

Mapping two measures to the International Classification Of Functioning, Disability and Health and the brief ICF core set for spinal cord injury in the post-acute context

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Abstract

Objective: To evaluate the extent to which the rehabilitation outcome levels (ROL) and the spinal cord independence measure (SCIM) III could be mapped to the International Classification of Functioning, Disability and Health (ICF) and the brief core set for spinal cord injury (SCI) in the postacute context. **Methods:** Two professionals used the published protocol to map the concepts derived from both measures to the ICF categories. Further, the endorsed categories at the second level of the ICF were used to determine the coverage of the Brief ICF Core Set for SCI. **Results:** Three items of the ROL could not be conceptualised within the ICF, while the rest were mapped to 42 second-level categories, mainly to the activity and participation domain. All the items of the SCIM III were mapped, yielding 52 ICF categories, mostly at the third level (32). For the mapping to the Core Set for SCI, the ROL covered five and the SCIM III all nine categories of ‘activities and participation’ included as the candidate categories of the brief version. **Conclusion:** In terms of content, the ROL appears to be a more global measure of functioning, compared with the SCIM III that covers specific ‘activity’ aspects as proposed in the Brief Core Set for SCI. It is thus recommended that standardised measures, such as the SCIM III, be used due to its conceptual underpinnings and coverage of important aspects.

→ Implications for rehabilitation

- Rehabilitation professionals should select appropriately validated outcome measures specific to the health condition in order to evaluate the effectiveness of rehabilitation.
- Rehabilitation professional working with outcome measures should be aware of the limitations of measures, in terms of content, and supplement the evaluation with appropriate standardised measures or the use of the Core Sets.
- To enhance evidence-based practise in routine clinical practise, standardised outcome measures should be used.

Background

The goal of research in the field of outcome measurement is to identify patient characteristics altered following the onset of a health condition and to determine the efficacy of rehabilitation.[1] For the aforementioned purposes, many outcome measures,

both disease-specific [2–4] and generic, have been developed and proposed.[5] Over the last two decades, the development of outcome measures for the spinal cord-injured (SCI) population has evolved; however, limited knowledge is available on whether or not the content of certain outcome measures used in clinical settings is based on a conceptual or theoretical framework that usually serves as validation for the inquiry of interest.[6]

In South Africa, the SCI-rehabilitation discipline is under development and the use of outcome measures in care has only gained momentum recently. As such, the implementation of outcome measures in SCI is still decentralised.[7] One instrument in use in SCI – rehabilitation in South Africa is the rehabilitation outcome levels (ROL). The ROL is a generic measure of functioning and is used to determine health and rehabilitation needs as well as to predict prognosis during in-patient rehabilitation. A recent local study that used the ROL found that 68% of participants achieved community reintegration at the end of in-patient rehabilitation, indicating an optimal level of functioning.[8] However, the aforementioned study did not report on the psychometric properties of the outcome measure. Furthermore, to our knowledge, no other studies are available that ‘prove’ the rigour of the measure.

The Spinal Cord Independence Measure (SCIM) version III is an outcome measure that covers similar but not identical constructs as the ROL. The SCIM III has been proposed by many as the functional rating scale of choice due to its sound psychometric properties.[2,9–11] Similar to the ROL, the first version of the SCIM was developed prior to the universal use of the International Classification of Functioning, Disability and Health (ICF), thus leaving a void in the literature regarding its conceptual underpinnings and targeted functioning aspects.

Since the year 2001, the ICF became the conceptual model for the description of health status and disability.[12] Prior to this, limited consensus persisted in the arena of an operative model to be used for the description of disability and its impact on the individual.[12] Many outcome measures have been developed without the use of the ICF as the conceptual basis and therefore the uncertainty remains whether or not those measures are fit for current practice. This scenario of adopting measures without validating its content could give rise to a possible mismatch between ‘what we intend to measure and what we actually measure’.[13] To assist us with what is relevant to evaluate for specific health conditions, certain ICF Core Sets have been developed.[14,15]

Specific to the SCI population, both Comprehensive and Brief ICF Core Sets for the early post-acute and long-term context have been developed,[16,17] which provide us with a framework concerning ‘*the what*’ to measure for the relevant assessment of functioning. In this study, the Brief Core Set was chosen for a number of reasons. First, the introduction of outcome measures into the clinical environment should allow healthcare providers to make brief assessment of their patients’ functioning in the presence of high workload. Second, the candidate categories covered in the ‘activity and participation’ domain of the

Brief ICF Core Set are appropriate to the immediate post-acute/in-patient rehabilitation goals that focus on mobility and self-care. Lastly, the candidate categories of the Brief Core Set were determined based on methodological considerations that controlled for all other categories contained in the Comprehensive ICF Core Set.[18]

With the adoption of outcome measures into the era of the ICF and the existence of ICF core sets for SCI, little is known about the conceptual basis and coverage of important functioning aspects, as proposed by the ICF and the Brief ICF Core Set for SCI in the post-acute context, of two outcome measures, of which one is used as part of the clinical routine (ROL) and the other a gold standard measure (SCIM III) not currently utilised in South African SCI-care. The objectives of this study were as follows: (i) to determine extent to which the ROL and SCIM III could be mapped to precise categories of the ICF and (ii) to examine the extent that the endorsed codes from each respective measure covered the candidate categories contained in the Brief ICF Core Set for SCI in the post-acute context.

Methods

Research design

The qualitative mapping was applied to study the comparative content validity of two measures in relation to the Brief ICF Core Set for SCI. The published ICF linking of outcome measures protocol and the updated version [19,20] were used to standardise the procedure of qualitatively linking items of both outcome measures to the categories of the ICF and thereafter to the Brief Core Set for SCI in the post-acute context.[16]

The ROL and SCIM III

The ROL was first published in 1995, prior to the implementation of the ICF. The developers of the ROL argue that the importance of applying outcome levels in the planning process of individual patients lies in the ability of outcome levels to guide goal setting, since lower levels must be reached before higher ones.[21] The ROL consists of six distinct levels, representing different functioning aspects that range from impairment to participation outcomes. Each level is written as a set of criteria that needs to be fulfilled, rather than specific items. These levels are defined as groupings or categories of patient problems and conditions, which according to Landrum et al.,[21] are understood to represent levels of progress along a continuum in the process of rehabilitation. On admission to and discharge from rehabilitation, healthcare professionals are responsible for allocating and recording the most appropriate functioning level of each patient.

The SCIM III is currently considered the gold standard outcome measure of investigating functional abilities in the SCI population due to its favourable psychometric properties. This measure includes 19 items across four functional areas namely: (i) self care, (ii) respiration, (iii) sphincter management and (iv) mobility. Similar to the ROL, the first version of this measure was published prior to the acceptance of the ICF in 2001, and both measures contain concepts related to the activity and participation domain.[2]

Brief ICF core set for SCI in the post-acute context

To facilitate the application of the ICF, experts have developed both comprehensive and Brief Core Sets for SCI in the post-acute and long-term context.[17] These Core Sets define the relevant and essential categories of functioning to be evaluated in survivors of SCI. A Comprehensive Core Set for SCI in the post-acute context is available; however, we decided to use the Brief Core Set that includes fewer categories that sufficiently capture the typical spectrum of problems experienced in the functioning of survivors with SCI.[16] The categories in the Brief Core Set include three body structure and eight functions, nine activities/participation and five environmental factors.

Practise and standardisation of the linking procedure

The two experts (health professionals and academics) that were responsible for the mapping are familiar with the nomenclature of the ICF and its application in research and clinical practise. Prior to the mapping exercise, both experts were required to study the four main linking rules [19] and the updated rules.[20] On the day of the mapping, a practise run was held where another functional rating scale (Barthel Index) was mapped and the process was refined based on emerging issues. Experts were advised to identify and map all the meaningful concepts within each item, including the response options, in the outcome measure to the most precise second and third-level category of the ICF, where applicable. If a single item encapsulated different concepts, the meaningful units in each concept were then linked. In addition, if a concept of an item was not explicitly named in a particular category, the lower level of the category (at the second level) was linked. If the information provided by the meaningful concept was not sufficient to endorse a specific code and category, the concept was assigned 'not definable' (nd).[20]

Apart from linking the meaningful concepts to the categories of the ICF, the identified second-level categories of each item in the outcome measure were mapped to the Brief ICF Core Set for SCI in the post-acute context for evaluating the coverage of pertinent categories.[16]

Data analysis

The result of the mapping was the extent to which items could be mapped to the second- and third-level categories of the ICF. The number of categories addressed per domain of the ICF of each outcome measure was determined, as well as the inter-observer agreement for the endorsement of categories at the two distinct levels. Higher levels of absolute agreement were interpreted as the clarity of the concepts from the measures and the ability to locate a specific category of the ICF to correspond with the desired functioning aspect. To account for chance to influence agreement levels, we computed the Prevalence-Adjusted Bias-Adjusted Kappa (PABAK) [22] at the second and third-level of the ICF. The evaluation of conceptual coverage of measures concerning the categories in Brief ICF Core Set for SCI was done using the second-level categories of the ROL and SCIM III, except for one third-level category of the SCIM III.

Results

Mapping of the ROL to the categories of the ICF

As seen in Table 1, 24 meaningful concepts were identified where duplicates were subtracted rather than removed from the list (e.g. self-care, mobility and communication). Of the 24 concepts (Table 2), 11 that were derived from *level 2* (representing physiological maintenance) yielded 20 second-level categories. The 2 concepts from *level 3* (residential re-integration), 7 from *level 4* (community re-integration) and 4 from *level 5* (return to productive activity) were linked to 6, 10 and 6 unique second-level categories, respectively. Furthermore, 3 of the 24 concepts were meaningful, namely 'physiological stability', 'self-management' and 'self-directed health monitoring', but could not be mapped to a specific category of the ICF and was thus coded 'nd'. In total, the 21 concepts were mapped to 42 second-level and 3 third-level categories of the ICF. Of the second-level categories, 13 'body structure and function' and 29 'activity and participation' categories were identified. The inter-observer (absolute) agreement (and PABAK) of linking concepts to the second- and third-level categories was 57% (0.357) and 0% (-0.500), respectively.

Mapping of the SCIM III to the categories of the ICF

In Table 3, the 19 items of the SCIM III were mapped to categories of the ICF. From the items, 20 different (duplicates were removed) second-level categories and 32 (duplicates were removed) third-level were identified. Of the 20 second-level categories, 16 were classified in the 'activity and participation' domain. Of the 32 third level categories, 25 were derived from the 'activity and participation' domain. The inter-observer (absolute) agreement (and PABAK) of linking concepts to the second and third-level categories was 80% (0.700) and 72% (0.591), respectively.

Table 1. Concepts identified from the rehabilitation outcome levels (ROL) outcome measure.

Rehabilitation outcome level	Concepts identified
Level 0: Physiological instability ^a . Usually occurs early after onset in an acute setting. Assessment, diagnosis and management of medical conditions are ongoing. Includes unmanaged medical problems presenting at a later stage, e.g. pressure sores/inadequate bladder management.	No specific meaningful concepts related to the categories of the ICF were identified. <ul style="list-style-type: none"> • Unmanaged medical problems • Identifying immediate and secondary complications
Level 1: Physiological stability ^a . Medical problems addressed and appropriately managed. Condition is stable – no longer requires acute care setting.	No specific meaningful concepts related to the categories of the ICF were identified <ul style="list-style-type: none"> • Medical problems identified and managed
Level 2: Physiological maintenance ^b . Management plans in place to ensure ongoing maintenance of skin integrity, respiration, nutrition, range of movement and bowel and bladder care. Basic functional goals at this stage should include bed mobility, self-care and communication, cognition and behaviour.	Patient presents with safe systems of: <ul style="list-style-type: none"> • Nutrition • Respiration • Skin preservation • Joint maintenance • Bladder and • Bowel management Functional goals include: <ul style="list-style-type: none"> • Self-care • Bed mobility • Communication • Cognition • Behaviour
Level 3: Residential re-integration ^b . Safe functioning at home. Includes: Physiological stability, self-care, mobility around home, effective communication, simple housekeeping, household planning and management.	Goals include proficiency in: <ul style="list-style-type: none"> • Self-care • Mobility in and around dwelling • Communication • Home keeping and management • Physiological stability^c
Level 4: Community re-integration ^b . Subject functions appropriately in the community. Includes: self-management, self-directed care of health, ability to function socially, community mobility, recreational activities, community activities, complex home management, financial management and safety in the community.	Goals include: <ul style="list-style-type: none"> • Self-management^c • Social competencies • Community mobility • Financial management • Self-directed health monitoring^c • Participation in sport, recreation and community activities Independence in: <ul style="list-style-type: none"> • Self-care • Mobility • Communication • Community integration
Level 5: Return to productive activity ^b . It includes a focus on vocational, a vocational or educational pursuits, household management, school or employment. Productive activities within the patients' level of ability. Includes paid work, unpaid work, volunteer work and education/training.	Patient should be able to: <ul style="list-style-type: none"> • Engage in vocational and educational pursuits • Household management • Attend school or • Work (paid/unpaid or volunteering)

^aLevels 0 and 1, no meaningful concepts consistent with the categories of the ICF and Brief Core Set for SCI in the post-acute context have been identified. The terms 'unmanaged medical problems', 'identify immediate and secondary complications' and 'medical problems identified and managed' only denote meaningful units qualitatively.

^bCombining levels 2–5, 24 unique meaningful concepts were identified (excluding duplicate concepts), of which 21 were relevant for the mapping to the ICF categories.

^cThese items were meaningful but no ICF codes were endorsed.

Mapping of ROL and SCIM III to the brief ICF core set for SCI

As evident in Table 4, the ROL covered 4 of the 11 impairments (body function and structure) and 5 of the 9 'activity and participation' categories in the Brief ICF Core Set for SCI. Considering the coverage of the SCIM III, 3 of the 11 impairments and all 9 'activity and participation' categories were addressed. Concerning 'activity' items in the ROL, the item 'self-care' seemed to lack a clear definition as the two experts only agreed on its implied meaning to be related to the category 'washing oneself' (d510). Further, no agreement was found when 'self-care' was also mapped to the category 'toileting (d530) and dressing (d540)'. In the ROL, self-care is used as an umbrella term for multiple tasks, and no distinction was made concerning dressing and bathing of the upper and lower body, as evident in the SCIM III. The results further demonstrate that none of the measures contains items related to environmental categories.

Items ROL	Second-level codes	Third-level codes	Second-level category
Level 0 and 1: Presence of unmanaged medical problems Identifying immediate and secondary complications Medical problems identified and managed			
Level 2: Patient presents with safe systems of;			
Nutrition	b530 , b510 , b515		Weight maintenance function; ingestion functions; digestive functions
Respiration	b440		Respiration functions
Skin preservation	b810, b840		Protective functions of the skin; sensation related to the skin
Joint maintenance	b710, b715		Mobility of joint functions; stability of joint functions
Bladder and	b610		Urinary excretory functions
Bowel management	b525		Defecation functions
Functional goals include; Self- care	d510, d520, d530, d540		Washing oneself; caring for body parts; toileting; dressing
Bed Mobility	d410		Changing basic body position
Communication	d310, d315		Communicating with-receiving-spoken messages; non-verbal messages
Cognition	b110, b164		Consciousness functions; high-level cognitive functions
Behavior	b126		Temperament and personality functions
Level 3: Goals include proficiency in;			
Self-care	d510, d520, d530, d540		Washing oneself; caring for body parts; toileting; dressing
Mobility in and around dwelling	d450		Walking
Communication	d310, d315		Communicating with-receiving-spoken messages; non-verbal messages
Home keeping and management	d620, d630, d640, d650, d660		Acquisition of goods and services; preparing meals; doing housework; caring for household objects; assisting others
Physiological stability	nd		
Level 4: Goals include;			
Self-management	nd		
Social competencies	d710, d720, d730, d740, d750		Basic interpersonal interactions; complex interpersonal interactions; relating with strangers; formal relationships; informal social relationships
Community mobility	d465		Moving around using equipment
Financial management	d860, d865	d8708	Basic economic transactions; complex economic transactions
Self-directed health monitoring	nd		
Participation in sport, recreation and community activities	d910, d920		Community life; recreation and leisure
Independence in; Self-care	d510, d520, d530, d540		Washing oneself; caring for body parts; toileting; dressing
Mobility	d450		Walking
Communication	d310, d315		Communicating with-receiving-spoken messages; non-verbal messages
Community integration	d910		Community life
Level 5: Patient should be able to;			
Engage in vocational and educational pursuits	d820, d825		School education; vocational training
Household management	d699		Domestic life
Attend school or	d820		School education
Work	d840, d845, d850	d8500, d8502	Apprenticeship; acquiring, keeping and terminating a job; remunerative employment

ROL= Rehabilitation Outcome Level measure

Codes in italics = Indicate disagreement between the two experts that conducted the mapping

nd = not definable

Discussion

Many outcome measures in the rehabilitation arena have been developed prior to the acceptance of the ICF framework as the standard language for the description of health and disease. In this study, we aimed to evaluate whether the ROL and the SCIM III could be mapped to the ICF and the functioning aspects contained in the Brief ICF Core Set for SCI in the post-acute context.

The main findings of the study suggested that almost all except for 2 of the 21 concepts from the ROL were linked to second-level categories of the ICF. The lack of identifying third-level categories could be explained based on the broad nature of the contained concepts in the items. For example, the concept ‘mobility’ which was classified under the

walking category (d450) could have been conceptualised differently by other health professionals, for instance as ‘mobility of the upper body/lower body’ or ‘using a wheelchair/other assistive device’. The same ambiguity is apparent for the item ‘self-care’, which was uniformly classified under the ‘washing oneself’ category (d510) by both experts. Furthermore, three of the meaningful concepts in the ROL could not be linked to the ICF and were thus coded ‘not definable’ (*nd*).

Concerning the SCIM III, all the concepts derived from the 19 items were mapped to the ICF, with more third-level than second-level categories identified. The higher level coding demonstrates the explicit nature of the items, which reduces the ambiguity of the task or action under study. Further, the agreement between the examiners was higher for the SCIM III than the ROL. The endorsement of codes to higher-level categories seems not only complex in this study but has been reported elsewhere.[23] These findings stress the need of operational definitions of terms in outcome measures and the possible development of training manuals to standardise the rating procedure and the evaluation of patients.

Table 3. Linking of items of the SCIM III to specific second and third-level categories of the ICF.

Items SCIM III	Second-level codes	Third-level codes	Second-level category
1. Feeding (cutting, opening containers, pouring, bringing food to mouth, holding cup with fluid)	d550, d560, d430, d445	d4401, d4400, d4402, d4453	Eating; drinking; lifting and carrying objects; hand and arm use; fine hand use
2a. Bathing (soaping, washing, drying body and head, manipulating water tap). Upper body	d510	d5100, d5101, d5102, d4402, d4453	Washing oneself; fine hand use; hand and arm use
2b. Bathing (soaping, washing, drying body and head, manipulating water tap). Lower body	d510	d5100, d5101, d5102, d4402, d4453	Washing oneself; fine hand use; hand and arm use
3a. Dressing (clothes, shoes, permanent orthoses: dressing, wearing, undressing). Upper body	d540	d5400, d5401, d5402, d5403, d5404.	Dressing
3b. Dressing (clothes, shoes, permanent orthoses: dressing, wearing, undressing). Lower body	d540	d5400, d5401, d5402, d5403, d5404.	Dressing
4. Grooming (washing hands and face, brushing teeth, combing hair, shaving, applying makeup)	d520	d5200, d5201, d5202, d5100	Caring for body parts; washing oneself
5. Respiration	b440		Respiration functions
6. Sphincter Management – Bladder	b610, b620	b6101, b6200, b6202, d5300	Urinary excretory functions; urination functions; toileting
7. Sphincter Management – Bowel	b525	b5250, b5251, b5252, b5253, d5301	Defecation functions; toileting
8. Use of Toilet (perineal hygiene, adjustment of clothes before/after, use of napkins or diapers).	d530	d5300, d5301, d5400, d5401	Toileting; dressing
9. Mobility in Bed and Action to Prevent Pressure Sores	d470, d455	d4559	Changing body position; moving around
10. Transfers: bed-wheelchair (locking wheelchair, lifting footrests, removing and adjusting arm rests, transferring, lifting feet).	d420, d440	d4200, d4201, d4402, d4453	Transferring oneself, fine hand use; hand and arm use
11. Transfers: wheelchair-toilet-tub (if uses toilet wheelchair: transfers to and from; if uses regular wheelchair: locking wheelchair, lifting footrests, removing and adjusting armrests, transferring, lifting feet).	d420, d440, d445, d429	d4200	Transferring oneself; changing and maintaining body position
12. Mobility Indoors	d450, d465	d4502, d4508	Walking and moving, walking around using equipment
13. Mobility Outdoors (10-100 meters)	d450, d465	d4500, d4508	Walking and moving, walking around using equipment
14. Mobility Outdoors (more than 100 meters)	d450, d465	d4500, d4501, d4502, d4508	Walking and moving, walking around using equipment
15. Stair Management	d450, d455	d4502	Walking and moving, moving around
16. Transfers: wheelchair-car (approaching car, locking wheelchair, removing arm and footrests, transferring to and from car, bringing wheelchair into and out of car).	d420, d430	d4200	Transferring oneself; carrying, moving and handling objects
17. Transfers: ground-wheelchair	d420	d4200, d4201	Transferring oneself

SCIM III = Spinal Cord Independence Measure III; ICF = International Classification of Functioning, Disability and Health
Codes in italics = Indicate disagreement between the two experts that conducted the mapping

Table 4. Coverage of categories in the brief core set for SCI (post-acute context) when mapping items of the ROL and SCIM III.

Brief ICF core set for SCI			ROL	SCIM III	
Domain	Second-level code	Category	Item in measure	Item in measure	
Body functions	b730	Muscle power function			
	b620	Urination function	'Bladder management'	'6. Sphincter management-bladder'	
	b525	Defecation function	'Bowel management'	'7. Sphincter management-bowel'	
	b280	Sensation function			
	b440	Respiration function	'Safe systems of respiration'	'5. Respiration'	
	b735	Muscle tone function			
	b152	Emotional function			
	b810	Protective functions of the skin	'Safe system of skin preservation'		
Body structures	s120	Spinal cord and related structures			
	s430	Structure of respirator system			
	s610	Structure of urinary system			
Activities and Participation	d420	Transferring oneself		'10. Transfer from bed to wheelchair' '11. Transfer: wheelchair-toilet-tub' '16. Transfers: wheelchair to car' '17. Transfers: ground to wheelchair'	
	d410	Changing basic body positions	'Bed mobility'	'9. Mobility in bed and prevention of pressure sores'	
	d445	Hand and arm use		'2a and 2b Bathing (upper and lower body)': derived from third level category	
	d530	Toileting	'Self-care'	'8. Use of toilet'	
	d550	Eating		'1. Feeding'	
	d450	Walking	'Mobility'	'12. Mobility indoors' '13. Mobility for moderate distances' '14. Mobility outdoors' '15. Stair management'	
	d510 ^a	Washing oneself	'Self-care'	'2a. Bathing upper body' '2b. Bathing lower body'	
	d540	Dressing	'Self-care'	'3a. Dressing of upper body' '3b. Dressing of lower body'	
	d560	Drinking		'1. Feeding (also includes drinking)'	
	Environmental factors	e310	Immediate family		
		e355	Health professionals		
		e115	Products and technology for personal use in daily living		
e120		Products and technology for personal indoor and outdoor mobility and transportation			
	e340	Personal care providers and personal assistants			

ROL, Rehabilitation Outcome Levels measure; SCIM III, Spinal Cord Independence Measure version III; d510^a, Indicates that for mapping of the self-care item (only for ROL), both experts agreed only on this code; shaded grey, indicates that no items in the outcome measure corresponded to the category in the Brief Core Set for SCI in the post-acute context.

Subsequent to the endorsement of codes of items in the ROL and SCIM III, the second-level categories identified from each measure were used to determine the extent of coverage of the Brief ICF Core Set for SCI in the post-acute context. The ROL showed limited coverage of the 'activity and participation' candidate categories contained in the Brief ICF Core Set, addressing five out of the nine. On the contrary, the SCIM III covered all nine 'activity and participation' categories, providing full coverage of the domain in the Brief ICF Core Set for SCI in the post-acute context. In addition to covering more pertinent aspect of functioning, the SCIM III distinguished between upper body and lower body proficiency for items concerning bathing and dressing, aspects not captured in the ROL or any other functional rating scale used in SCI.[24,25] The findings imply that the SCIM III can be used in the clinical context, as earlier suggested,[9–11] but now with proven content validation. Conceptually, the ICF and Core Sets do not only allow us to validate constructs of measurement but also provide the platform to evaluate which functioning domains are represented in measures. Although the purpose of some measures, such as the SCIM III, was not designed to cover the entire spectrum of

functioning problems but rather one domain/construct, the ICF is capable of identifying the extent to which the relevant categories are covered or not included. Contrary to the SCIM III, the ROL was designed to represent functioning aspects along the continuum of the health condition, i.e. impairment to activity and participation aspects, and claims to be grounded within the bio-psychosocial model.[21] However, we found gaps in coverage of pertinent aspects for persons with SCI in the impairment and activity domain, but most specifically within the environmental factors domain. The ICF is clear when dealing with 'involvements in life situations', emphasising the consideration of the environmental influence on the functioning of individuals.

The results of this study suggest that the ROL is a more global measure of functioning, covering a wider spectrum of ICF categories of activity and participation than the SCIM III. However, more specific to SCI, the SCIM III allows for a more detailed assessment of aspects, e.g. mobility, and is more 'targeted' to categories included in the Brief ICF Core Set than the ROL. As a result, we know little about the extent to which outcomes are addressed and how survivors of SCI describe their perceived involvement in life situations, which hinder the alignment of rehabilitation structures and processes towards optimal patient-oriented outcomes. We initiated an ongoing qualitative study that is explorative in nature and aims to provide a broad and thick description of the life areas still affected after rehabilitation and the factors influencing the survivors' self-perceived participation. We will further evaluate the extent to which the identified concepts are covered within the ICF and more specifically the ICF Core Sets for SCI in the appropriate context. These projects could assist in the development of appropriate measures for the context and justify the use of the ICF in healthcare service delivery.

The study presents with some limitations. More independent health professionals at the centre could have been used for the mapping of the ROL since limited information is available concerning the possible hidden meaning of concepts in the measure. This could have enhanced the internal validity of the endorsed codes and categories relevant for each measure. In addition, the Comprehensive ICF Core Set for SCI in the post-acute context could have been used to provide a wider range of categories for the items to be mapped to. However, that would have been merely a theoretical exercise. We believe that the Brief Core Sets are administratively more practical in the 'real-world' setting compared with the Comprehensive ICF Core Sets.

In conclusion, the ROL appears to be a more global measure of functioning that covers a wider spectrum of activity and participation categories of the ICF (although with less preciseness) than the SCIM III. With regard to SCI assessment of functioning, the SCIM III covered all the candidate categories of activity and participation in the Brief ICF Core Sets for SCI, indicating its suitability for this population, while the ROL presented with limitations. Moreover, both measures do not cover environmental aspects; therefore, the assessment of functioning should be supplemented with a measure capturing this contextual component.

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Declaration of interest

The authors declare that they have no competing interests.

References

1. Patrick DL, Chiang YP. Measurement of health outcomes in treatment effectiveness evaluations: conceptual and methodological challenges. *Med Care*. 2000;38:14–25.
2. Catz A, Itzkovich M, Agranov E, et al. SCIM-spinal cord independence measure: a new disability scale for patients with spinal cord lesions. *Spinal Cord*. 1997;35:850–856.
3. van Hedel H, Wirz M, Dietz V. Assessing walking ability in subjects with spinal cord injury: validity and reliability of 3 walking tests. *Arch Phys Med Rehabil*. 2005;86:190–196.
4. Field-Fote EC, Fluet GG, Schaefer EM, et al. The spinal cord injury functional ambulation inventory (SCI-FAI). *J Rehabil Med*. 2001;33:177–181.
5. Buck D, Jacoby A, Massey A, et al. Evaluation of measures used to assess quality of life after stroke. *Stroke*. 2000;31:2004–2010.
6. Ullrich PM, Spungen AM, Atkinson D, et al. Activity and participation after spinal cord injury: state-of-the-art report. *J Rehabil Res Dev*. 2012;49:155–174.
7. Inglis G, Faure MR, Frieg A. The awareness and use of outcome measures by South African physiotherapists. *South Afr Soc Physiother*. 2008;64:5–11.
8. Hassan SAM, Visagie S, Mji G. The achievement of community integration and productive activity outcomes by CVA survivors in the Western Cape Metro Health District. *South Afr J Occup Ther*. 2012;42:11–16.
9. Anderson KD, Acuff ME, Arp BG, et al. United States (US) multi-center study to assess the validity and reliability of the Spinal Cord Independence Measure (SCIM III). *Spinal Cord*. 2011;49:880–885.
10. Bluvshstein V, Front L, Itzkovich M, et al. SCIM III is reliable and valid in a separate analysis for traumatic spinal cord lesions. *Spinal Cord*. 2011;49:292–296.
11. Itzkovich M, Gelernter I, Biering-Sorensen, et al. The Spinal Cord Independence Measure (SCIM) version III: reliability and validity in a multi-center international study. *Disabil Rehabil*. 2007;30:1926–1933.
12. WHO. ICF, towards a common language for functioning, disability and health. Geneva: WHO; 2002.
13. Wade DT. Measurement in neurological rehabilitation. New York: Oxford University Press; 1992.
14. Cieza A, Ewert T, Ustun B, et al. Development of ICF Core Sets for patients with chronic conditions. *J Rehabil Med*. 2004;44:9–11.
15. Ewert T, Grill E, Bartholomeyczik S, et al. ICF Core Set for patients with neurological conditions in the acute hospital. *Disabil Rehabil*. 2005;27:367–373.
16. Kirchberger I, Cieza A, Biering-Sorensen F, et al. ICF Core Sets for individuals with spinal cord injury in the early post-acute context. *Spinal Cord*. 2010;48:297–304.
17. Cieza A, Kirchberger I, Biering-Sørensen F, et al. ICF Core Sets for individuals with spinal cord injury in the long-term context. *Spinal Cord*. 2010;48:305–312.
18. Grill E, Stucki G. Criteria for validating comprehensive ICF Core Sets and developing Brief ICF Core Set versions. *J Rehabil Med*. 2011;43:87–91.

19. Cieza A, Brockow T, Ewert T, et al. Linking health-status measurements to the international classification of functioning, disability and health. *J Rehabil Med.* 2002;34:205–210.
20. Cieza A, Geyh S, Chatterji S, et al. ICF linking rules: an update based on lessons learned. *J Rehabil Med.* 2005;37:212–218.
21. Landrum P, Schmidt N, Mclean A. Outcome oriented rehabilitation. Gaithersburg, MD: Aspen; 1995.
22. Sim J, Wright CC. The Kappa statistics in reliability studies: use, interpretation and sample size requirements. *Phys Ther.* 2005;85:257–268.
23. Morriello C, Byrne K, Cieza A, et al. Mapping the Stroke Impact Scale (SIS-16) to the International Classification of Functioning, Disability and Health. *J Rehabil Med.* 2008;40:102–106.
24. Granger CV, Hamilton BB, Zielezny M, et al. Advances in functional assessment in medical rehabilitation. *Top Geriatr Rehabil.* 1986;1:59–74.
25. Anderson K, Aito S, Atkins M, et al. Functional recovery measures for spinal cord injury: an evidence-based review for clinical practice and research. *J Spinal Cord Med.* 2008;31:133–144.