter management – bladder	☐	☐
Sphincter management – bowel	☐	☐
Use of toilet	☐	☐

Continued

Continued

Item	Yes	No
Mobility in bed	☐	☐
Transfers: bed - wheelchair	☐	☐
Transfers: wheelchair - toilet - tub	☐	☐
Mobility indoors	☐	☐
Mobility moderate distance (10-100 meters)	☐	☐
Mobility outdoors (more than 100 meters)	☐	☐
Stair management	☐	☐
Transfers: wheelchair - car	☐	☐
Transfers: ground - wheelchair	☐	☐

4. Do you hear about Spinal Cord Independence Measure (SCIM) regardless whether use it in your clinical practice?
- ☐ Yes (Please answer question 5 to 10)
- ☐ No (Please answer question 9 and 10)
5. If you have heard about SCIM, which source you learned about it?
- ☐ Published articles
- ☐ Lectures in the conference
- ☐ Peer recommendation
- ☐ Other, specify____
6. Do you know the latest version of the SCIM used in clinical practice?
- ☐ Version I
- ☐ Version II
- ☐ Version III
- ☐ Version IV
- ☐ Unknown
7. If you have heard about the SCIM, but did not use in you clinical practice, which of the following reason(s) could be attributed to? (Multiple choices)
- ☐ I don't feel confident in my interpretation of the SCIM as it was published only in English
- ☐ I feel I need more training before using it
- ☐ It takes too long to use
- ☐ It is too complicated
- ☐ It is not helpful for patient care
- ☐ Other, specify____
8. Do you know whether it has the Chinese translation of the SCIM?
- ☐ Yes
- ☐ No
9. Do you think you should accept formal training before using SCIM in the clinical practice?
- ☐ Yes
- ☐ No
10. If choose "Yes" above, which kind of training would you recommended?
- ☐ Online course
- ☐ Hands-on workshop
- ☐ Booklet for self-study
- ☐ Other, specify