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Published in: Journal of Rehabilitation Medicine

DOI: 10.2340/16501977-0897

2012

Citation for published version (APA):
Lexell, J., Malec, J. F., & Jacobsson, L. J. (2012). Mapping the Mayo-Portland adaptability inventory to the international classification of functioning, disability and health. Journal of Rehabilitation Medicine, 44(1), 65-72. https://doi.org/10.2340/16501977-0897

Total number of authors: 3

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ORIGINAL REPORT

MAPPING THE MAYO-PORTLAND ADAPTABILITY INVENTORY TO THE INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH

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Objective: To examine the contents of the Mayo-Portland Adaptability Inventory (MPAI-4) by mapping it to the International Classification of Functioning, Disability and Health (ICF).

Methods: Each of the 30 scoreable items in the MPAI-4 was mapped to the most precise ICF categories.

Results: All 30 items could be mapped to components and categories in the ICF. A total of 88 meaningful concepts were identified. There were, on average, 2.9 meaningful concepts per item, and 65% of all concepts could be mapped. Items in the Ability and Adjustment subscales mapped to categories in both the Body Functions and Activity/Participation components of the ICF, whereas all except 1 in the Participation subscale were to categories in the Activity/Participation component. The items could also be mapped to 34 (13%) of the 258 Environmental Factors in the ICF.

Conclusion: This mapping provides better definition through more concrete examples (as listed in the ICF) of the types of body functions, activities, and participation indicators that are represented by the 30 scoreable MPAI-4 items. This may assist users throughout the world in understanding the intent of each item, and support further development and the possibility to report results in the form of an ICF categorical profile, making it universally interpretable.

Key words: brain injuries; disability evaluation; outcome assessment; rehabilitation; research design.

J Rehabil Med 2012; 44: 65–72

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Submitted May 25, 2010; accepted August 23, 2011

INTRODUCTION

The International Classification of Functioning, Disability and Health (ICF) is a universal framework and an international language for describing all aspects of a disability (1–3). It can be used to facilitate assessment and goal planning following a trauma or disease, as well as to improve outcome research by understanding the content of measurement tools. The value of linking various outcome measures to the ICF is increasingly recognized, and rules have been developed that enable researchers to map the contents and items of measures to the ICF (4, 5). The rationale for developing such linkages is to provide a validation and better understanding of measures by describing the concrete human features and functions in the ICF to which these measures relate. Recent studies have linked a variety of measures to the ICF taxonomy (6), for example the Stroke Impact Scale (7), health-related quality of life measures (8), and measures of participation including the Mayo-Portland Adaptability Inventory (MPAI-4) (9). In this latter study, Resnick & Plow (9) reported that the MPAI-4 linked to all 9 ICF Activity and Participation chapters; however, these researchers did not extend the linkage to other ICF components and domains.

The development of the Mayo-Portland Adaptability Inventory, now in its fourth edition (MPAI-4), spans 20 years (10, 11). The MPAI-4 is a 30-item inventory that includes indicators of body functions, activities, and participation that are often affected by acquired brain injury (ABI), both traumatic and non-traumatic. The MPAI-4 was developed and refined using both contemporary (i.e. Rasch analysis) and classic psychometric procedures (12, 13). These psychometric analyses identified a strong primary factor in MPAI-4 items representing global outcome after ABI. In addition, 3 levels of complexity of functions and activities were also identified, which are represented by the 3 subscales: Ability Index, Adjustment Index and Participation Index.

Through Rasch analysis, items were identified for the inventory as a whole that define a broad range of outcome after ABI, from extremely severe disability associated with no or limited adjustment and participation to normal adjustment and participation associated with resolution of or compensation for the consequences of the ABI. The Rasch analyses yielded an ultimate set of 30 items comprising the MPAI-4. Although these 30 items by no means comprehensively describe all possible consequences and outcomes of ABI, they do satisfactorily represent the range of outcomes for reliable measurement (10).

The MPAI-4 is intended to be transcultural. It has been translated into Swedish (14), Italian (15), Danish, Spanish, French, German, Portuguese and Hebrew, and is widely used in Australia and UK in addition to the USA and Canada.

Unlike the ICF, the MPAI-4 is a linear metric; that is, it provides an ordinal numeric rating describing the degree of outcome
METHODS

Mayo-Portland Adaptability Inventory

The MPAI-4 (10) was primarily designed to assist in the clinical evaluation of people treated for ABI, which, using Rasch methods, can be converted into a parametric-equivalent measure (16). The ICF, in contrast, is a taxonomy; that is, a compilation of descriptors of body structures and functions, activities, participation indicators, and the personal and environmental contexts in which these occur. Thus, mapping an existing measure to the ICF provides a validation and better understanding of the measure by describing the concrete human features and functions in the ICF to which the measure relates.

The aim of this study was more fully to describe the contents of the MPAI-4 by mapping it to the ICF. We were interested in performing this mapping procedure in order to provide better definition through more concrete examples (as listed in the ICF) of the types of functions, activities, and participation indicators that are represented by each of the MPAI-4 items. Mapping the MPAI-4 to the ICF would also assist MPAI-4 users throughout the world in understanding the intent of each item. Although the success of the mapping procedure may provide evidence of content and construct validity of the MPAI-4, the process described in this paper was not conducted to evaluate consensual understanding of the MPAI-4. That is, we were not interested in evaluating whether a sample of users of the MPAI-4 tended to agree about the way in which MPAI-4 items linked to the ICF. Rather our intention was to map the MPAI-4 to the ICF in order to prescribe, to the degree that the MPAI-4 and the ICF describe similar domains, how MPAI-4 items should be understood in terms of the ICF. Ultimately, the benefit of such a rigorous process is to facilitate the cross-cultural use of the instrument and support the development and the possibility to report results obtained with the MPAI-4 in the universal language of the ICF.

Table I. Summary of the mapping of the Mayo-Portland Adaptability Inventory (MPAI-4) to the International Classification of Functioning, Disability and Health (ICF)

| MPAI-4 subscales                     | Abilities | Adjustment | Participation |
|--------------------------------------|-----------|------------|---------------|
| Items, n                             | 13        | 9          | 8             |
| Meaningful concepts identified, n    | 29        | 32         | 27            |
| Content density, % (number of meaningful concepts identified/number of items) | 2.2       | 3.6        | 3.4           |
| Meaningful concepts mapped to ICF, n (%) | 24 (83)   | 9 (28)     | 24 (89)       |
| Meaningful concepts not mapped to ICF, n (%) | 5 (17)    | 23 (72)    | 3 (11)        |
| Number of unique ICF categories identified, n | 81        | 46         | 73            |
| Bandwidth of content coverage, % (number of ICF categories identified/total number of ICF categories, i.e. 1454) | 6         | 3          | 5             |
| ICF categories per component, n (%)  | 2.8       | 1.4        | 2.7           |
| Body Functions (n = 493)             | 41 (8)    | 40 (8)     | 1 (0.2)       |
| Activity and Participation (n = 393) | 40 (10)   | 20 (5)     | 75 (19)       |
| Environmental Factors (n = 258)      | 10 (4)    | 9 (3)      | 27 (10)       |

As several ICF categories were mapped to multiple items, the total number of unique ICF categories was 200.

Three items were mapped to three ICF categories and two items were mapped to eight ICF categories, respectively.

Two items were mapped to three ICF categories.

Ten environmental factors were linked to more than one subscale; the total number of unique factors were 34.
Mapping the MP AI-4 to the ICF

Table II. Mapping of the Mayo-Portland Adaptability Inventory (MP AI-4) subscale Ability Index (items 1–12) to the International Classification of Functioning, Disability and Health (ICF)

| Item                  | Meaningful concept | Main ICF code |
|-----------------------|--------------------|---------------|
| 1. Mobility           | Walking            | b770 Gait pattern functions |
| Mobility              | Moving             | d4500 Walking short distances |
| Mobility              | Balance            | d4501 Walking long distances |
|                      |                    | d4502 Walking on different surfaces |
|                      |                    | d4503 Walking around obstacles |
|                      |                    | d4600 Moving around within the home |
|                      |                    | d4601 Moving around within obstacles other than home |
|                      |                    | d4602 Moving around outside the home and other buildings |
|                      |                    | d465 Moving around using equipment |
| Use of hands          | Use of hands       | b7300 Power of isolated muscles and muscle groups |
| Use of hands          | Strength in hands  | b7600 Control of simple voluntary movements |
| Use of hands          | Coordination in    | b7601 Control of complex voluntary movements |
| Use of hands          |                    | b7602 Coordination of voluntary movements |
|                      |                    | d4400 Picking up |
|                      |                    | d4401 Grasping |
|                      |                    | d4402 Manipulating |
|                      |                    | d4403 Releasing |
|                      |                    | d4450 Pulling |
|                      |                    | d4451 Pushing |
|                      |                    | d4452 Reaching |
|                      |                    | d4453 Turning or twisting the hands or arms |
|                      |                    | d4454 Throwing |
|                      |                    | d4455 Catching |
| Vision                | Seeing             | b2100 Visual acuity functions |
|                      |                    | b2101 Visual field functions |
|                      |                    | b2102 Quality of vision |
| Audition              | Hearing            | b2300 Sound detection |
|                      |                    | b2301 Sound discrimination |
|                      |                    | b2302 Localisation of sound source |
|                      |                    | b2303 Lateralization of sound |
|                      |                    | b2304 Speech discrimination |
|                      |                    | b2400 Ringing in ears or tinnitus |
| Dizziness             | Feeling unsteady   | b2402 Sensation of falling |
|                      | Dizzy              | b2401 Dizziness |
| Motor speech          | Clearness of speech| b3100 Production of voice |
|                      |                    | b3101 Quality of voice |
|                      | Rate of speech     | b320 Articulation functions |
|                      | Stuttering         | b3300 Fluency of speech |
|                      |                    | b3301 Rhythm of speech |
|                      |                    | b3302 Speed of speech |
|                      |                    | b3303 Melody of speech |
| Verbal communication  | Communication      | b1670 Reception of language |
|                      | Expressing         | b1671 Expression of language |
|                      | language           | b1672 Integrative language functions |
|                      | Understanding      | d166 Reading |
|                      | Dizzy              | d170 Writing |
|                      |                    | d310 Communicating with – receiving – spoken messages |
|                      |                    | d320 Communicating with – receiving – formal sign language messages |
|                      |                    | d325 Communicating with – receiving – written messages |
|                      |                    | d330 Speaking |
|                      |                    | d340 Producing messages in formal sign language |
|                      |                    | d345 Writing messages |
|                      |                    | d3600 Using telecommunication devices |
|                      |                    | d3601 Using writing machines |
|                      |                    | d3602 Using communication techniques |
|                      |                    | d3150 Communicating with – receiving – body gestures |
|                      |                    | d3350 Producing body language |
|                      |                    | d3500 Starting a conversation |
|                      |                    | d3501 Sustaining a conversation |
|                      |                    | d3502 Ending a conversation |
|                      |                    | d3503 Conversing with one person |
|                      |                    | d3504 Conversing with many people |
|                      |                    | d7104 Social cues in relationships |
| Attention/concentration| Attention          | b1400 Sustaining attention |
|                      |                    | b1401 Shifting attention |
|                      |                    | b1402 Dividing attention |
|                      |                    | b1403 Sharing attention |
|                      |                    | d160 Focusing attention |
| Memory                | Learning           | b1440 Short-term memory |
|                      |                    | b1442 Retrieval of memory |
| Fund of information   | Remembering        | b141 Long-term memory |
| Problem-solving       | Problem-solving    | b1646 Problem-solving |
|                      |                    | b1640 Abstraction |
|                      |                    | b1641 Organization and planning |
|                      |                    | b1642 Time management |
|                      |                    | b1643 Cognitive flexibility |
|                      |                    | b1645 Judgement |
|                      |                    | d1750 Solving simple problems |
|                      |                    | d1751 Solving complex problems |
| Visuospatial abilities| Drawing            | b1561 Visual perception |
|                      | Assembling         | b1565 Visuospatial perception |
|                      | Route-finding      | d3352 Producing drawings and photographs |
|                      | Being visually aware|                       |

unique ICF categories identified; (v) the bandwidth of content coverage (i.e. the number of ICF categories that we were able to identify divided by the total number of ICF categories, i.e. 1454); and (vi) content diversity (i.e. the ratio of ICF categories to meaningful concepts identified). We also reported the number of mapped categories at specific ICF levels and the specific linkages between the MP AI-4 items and ICF categories. Finally, we reported on the 30 scoreable MP AI-4 items relating to the different environmental factors. Taken together, points (i) to (vi) give a quantitative summary of the mapping and enable a more concrete comparison with other instruments that are mapped to the ICF.

RESULTS

A summary of the mapping of the MP AI-4 to the ICF is shown in Table I. All items in the 3 subscales of the MP AI-4 could be
Table III. Mapping of the Mayo-Portland Adaptability Inventory (MPAI-4) subscale: Adjustment Index (Items 13–21) to the International Classification of Functioning, Disability and Health (ICF)

| Item | Meaningful concept | Main ICF code |
|------|--------------------|---------------|
| 13. Anxiety | Anxiety | b1341 Onset of sleep |
| | Being tense | b1520 Appropriateness of emotion |
| | Fearful | b1521 Regulation of emotion |
| | Flashbacks of stressful events | b1522 Range of emotion |
| 14. Depression | Depression | b1302 Appetite |
| | Sad | b1340 Amount of sleep |
| | Hopeless | b1342 Maintenance of sleep |
| | Poor appetite | b1343 Quality of sleep |
| | Poor sleep | b1344 Functions involving sleep cycle |
| | Worry | b1520 Appropriateness of emotion |
| | Self-criticism | b1521 Regulation of emotion |
| | | b1522 Range of emotion |
| 15. Irritability, anger, aggression | Irritability | b1520 Appropriateness of emotion |
| | Anger | b1521 Regulation of emotion |
| | | b1522 Range of emotion |
| | Impulse control | b1304 Impulse control |
| 16. Pain and headache | Pain | b2800 Generalized pain |
| | Headache | b2801 Pain in body part |
| | | b28010 Pain in head and neck |
| | | b2802 Pain in multiple body parts |
| | | b2803 Radiating pain in a dermatome |
| | | b2804 Radiating pain in a segment or region |
| 17. Fatigue | Fatigue | b1300 Energy level |
| | Lack of energy | b4552 Fatiguability |
| 18. Sensitivity to mild symptoms | Sensitivity to mild symptoms | b1601 Form of thought |
| | attributed to brain injury | b1602 Content of thought |
| | Concern of symptoms | b1603 Control of thought |
| | Worry of symptoms | b1520 Appropriateness of emotion |
| | | b1644 Insight |
| | | b1800 Experience of self |
| | | b1801 Body image |
| | | b1802 Experience of time |
| 19. Inappropriate social interaction | Social interaction | d7100 Respect and warmth in relationships |
| | Childish | d7101 Appreciation in relationships |
| | Silly | d7102 Tolerance in relationships |
| | Rude | d7103 Criticism in relationships |
| | Behaviour not fitting | d7104 Social cues in relationships |
| | | d7105 Physical contact in relationships |
| | | d7202 Regulating behaviours within interactions |
| | | d7203 Interacting according to social rules |
| | | d7204 Maintaining social space |
| 20. Impaired self-awareness limitations | Recognition of limitations | b1601 Form of thought |
| | Recognition of disabilities | b1602 Content of thought |
| | | b1603 Control of thought |
| | | b1520 Appropriateness of emotion |
| | | b1644 Insight |
| | | b1800 Experience of self |
| | | b1801 Body image |
| | | b1802 Experience of time |

mapped to components and categories in the ICF. A total of 88 meaningful concepts in the instrument were identified. For the 30 scoreable items of the MPAI-4, there were, on average, 2.9 meaningful concepts per item (content density), and 65% of all concepts could be mapped. Bandwidth, i.e. the breadth of the aspects measured, is represented by the absolute and relative number of the 1454 unique categories in the ICF that we were able to link to the items in the MPAI-4 (200; 14%). Content diversity was 2.3, indicating a relatively high amount of diversity, i.e. 2 or more ICF categories per meaningful concept on the average. The items in the MPAI-4 could be mapped to 34 (13%) of the 258 Environmental Factors in the ICF.

The results of the mapping are shown in Tables II–IV. It should be noted that several items could be mapped to the same ICF category, so the sum of all unique ICF categories is less than for the 3 subscales together (cf. Table I). In the Ability Index, the mapping was equally divided between Body Functions (b) categories and Activity/Participation (d) categories. Items in the Adjustment Index (not including the 3 that also contributed to the Participation Index) mapped primarily to Body Functions, but also to Activity/Participation categories. Of the 76 mappings for the Participation Index, all except 1 was to Activity/Participation categories. For all 3 subscales, 19 mappings were at the 3rd level (3 digits), 1 at the 5th level and the remaining at the 4th level.

The different MPAI-4 items and how they relate to the Environmental Factors in ICF are shown in Table V. Many of the MPAI-4 items could be mapped to the same environmental factor, but there were also several items that mapped to different factors. In summary, 14 of the 34 (41%) environmental factors were identified and used to map an item, whereas the other 20 environmental factors (59%) were linked to only 1 item.

DISCUSSION

Since the introduction of the ICF in 2001, there has been a rapid increase in the number of studies using the ICF in a variety of fields (2, 3, 6). With the development of a systematic set of rules for linking the ICF to existing health status measures, the nature of the measures can be clarified (5) and this will assist researchers and other users in selecting measures that
Table IV. Mapping of the Mayo-Portland Adaptability Inventory (MPAI-4) subscale Participation Index (Items 22–29) to the International Classification of Functioning, Disability and Health (ICF)

| Item | Meaningful concept | Main ICF code |
|------|-------------------|---------------|
| 22. Initiation | Getting started on activities | b1301 Motivation |
| 23. Social contacts with friends, work associates, and other people who are not family, significant others, or professionals | Social contacts with friends, work associates, and other people | d7500 Forming relationships, with friends, d7501 Informal relationships with neighbours, d7502 Informal relationships with acquaintances, d7503 Informal relationships with co-inhabitants, d7504 Informal relationships with peers |
| 24. Leisure and recreational activities | Leisure activities | d9100 Informal associations, d9102 Ceremonies, d9200 Play, d9201 Sports, d9202 Arts and culture, d9203 Crafts, d9204 Hobbies, d9205 Socializing |
| 25. Self-care | Self-care | d2301 Managing daily routine, d2302 Completing the daily routine, d2303 Managing one’s own activity level, d5100 Washing body parts, d5101 Washing whole body, d5102 Drying oneself, d5200 Caring for skin, d5201 Caring for teeth, d5203 Caring for fingernails, d5204 Caring for toenails, d5300 Regulating urination, d5301 Regulating defecation, d5302 Menstrual care, d5400 Putting on clothes, d5401 Taking off clothes, d5402 Putting on footwear, d5403 Taking off footwear, d5404 Choosing appropriate clothing, d550 Eating, d560 Drinking |
| 26. Residence | Homemaking | d2301 Managing daily routine, d2302 Completing the daily routine, d2303 Managing one’s own activity level, d5700 Ensuring one’s physical comfort, d5701 Managing diet and fitness, d5702 Maintaining one’s health, d6300 Preparing simple meals, d6301 Preparing complex meals, d6400 Washing and drying clothes and garments |

Contd.

| Item | Meaningful concept | Main ICF code |
|------|-------------------|---------------|
| 27. Transportation | Transportation | d4700 Using human-powered vehicles, d4701 Using private motorized transportation, d4702 Using public motorized transportation, d4750 Driving human-powered transportation, d4751 Driving motorized vehicles, d4752 Driving animal-powered vehicles, d4800 Riding animals for transportation |
| 28A. Paid employment | Employment | d825 Vocational training, d840 Apprenticeship (work preparation), d8450 Seeking employment, d8451 Maintaining a job, d8500 Self-employment, d8501 Part-time employment, d8502 Full-time employment |
| 28B. Other employment | Homemaking, Studying, Volunteer work, Retired | d820 School education, d830 Higher education, d855 Non-remunerative employment |
| 29. Managing money and finances | Managing money, Managing finances, Shopping, Keeping an account | d6200 Shopping, d860 Basic economic transactions, d865 Complex economic transactions |

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relate to specific outcomes, as described in the ICF. Despite this development and our knowledge of the importance of such a rigorous and somewhat time-consuming process, too few existing measures have been mapped to the ICF. With all the advantages of this process, we can assume that further efforts will be undertaken to perform such work.

The process of mapping the MPAI-4 to the ICF revealed the MPAI-4 to be a relatively diverse and broadly based assessment instrument characterized by 88 meaningful concepts.
that mapped to 200 unique ICF categories. A large majority (90%) of mappings could also be made at the specific 4th level of the ICF. As might be expected, the MPAI-4 Ability and Adjustment Indices were mainly mapped to the Body Functions categories. However, items on these subscales also mapped frequently to the Activity/Participation ICF categories. For example, a thorough assessment of even basic abilities, such as language reception and expression, often requires evaluation of more complex communication activities. These mappings to the Activity/Participation domain are consistent with the original design of the MPAI-4 as an evaluation of abilities that are instrumental to activities of daily living, adaptation and community integration.

The success of the mapping procedure and the rich linkages that were identified between most items of the MPAI-4 and the ICF provide evidence of the construct validity of the MPAI-4. However, our intention in conducting this mapping procedure was not to evaluate how well the MPAI-4 could be translated into ICF terms by most users. Rather, our small group of two expert users and one of the developers of the MPAI-4 (instead of a larger group of raters, as suggested in the linking rules (4, 5)) intended to augment the understanding of the MPAI-4 items through examples furnished by the ICF and to enhance the usefulness of the MPAI-4 in this way. Mapping the MPAI-4 to the categories of the ICF provides a more detailed description through examples of the types of functions and activities that are represented by each item.

For the speech and communication items of the MPAI-4, the intent was to cover communication broadly in both basic functions and activities, but not to include an assessment of more complex human activities, such as, conversation and discussion (d350). Mapping the ICF to the MPAI-4 item “Non-verbal communication” allowed a more detailed description of this item describing not only non-verbal means of communication, e.g. gestures, but also the pragmatics of communication, e.g. starting and ending conversations appropriately, and conversing with multiple people. Similarly, the item “Use of hands” was intended to cover the use of hands in daily activities;

| Item number of the MPAI-4                      | Environmental categories                                                                 |
|-----------------------------------------------|------------------------------------------------------------------------------------------|
| 1–20, 22, 25                                  | e110 Products or substances for personal consumption                                      |
| 1–20, 22, 25, 26                              | e115 Products and technology for personal use in daily living                            |
| 1, 27                                         | e120 Products and technology for personal indoor and outdoor mobility and transportation |
| 6, 7A, 7B                                    | e125 Products and technology for communication                                           |
| 28B                                          | e130 Products and technology for education                                               |
| 28A                                          | e135 Products and technology for employment                                               |
| 24                                           | e140 Products and technology for culture, recreation and sport                           |
| 26                                           | e155 Design, construction and building products and technology of buildings for private use |
| 29                                           | e165 Assets                                                                              |
| 3                                            | e240 Light                                                                               |
| 4                                            | e250 Sound                                                                               |
| 21                                           | e310 Immediate family                                                                    |
| 21                                           | e315 Extended family                                                                     |
| 23                                           | e320 Friends                                                                            |
| 23                                           | e325 Acquaintances, peers, colleagues, neighbours and community members                  |
| 19, 21, 23, 24, 26, 27, 28A, 28B, 29          | e410 Individual attitudes of immediate family members                                    |
| 19, 21, 23, 24, 26, 27, 28A, 28B, 29          | e415 Individual attitudes of extended family members                                     |
| 19, 21, 23, 24, 26, 27, 28A, 28B, 29          | e420 Individual attitudes of friends                                                     |
| 19, 21, 23, 24, 26, 27, 28A, 28B, 29          | e425 Individual attitudes of acquaintances, peers, colleagues, neighbours and community members |
| 1, 3, 23, 24, 26, 28A, 28B                    | e460 Social norms, practices and ideologies                                               |
| 1, 3, 23, 24, 26, 28A, 28B                    | e465 Social norms, practices and ideologies                                               |
| 1, 3, 23, 24, 26                              | e515 Architecture and construction services, systems and policies                         |
| 26                                           | e520 Open space planning services, systems and policies                                   |
| 26                                           | e525 Housing services, systems and policies                                              |
| 25, 26, 27, 28A, 28B, 29                      | e530 Utilities services, systems and policies                                            |
| 3, 4, 6, 7A, 7B, 23, 24, 28A, 28B, 29         | e535 Communication services, systems and policies                                        |
| 27                                           | e540 Transportation services, systems and policies                                       |
| 23, 24, 28B                                  | e555 Associations and organizational services, systems and policies                       |
| 23, 24, 25, 26, 27, 28B, 29                   | e560 Economic services, systems and policies                                             |
| 23, 24, 25, 26, 27, 28B, 29                   | e565 Economic services, systems and policies                                             |
| 23, 24, 25, 26, 27, 28B, 29                   | e570 Social security services, systems and policies                                      |
| 23, 24, 25, 26, 27, 28B, 29                   | e575 General social support services, systems and policies                              |
| 1–20, 22, 25, 26                             | e580 Health services, systems and policies                                               |
| 28A                                         | e585 Education and training services, systems and policies                               |
| 28A                                         | e590 Labour and employment services, systems and policies                                |
hence, the mappings were mainly to categories in the Activity/Participation component.

This study also suggested possible limitations of and challenges to the ICF taxonomy when being used in a mapping process. For example, “short-term” and “long-term” memory have different meanings in different contexts. We believe that the MPAI-4 memory item, which rates new learning capacity, was appropriately mapped to the ICF category “short-term memory” and that the MPAI-4 “Fund of Information” item (which refers to remotely acquired knowledge) was appropriately mapped to the ICF category “long-term memory”. However, in other contexts, both short-term and long-term memory can refer to different components of the new learning process. The division between functions and activities is at times vague in the cognitive domain. The MPAI-4 “Problem-solving” item mapped to “solving simple problems” and “solving complex problems” in the Activity/Participation component and also mapped to apparently similar cognitive functions, e.g. “problem-solving”, “organization” and “time management”, in the Body Functions component.

The items “Anxiety”, “Depression”, and “Irritability/Anger/Agression” in the MPAI-4 did not map to any specific ICF categories. Instead, these items mapped to more general categories describing appropriateness, regulation, and range of emotions in the ICF. The ICF is focused on positive functions and activities rather than psychopathology. However, identification of more specific human functions and activities that assist in the regulation of specific negative emotions would appear to be a necessary elaboration of the ICF. For instance, specific coping skills to prevent persistence of depression might be identified distinctly from coping skills involved in managing aggressive impulses following an ABI. Similar shortcomings were found for the MPAI-4 items “Sensitivity to Mild Symptoms” and “Impaired Self-awareness”. While the MPAI-4 item “Initiation” could be mapped to the ICF category “Motivation”, other categories are lacking to more fully describe the cognitive and affective processes involved in beginning and sustaining a behavioural sequence appropriately.

On the other hand, the MPAI-4 “Self-care” and “Residence” items were mapped to substantially more ICF categories. In these cases, the ICF provides a detailed listing of activities that might be targeted for intervention in a rehabilitation plan for those individuals who are rated with limitations and restrictions in these areas on the MPAI-4. In general, mapping of the Participation Index of the MPAI-4 to the ICF (cf. Table IV) was relatively rich, detailed, and not specific to ABI. With reference to these ICF linkages, the Participation Index may furnish an extensive list of goals for the rehabilitation process for individuals with ABI as well as other disability groups. Assessments with the Participation Index identifies the broad areas for intervention and provides a quantifiable measure of progress, whereas, the ICF linkages identify specific activities for rehabilitation.

Although the MPAI-4 was not intended to assess environmental factors relevant to brain injury medicine and rehabilitation, many items could be mapped to many of the ICF Environmental categories. This provides additional information that may be used to enhance the rehabilitation process by identifying intervention targets not only within the person but also within his or her environment.

In conclusion, this study shows that all items in the MPAI-4 could be mapped to the ICF and a standard coding framework. This provides better definition through more concrete examples (as listed in the ICF) of the types of body functions, activities, and participation indicators that are represented by each of the MPAI-4 items. Thereby, ICF descriptors, which are meant to be transcultural, may assist MPAI-4 users throughout the world in understanding the intent of each item. Successful mapping also offers a type of construct validation for the MPAI-4, in that a relationship between the MPAI-4 metric and the widely accepted ICF taxonomy were established. In a broader perspective, such a rigorous process may support further development of the MPAI-4 and the possibility of reporting results obtained with the MPAI-4 in the form of an ICF categorical profile, making it universally interpretable.

ACKNOWLEDGEMENTS

The study was completed within the context of the Centre for Ageing and Supportive Environments (CASE) at Lund University, funded by the Swedish Council for Working Life and Social Research. Financial support was received from Skane County Council’s research and development foundation and from Norrbotten County Council.

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