Movement and Mobility: Conceptual definitions and relevant measures

By

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Abstract

Movement and mobility are concepts that are frequently used in the nursing field. Movement is a fundamental human ability which changes as individuals grow and as a result of illness or injury. Movement is one of many factors which affects mobility. Decreased mobility can lead to decreased quality of life and independence. As individuals age the incidence of mobility difficulties increases, reaching 81% for women and 57% for men at the age of 90. Most of the tasks that nurses help their patients complete involve some degree of movement or mobility, so it is important for nurses to be able to determine if their interventions are returning patients to their optimal level of functioning in movement and mobility.

Despite the importance of these concepts, they are often confused or used interchangeably. These concepts need to be clarified to ensure proper measurement of outcomes. A concept analysis was completed to clarify and compare movement and mobility that was followed by a scoping review in order to identify and analyze measures that claimed to measure either movement or mobility. The measures were analysed using the International Classification of Functioning, Disability, and Health (ICF), an alpha-numeric system created to code health information. Because the code set generated by the scoping review was larger than the data sets seen in existing studies, existing methods for analyzing and presenting data were further developed. Finally, the concepts of movement and mobility were operationalized using an example case to show how the information from the scoping review can be used to select measures of movement and mobility for clinical and research purposes.

Co-authorship

I hereby declare that this thesis incorporated material that was a result of a collaborative effort, as follow. The first manuscript, *Movement and Mobility: A concept analysis*, was developed and critiqued by Dr. Rosemary Wilson and Dr. Kevin Deluzio. The second manuscript, *Methods for reporting data obtained from linking health measures to the International Classification of Functioning, Disability and Health codes: historical and proposed methods*, was developed with the assistance of my committee including Dr. Rosemary Wilson, Dr. Catherine Goldie, Dr. Jennifer Medves, and Dr. Kevin Deluzio. The third manuscript, *Measures of movement and mobility used in clinical practice and research: a scoping review*, was developed with the assistance of Dr. Rosemary Wilson, Amina Regina Silva, Colleen McLoughlin, Stéfany Petry, Dr. Catherine Goldie, Dr. Jennifer Medves, Dr. Kevin Deluzio, and Amanda Ross-White. The fourth manuscript, *Operationalizing movement and mobility*, was developed with the assistance of Dr. Rosemary Wilson. The fifth manuscript (Appendix A), *Measures of movement and mobility used in clinical practice and research: a scoping review protocol*, was developed with the assistance of Dr. Rosemary Wilson, Dr. Dana Edge, Dr. Elizabeth VanDenKerkhof, Dr. Kevin Deluzio, and Amanda Ross-White.

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List of Abbreviations

10MWT – 10-meter Walk Test

6MWT – 6-minute Walk Test

ADL – Activities of Daily Living

AGA – Ability to Get Around

AIMS – Arthritis Impact Measurement Scales 2

BRD – Bed Rise Difficulty

CHART – Craig Handicap Assessment and Reporting Technique Mobility Subscale

CINAHL – Cumulative Index of Nursing and Allied Health

D&D – Dungeons and Dragons

FAM – Foot and Ankle Ability Measure

GMT – Global Mobility Task

HAL – Hemophiliac Activity List

HAPI – Health and Psychosocial Instrument database

HBMA – Home-Bound Mobility Assessment

ICF – International Classification of Functioning, Disability and Health

JBISRIR – Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports

JBI SUMARI – Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information

LLFDI – Late-Life Function and Disability Instrument

LSA – Life Space Assessment

MOBAM-IN – Mobility Activities Measure for Inpatient Rehabilitation Settings

NANDA – North American Nursing Diagnosis Association

OPTIMAL – Outpatient Physical Therapy Improvement in Movement Assessment Log

PROMIS – Patient-Reported Outcomes Information System Physical Function Item Bank

PROMs – Patient Reported Outcome Measures

QOL – Quality of Life

RMA – Rivermead Motor Assessment

RMI – Rivermead Mobility Index

TUG – Timed Up and Go

UAB-LSA – University of Alabama at Birmingham study of Aging Life-Space Assessment

UPDRS - Unified Parkinson's Disease Rating Scale

VAP – Vestibular Activities and Participation

WHO – World Health Organization

WORQ-UP – Work-Related Questionnaire for Upper Extremity Disorders

Chapter 1 Introduction

The ability of individuals to move around their environment affects many parts of their life and any change in mobility can have severe consequences. Difficulty with mobility is a common problem, particularly as individuals age. By the age of 70, 22% of women will have a disability affecting mobility: this percentage will rise to 81% by the age of 90. In men, the percentages are 15% at the age of 70 and 57% at the age of 90.[1] This loss of mobility is significant for individuals because mobility impairments have been shown to be predictive of mortality and dependence.[2] Mobility has also been shown to have strong links with quality of life,[3-5] which may be linked with wellbeing because mobility allows for greater independence.[5] Mobility has also been associated with social inclusion and participation;[3, 6, 7] sense of self and self-esteem;[6, 8, 9] freedom and autonomy;[9] zest for life;[9] and productivity and leisure occupations.[6]

Nursing practice has a focus on improving individuals' day to day lives and has been defined by Henderson as doing for others what they would do for themselves if they had the strength, will, and knowledge. This is done with the understanding that the goal is to make patients as independent as possible, as soon as possible.[10] Most of the tasks that nurses help their patients with involve moving to some degree, making movement and mobility important parts of a person's independence.

In practice, nurses need to know if their interventions are effective in returning patients to their optimal level of functioning in movement and mobility. However, the understanding of, and distinction between, the concepts of movement and mobility is often unclear; for example, in the International Classification of Functioning, Disability and Health (ICF), *Mobility* is a chapter title that includes the subsections: *Changing and maintaining body position; Carrying, moving*

and handling objects; Walking and moving; and *Moving around using transportation*, indicating that mobility is a concept which includes various types of movement.[11] Yet, in the nursing diagnosis system developed by the North American Nursing Diagnosis Association (NANDA), *Movement* is a major heading that includes the following diagnosis: *Impaired physical mobility; Risk of peripheral neuromuscular dysfunction; Risk of injury in perioperative; Intolerance to activity; Fatigue; Lack of leisure; and Disability (partial or total) to organize and maintain the home* indicating that movement is a concept which encompasses many concepts including mobility, fatigue, and disability in the home.[12]

The International Classification of Functioning, Disability, and Health

The purpose of the ICF is to provide health care workers and researchers with a standardized language and framework for describing functioning, disability, health and health-related states.[11] In the field of nursing, the ICF can form a framework for nurses to address activity limitations and participation restrictions. As a model it can help to plan interventions for functional goals and participation in society.[13] Occupational therapists have found that the ICF can be useful for supporting communication between professionals – though it does not replace the professional language of a particular profession.[14] Speech-Language Pathologists have also used the ICF as a framework for comprehensive rehabilitation, and audiology rehabilitation clinics have used the ICF to assist students with choosing an assessment and treatment approach.[14]

A systematic review of 670 papers was conducted by Cerniauskaite et al. to determine how the ICF was used in the first 10 years of its existence. The authors found that the ICF had been cited in the following types of papers: conceptual papers; papers that developed the ICF and ICF related instruments; papers that implemented the ICF in a clinical context; papers that

explored the ICF in non-clinical context; linking papers, in which health measures were analysed with the ICF; and articles in which the ICF is only mentioned.[15]

The ICF contains 4 main sections: Body Functions (b), Body Structures (s), Activities and Participation (d), and Environmental Factors (e).[11] These categories are independent of heath conditions (either diseases or disorders). Personal factors, such as age and ethnicity, are also considered by the ICF framework; however, the creation of codes for this portion of the ICF has not been completed.

Within each component, there are a number of chapters. For example, under Activities and Participation there are nine chapters or level one classifications. Each chapter then branches into level two classifications. Most of the level two classifications branch further into level three codes and a few branch to level four codes.[11]

Consider the following branch of codes that belong to the Activities and Participation component of the ICF as an example of how the constructs become more specific at each level. An individual looking for a code that would specify the ability to put on shoes would follow these branches:

Component: *d* Activities and Participation

Level One Classification: *d5* Self-care

Level Two Classification: *d540* Dressing

Level Three Classification: *d5402* Putting on footwear.[11]

At Level Two and Three of the Classifications are also “other specified” and “unspecified” codes which end with an 8 or 9 respectively. The “other specified” codes are used when additional information not covered by the ICF classification is documented. The

"unspecified" codes are used for items that are more general then any of the ICF categories listed.[16]

ICF Linking Protocol. The ICF can also be used to code health care data. In particular, it has been used to assess content validity of measures by linking items in the measure to specific ICF codes. Linking to the ICF is a powerful tool because it can provide a succinct summary of large sets of information that can be quickly contextualized. For example, Stamm et al. used the ICF to analyse and compare the content of questionnaires used to assess functioning in patients with hand osteoarthritis.[17] In Chapter 4, this technique will be used to determine if measures assess the concept of movement, mobility, or a combination of the two.[18]

A set of ten rules for linking ICF codes to health-status measurements was first published in 2002 by Cieza et al. to provide a standardized method for linking.[16] The rules were redefined and simplified in 2005 when it was found that they were being applied beyond the scope they were initially created for.[19] The rules were subsequently returned to ten rules in 2016 after a decade of use outlined challenges that remained in the linking process.[19, 20]

One of the major changes in the 2005 rules was to use neither the "other specified" nor the "unspecified" categories of the ICF. This was done to reduce the ambiguity of the results of the linking process and to simplify the rules.[19] The updated linking rules also allowed for the use of the "pf" code for personal factors. Personal factors had not previously been used because the ICF does not yet have specific codes. However, this caused a loss of precision since personal factors were assigned the code "nc" for not covered.[19]

Cieza et al. published a refinement of the rules in 2016. Of particular significance was the change in the rule regarding the use of "other specified" and "unspecified" codes. Users are once again encouraged to use these codes because experience has shown that not using them led to a

loss of information.[20] This change constitutes more than a small refinement. Ignoring a small yet significant portion of the ICF codes would have resulted in missing useful information when coding was done so the reintroduction of these codes is a major change. There were also smaller changes made to the rules which are not relevant to the coming discussion.

The most recent iteration of ICF linking rules dictates that researchers follow this process listed below.[20] A selection of items from physical activity measures have been collated in Table 1-1 to show the end result of the linking process.

1) Acquire a good knowledge of the conceptual and taxonomical fundamentals of the ICF;
2) Ask "What is this piece of information about?" or "What is this item about?" to identify the main concept – in Table 1-1 the main concept of question 20 of the Long International Physical Activity Questionnaire is highlighted in yellow both in the question itself and in the main concept;[1]
3) Identify all additional concepts that are appropriate – in Table 1-1 the additional concepts are highlighted in green, the additional concepts are found in the section header and in the question itself;
4) Identify the perspective of the piece of information, for example *performance* describes what an individual does in their environment, *capacity* describes an individual's ability to do an action in a "standardized" environment, and *need or*

[1] The term concept was used in the published linking rules for rules two and three. Given that a concept is an agreed upon definition that is often abstract and not operationalized, we would argue that the data generated by these questions of the measure are constructs. Constructs are more specific and less abstract. For example, 'mobility' is a concept but 'getting to the store' is construct. While it is possible for a measure to ask about mobility, it is far more likely for the measure to look at constructs. This thesis will continue to use the term 'concept' in order to remain consistent to the published linking rules. However, the distinctions should be understood and kept in mind.

dependency describes an individual's kind or level of needs – in Table 1-1 the perspective is noted in column two and is performance because it asks the participant to describe what they do in their daily life;

5) Identify the category of the response options, for example *duration* describes a response option that asks "how long?" and *confirmation or agreement* describes a yes/no option – in Table 1-1 the classification is in the fourth column and is based on the response options that were in the questionnaire and were listed verbatim in column three;
6) Link the concepts identified in steps 2 and 3 to the most precise ICF category – in Table 1-1 the concept of walking 10 minutes was coded as *d4500* Walking short distances and the concept of recreation, sport, exercise or leisure was coded as *d9208* Recreation and leisure, other specified;
7) Use "other specified" and "unspecified" as appropriate. Other specified should be used when the concept fits within a chapter but the details provided do not fit with any of the other specific categories. Unspecified should be used when the concept fits within a chapter but there is insufficient information to link it to a specific category – in Table 1-1 the code *d9208* Recreation and leisure, other specified was used because the concept was specified as walking while doing recreation and leisure activities but the other available level four codes such as *d9200* Play and *d9205* Socializing do not match the concept;
8) Use the code not definable (*nd*) when the information on the concept is insufficient for making a link to a specific code. *nd* can be made more specific by using *nd-gh* (not definable-general health), *nd-ph* (not definable-physical health), *nd-mh* (not

definable-mental health), *nd-dis* (not definable-disability), *nd-func* (not definable-functioning), and *nd-dev* (not definable-child's development) – in Table 1-1 an example of a not definable code is seen in the Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) questionnaire where the question is with regards to the first activity an individual does upon waking which does not have enough detail to link to a specific code;

9) Use personal factor (*pf*) when the concept is a personal factor as defined by the ICF – in Table 1-1 an example of a personal factor is seen in the PARA-SCI questionnaire where the question pertains to changes in the individual's personal routine; and
10) Use the code not covered (*nc*) when the concept does not fall under the purview of the ICF. *nc* can be further specified with not covered-health condition (*nc-hc*) and not covered-quality of life (*nc-qol*) – in Table 1-1 an example of a concept that is not covered by the ICF is in Transport and Physical Activity Questionnaire (TPAQ) where the question concerns the actions about another person.[20]

Table 1-1. Sample of ICF linking rules

International Physical Activity Questionnaire – Long [21]								
Verbatim health information	**Perspective**	**Response options**	**Classification**	**Main concept**	**Additional concepts**	**ICF category of main concept**	**ICF category of other concepts**	**Annotations**
Part 4: Recreation, sport, and leisure-time physical activity This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.								
20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?	Performance	Days per week No walking in leisure time -> Skip to question 22	Frequency	Walk, 10 mins	For recreation, sport, exercise or leisure	D4500 Walking short distances	D9208 Recreation and leisure, other specified	
Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) [22]								
After you opened your eyes what was the first thing you did?	Performance	Activity Type	Qualitative	First activity		Nd-func		
Compared with the morning/evening routine you just described (day 1), were there any differences in your morning/evening routine (day 2 and day 3)? *If no differences, do not go through the morning or evening routine again.* Indicate on recording sheet same as day 1.	Performance			Differences in routine		pf		
Transport and Physical Activity Questionnaire (TPAQ) [23]								
i. I see people in my neighbourhood walking for travel.	N/A	Strongly agree to Strongly disagree	Agreement / Intensity	Others walking		Nc		

Instead of always using the complete set of 1424 ICF codes, a series of Core Sets has been created. Each Core Set is a tailored short list of ICF categories for a specific health condition. As of 2015, 34 ICF Core Sets had been developed, and a standard process for developing Core Sets was established.[24, 25] Examples of Core Sets include the Low Back Pain set, the Diabetes Mellitus set, the Stroke set, and the Geriatric set. The codes that are included in the Low Back Pain Brief set are: *b130* Energy and drive functions, *b134* Sleep functions, *b152* Emotional functions, *b280* Sensation of pain, *b455* Exercise tolerance functions, *b710* Mobility of joint functions, *b715* Stability of joint functions, *b730* Muscle power functions, *b735* Muscle tone functions, and *b740* Muscle endurance functions.[10]

Rationale

When an individual has an illness or injury that impacts their movements there are a variety of interventions that nurses and interdisciplinary team members can use to address the issue, including medications, physical therapy, and assistive devices. However, when a patient is released from hospital to return home, they must also be mobile. Mobility allows individuals to accomplish the tasks they need to navigate their everyday life, from walking up the front steps of their home to getting to the store for food. Researchers and clinicians need to know that they are measuring the correct concept given the circumstances. To evaluate an exercise regime used to improve movement in an individual who has had a joint replacement or the effect of medications on the symptoms of Parkinson's, a movement measure might be the ideal method of assessment. But if an individual is going to be released home after a stroke or a community nurses is assessing what types of supports are needed by a senior in the community, a measure of mobility might better indicate if they will be able to navigate their environment. Failure to measure the

correct concept could result in falls, insufficient access to health care services, or individuals who cannot meet their basic life needs.

The need for this thesis work became apparent during reviews of the literature for previous work that the terms movement and mobility are often used interchangeably.[26] The first step of this emergent design project was to explore the concepts of movement and mobility using a concept analysis to determine if they were indeed distinct concepts (Chapter 2).[27] Emergent designs have been used in a variety of situations such as technology and education and is used when desired changes cannot be foreseen in the initial planning.[28] That was useful in this thesis because decisions made in later manuscripts were dependent on the findings of the earlier manuscripts. After verification of the distinction of the concepts, it became necessary to explore how these concepts are measured which lead to the next step.

To borrow wise words from a professor, "you shouldn't be trying to measure light with a ruler," in conversation with R. Wilson (June 2015). The measurement of movement and mobility, for both research and clinical purposes, requires the use of appropriate measures. An exhaustive and rigorous scoping review was needed to provide nurses and other interdisciplinary team members with a detailed summary of the measures that exist to assess movement, mobility or a combination of both.

Assessing what concepts of functioning, disability, and health, including movement and mobility, are covered by a measure can be determined by linking the items in a measure to the ICF using linking rules developed by Cieza et al.[16, 19, 20] The number of measures that exist for movement and mobility is vast and the data collected for the scoping review (Chapter 4) generated more linking data then has been previously published. As a result, an assessment and

synthesis of methods previously used was completed and these methods were expanded to increase the usability and accessibility of the presentation of the data (Chapter 3).

The next step was the completion of the scoping review, and the presentation of its data (Chapter 4). Finally, based on the findings and data generated by the scoping review, a guide to selecting a measure or set of measures for movement and mobility was created with a sample case illustrating the process (Chapter 5).

Research Questions

The five manuscripts in this thesis address the following questions:

1) What are the defining attributes, antecedents and consequences of movement and mobility in the context of patients; functioning, disability, and health, as defined in the ICF? (Creation of conceptual definitions: Chapter 2)
2) How have data that has been generated by linking health information to the ICF been presented in the literature and how can the presentation of this data be adapted for larger data sets? (Development of methods: Chapter 3)
3) What tools exist to measure movement and/or mobility in adults and how do the concepts they measure compare to the conceptual definition of movement and mobility when linked to the ICF? (Comparison of conceptual definition to existing movement and mobility tools: Chapter 4)
4) How can researchers and clinicians select tools to measure movement or mobility in a systematic and comprehensive manner? (Selecting tools for research and clinical practice: Chapter 5)

Format and Structure of the Thesis

This work uses an inductive approach, moving from specific examples of movement and mobility in clinical and general life situations to build on their relationship with one another and other concepts that are closely related. These relationships will gradually be built into a framework that allow for the assessment of both movement and mobility and other concepts related to functioning, disability, and health. The thesis is based on the constructive paradigm because it is comprised of a variety of methods suited for the objectives of the work. A critical approach is taken towards existing definitions and measures.[29]

The manuscripts in this thesis were ordered such that the ideas build on one another, the initial manuscripts informing the later manuscripts. Chapter 2 is the manuscript "Movement and Mobility: A Concept Analysis", which has been published in *Advances in Nursing Science*.[30] The concept analysis contains the definitions of movement and mobility that will be used for the remainder of the thesis. Within the concept analysis, the defining attributes, antecedents and consequences of each concept are connected to the ICF codes that were used to extract data in the scoping review in Chapter 4. Chapter 3 is the manuscript "Methods for reporting data obtained from linking health measures to the International Classification of Functioning, Disability and Health codes: historical and proposed methods", which has been submitted and is under review by *Disability and Rehabilitation*.[31] This manuscript is the methods for analysing and presenting large amounts of data from linking health measures to the ICF and is used in Chapter 4 to summarize, analyse and present the data. Chapter 4 is the manuscript "Measures of movement and mobility used in clinical practice and research: a scoping review" which has been accepted for publication in the *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* (renamed *JBI Evidence Implementation*).[32] The scoping review contains

an exhaustive collection of measures that have been identified as measuring either movement or mobility in adults. These measures are linked to the ICF codes and their characteristics have been analysed. Chapter 5 is the manuscript "Operationalizing movement and mobility" which has been submitted to *International Journal of Rehabilitation Research* and is under review.[33] It contains practical advice for researchers and clinicians on selecting measures of movement and/or mobility using the information provided in the scoping review. The numbering of tables and figures in these manuscripts has been modified to conform to required thesis formatting. Chapter 6 is a summary of the key finding of this research, the strengths and limitations of the overall thesis, implications for nursing practice and recommendations for area of further practice, policy, and research.

The manuscript "Measures of movement and mobility used in clinical practice and research: a scoping review protocol", which outlines the methods for the scoping review in Chapter 4, has been published in *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* and can be found in Appendix A.[18]

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Chapter 2 Movement and Mobility: A concept analysis

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Abstract

This article provides an analysis of the concepts of movement and mobility within the context of the International Classification of Functioning, Disability, and Health (ICF) for patients' functioning, disability, and health. The methodology developed by Walker and Avant was used to clarify definitions, components, and relationships relevant to the two concepts and to the elements of the ICF framework. Definitions and the relationship between concepts are key information that clinicians and researchers need to measure the correct concept when they are assessing the effectiveness of interventions in nursing practice. Concept analysis findings are grounded by the notion that movement occurs when the body causes its own displacement and is explained by the basic principles of physics, human anatomy, and physiology. Mobility is then distinct because it is affected by the environment that the individual is in and can be assisted by any type of mobility aid. Mobility does not need to me generated by the individual's muscles but does need to be controlled by the individual who is mobile. An individual's mobility in his or her environment is important to his or her well-being and needs to be understood in relationship to his or her movements.

Introduction

Movement and mobility are two concepts that are frequently used in tandem or interchangeably in health care literature. Despite the confusion that is sometimes present, movement and mobility are two distinct concepts with specific uses. Movement is a change in position or place,[1] whereas mobility is the ability to move freely or with ease.[2] Movement is often used in the measurement of specific symptoms or outcomes from interventions, whereas mobility is measured to determine an individual's ability to navigate his or her environment. An example of this is shown in a phenomenological study where movement is used in the background section to describe symptoms, and mobility is used by participants to describe their lived experience.[3] Measuring the incorrect concept could result in incorrect conclusions being drawn in research or clinical settings or patients failing to receive the help that they need. Because of the confusion concerning movement and mobility, a concept analysis is necessary to clarify the defining attributes, antecedents, and consequences of both terms.[4] The aim of these concept analyses is to define movement and mobility in the context of patients' functioning, disability, and health, as defined in the International Classification of Functioning, Disability and Health (ICF),[5] so that their differences are understood, they can be measured as distinct concepts, and their interactions are understood. Clear conceptual definitions of movement and mobility will allow for the terms to be used consistently in a variety of contexts, including in research articles, diagnosis, frameworks, and tools. Once the concepts of movement and mobility are defined, it can be determined whether the tools that are used to measure them are true to the concepts they are meant to measure. The following concept analyses are completed using the methodology developed by Walker and Avant.[4] This method was chosen because it is a straightforward step-by-step process that includes identifying all uses of the concept that can be

discovered; determining the defining attributes; identifying antecedents and consequences; identifying a model case; identifying contrary, borderline, related, and invented cases; and defining empirical referents.[4] Identifying all the uses of the concept includes analysing the various ways in which the word is used.[4] Determining the defining attributes, antecedents, and consequences includes identifying the attributes that make up the concept and events that always precede or follow the concept.[4] Model, contrary, borderline, related, and invented cases serve as examples that help clarify the concept.[4] Defining empirical referents identifies tools that measure the concepts.

The International Classification of Functioning, Disability and Health

The purpose of the ICF is to provide health care workers and researchers with a standardized language and framework for describing the components of health and health-related states.[5] The ICF contains 4 main sections: body functions, body structures, activities and participation, and environmental factors.[5] These categories are independent of heath conditions (either diseases or disorders). Personal factors, such as age and ethnicity, are also considered by the ICF framework; however, at this time, they do not have a section of codes in the ICF. The ICF can be linked to existing health status measures in order to determine what concepts are being measured by the tool.[6-8] To assess movement and mobility measures using the ICF, the ICF codes will be divided into the antecedents, defining attributes, and consequences of movement and mobility so that when the tools are linked to the codes, we will be able to determine which concept is being measured. When measures are linked to the ICF, it can then serve as a connecting framework between the intervention and outcome measure. This results in more appropriate outcome measures being selected.[7] Linking the measures will also allow for content comparison between the measures.[7]

Use of the Concept of Movement

The *Cambridge Dictionary* lists several definitions for movement. The first, and most basic, is "a change in position or place." The change in position could refer to a part of a person's body, his or her overall displacement over a period of time, or an inanimate object.[1] In the context of politics, movement could also mean "a group of people with a particular set of aims," such as the environmental movement.[1] Movement can be used as a general term to describe "the act or process of changing a situation or event, or of changing the way something happens or is done," such as the movement towards free trade or smaller family sizes.[1] In the field of music, a movement is "one of the main parts of a piece of classical music," and in watchmaking, the movement is "the part of a clock or watch that turns the hands that point to the time".[1] Movement can also be used as an abbreviation of the compound term "bowel movement", which is the "act of emptying the bowels".[1]

A search of health care databases, including the Cumulative Index of Nursing and Allied Health (CINAHL) and MEDLINE, was completed using the terms "Movement OR Mobility" AND "Nurse". A review of the results showed that the concept of movement is most often used to refer to the change in position of a person's body parts or whole body. However, there are also examples of political movement, such as in the article, "Baccalaureate Nursing Student's Identification with the Women's Movement,"[9] which discusses the effect of the women's movement on nursing recruitment and satisfaction within the profession. Movement is also used in the general sense of changing a situation or event, such as in "Factors influencing movement of chronic psychiatric patients from the orientation to the working phase of the nurse-client relationship on an inpatient unit,"[10] which discusses the change in situation from one phase of a

relationship to another. The technical uses of movement that are specific to music and watchmaking are not seen in health care literature.

Because this analysis is interested in human movement, the use of movement in the context of music and watchmaking are invalid uses of the concept. While political movements and general movements are used in the health care setting, they are not specific to an individual's health and functioning, so they will not be considered in this context.

Defining Attributes of Movement

Human movement can be complex and can have up to 9 defining attributes. These attributes are a context, displacement with both a start and end position, speed, velocity, acceleration, force generated by the human's muscles, that it is a part of the human body that is moving instead of an external object, coordination and planning. Because human movement involves the movement of a physical object, either a part of the human body or the whole body, it is prudent to return to basic physics in order to understand its defining attributes.

The change in position of an object is also referred to as displacement and requires a point of reference.[11] Movement cannot occur in a vacuum; to know that an object is moving, there must be a reference point. As a result, all movement is described in relation to another object as a point of reference.[11] For example, an individual who is lying on a bed may not be moving when using the bed, the room, or the earth as the point of reference. However, relative to the sun, the individual is moving at great speed.

In most instances, the point of reference for a movement can be inferred on the basis of the context. For example, when a parent tells a child to stop moving while they are sitting on a moving train, a reasonable individual will understand that the parent wishes that the child will stop squirming in his or her seat, not that the child should throw him- or herself from the train in

an effort to stop moving relative to the earth. However, there are instances in scientific study where it is beneficial or necessary to explicitly state what the movement is being measured relative to. For example, when studying a volleyball player who is spiking a ball, a researcher could either consider the movement of the player's hand relative to the ball, which will give performance indicators, or the movement of the hand relative to the forearm, which will provide information that is relevant to overuse injuries.

For there to be movement, there must be a start position and an end position.[11] All movement has speed, the distance traveled over the elapsed time; velocity, the displacement (which includes a direction) over the elapsed time; and acceleration, the rate at which the moving object changes velocity.[11] Newton's first law of motion states that "an object continues in a state of rest or in a state of motion at a constant speed along a straight line, unless compelled to change that state by a net force".[11(p81)] While a body could theoretically maintain a constant velocity while moving, realistically, the human body alters between states of rest and movement, meaning that forces are applied that result in positive and negative acceleration.

Fundamental human movements including balance; spilling, falling, and landing; walking and running; jumping; object manipulation; throwing, striking, and catching; climbing and swinging; and airborne manoeuvres.[12-14] All of these human movements have forces, including gravity, that are applied to the body and the external objects, such as boxes that are being carried or balls that are being kicked. However, the predominant forces at work are internally generated by muscle contractions. When considering movement from an individual's health perspective, movement infers input from the individual. An individual who is unconscious and being carried is experiencing displacement and acceleration but is *being moved* and is not *moving*.

Movements can be broken down into 3 subgroups which share the defining attributes that were previously explained but have some distinct differences. Simple involuntary movements, such as a tremor or a reflex, have all the previously discussed defining attributes. Simple voluntary movements, such as looking to the side, not only have all the previously defined attributes but also include a cognitive portion, where the individual makes a choice and consciously instigates the movement. Complex movements, which are voluntary by nature, include most of the movements previously listed, such as running, jumping, and climbing.[12-14] Each are constructed of many smaller movements and, as a result, require coordination and planning to be successfully executed.

In summary, when simple human movement occurs, the following are involved: a context, displacement with both a start and end positions, speed, velocity, acceleration, force is being generated internally by the human's muscles, and it is a part of the human body that is moving and not an external object. When the movement is complex, coordination and planning are also required.

Antecedents and Consequences of Movement

By identifying the antecedents and consequences of a concept, it is easier to understand the context of the concept.[4] Antecedents and consequences cannot be defining attributes; an antecedent is an event or incident that must occur before the concept can occur, and consequences are events or incidents that occur as a result of the concept.[4]

Antecedents. For human movement to occur, there are a number of systems that have to be functional. The joints must be intact; this includes the ligaments, which connect bone to bone, and the joint lubrication, which is called synovial fluid.[12, 14, 15] The required muscles and tendons, which connect the muscles to bone, must be intact and in sufficient shape to exert the force

needed to initiate and control movement.[12, 14, 15] The amount of force that is required for movement will vary depending on the situation. Finally, the motor and sensory neurons that connect to the muscles must be intact and functioning in order to conduct the signals that the muscles need to contract.[14, 15] Because the brain is not involved in simple involuntary movements (which are managed by the nerves in the spinal cord), it is not an antecedent to all of the cases of movement and therefore is not listed as one.

Unlike simple movements, especially simple involuntary movements, complex movements must be learned. This occurs through the natural development of childhood, such as when a toddler moves from crawling to walking, or through formal instruction, such as when a teenager is coached how to do a cartwheel.

Consequences. The most significant consequence of human movement is the ability to interact with the environment. At the most basic level, a simple involuntary movement can result in an individual pulling his or her arm away from a flame or any other painful and damaging stimulus.[15, 16] With complex movements, a whole series of simple voluntary movements could result in an individual walking into a university classroom that will provide him or her with education, employable skills, and interaction with peers and mentors. In both cases, the individual uses movement to fulfil the fundamental human drives to avoid what is unpleasant, and he or she does not want to experience, and to emphasize experiences that are physically or socially beneficial.[17] Simply stated, the main consequence of movement is mobility.

Model Case of Movement

A model case provides a pure example of the concept that includes all of the defining attributes.[4] A model case has been created for each group of movements - simple involuntary

movement, simple voluntary movement, and complex movement - to describe them in order of complexity.

Simple involuntary movement. A nurse sits her patient at the edge of the examination table and, using a small rubber hammer, raps just below the knee cap. This applies pressure to the patellar tendon and stretches the quadriceps muscle. A nerve impulse is sent to the spinal cord where it activates a motor neuron. The movement is initiated as the motor neuron sends an activating impulse to the quadriceps and causes the quadriceps to contract and start the movement.[15] The lower leg, which had been stationary and hanging at a 90^{o} angle relative to the thigh, accelerates and swings into almost 180^{o} of extension relative to the thigh due to the force exerted by the quadriceps. As the lower leg approaches full extension, the force exerted by the quadriceps decreases as it relaxes and the tendons and ligaments provide resistance to prevent the knee from overextending. These forces, as well as gravity, cause negative acceleration until the lower leg comes to a stop at its end position at near complete extension, which ends the movement.

Simple voluntary movement. Tommy sits on the branch of an apple tree as his sister, Maggie, approaches on the sidewalk. Held in Tommy's right hand is a very rotten apple. Knowing that if Maggie hears or sees him she will throw an apple at him, Tommy remains perfectly still. The moment Maggie is lined up beneath him, Tommy makes the conscious decision to drop the apple. Nerve impulses are sent from his brain, down his spinal cord, and through the motor neurons to his right hand. This causes the muscles on the outside of his thumb to contract and pull his thumb away from his index finger. The apple is released and falls; chaos ensues.

Complex movement. Lynda is at the end of the dock. To enter the cold water as quickly as possible, she decides to dive. She steps forward with her left leg so that her toes are just at the edge of the dock. As soon as this motion is complete, her arms swing forward. The momentum of the step and swinging arms cause her centre of gravity to move from over her feet to over the water, and just before gravity can pull her into a belly flop, her legs push off from the dock, her head ducks, her core body arches, as her arms are held firmly over her head in a streamlined position. Lynda enters the water arms and then head first in a streamlined position that sends up no splash. Once fully submerged, Lynda uses her core and hips to execute 2 quick wave-like dolphin kicks before pulling her arms down and to the side, allowing her head to rise above the surface of the water. This was a learned skill that requires advanced planning and the coordination of all body parts.

Additional Cases of Movement

Cases that are the opposite of the concept of interest or are closely related to the concept of interest help clarify the defining attributes of a concept.[4] The following are examples of a contrary case, borderline case, and a related case.

Contrary case. Henry has been in a coma since a motor vehicle accident 2 weeks ago. His neurologist, Lilly, is making her rounds and administers the Glasgow Coma Scale. To assess motor response, Lilly performs a trapezius pinch by twisting and squeezing the middle of the muscle between the neck and the shoulder and above the clavicle.[18] Henry has no reaction; he does not move his hand towards the painful stimulus in an attempt to remove it, and there is no abnormal flexion or extension because the muscles do not contract. Because Henry demonstrates no movement, he is given a motor score of 1.

Borderline case. The dictionary lists bowel movements as a possible use of the word movement. This case shares many attributes with the concept of human movement that has been previously described. There is force exerted by a group of muscles in the intestines that results in the movement of waste out of the body. There are 2 sets of movement that can be analysed in this context. There is the movement of the muscles in the large intestine as they contract and relax, which have measureable speed, velocity, and acceleration and are moving in relation to the other structures in the abdomen.[15] There is also the movement of waste as it passes through and then out of the body and which has its own speed, velocity, acceleration and context; however, the waste is being acted on by the body but is not a part of the body. The movement of the intestines can be considered to be human movement, but the movement of waste cannot. In the clinical context, when a patient is asked whether he or she has had a bowel movement, the clinician is referring to the movement of waste, which can be affected by factors other than improper intestinal movement. Since bowel movements is missing a defining attribute, that the movement occurs to a part of the body, it is a borderline case.

Related case. Mobility for the ICF includes the section *Changing and maintaining body position*.[5] Maintaining a body position includes balancing when standing, and balance is frequently measured in individuals who have difficulty with movement. However, balance and maintaining a position are related to but are not movement. For example, Layla decides to run off and join the circus. In her first show, her act is to stand on her toes on a large rubber ball with one leg extended out behind her and china dishes stacked in both hands and on her head. Layla moved to get into this position and she will move to come down from this position when the show is ended. While she is in the position she is not moving so that she does not drop the china or fall, but she is balancing. There is muscle contraction occurring in order to maintain her

balance, but she is not experiencing displacement, speed, velocity or acceleration. As such, she is balancing but not moving.

Balance is also not a defining attribute of movement because it does not always precede a movement. Balance is required for certain movements, such as walking or running along a log, but not by all movements. Sticking out your tongue, waving goodbye, and rolling over in bed are all movements that do not require balance.

Use of the Concept of Mobility

Mobility, in the most general sense of the word, is "the ability to move freely or to be easily moved".[2(p1)] When used in the context of communications and technology, it is the ability to have services on a device that can travel from place to place without requiring wires.[2] In the context of economics and jobs, mobility refers to the ability of someone to change his or her situation by changing employment, changing social class, or moving to a different place.[2] The interest for this article is mobility as it pertains to the human body in the context of an individual's functioning, disability, and health; as a result, the general definition is applicable.

Mobility is widely discussed in health care literature with a number of definitions used. Yeung et al.[19] built on the mobility framework constructed by Webber et al.[20] and defined mobility as "the ability to get around (AGA) one's home, neighbourhood or wider community independently (e.g. walking, driving and using public transport) with or without the help of specialist mobility aide (e.g. walkers, manual and powered wheelchairs, and mobility scooters) or others (e.g., friends, family, volunteers, specialist transport or public transport)".[19(p19)] It has also been described as being able to meet the challenges of the environment by moving within and between environments by using any type of movement to accomplish the tasks of daily living.[21, 22] There are also specific types of mobility described in the literature such as wheeled

mobility, which has the same general definition as other mobility but is specific to wheelchair users.[23]

Defining Attributes of Mobility

There are 4 defining attributes of mobility: it is when someone is moving; the movement can occur in any way; it depends on the environment; and it is done by the choice of the individual who is moving. When examining definitions and explanations of mobility in health care literature, there are a number of reoccurring themes.

First, mobility is when an individual is moving around. Second, movement can occur using any method, including walking, biking, driving, or using public transport.[19, 22] It can also be facilitated by equipment such as walkers, manual or powered wheelchairs, or scooters or by other individuals such as friends, family, volunteers, or specialist.[19, 23] Finally, mobility is dependent on the environment. The environment can be an individual's home, neighbourhood, or community, and each of those environments has a unique makeup.[19, 20] The environment can either facilitate or be a barrier to mobility.

Discussions of mobility in the health care environment also include the element of choice. Mobility means moving one's self to a *chosen* location and moving one's self via *desired* means.[22] This means that the movement, however it is achieved, must be under the direction of the person who is mobile.

Antecedents and Consequences of Mobility

Identifying the antecedents and consequences of mobility makes it easier to understand the context of the concept and how it relates to other concepts.[4] Antecedents are events or incidents that are required before the concept can occur, and consequences are events or incidents that result from the occurrence of the concept.[4]

Antecedents. For there to be mobility, the person who is to be moved must have the will to move and must control the movement. For example, infants will develop the ability to crawl on hands and knees at about 8 months of age and will have upper limb mobility prior to that when they develop the ability to hold objects.[24] However, a newborn who is being carried from one story of the house to another is being moved but cannot be said to be mobile, because in that context, he or she is not trying to accomplish the movement. In the same way, an individual who has been hit by a car and continues to move along the road on the hood of the car cannot be considered to have mobility because, in this situation, he or she does not control their movement relative to the road, and in all likelihood, he or she would like to stop this movement. When this individual ends up in hospital in a coma, he or she will not be mobile even though he or she is wheeled from the emergency department to the operating room then to the surgical floor. All of these movements are outside of the individual's control, as are the movements that occur when the individual is turned to prevent pressure sores and when he or she is moved to provide basic care. As such, these movements do not constitute mobility. The second antecedent for mobility is movement; the force that controls the movement does not need to be internally generated but does need to be controlled by the person who is mobile.

Consequences. The consequences of mobility are being able to meet the needs of daily life and maintain a sense of self.[22] The needs of daily life can be physical, such as activities of daily living (ADL) or getting away from danger, or emotion, such as the need to play or interact with others. Having the mobility to help meet these needs is a key part of independence.[22] A meta-synthesis of studies of older adults' perception of mobility found that mobility signified independence, well-being, and freedom, which are important to individuals maintaining a sense

of self.[22] For nurses, this means that older individuals who are able to maintain their mobility will be more likely to be able to remain at home and avoid long-term care.

Model Case of Mobility

A model case of mobility is when an individual's mobility meets all his or her needs, which can include self-care, recreation, employment, domestic tasks, and socialization. An individual with perfect mobility is as follows: Anne is a nurse who lost her lower left leg while serving in the military. On a typical day, she wakes up early and showers, dresses, and fixes breakfast independently. With the use of a prosthetic limb, she has no problem walking to the local pool, and she swims there 4 times a week to get enough exercise to stay in shape. Anne can maintain the same paces in the pool that she did when she was a teenager and swimming competitively. After her swim, Anne drives to the local children's hospital. Her shift will keep her on her feet, but she has the energy and the stamina to keep going. Anne is quick to help colleagues transfer their patients. She always takes time to play with the kids, even if it means getting on the floor to push the train set around with toddlers, and is able to duck the occasional flying stuffed animal. She is able to fill out charts neatly and in a timely manner and has the steady hands required to insert catheters and change dressings. Anne returns home in the evening and promptly takes care of housework, home maintenance, and shopping for necessities. This means that when her days off come around, she is able to visit friends and family in the surrounding towns and cities.

Additional Cases of Mobility

Contrary case. The complete loss of mobility is referred to as immobility. A contrary case of mobility is described. Jonathan is a young man of 16 who loved to play rugby. During his last game, there was an accident that left him paraplegic. After being reassured that their son

would live, his parents began worrying about how he would be able to get around. They live in a small rural community that is not conducive for someone in a wheelchair to get around in; the sidewalks are in disrepair or non-existent, and very few buildings are wheelchair accessible. They want to bring Jonathan home from the hospital as soon as possible, but they live in an old farmhouse with narrow halls and tight corners. They want to make it more accessible but cannot afford the renovations. Although only Jonathan's legs that are paralyzed, you would never know it. Discouraged and angry with his predicament, Jonathan refuses to make even the most feeble attempt at self-care. To make matters worse, he has decided to make those around him suffer and refuses to move when care is being provided for him. Instead, he lays there like a lump, forcing the nurses to turn his large muscular frame. Everyone in the community wonders about Jonathan's future; there has never been a wheelchair-bound teenager in their community. School officials are unsure as to how to accommodate him, and everyone wonders what such an athletic boy will do with his downtime now that he is confined to a wheelchair. Jonathan has lost mobility because of the lack of movement in his legs, because his environment is unsuited to his needs, and because his emotional state has caused him to voluntarily relinquish all control over his movements, even down to the most basic level of self-care.

Borderline case. A concept that shares many attributes with the concept of mobility is ADLs, which are activities that an individual needs to complete in order to be able to function independently; examples of ADLs include transfers, dressing and bathing.[25] ADLs often share many attributes with mobility because some activities will be mobility activities, such as transfers. Other activities, such as bathing, not only require the individual to be mobile enough to move into the shower or tub and reach all parts of his or her body but also require that the individual has the cognitive resources to complete all stages of the task and access to the

materials required including soap, cloth, and clean water. As a result, some ADLs may be mobility activities but others are activities that build on an individual's mobility.

Related case. A related case to the concept of mobility is range of motion, which is sometimes referred to in the literature as mobility.[26] Range of motion is similar to mobility because it measures the ability of a joint or body segment to be moved. However, further exploration of the term "mobility", when used in the context of the human body, found that the defining attributes included that the movement be under the direction of the person who is moved. Range of motion can be either active or passive and does not need to be under the direction of the person who is being moved. As a result, an individual is mobile when he or she touches his or her toes and the range of motion for their spine could be measured; but an individual who is under anesthesia following a complete knee replacement can have the range of motion measured by the surgeon but cannot be said to be mobile.

Invented case. An invented case of reestablishing mobility would be the case of Horace Jones. During his first life, Horace decided that once was not enough and left instructions that his body be cryogenically frozen upon his death. Unfortunately, his estate was somewhat depleted upon his death and only his head was preserved. Upon being unfrozen, Horace had to gradually regain his mobility. First, he had to wait for his vocal cords to thaw so that he could issue instructions regarding personal care. Then, Horace had to be suited with a robotic body so that he could move about the hospital facility independently. Finally, to be allowed to venture into the outside world, Horace had to be licensed to use the jet packs that were used to transport people around and between cities.

Empirical Referents of Movement and Mobility

Empirical referents are the actual phenomenon that, when they exist, demonstrate the occurrence of the concept itself.[4] They are extremely important when considering instrument development because they contribute to content and construct validity.[4] There are numerous tools which claim to measure either movement or mobility. Some tools measure what they intend to, whereas others measure aspects of one concept while claiming to measure the other. Other tools measure the antecedents of movement, such as muscle strength, or the consequences of mobility, such as ADLs. The methodology developed by Cieza and colleagues can be used to assess what concepts a tool measures using ICF codes.[6-8]

Table 2-1. ICF Codes for Movement

ICF Codes for Movement	
B750 Motor reflex functions	A motor reflex is an involuntary movement induces by a specific stimulus.
B755 Involuntary movement reaction functions	A movement can occur when there is an involuntary contraction of large muscles as a reaction to body position, balance or threatening stimuli.
B760 Control of voluntary movement functions	This covers both simple and complex voluntary movements.
B765 Involuntary movement functions	This covers unintentional or involuntary muscle contractions that can be grouped into impairments such as: tremors, tics, mannerisms, stereotypes, motor perseveration, chorea, athetosis, vocal tics, dystonic movements and dyskinesia.
B770 Gait pattern functions	Walking, and the pattern of gait are complex movements that cause the individual to move their whole body in the upright position.
B789 Movement functions, other specified and unspecified	This covers movement functions not previously mentioned.
B798 Neuromusculoskeletal and movement-related functions, other specified	This covers neuromusculoskeletal and movement-related functions not previously mentioned.
B799 Neuromusculoskeletal and movement-related functions, unspecified	This covers neuromusculoskeletal and movement-related functions not previously mentioned.
D410 Changing basic body position	This includes a variety of complex movements, including moving to or from lying down, squatting, kneeling, sitting, standing, bending, or shifting the center of gravity.
D420 Transferring oneself	This includes transfers without changing body, such as sliding from one seat to another, and is a complex movement.
D429 Changing and maintaining body position, other specified and unspecified	Changing body position infers movement; however, maintaining body position does not.
D450 Walking	This is made up of a complex set of movements that results in the displacement of an individual.
D455 Moving around	This is a set of complex movements, including crawling, climbing, running, jogging, jumping, and swimming, that result in the displacement of the individual.
D469 Walking and moving, other specified and unspecified	This covers other types of moving that have not been previously covered.

Table 2-1 provides a list of the defining attributes of movement, as they are defined by the ICF codes and the rational for inclusion. Table 2-2 provides a list of the defining attributes of mobility, as they are defined by the ICF and the rational for inclusion. These tables and Cieza's methodology can be used to determine which concept a tool measures.[6-8] For a complete table of the ICF codes broken down by defining attributes, antecedents and consequences for each concept are available.

Table 2-2. ICF Codes for Mobility

ICF Codes for Mobility	
D430 Lifting and carrying objects	Interacting with the environment, including lifting and carrying objects, is part of mobility.
D435 Moving objects with lower extremities	Interacting with the environment, including moving objects with the lower extremities, is part of mobility.
D440 Fine hand use	Interacting with the environment, including manipulating objects with fine hand movements, is part of mobility.
D445 Hand and arm use	Interacting with the environment, including moving objects with the hands and arms, is part of mobility.
D449 Carrying, moving and handling objects, other specified and unspecified	Interacting with the environment, including carrying, moving and handling objects, is part of mobility.
D460 Moving around in different locations	Moving around within a given environment is the hallmark of mobility.
D465 Moving around using equipment	Moving around with the use of equipment is a type of mobility.
D470 Using transportation	Using transportation allows an individual to be mobile.
D475 Driving	Driving allows an individual to be mobile.
D480 Riding animals for transportation	Using animals for transportation allows an individual to be mobile.
D489 Moving around using transportation, other specified and unspecified	Using any type of transportation allows an individual to be mobile.
D498 Mobility, other specified	This deals with other types of mobility.
D499 Mobility, unspecified	This deals with other types of mobility.

Implications for Future Theory, Research, and Practice

With the concepts of movement and mobility defined, both with their defining attributes and how they relate to other concepts, it is now possible to assess tools that claim to measure movement or mobility. When a tool that claims to measure movement or mobility is identified, the methodology that was developed by Cieza and colleagues can be used to code the tools with the ICF codes.[6-8] Since all of the codes in the ICF have been associated with movement and mobility, a reviewer can now say with confidence if the tool measures movement or mobility.

These concept analyses allow for several variables to be calculated when assessing tools for movement and mobility. These are which parts of the tool measures movement and which parts measure mobility; which parts of a tool measure the antecedents or consequences of movement; which parts of a tool measure the antecedents or consequences of mobility; and of the list of ICF codes that refer to movement or mobility, how many are covered by a tool. These variables can then allow clinicians and researchers to make informed decisions about which tools best measure their outcomes of interest.

For example, a nurse who wishes to measure their patients' ability to navigate their environment and live independently should use a measure of mobility rather than a measure that focuses on movements. Such measures could impact when patients are discharged or what support services are made available to individuals returning home to help them live independently. This concept analysis will also allow future theory building as the association between the concepts of movement and mobility and concepts such as ADLs and independence.

Conclusion

Movement and mobility are concepts that are important in health care and to patient's everyday lives. This concept analysis has shown that movement is physical displacement of all or a part of the human body and that mobility occurs when the individual who is moving wants to move and controls his or her movements, however the movement is accomplished. There are a number of tools that can be used to measure movement and mobility and they can be assessed by using the ICF codes developed by the World Health Organization.

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Chapter 3 Methods for Reporting Data Obtained from Linking Health Measures to the International Classification of Functioning, Disability and Health Codes: historical and proposed methods

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Abstract

The International Classification of Functioning, Disability and Health (ICF) was established in 2001 to provide a common language, in the form of alphanumeric codes, to describe health components of functioning and disability. To facilitate the use of these codes to describe and compare health measures, a set of linking rules was created by Cieza and colleagues. However, recent updates in the linking rules and larger sets of measures have made presenting data difficult. The objective of this paper is to explore how data generated by linking rules has been presented in the literature and to provide guidance on using and interpreting these methods. A hand search of two systematic reviews on the use of the ICF was completed followed by a search of the Cumulative Index to Nursing and Allied Health Literature. The codes can be summarized and presented as the percentage of the measure covered by a set of codes or the percentage of a set of codes covered by the measure. All ICF codes, including those that are "other specified" and "unspecified," should be used when linking to health information. A summary of how many and why these codes were used should be provided. If these codes were not used this should be stated and explained.

Introduction

The International Classification of Functioning, Disability and Health (ICF) was developed by the World Health Organization to provide a scientific basis for understanding and studying health; to establish a common language for describing health and health-related states; to permit comparison of data across countries, disciplines, services, and time; and to provide a systematic coding scheme for health information.[1] The ICF contains four following components: Body Functions (b), Body Structures (s), Activities and Participation (d), and Environmental Factors (e).[1] Each component branches into chapters, such as *d5* Self-care, and then into level two and three codes such as *d540* Dressing and *d5404* Choosing appropriate clothing.[1]

To simplify using the ICF, Core Sets have been created. These are short lists of ICF codes for specific health conditions. As of 2015, 34 ICF Core Sets had been developed, and a standard process for developing Core Sets was established.[2, 3]

A systematic review of 670 papers was conducted by Cerniauskaite et al. to determine how the ICF has been used since its release in 2001. These papers were grouped into six categories: conceptual papers; development of ICF and ICF related instruments; implementation in clinical context; non-clinical context; linking papers, in which health measures were analysed; and articles in which the ICF is only mentioned.[4]

Linking rules for the ICF were established by Cieza et al. to create a systematic way of associating health measures with the ICF codes.[5-7] A detailed overview of the linking rules can be found in Appendix B. Cerniauskaite et al. identified 73 papers that described measurement tools or research protocols that were linked to ICF categories.[4] Fayed et al. completed a systematic review to determine the extent to which linking rules have been used and to collect

feedback on methods; they identified 109 articles, 58 of which employed published linking rules.[8]

The changes in the linking rules over time has created challenges. In the initial 2002 rules all ICF codes were used, but the changes implemented in 2005 recommended that codes that ended in "other specified" or "unspecified" not be used.[5, 6] As a result, the authors found that important information was being missed in the linking process and in 2016 the most recent update to the rules recommended that the "other specified" or "unspecified" codes be used.[7] However, this means that a decade's worth of publications have not used the "other specified" or "unspecified" codes and there is no guidance on how to incorporate them into data calculations and presentation.

In the past, the linking process has been performed on smaller data sets, resulting in simple methods to present the data. These methods, such as presenting the raw codes in table format, are not practical for large datasets.

The objective of our work therefore is twofold: to explore how data generated by linking rules has been presented in the literature and to provide guidance on using and interpreting these methods.

A search of the literature was conducted to identify methods that have been used to present and compare ICF linking data for health measures. The search started with studies that were already known to the primary author, followed by a hand search of the references from a scoping review by Fayed et al. and systematic review by Cerniauskaite et al..[4, 8] When it was found that none of the articles used methods that would be appropriate for summarizing, analyzing, and presenting large data sets, key words were identified and a search of the Cumulative Index to Nursing and Allied Health Literature (CINAHL) database was completed.

The focus was on identifying papers that compared multiple measures using the ICF, excluding papers that used the ICF for children and youth.[9] The search ended when five papers, slightly more than 25% of the final sample size, were assessed and not found to have any new reporting methods. Data were extracted from 18 papers in all.

Historical Methods

A summary of the methods that were used in each of the papers reviewed is presented in Table 3-1. The level of code indicates the level of classification (one through four) that was used when presenting the data. Reporting the chapter frequency includes listing the number of times a code was used from each of the components; the personal-factors component was sometimes reported here. Reporting the code frequency per tool was generally done in a table with the codes used on either the columns or rows and the tool names on the other edge with the number of times the codes were used in each of the tools counted in the appropriate cells. The not covered (nc) / not defined (nd) count reporting was either the number of times that the nc or nd code was used and/or a list of the concepts that were coded with nc or nd, as an indication of how many and which codes were unable to be coded to the ICF.

Table 3-1. Type of ICF reporting by study

Authors	Level of Code	Component Frequency	Code Frequency per Tool	Code Presence in Tool	nc / nd Count	Bandwidth	Percentage of Linked ICF Categories also in a Core Set	Content Diversity / Density	Frequency Distribution	Other
Borchers [10]	Level 3	X	X							
Cieza [11]	Level 3	X	X		X					
Escorpizo [12]	Level 3	X		X	X					The number of tools that had codes in all 4 categories
Geyh [13]	Level 3		X			X		X	For each component and level	
Hebert [14]	Level 1									The level 1 code that most of the items fell under
Noonan [15]	Level 3 & 4	X	X		X				For each component and the Activity and Participation Chapters	
Sigl [16]	Level 3 & 4	X		X						
Stamm [17]	Level 3	X	X		X		X	X		The number of ICF categories each tool was linked to. If the tool reported capacity or performance Number of different ICF categories
Stamm [18]	Level 3 & 4	X	X		X					
Stucki [19]	Level 3	X	X		X				For each component	Percentage of concepts linked to the top 87 categories.
Weigl [20]	Level 3	X								
Ballert [21]	Level 3	X	X						For each component	All data presented at the component and chapter level

Authors	Level of Code	Component Frequency	Code Frequency per Tool	Code Presence in Tool	nc / nd Count	Bandwidth	Percentage of Linked ICF Categories also in a Core Set	Content Diversity / Density	Frequency Distribution	Other
										The perspective and categorization of responses by chapter.
Darzins [22]	Level 3	X	X		X					Percentage of the concepts linked to a level 2 or 3 code. Number of level 2 codes in both tools.
Vincent [23]	Level 2						Core Set Representation Core Set Unique Disability Representation Measure to (B/C) Core Set Absolute Linkage Measure to (B/C) Core Set Unique Linkage			Measure to ICF Linkage
Alghwiri [24]	Level 2	X	X		X					The number of codes at the first and second level. Pie charts indicated the percentage of each tool covered by each component.
Azzopardi [25]	Level 1	X	X		X					
Oliveira [26]	Level 3			X						
Arumugam [27]	Level 2 & 3	X			X		Core Set Representation Measure to (B/C) Core Set Absolute Linkage			Radar plots describing the percentage of questionnaire items under each domain.

General Calculation methods.

Bandwidth. This variable represents the breadth of the health-related aspects measured. It is the percentage of the total ICF categories covered by the measure.[13]

Application: This type of statistic is limited in its usefulness. Given the size and the breadth of the ICF, it would be unrealistic to expect a tool to measure all of the concepts—or even most of the concepts—covered by the ICF. Geyh et al.'s study assessed health-related quality of life measures, and the tool with the broadest bandwidth covered 5% of the Body Functions codes, 17% of Activity and Participation codes, and 4% of the Environmental Factors.[13] Given the participant burden of a measure that spans even a single component of the ICF, such a measure would be impractical for clinicians and researchers. However, it is possible that this statistic could be useful when assessing curricula, which are designed to cover a wide view of health and functioning.

Measure to ICF linkage. This variable is the percentage of items from a measure that can be linked to an ICF code.[23, 28] The equation is:

$$Measure\ to\ ICF\ linkage = \frac{The\ number\ of\ items\ linked\ to\ at\ least\ 1\ ICF\ code}{Total\ number\ of\ items\ on\ the\ measure} * 100\%$$

Application: This calculation's usefulness would be limited to situations when the concept that the measure is assessing is related to health and function and includes aspects that are not in the ICF. It would not provide any helpful information when discussing measures, such as walking tests or questionnaires, which would consistently return results of 100%.

Frequency distribution. This variable is a count of the number of codes that belong in a group, frequently an ICF component, and what that number is as a percentage of all the codes used.[13, 15, 19, 21] The equation is:

$$Frequency\ distribution = \frac{Number\ of\ ICF\ codes\ in\ the\ component}{Total\ number\ of\ ICF\ codes\ used} * 100\%$$

Application: Stucki et al.'s paper summarizes the number of codes that fall into each of the components, which for the Bariatric Quality of Life Index is body structures, 1 (4%); body function, 18 (64%); activity and participation, 5 (17%); environmental factors 1 (4%); and personal factors 3 (11%).[19] In Geyh et al., the number of codes at each level of the ICF hierarchy was counted and the percentage of the total was calculated.[13] Frequency distributions serve to give a broad overview of the characteristics of the data set and/or the measure but need to be followed by a more detailed analysis.

Content density. Content density is an expression of how many codes are used for each measure; the formula is:[13, 17]

$$Content\ density = \frac{Number\ of\ ICF\ codes\ in\ the\ measure}{Number\ of\ items\ in\ the\ measure}$$

Application: If there is one concept for each of the items in the measure, the value will be 1; the more concepts identified for each item in the measure the higher the ratio will be. A number of less than one means that not every item had an identified concept that relates to an ICF code.[13] This is useful when researchers and clinicians want to compare how conceptually complex or straight forward measures are.

Content diversity. Content diversity is an indication of if the concepts in a measure are repetitive or different; the formula is:

$$Content\ diversity = \frac{Number\ of\ unique\ ICF\ categories\ used\ during\ the\ linkage}{Number\ of\ total\ ICF\ codes\ used\ in\ the\ measure}$$

Application: A value of one for this ratio indicates that each meaningful concept identified in the measure has a unique ICF code and, as a result, has concept diversity. The lower the number, the more of the measure's concepts are linked to the same ICF codes, and the

measure has less conceptual variety.[13] This allows researchers and clinicians to quickly compare if a measure is focused on a few codes or if there are a variety of codes used.

Content density and content diversity do not provide any information regarding which areas of the ICF codes are covered. However, if this has already been established, content density and content diversity could help decide between measures that cover the same ICF areas. The final limitation of these ratios is that they can be affected by the number of items in the measure. For example, a small measure with one item, one meaningful concept and one ICF category/code would have a content diversity of 1, and a tool that had 500 items with 500 meaningful concepts linked to 400 ICF categories would have a content diversity of 0.8. The second measure would have more codes (and is likely more diverse) but has a lower content diversity ratio then the first measure.

Both content density and content diversity provide useful information and should be reported with additional information, including the number of items in the measure, to give a fuller understanding of the measure.

Core Set methods. The calculations that are described below can be done with any defined group of ICF codes; they need not be restricted to published Core Sets.

Measure to (brief or comprehensive) core set absolute linkage. This measure is the percentage of items from a measure that is linked to the ICF codes in a Core Set.[23, 27, 28] This gives an overview of how much of the measure is related to the core set of interest and what percentage covers other concepts. The equation is:

$$Measure\ to\ (Brief\ or\ Comprehensive)\ Core\ Set\ Absolute\ Linkage$$
$$= \frac{Number\ of\ items\ linked\ to\ a\ code(s)\ appearing\ in\ the\ Core\ Set}{Total\ number\ of\ items\ on\ the\ measure} * 100\%$$

One of the limits of this statistic is that it provides no concept of the diversity within the Core Set. If a Core Set has 10 codes and two measures with 10 items each are being compared both will be scored 100% even if measure A has one item covering each of the 10 codes and measure B covers one of the Core Set codes 10 times.

Core Set representation. This is defined as "the percentage of unique core set codes that appear when the measure's items were linked to ICF codes".[23] Unique ICF codes means that once a code is used, subsequent uses of the code are not counted. It expresses how much of the Core Set is covered by the measure as opposed to how much of the measure is covered by the Core Set in the Measure to Core Set Absolute Linkage equation. The equation for Core Set representation is:

$$Core\ Set\ Representation = \frac{Number\ of\ unique\ ICF\ codes\ from\ the\ measure\ that\ appear\ in\ the\ Core\ Set}{Total\ number\ of\ codes\ on\ the\ (Brief\ or\ Comprehensive)\ Core\ Set} * 100\%$$

This equation gives a representation of the scope of coverage of the Core Set. The references for this equation do not indicate how to deal with different levels of codes or with the "other specified" or "unspecified" codes.[23, 27, 28] Both the measure to core set absolute linkage and core set representation provide information on the content validity of measures.

Core Set unique disability representation. This representation is defined as "the percentage of unique core set disability codes that appeared when the measure's items were linked to ICF codes".[23] This equation is based on the same logic as the Core Set representation equation; the only difference being that the Core Set has been restricted to a smaller subgroup. The equation is:

$$Core\ Set\ Unique\ Disability\ Representation$$

$$= \frac{Number\ of\ unique\ (d)\ codes\ from\ the\ measure\ that\ appear\ in\ the\ Core\ Set}{Total\ number\ of\ diability\ codes\ on\ the\ (Brief\ or\ Comprehensive)\ Core\ Set} * 100\%$$

The references for this equation also do not indicate how to deal with different levels of codes or with the "other specified" or "unspecified" codes.[23, 28]

Measure to (brief or comprehensive) Core Set unique linkage. This measure is the percentage of items from a measure that could be linked to unique ICF codes.[23, 28] This differs from the measure of the Core Set absolute linkage, in that it takes into account if a code has been used repeatedly and gives a better idea of the extent to which the measure represents the range of content from the Core Set. The equation is:

$$Measure\ to\ (Brief\ or\ Comprehensive)\ Core\ Set\ Unique\ Linkage$$

$$= \frac{Number\ of\ items\ that\ are\ linked\ to\ Unique\ codes\ in\ Core\ Set}{Total\ number\ of\ items\ on\ the\ scale} * 100\%$$

Recalculating the examples from the measure to Core Set absolute linkage would be as follows: measure A would have a score of 100% and measure B would have a score of 10%. While this equation takes into account the effect of repeated codes, this could also be taken into account by calculating and reporting both the Measure to Core Set Absolute Linkage and the Core Set Representation.

Percentage of linked ICF categories also in a Core Set. This equation is the number of ICF codes that also appear in the Core Set divided by the total number of codes linked to the measure. Stamm et al. use the Core Set for Osteoarthritis and found that 86.2% of the linked ICF categories of the Osteoarthritis measures they assessed were also covered by the Core Set.[17] They do not provide a description of their calculations, nor a reference. Based on the description, it is likely that the formula was:

$$Percentage\ of\ linked\ ICF\ categories\ also\ in\ a\ core\ set = \frac{Codes\ used\ in\ the\ measure\ also\ in\ the\ Core\ Set}{Total\ number\ of\ ICF\ Codes\ linked\ to\ the\ questionnaire} * 100\%$$

The limitation with this statistic in Stamm et al. is that all six questionnaires are grouped together, which prevents comparison or an understanding of what each individual questionnaire covers.[17] This also does not indicate the breadth of the measures; for example, if there are 100 ICF codes used for all the measures but 90 of them are the code b730 Muscle power functions, 90% of the linked ICF categories from the questionnaires would also be in the Core Set for Osteoarthritis but only 10% (one of the 10 Osteoarthritis level two codes) is represented. Also, if all 10 of the Osteoarthritis Core Set codes were used but there were 20 other codes, the results would be 33% (10/30 * 100% = 33%). The information provided by this equation is redundant if both the *Measure to Core Set Absolute Linkage* and the content density are reported.

Other. The Other section of the table lists manners of numerically describing the linking of the ICF to measures. They show the variety of ways that the linking can be described. For example, Alghwiri et al. uses pie charts to visually represent the percentage of each tool covered by each component.[24] The ICF linking process also provides information regarding the perspective and categorization of responses options, discussed in rules 4 and 5 of the linking rules,[7] which were reported and discussed in two of the studies.[17, 21]

Many studies also reported on the coding agreement between reviewers using either the percentage of agreement or a kappa coefficient. The mechanics and utility of these methods have been discussed in other papers analysing methods for interrater agreement and will not be discussed further in this paper.[29]

Guidance on Selecting and Interpreting

There are a number of issues to consider when selecting and interpreting the methods used to present and compare ICF codes. These include the direction of comparison, whether unique or overall codes were used, the level of code, as well as how "other specified" and "unspecified" codes were dealt with.

Direction of comparison. When comparing a measure and an ICF code group (either a Core Set or another predefined group), the comparison can be either how much of the measure is covered by the Core Set or how much of the Core Set is covered by the measure. This can be illustrated with a Venn diagram, see Figure 3-1, where the blue on the left represents the Core Set and the yellow on right represents the items in the measure, with the green being the overlap.

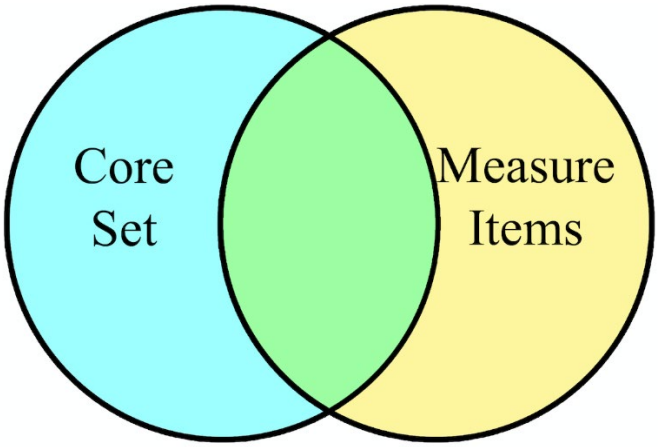

Figure 3-1. Venn Diagram showing the overlap of Core Set and Measure Items

When calculating the amount of the measure that is covered by a Core Set, what is being described is the fidelity of the tool to the concept, or set of concepts, that are desired. This is calculated as follows:

$$Measure\ coverage\ by\ Core\ Set = \frac{Number\ of\ items\ in\ the\ measure\ covered\ by\ the\ Core\ Set}{Number\ of\ items\ in\ the\ measure} * 100\%$$

When calculating how much of the Core Set is covered by the measure, the logic of Geyh, et al. to measure bandwidth is used, but to a more restricted set than the whole of the ICF.[13] This is calculated as follows:

$$Core\ Set\ Representation = \frac{Number\ of\ codes\ from\ the\ Core\ Set\ used\ in\ the\ measure}{Number\ of\ codes\ in\ the\ group} * 100\%$$

Table 3-2 compares a theoretical tool that asks about a patient's walking ability compared to the ICF codes under the d450 Walking section. Four of the five items have a code from the walking section, meaning that 80% of the measure is covered by walking codes. When the same measure is compared to a list of the codes in the walking group it can be seen that three different codes are used out of the six possible codes, meaning the Core Set Representation is 50%.

Table 3-2. Difference between calculating tool coverage and code coverage

Measure Coverage by Core Set			**Core Set Representation**	
Measure	**Cover by Codes**		**Code List**	**Cover by Measure**
Item 1	D4500		D4500	X
Item 2	Not covered		D4501	
Item 3	D4502		D4502	X
Item 4	D4500		D4503	X
Item 5	D4503		D4508	
			D4509	
Percentage	(4 / 5) *100% = 80%		Percentage	(3 / 6) *100% = 50%

A clinician or researcher would consider the Measure Coverage by the Core Set if they are interested in how faithful a measure is to a core set and would consider the Core Set Representation if they are looking for a measure that spans a certain set of concepts.

Unique codes versus overall codes. When a researcher is calculating the amount of a measure that is covered by a Core Set, they need to consider if they are going to use unique or overall codes. Unique codes are when each code is only counted once; instead of counting how

many times a code is used in a measure it simply asks: “is this code used in the measure” and takes a yes/no answer for each. Calculating Core Set Representation inherently uses unique codes.

The Overall Code Percentage is calculated in the same manner as the Measure Covered by Core Set listed above. The Unique Code Percentage is calculated as follows:

$$Measure\ Unique\ Code\ Percentage = \frac{Number\ of\ unique\ codes}{Number\ of\ items\ in\ the\ measure}$$

It is important to understand that the Measure Covered by Core Set indicates how much of the measure covers the code group of interest, whereas the Measure Unique Code Percentage indicates the scope of the measure within the code group. When interpreting the findings, an individual can compare the Measure Covered by Core Set percentage with a Measure Unique Code Percentage to get an idea of the amount of code repetition.

Level of code. All the calculations previously described can be done at any level of code. The majority of the studies reviewed for this paper used either level two or level three codes. Once a measure has been coded at a more detailed level, the codes can be “rolled up,” meaning that if a measure has been coded at level three it can be analysed at the component level or at levels one, two or three. However, a measure cannot be “rolled down,” to a lower level.

Rolling up codes can greatly simplify the amount of information presented, but exchanges specificity for simplicity. For example, *d455 Moving Around* contains among its level three codes *d4550 Crawling*, *d4552 Running*, and *d4554 Swimming*. A measure that assesses a person’s ability to swim would serve a very different purpose than a measure that assesses a person’s ability to crawl and run. The higher the level of code used, the less information about the measures is available for assessment.

"Other specified" and "unspecified" codes. Prior to the second revision of the linking rules in 2016, it was recommended that the "other specified" and "unspecified" codes not be used [7]. As a result, many of the published articles that have used linking rules did not include "other specified" and "unspecified" codes and did not have to address the challenges they present. The disadvantage of not using these codes is that information can be lost.

However, the use of "other specified" and "unspecified" codes complicates the calculations that have been previously discussed. Table 3-3 gives an example of how excluding them can drastically change the percentages. Based on the amount of information that can be lost when "other specified" and "unspecified" codes are not used, they should be coded and included in the calculations.

Table 3-3. Difference between calculating the overall and unique percentage

Measure Covered by Core Set			**Measure Unique Code Percentage**	
Tool	**Codes**		**Tool**	**Codes**
Item 1	D4500		Item 1	D4500
Item 2			Item 2	
Item 3	D4502		Item 3	D4502
Item 4	D4500		Item 4	D4500 (repeat)
Item 5	D4503		Item 5	D4503
Percentage	(4 / 5) * 100% = 80%		Percentage	(3 / 5) *100% = 60%

Readers should look for how many of the codes are "other specified" or "unspecified," the percentage of codes that fall into this group, or the number of items with one of these codes to understand the content of the tool.

If a researcher is calculating the coverage of the code group by the measure, such as how much of the *d450 Walking* section is covered by specific tools, they would need to keep in mind the effect of "other specified" or "unspecified" codes. If a tool covers all aspects of the *d450 Walking* section except for the "other specified" and "unspecified" codes and the number of

codes used in the denominator is six, the percentage of coverage of the codes would be 67%. It could be argued that it would be unrealistic to expect measures to regularly include items that are very general and, as a result, have an "unspecified" code or extra information suitable for an "other specified" code and a Core Set coverage of 100% would be more appropriate. However, that type of calculation would also result in a Core Set coverage of 100% for a tool that uses four codes including *d4508* and *d4509* instead of the more specific codes and of 150% for a measure that contained all six of the *d450* codes.

To clarify how many codes are "other specified" or "unspecified" within a code group, reporting can be done as follows: *This measure covered 54% of the movement code group, within this code group 30% of the codes were "other specified" or "unspecified." The following table summarizes the concepts that were assigned an "other specified" or "unspecified" code.* If "other specified" or "unspecified" codes are not used this should be stated and discussed.

General recommendations for reporting. The process of linking measures to the ICF is one of discovery. As a result, though the initial plan for reporting may include using a higher level of classification, initial coding should be done at as detailed a level as possible. This will provide the researcher with more detailed data that can be summarized and presented at a more general level if that is the most logical way to share the data.

When reporting data obtained through the linking process, it is useful to start with broad descriptors of the measures and results of the coding. For example, most of the studies reviewed had results sections with the component frequency presented first proceeded by a discussion of the findings at the more detailed levels. This allows for a discussion of which areas of code were not covered and why these areas did not appear in further discussion. This beginning section also reports the number of *nc* and *nd* codes. When the number of *nc* and *nd* codes is small and they

form a small percentage of the overall codes, it is generally not necessary to discuss them further. However, if there is a large number of the codes or they cover a significant percentage of the measures being assessed, a more detailed accounting of what meaningful concepts were covered by nc and nd codes should be provided.

Most of the reviewed papers included a table of the code frequency for each of the measures being assessed. This is an excellent way to provide an overview of the data prior to discussion. However, when many measures are being assessed and they cover large sections of the ICF, tables for code frequency become unrealistic and unwieldy. At this point, providing percentage calculations becomes not just useful, but essential for the data to be useable for researchers and clinicians.

As a part of the research process, it is advisable to calculate both content diversity and density. If there is a wide range of results, these should then be presented in a table, but if the measures have similar results, they can simply be summed up in a description without need for a detailed analysis.

Researchers should use the most recent version of the Cieza et al. linking rules and, as a result, should use "other specific" and "unspecified" codes where they are appropriate.[7] As a result, these codes should be included in the calculations. If there are a large number of "other specified" or "unspecified" codes that may be skewing the calculations, there should be a discussion dedicated to which meaningful concepts were coded "other specified" or "unspecified." Specifically, the annotation section of the ICF tables provides details of what other information was specified in an "other specified" code. It is advisable to review and report the annotations to provide information on which concepts are not specifically covered by the ICF. This information may be useful for future development and critique of the ICF.

The most useful percentages to report are those that show variation between tools. Percentages that are regularly at or close to either 0 or 100 % need not be reported in detail. After removing the options that do not show variation between tools, the remainder of the decision making regarding the utility of the calculations should be based on the specific research questions of the study.

Conclusion

Recent changes to the linking rules developed by Cieza et al.[7] and large data sets have caused challenges in presenting the data generated when health measures are linked to the ICF. It is recommended that researchers should always code to the most detailed level possible and only roll up their codes if they find that the benefits of simplifying outweigh the loss of specificity. When the data set is small enough, a table of the code frequency per measure should be used. When the data set becomes too large for a table to be practical, researchers should summarize the area of the ICF that the measures cover using either Core Sets or another defined group. Overlap between measures and a Core Set should be presented using both Measure Coverage by Core Set and Core Set Representation; this combination provides the reader with an understanding of how much of the measure is associated with the Core Set and if the codes from the Core Set are varied or repetitive. Researchers should consider using the “other specified” and “unspecified” codes and indicate in reporting how many codes in the Core Set and in the measure were “other specified” or “unspecified.”

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Chapter 4 Measures of Movement and Mobility Used in Clinical Practice and Research: a scoping review

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Abstract

Objective. The first objective of this scoping review is to identify all the tools designed to measure movement or mobility in adults. The second objective is to compare the tools to the conceptual definitions of movement and mobility by mapping them to the International Classification of Functioning, Disability and Health (ICF).

Introduction. The concepts of movement and mobility are distinct concepts that are frequently conflated, and the differences are important to patient care. Movement is a change in the place or position of a part of the body or of the whole body. Mobility is derived from movement and is defined as the ability to move with ease. Researchers and clinicians, including nurses, physiotherapists, and occupational therapists who work with older adults and in rehabilitation, need to be confident that they are measuring the outcome of interest.

Inclusion criteria. This scoping review considered studies that included participants that are adults, aged 19 and older, with any level of ability or disability. The concepts of interest are tools that measure movement or mobility relative to the human body.

Methods. The Cumulative Index of Nursing and Allied Health Literature, Health and Psychosocial Instruments, MEDLINE, and Excerpta Medica Database were searched in June 2018 and Open Grey, Dissertation Abstracts International, and Google Scholar were searched in November 2018. They were limited to articles in English and the date range was from the inception of the database to the current date. Data was extracted from the studies using a custom data extraction tool. Once tools were identified for analysis, they were coded using the table format developed by Cieza and colleagues.

Results. The findings of this review are presented in narrative format with tables and figures used to aid in comprehension where appropriate. There were 702 unique tools identified,

with 651 of them available to be coded for the ICF. There were 385 ICF codes used when coding the tools. From these codes the percentage of codes of the defining attributes of movement and mobility that were covered could be calculated as well as the percentage of tool items which were linked to the antecedents, consequences, or defining attributes of movement or mobility.

Conclusions. While there are many tools which measure only movement or mobility, there are many which measure a mixture of the defining attributes as well as the antecedents and consequences. The tool name alone should not be considered a guarantee of the concept measured and tool selection should be done with a critical eye. This study provides a starting point from which clinicians and researchers can find tools which measure the concepts of movement and mobility that are of interest and importance to their patient population.

Background

This review will scope the literature of measures of movement and mobility used in clinical practice and research. The measures that are found will be assessed to determine how closely they design to the concepts, movement or mobility, that they aim to capture using the methodology developed by Cieza and colleagues.[1-3]

Humans do not react passively to their environment; instead they develop ways to avoid unpleasant experiences while maximizing exposure to positive experiences.[4] Being able to move and having mobility are essential to humanity's ability to maximize their interaction with their environment. However, mobility disability is a common problem, particularly in older adults. The prevalence for mobility disability at the age of 65 years is 16% for women and 14% for men; these numbers rise to 90% and 74% by the age of 95 years.[5]

The concepts of movement and mobility are frequently used together in the literature. While they are related when used in the context of the human body, they have distinct meanings. Movement is a change in the place or position of a part of the body or of the whole body.[6] Mobility is derived from movement and is defined as the ability to move with ease.[7]

Movement is often discussed in the context of symptoms, with problems arising when movement becomes difficult or voluntary control is lost.[8-11] Movement often refers to a single body part[11] or a single joint.[10] Due to the fact that movement is concrete and often specific to a single part of the body, it has a finite existence with defined start and stop points that allow for easy measurement.[9] There are three types of movements: simple involuntary movements, such as a reflex or tremor; simple voluntary movements, such as flexing a finger; and complex voluntary movements, such as diving into a pool. The attributes of movement are they: (a) occur in a context, (b) have displacement with both a start and end position, (c) have speed, (d) have

velocity, (e) have acceleration, and (f) have force that is generated internally by the human's muscles. Complex voluntary movements also have the following attributes: (a) they are coordinated, and (b) they have been planned.[12] In addition to knowing the attributes of a concept it is important to understand the antecedents, an event or incident needed before the concept can occur, which are the systems that need to be functional such as the bones, joints and muscles, and the consequences, which are the results of the concept such as being able to interact with the environment, of the concept.[12]

Mobility is described as a state of being or a spectrum with complete mobility existing at one end and complete immobility existing at the other.[8, 13-18] There are three parts that reappear in most definitions of mobility: mobility exists when an individual is moving around; the movement can be accomplished by any means including, walking, driving, or public transportation and can be facilitated by equipment; and mobility is dependent on the environment which can either be a facilitator or a barrier.[12] Mobility is often used in a general sense; however, it can be specific to a particular environment such as a level plane, stairs or a bed.[16, 19, 20] For example, bed mobility can be measured by determining if an individual can roll and sit up when laying in a bed.[20] Because mobility is affected by the environment that the person is trying to navigate, simplifying the environment to a level plane rather than multiple surface types makes measuring simpler, but the results less generalizable.

A variety of tools have been developed that claim to measure movement and mobility. These tools can include both Patient Reported Outcome Measures (PROMs), which capture the patient's view of their symptoms, or functional status,[21] and practical measures, which are generally task based and scored on a pre-defined criterion established by the measure.

The concepts of movement and mobility are distinct, and the differences are important to patient care. In a phenomenological study of the experience of living with Parkinson's Disease, both the concepts of movement and mobility were used.[13] The concept of movement was used to described the symptoms of Parkinson's, particularly bradykinesia which is slowness of movement. The concept of mobility was introduced when patients discussed their experience with the disease. For example, one couple had moved to an apartment because of their mobility concerns while others described difficulty in completing daily activities or continuing social relationships because of impaired mobility.[13] This contrast in the use of concepts shows that while movement is useful in the description of symptoms, impaired mobility is the concept that interferes with patients' daily functioning.

Because movements have distinct starting and stopping points, they are much easier to measure. For example, using a motion capture system, such as the Qualisys™ camera system (www.qualisys.com), allows researchers to record changes in position with sub-millimeter and millisecond accuracy and calculate variables such as stride length and cadence. Since mobility is often measured with patient reported outcomes, to determine the patient's perception of their ability, it is difficult to compare between measures and different measures may focus on different areas of mobility.

Researchers and clinicians, including nurses, physiotherapists, and occupational therapists who work with older adults and in rehabilitation, need to understand the difference between the concepts of movement and mobility to ensure that they are measuring the outcome of interest. For example, interventions that target specific symptoms are better assessed with measures of movement. On the other hand, interventions which are designed to have an impact

on what the individual can accomplish in their daily lives are better assessed with measures of mobility.

When selecting and using tools to measure a patient's movement or mobility, before considering validity and reliability, it is important that clinicians and researchers be confident that the tool measures the concept of interest. Tools can be assessed to determine what concepts they measure using the International Classification of Functioning, Disability and Health (ICF).[22]

The ICF is a classification system that was developed by the World Health Organization (WHO). The goals of the ICF are to: provide a scientific basis for understanding health; provide a common language for the description of health and health related states; allow comparison across countries, health care disciplines and time; and provide a systematic coding scheme for health information.[22] The ICF has four main components for coding: body functions and structures; activities and participation; environmental factors; and personal factors.[22] There is also an ICF code set that was created specifically for Children and Youth in order to address the complexities that are associated with childhood development as they cause differences in the manifestations of disability and health.[23] Because of the complexities associated with childhood development this scoping review will be limited to tools used in the adult population. This population includes older adults who have a high prevalence of mobility disability.

Guidelines have been created that allow the linking of health-status measures to the ICF codes.[1-3] Once the tools are linked to the level 2 ICF codes it can be determined (a) what concepts the tool actually measures and (b) what percentage of the codes that are associated with movement and/or mobility are covered by the tool. This information can be used to help inform what tools cover which aspects of movement and mobility. While researchers and clinicians will have to compare the validity and reliability of the tools in order to decide which ones best fit

their needs, they can use the compiled information to understand which tool or tools measure the concepts they are interested in. The table can also help researchers and clinicians select tools by helping them narrow down the list of existing tools to those which have the attributes, such as being mostly composed of mobility items and being a PROM, that they need.

An example of this process can be seen in the paper entitled *Generic patient-reported outcomes in child health research: a review of conceptual content using World Health Organization definitions*.[24] The paper uses the WHO definitions of functioning, disability and health and quality of life (QOL) in conjunction with the ICF codes to determine which concepts the health measures were associated with. Some of the content analysis found complete agreement with the concept they measured, such as the Functional Disability Inventory and the Satisfaction with Life Scale, while most were split between the two concepts with the General Health Questionnaire linking 42.9% of the time with QOL and 57.1% of the time with functioning, disability and health. They determined that instrument users have to be able to identify the concept that they are looking to measure and the concept that the tool assesses in order to properly select an instrument.[24] Completing a similar assessment of movement and mobility tools will provide researchers and clinicians with an accurate picture of which tools are linked to the concept that they wish to assess.

A search for existing scoping reviews on the topic of measures of movement and mobility was conducted in the Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports (JBISRIR), Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health (CINAHL), PubMed Central, but no reviews were found. There were four systematic reviews found that had similar goals. The study that was most similar to the goals of this scoping review searched for patient-reported mobility measures, as opposed

to any type of measure for both movement and mobility and is the only study to link the measures identified to ICF codes.[25] The second systematic review included only mobility measures that are not disease specific and used the ICF definition for mobility instead of ICF codes.[26] The final two reviews were disease specific, one for patients with spinal cord injuries and one for stroke survivors, neither of which used ICF codes and one of which only used walking ability.[27, 28]

Identifying what concepts are being measured by each tool will provide clinicians and researchers with a map of the tools that are available to measure the outcomes of interest for their patient population. Researchers and clinicians can then compare the validity and reliability of tools that have been established as measuring the concept of interest in order to select the tool that best suits their needs. A scoping review has been selected because the focus of the review is to map the extent of the tools available and indicate if they measure movement or mobility rather than assessing the effectiveness of the tools. The objectives, inclusion criteria and methods for this scoping review were specified in advance and documented in a protocol.[29]

Keywords. Adults; Measure; Mobility; Movement; International Classification of Functioning, Disability and Health (ICF)

Review question

The first objective of this scoping review was to identify all the tools designed to measure movement or mobility in adults. The second objective was to compare the tools to the conceptual definitions of movement and mobility by mapping them to the ICF. The specific questions that were answered for each tool by the mapping includes:

· Does the tool measure movement, mobility, or a combination of the two?

· Does the tool measure the antecedents or consequences of movement or mobility?

· If a tool measures movement, what percentage of the ICF codes associated with movement are covered? and

· If a tool measures mobility, what percentage of the ICF codes associated with mobility are covered?

Methods

This scoping review developed using JBI methodologies and the PRISMA extension to scoping reviews.[30, 31] It was developed by three knowledge users including the primary reviewer and two of the co-reviewers.

Inclusion criteria scoping review

Participants. This scoping review considered studies that included participants that are adults, aged 19 and older, with any level of ability or disability. Studies that are specific to children, aged 18 and younger, were excluded. Three of the databases allowed for searched to be limited by age. Two of these databases (CINAHL and MEDLINE) limited adults to 19 plus; whereas EMBASE limited adults to 18 and above. Studies that were specific to people 18 years and over were included; studies that were specific to people 18 years and younger were excluded.

Concept. The concepts of interest were tools that measure movement or mobility relative to the human body, as discussed in the background. These tools included both PROMs[21] and practical measures. All tools that claimed to measure movement or mobility were included. Tools that focused only on the technical aspects of devices used to measure movement, such as pedometers, instead of the movement being measured were not included.

Context. This scoping review considered studies from any context. Studies were included regardless of country of origin, healthcare setting or sociocultural setting.

Study types. This review considered experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies were considered for inclusion. This review also considered descriptive observational study designs including case series, individual case reports, descriptive cross-sectional studies, and validation studies for inclusion.

Only studies published in English were included. Studies available since the inception of the searched databases were included as the goal was to include all tools that are used in research or clinic.

Search strategy

The search strategy aimed to find both published and unpublished articles. A three-step search strategy was used in this review.

Stage 1. This stage involved an initial limited search of the Health and Psychosocial Instrument database (HAPI) (established in 1985) and CINAHL (established in 1981) which has been undertaken and followed by an analysis of the text words contained in the title and abstract, and of the index terms used to describe relevant article. The key words from relevant articles were used to build the searches for Stage 2 which were designed to identify all of the tools that measure movement or mobility. Once a tool was identified it was not the goal to identify every article that uses the tool.

Stage 2. The text words contained in the title and abstract of relevant articles, along with the controlled language index terms used to describe the papers were analyzed to develop keywords for stage 2. A second extensive search was undertaken of all keywords and index

terms identified as relevant to the review across all included databases. Individual search strategies were tailored for each information source. Full search strategies for CINAHL, HAPI, MEDLINE, EMBASE, Open Grey, Dissertation Abstracts International and Google Scholar are detailed in Appendix C and were developed with the assistance of a librarian with experience in JBI methodology.

Stage 3. The reference list of all studies selected for tool classification were screened for additional studies for the final stage of the process. In order to simplify this process, the extraction tables, described below, were reviewed for tools that were mentioned but not the main focus of the study. These reference lists were the focus of the final search.

Study selection

Following the search, all identified citations were collated, uploaded into Covidence[32] and duplicates removed. Titles and abstracts were then screened by two independent reviewers for assessment against the inclusion criteria for the review. Studies that met the inclusion criteria were retrieved in full and their details were imported into SUMARI. The full text of selected studies was retrieved and assessed in detail against the inclusion criteria. Full texts that were not available from the primary reviewer's university library were requested as interlibrary loans and added if they were found. Full text studies that did not meet the inclusion criteria were excluded and the reasons for exclusion are provided in Appendix D. All disagreements that arose between the reviewers were resolved through discussion, or with a third reviewer.

Data extraction

Data were extracted from papers included in the review using the Study Data Extraction Table (Appendix E). Data extracted for each study and included:

- tool's name,
- authors' names,

- year of publication,
- aim of the study, and
- disease or symptom specific.

The studies found were not further analyzed for details such as study type, age of participants, number of participants, location of the study, and if the study was published or unpublished. These were not included because the focus was on the tools analyzed and these would not add to the discussion.

The Tool Data Extraction Table (Appendix F) was used to extract the following information.

- verbatim health information,
- perspective,
- response options,
- classification of response options,
- main concept,
- additional concepts,
- ICF category of main concept,
- ICF category of other concepts, and
- annotations.
- PROM or practical test.

This process was based on the linking rules created for the ICF and health measures.[1-3] The data were extracted from each of the tools by two reviewers. This process was pilot tested by the primary reviewer and a co-reviewer to ensure that the inclusion and exclusion criteria would generate the needed articles and that the data extraction was both comprehensive and feasible. For example, when assessing a practical measure such as a camera system that is measuring stride length and cadence, as an individual walks 3 meters along a flat clear path would be assigned the codes B770 Gait pattern functions and D4500 Walking short distances. Any disagreements that arose between the reviewers were resolved through discussion or with a third reviewer (RW). As recommended in the most recent round of linking rules[3], both the "other specified" and "unspecified" codes were used. Reviewers always used the most specific code available, as a result second level codes, which have a letter and three digits such as *d450*

Walking, were only used if they did not branch into third level codes with a letter and four digits such as *d4500 Walking short distances*. As a shorthand second level codes are found occasionally in the data tables to indicate that all the third level codes from that section apply and were used in the calculations. The completed data tables can be accessed as a set of 30 Compendiums, with an index, that are accessible online: https://doi.org/10.5683/SP2/76LASW.

Data presentation

The tools that have been found are presented in alphabetical order to facilitate finding specific measures. Calculation methods can be found in Appendix G. The calculation methodologies are further explained in the paper *Methods for reporting data obtained from linking health measures to the International Classification of Functioning, Disability and Health codes: historical and proposed methods*.[33] Coverage of movement and mobility, antecedents and consequences of both are presented in accordance with the findings of the concept analysis reported by Moulton et al. 2019.[12] The main data table includes the following:

- The percentage of the ICF codes for movement that the tool covers,
- The percentage of the ICF codes for mobility that the tool covers,
- The percentage of the tool that measures mobility,
- The percentage of the tool that measures movement,
- The percentage of the tool that measures the antecedents of mobility,
- The percentage of the tool that measures the consequences of mobility,
- The percentage of the tool that measures the antecedents of movement, and
- The percentage of the tool that measures the consequences of movement.

A sample of the of the percentage of the ICF codes for movement that a tool covers based on the 3 meter walk previously described is as follows. The two codes from the example are 2 of the 55 possible lowest level movement codes. This means that the measure covers 3.64% of the possible movement codes. As an example of the percentage of the tool that measures movement is as follows. Since only 2 codes are used in this example and they are both movement codes the measure can be said to be 100% movement.

More basic and information and calculations that will be presented are:

- If the tool is a practical or PROM measure;
- The number of items in each tool;
- Content density, which is the number of concepts in a tool relative to the number of items in the tool;[33-35] and
- Content diversity, is an expression of how repetitive or unique of the concepts of a tool are.[33-35]

Review results

Description of studies. A total of 20985 citations were found after duplicates were removed. Titles and abstracts screening yielded 2003 citations for full text review and 1357 studies meet the inclusion criteria for this review. Full text studies that did not meet the inclusion criteria were excluded and the reasons for exclusion are provided in Appendix D. A flow chart showing the number of citations at each stage is detailed below (Figure 4-1). Following preliminary data extraction (n = 1357) 702 unique tools that measured movement or mobility were identified. Of these 702 tools, 51 complete tools could not be coded to the ICF for the following reasons:

a) the tool was not available in English,

b) not enough data was provided regarding the tool to allow for it to be coded or,

c) the full description of the tool was in a citation that was inaccessible to the reviewer.

If a tool was identified during preliminary data extraction but not available in its complete form, the original tool was retrieved whenever possible. In all, there were 651 identified tools that were coded to the ICF.

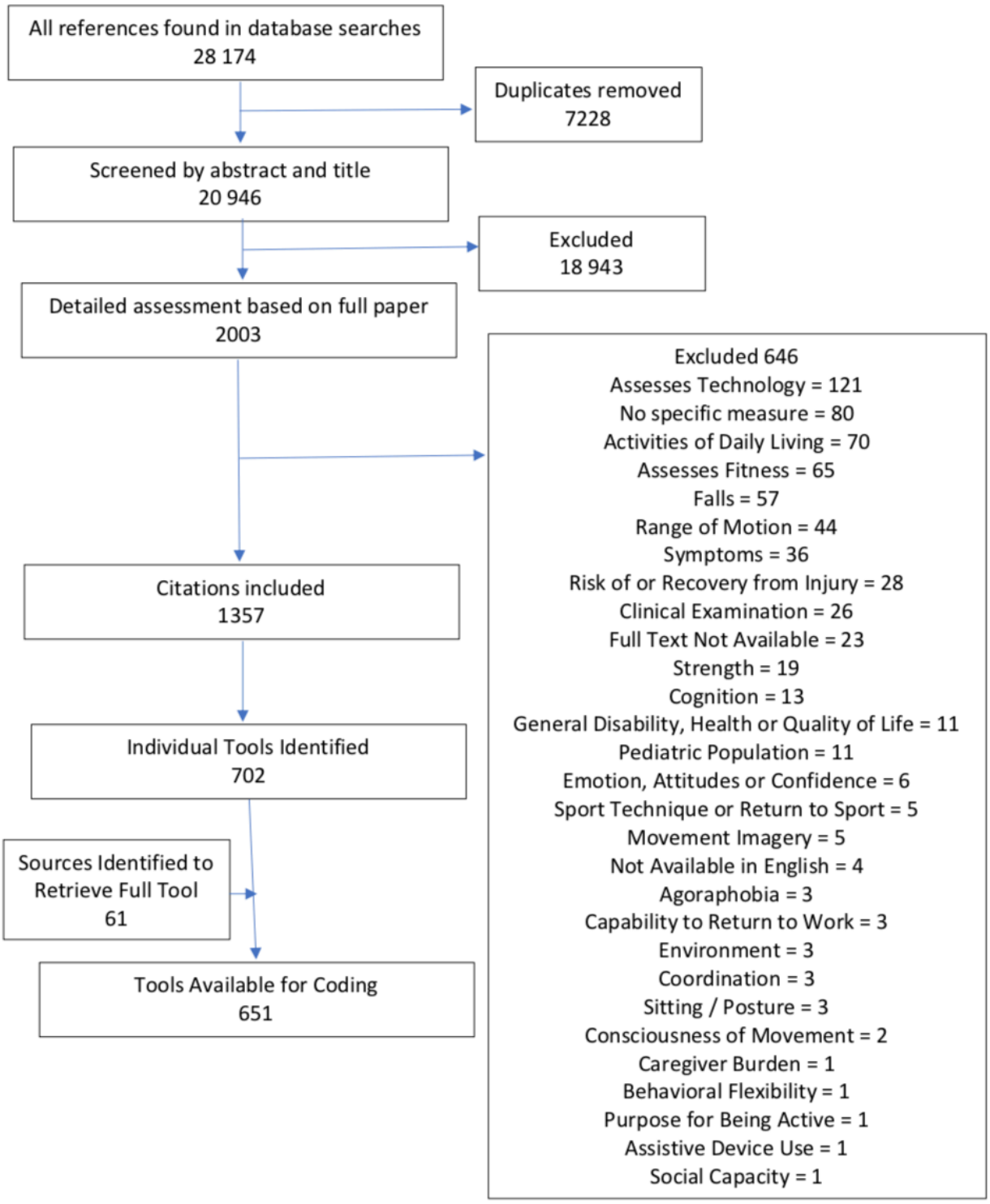

Figure 4-1. PRISMA Flow diagram of study selection and inclusion process[31]

Results

Study and Tool Characteristics. There were 1357 studies extracted. These ranged from studies published in 1975 to 2018 (the year in which the search was completed). The median year of publication was 2010 (2005 – 2014). While not all studies had a population of interest, many did. The most frequently occurring patient populations are shown in Table 4-1.

Table 4-1. Frequently occurring papulations for tools

Population of Interest	Percentage (Number of studies)
Stroke	13.19 (179)
Parkinson's Disease	6.85 (93)
Multiple Sclerosis	3.68 (50)
Osteoarthritis	3.54 (48)
Amputees	3.39 (46)
Spinal Cord Injury	2.43 (33)
Pain (mostly back, neck and fibromyalgia)	2.06 (28)
Involuntary movements	1.92 (26)
Cognitive Impairment or Intellectual Dysfunction	1.69 (23)
Wheelchair Users	1.62 (22)
Traumatic Brain Injury	1.47 (20)
Joint Arthroplasty	1.33 (18)
Chronic Obstructive Pulmonary Disease	1.18 (16)
Hip fracture	1.18 (16)
Rheumatoid Arthritis	1.11 (15)
Cancer	1.03 (14)

There were 117 other patient populations in the extracted studies. However, none of these populations represented more than 1% of the overall papers. Reliability was mentioned in 39% (531) and validity in 41% (556) of study aims and objectives.

In the extracted studies, 112 concepts were mentioned in the aims and objective. Of these concepts, 88 were mentioned in fewer than 1% of studies. The remaining 24 concepts are shown in Table 4-2.

Table 4-2. Concepts in the aims and objectives of included studies

Concept	Percentage (Number of studies)
Development of a tool	11.50 (156)
Compare tools	11.20 (152)
Responsiveness	5.80 (79)
Minimal Detectable Change	3.91 (53)
Assesses Psychometric properties	3.83 (52)
Compare measures to other variables	3.10 (42)
Predictive power	2.80 (38)
Translate measure	2.80 (38)
General assessment of measures	2.58 (35)
Assesses internal consistency	2.51 (34)
Assesses reproducibility	2.43 (33)
Alteration to an existing tool	2.36 (32)
Assesses sensitivity	2.28 (31)
Assesses feasibility	2.28 (31)
Assesses usefulness	2.14 (29)
Compares populations	1.99 (27)
Establish normative data	1.69 (23)
Establish cut-off points	1.33 (18)
Assesses clinimetric properties	1.25 (17)
Describe an existing tool	1.18 (16)
Rasch analysis	1.18 (16)
Cross-cultural adaptation	1.11 (15)
Factor analysis	1.11 (15)
Presentation of the tool	1.11 (15)

Of the 651 tools that were coded to the ICF 200 (31%) were PROM, 446 (69%) were practical, and 5 (0.77%) were a combination of PROM and practical measures. The 651 tools had

different numbers of studies describing them with a mean of 2.89 ± 6.20. The top five tools with the most studies were the 6-minute Walk Test (6MWT), with 85 studies; the Timed Up and Go (TUG), with 84; the 10-meter Walk Test (10MWT), with 52; Gait Speed, with 47; and Spatiotemporal Gait Parameters, with 31. These large number of studies per tool are balanced out by the large number of tools only mentioned by a small number of studies. There are 385 (59%) tools with only one study and 107 (16%) tools with two studies, which covers 75% of the tools. However, it should be noted that a larger number of studies on a single tool does not necessarily mean that the tool is the most useful for clinical or research purposes. It simply means that it has been studied more either because of the length of time it has been in circulation or its overall popularity.

Code Frequency. There are 1424 codes in the ICF.[22] This coding process for this study used 385 or 27% of these codes. A list of the most frequently used codes is shown in Table 4-3. The cut-off criteria for the most frequently mapped codes was 100. For ease of reference, the defining attributes of movement are coloured blue, the defining attributes of mobility are coloured green, the antecedents of movement are coloured yellow, the antecedents of mobility (excluding movement) are coloured pink, and the consequences of mobility are coloured gold.[12] This is the same colour coding as the Compendiums where the items in each tool are coloured according to the codes that were assigned to them. This allows for individuals to tell at a glance what concepts each tool covers.

Table 4-3. Frequency of ICF Codes mapped to movement and mobility measures (>100)

ICF Code	Description	Number of instances
D4508	Walking, other specified	438
B770	Gait pattern functions	409
D4500	Walking short distances	317
D4458	Hand and arm use, other specified	293
D4551	Climbing	293
D9201	Sports	251
D4104	Standing	232
D4558	Moving around, other specified	203
D465	Moving around using equipment	202
D4402	Manipulating	190
D4103	Sitting	187
B7658	Involuntary movement functions, other specified	163
B7600	Control of simple voluntary movements	149
D4401	Grasping	148
D4408	Fine hand use, other specified	146
D4154	Maintaining a standing position	140
D4602	Moving around outside the home and other buildings	121
D4153	Maintaining a sitting position	117
B7651	Tremor	114
D4452	Reaching	110
B7650	Involuntary contractions of muscles	109
D4502	Walking on different surfaces	101

Legend

Defining attributes of movement	Defining attributes of mobility
Antecedents of movement	Antecedents of mobility (excluding movement)
	Consequences of mobility

Shown in Table 4-4 are the 18 codes from the defining attributes of movement and mobility (coloured blue and green respectively) that were not used in any of the coded measures.

Table 4-4. ICF defining attribute code not mapped to movement and mobility measures

ICF Code	Description
B7501	Reflexes generated by noxious stimuli
B7502	Reflexes generated by other exteroceptive stimuli
B7509	Motor reflex functions, unspecified
B7603	Supportive functions of arm or leg
B7610	General movements
B7611	Specific spontaneous movements
B7619	Spontaneous movements, unspecified
B789	Movement functions, other specified and unspecified
B799	Neuromusculoskeletal and movement-related functions, unspecified
D4303	Carrying on shoulders, hip and back
D4304	Carrying on the head
D4358	Moving objects with lower extremities, other specified
D4359	Moving objects with lower extremities, unspecified
D4455	Catching
D446	Fine foot use
D4700	Using human-powered vehicles
D4703	Using humans for transportation
D4752	Driving animal-powered vehicles

Not Covered, Not Defined and Personal Factor Codes. The codes for Not Covered, Not Defined and Personal Factors were used a total of 208 times.

- Personal Factors, which are a part of an individual's background such as gender, race, profession, and past life events[22] n=65;
- Not Covered, which is any information not covered in the ICF[36] n=44;
- Not Covered – Health care, n=9;
- Not Covered – Quality of Life, n=1;

- Not Defined, which is any information that belongs to the universe of the ICF but cannot be assigned to an ICF component[36] n=3;
- Not Defined – General Health, n=33;
- Not Defined – Physical Health, n=8;
- Not Defined – Disability, n=2; and
- Not Defined – Function, n=43.

The ICF does not have a code that is specific to, or mentions, falling. This is likely because falling occurs when there is a failure of function. As a result, all items which contained the concept of falling were coded with nd-func, the abbreviation for the code Not Defined – Function.

Content Density, Content Diversity, and Code Coverage. Table G-1 in Appendix H presents content density; content diversity; measure coverage of defining attributes for movement and mobility; and coverage of each measure by the defining attributes, antecedents, and consequences of movement and mobility. The table also includes if the measure was a practical test, a PROM, or a combination of both, as well as the number of items in each measure.

The mean Content Density of all included tools is 1.27± 0.51, with a minimum of 0.92 and a maximum of 5.00. The Mean Content Diversity is 0.69 ± 0.30, with a minimum of 0.03 and a maximum of 1.00. The mean of the coverage of the movement defining attributes codes is 4.39 ± 4.57, with a minimum of 0.00 and a maximum of 32.73. The mean of the coverage of the mobility defining attributes codes is 3.05 ± 4.64, with a minimum of 0.00 and a maximum of 32.65.

On average, 61.63 ± 39.88% of the tools included are covered by the defining attributes of movement, 25.46 ± 35.72% are covered by the defining attributes of mobility, 2.84 ± 13.80% are coved by the antecedents of movement, 4.72 ± 11.47% are covered by the antecedents of

mobility that are not a defining attribute of movement, and 8.00 ± 18.71% are covered by the consequences of mobility.

Discussion

The aim of this scoping review was to gather a comprehensive list of tools that measure either movement or mobility and to assess what concepts these measures truly cover. Further, this discussion explores which concepts are most frequently measured by movement and mobility tools as well as which concepts are not covered. Finally, there is discussion regarding the selection of a tool.

Code Coverage. Movement and mobility are concepts that are frequently confused and used interchangeably. As an overview, to determine if the measures identified by this study assess the concept they claim to, two samples were taken. The first was all the measures with the word "movement" in the name, and the second were all the measures with the word "mobility" in the name. The measures with "movement" in the name have been bolded in Appendix H, Table H-1, whereas the measures with "mobility" in the name have been italicized for ease of reference. There are 26 measures which include the word "movement." These measures are:

1) the Abnormal Involuntary Movement Scale;
2) Akathisia Ratings of Movement Scale;
3) Breathing Movement Scale;
4) Countermovement Jump;
5) Counting Arm Movement Tests;
6) Finger Individual Movement Test;
7) Global Physiotherapeutic Muscle Examination – Movement Section;
8) Handwriting and Drawing Movements;
9) Jaw Movements;
10) Maryland Psychiatric Research Center Involuntary Movement Scale;
11) Movement Ability Measure;
12) Movement and Activity in Physical Space;
13) Neck Movement with the Fly;
14) Outpatient Physical Therapy Improvement in Movement Assessment Log Instrument;
15) Rating Scale for Psychogenic Movement Disorders;
16) Reaching Movements with KINARM;

17) Revised Version of the Ability for Basic Movement Scale;
18) Self-efficacy for Reaching Movements;
19) Squat Movement Screen;
20) Stopwatch Thumb-Movement Time;
21) Stroke Rehabilitation Assessment of Movement;
22) The Leeds Movements Performance Index;
23) The Simplified Functional Movement Disorders Rating Scale;
24) Timed Large Amplitude Rapid Alternating Movement Patterns;
25) Timed Movement Battery; and
26) Timed Functional-Movements.

Nine of the measures, 34.62%, have a movement code assigned to each of the items. Six of the measures, 23.07%, have no movement codes assigned to the items. Four of the measures with no movement codes are designed to assess the arms. The ICF codes that are specific to the arms are a part of the mobility code set because the arms are most frequently used to interact with the environment. For example, an individual could reach forward to stretch their muscles, but most of the time an individual will reach forward to push, pull, or grab an object.

There are 64 measures which include the word "mobility." These measures are:
1) "6-Clicks" Inpatient Basic Mobility Short Form;
2) 3 Question Self-Reported Mobility;
3) ADL-Oriented Assessment of Mobility;
4) Basic Amputee Mobility Scale;
5) Basic Mobility Scale;
6) Charite Mobility Index;
7) Chest Wall Mobility Measure;
8) Community Balance and Mobility Scale;
9) Craig Handicap Assessment and Reporting Technique (CHART) Mobility Subscale;
10) de Morton Mobility Index;
11) Early Mobility Impairment Questionnaire;
12) EG Motor Index Scoring System / Rating Scale for Assessment of Mobility after Stroke;
13) Elderly Mobility Scale;
14) Environmental Analysis of Mobility Questionnaire;
15) Functional Mobility Assessment Tools;
16) Global Mobility Task;
17) Hand Mobility in Scleroderma Test;
18) Hierarchical Assessment of Balance and Mobility;
19) High level mobility assessment tool;
20) Home-Bound Mobility Assessment;
21) ICF Mobility and Walking Scale;
22) ICU Mobility Scale;

23) Independent Mobility Questionnaire;
24) Index of Mobility-Related Limitations;
25) Item Bank to Measure Mobility;
26) Lateral-Mobility Task;
27) Lindop Parkinson's disease Mobility Assessment;
28) Mobility Activities Measure for Inpatient Rehabilitation Settings;
29) Mobility Assessment Tool for Walking;
30) Mobility Classification Tool;
31) Mobility Obstacle Course;
32) Mobility-Disability Severity Questionnaire;
33) Modified Elderly Mobility Scale;
34) Modified Rivermead Mobility Index;
35) Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Intervention;
36) Perme Intensive Care Unit Mobility Score;
37) Physical Mobility Scale;
38) Physical Performance and Mobility Examination;
39) Physiotherapy Functional Mobility Profile;
40) Power-Mobility Community Driving Assessment;
41) Prosthesis Evaluation Questionnaire – Mobility Section;
42) Prosthetic Limb Users Survey of Mobility;
43) Questions on Mobility;
44) Rivermead Mobility Index;
45) Self-Reported Measure of Function – Mobility Domain;
46) Sensory-Oriented Mobility Assessment Instrument;
47) Short-form Mobility Assessment Tool;
48) Southampton Mobility Assessment;
49) Telephone-Based Mobility Assessment Questionnaire;
50) Test of Wheeled Mobility;
51) The Amputee Mobility Predictor;
52) The Amputee Single Item Mobility Measure;
53) The Avlund mobility scales;
54) The Comprehensive High-level Activity Mobility Predictor;
55) The Mobility Scale for Acute Stroke Patients;
56) The New Mobility Score;
57) The Pregnancy Mobility Index;
58) The Surgical Intensive Care Unit Optimal Mobility Score;
59) Timed Bed Mobility;
60) Tinetti Performance-Oriented Mobility Assessment;
61) Tool for Assessing Mobility in Wheelchair Dependent People;
62) Tyson Group of Mobility Tests;
63) Vision Loss Mobility Course; and
64) Vision Loss Mobility Questionnaire.

Five of the measures, 7.81%, had a mobility code assigned to each of its items. Twenty-five of the measures, 39.06%, had no mobility codes assigned. This indicates far more variability and misuse of the term mobility. This is understandable, given that movement is a far more concrete term, whereas mobility much broader and less easily defined.

There are nine measures which cover 20.00% or more of the movement-defining attribute codes. These are:

1) Foot and Ankle Ability Measure (FAM), 20%;
2) Friedreich's Ataxia Impact Scale, 32.73%;
3) Hemophiliac Activity List (HAL), 20.00%;
4) Mobility Activities Measure for Inpatient Rehabilitation Settings (MOBAM-IN), 21.82%;
5) Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL) instrument, 25.45%;
6) Patient-Reported Outcomes Information System Physical Function Item Bank (PROMIS), 29.09%;
7) Rivermead Mobility Index (RMI), 20.00%;
8) Rivermead Motor Assessment (RMA), 21.82%; and
9) Vestibular Activities and Participation (VAP) questionnaire, 20.00%.

There are five measures which cover 20.00% or more of the mobility defining attribute codes. These are:

1) Arthritis Impact Measurement Scales 2 (AIMS), 33.33%;
2) Friedreich's Ataxia Impact Scale, 31.25%;
3) Late-Life Function and Disability Instrument (LLFDI), 22.92%;
4) Patient-Reported Outcomes Information System Physical Function Item Bank (PROMIS), 31.25%; and
5) Work-Related Questionnaire for Upper Extremity Disorders (WORQ-UP), 25.00%.

With 651 measures assessed, it is surprising that there are so few measures that cover 20% or more of the movement and mobility code sets. This may be because the code sets are so extensive and many of the measures have very few items. Of note is the fact that the average number of items for measures in this study was 10.82 (SD = ± 15.40). However, the average number of items in the measures that only assess the defining attributes of movement is 3.88 (SD = ± 5.95), while the average number of items in the measures that only assess the defining

attributes of mobility is 3.90 (SD = ± 5.54). This indicates that the more focused measures are generally shorter measures and that a more comprehensive coverage of the movement and mobility codes might be best accomplished by using a number of smaller measures.

Frequently Used Codes. Walking is a frequently measured activity in the assessment of both movement and mobility. There were four walking-based codes in the most frequently used codes list: Walking, other specified (d4508), Gait pattern functions (B770), Walking short distances (d4500) and Walking on different surfaces (d4502). This correlates with the fact that the top five tools by number of papers mentioning them were tests of walking and gait, with the 6-min walk test being to most common, at 85 papers. Alfano et al. states in their discussion of sporadic inclusion body myositis that the 6-min walk test has been the de facto standard when assessing function in neuromuscular disease.[37] They do not reference this statement; however, function is a very broad concept to be measured by a single movement test. Since neuromuscular disorders affect the nerves that control voluntary muscle movements, all muscles are at risk and affected.[38] It can be argued that walking, a small portion of functioning, can be far more easily replaced or supported then other areas of function. For example, weakness of the legs can be supported by canes and walkers, or eventually replaced by wheelchairs or scooters. Hand movements are not as easily replaced or supported. A single set of actions such as writing could be replaced with voice to text software but this does not help the individual in other aspects of life, such as dressing and preparing meals. As such, a loss in function of the hands could lead to a greater loss of independence than a loss of function in the legs, meaning that a walking test alone is a poor indicator of function.

That is not to say that walking tests are not of great use. As summarized in a study by Harada, Chiu, and Stewart, the 6-min walk test has been shown to be a measure of

cardiovascular exercise capacity in elderly patients with congestive heart failure and chronic lung disease, it has been applied as a tool for disease severity classification and assessment of prognosis in patients with chronic heart failure, and it is a strong predictor of morbidity and mortality in patients with left ventricular dysfunction.[39] This study then aimed to explore the usefulness of the 6-min walk test as a performance-based measure of mobility. This is a large stretch even for a well-founded test and should be approached with caution. Part of the issue in overextending the test is perhaps in the understanding of the complexity of the concept of mobility. In the examples, the authors say that an example of difficulty of a functional activity would be an elderly patient having difficulty walking to the store.[39] Difficulty with walking to the store would be a movement task, but a more functional and mobility-based question would be "can the individual get to the store?" regardless of the method used to cover the distance.[12]

In the results of their study, Harada, Chiu, and Stewart found that the 6-min walk distance was moderately correlated with the physical function subscale ($r = .55$) of the SF-36.[39] They conclude that the 6-min walk test is a reliable and valid test in relation to indicators of physical functioning and that it could serve as a useful measure of mobility.[39] However, one must consider the measure used as an indicator of mobility. They summarize the physical functioning section of the SF-36, saying that it refers to limitations in actives, such as bathing, dressing, walking, bending, climbing stairs, and running.[39] Given that climbing stairs and running have a basis in walking and, thus, walking-based tasks represent 50% of the tasks listed, the level of correlation is not surprising. However, moving from these six tasks to the conclusion that the 6-min walk test is a measure of mobility represents too far of a leap and a misunderstanding of the concept of mobility.

In addition to Walking, other specified (d4508), there were four additional "other specified" codes, including Hand and arm use, other specified (d4458); Moving around, other specified (d4558); Involuntary movement functions, other specified (b7658); and Fine hand use, other specified (d4408). The frequent appearance of "other specified" codes can be attributed to the frequency with which there are concepts that do not fit neatly into a more specific code, but instead use a specific body part or are a part of a specific condition. For example, pouring water from a jug to a glass uses hands and arms but does not neatly fall into one of the Fine hand use (d440) or Hand and arm use (d445) codes, so Hand and arm use, other specified (d4458) is used. Moving around, other specified (d4558) deserves particular mention since, in addition to its use as a general code for moving around in ways that are not otherwise listed, it was the code that described physical activity of any level of effort. A similar situation arises for Control of simple voluntary movements (b7600), which was also used frequently for movements that did not otherwise have a more specific code. For example, leg movements that are not walking, running, jumping, climbing, or moving objects with the feet, such as moving the whole leg up and down in a tapping motion, have no more specific code to describe them and could only be coded with b7600.

Of the 22 codes on the most frequently used codes list, only three are not defining attributes of movement or mobility. They are Sports (d9201), which is a consequence of mobility as well as Maintaining a standing position (d4154) and Maintaining a sitting position (d4153), which are antecedents of mobility. Given the wide variety of sports available and the frequency with which they are used for leisure, Sports (d9201) being one of the most frequently used codes is not surprising for tools which were designed to determine the highest level of movement and mobility an individual could attain.

Maintaining a standing/sitting position (d4154/d4153) were frequently used not only as a stand-alone concept being measured but also as a part of the process a person needed to complete more complicated tasks. Maintaining a standing or sitting position demands that an individual be capable of sitting or standing balance. When patients fall, there is the risk of injury and the likely cycle of fear of falling, which limits mobility and increases the risk of falling.[40] Because maintaining a position—which prevents falls—and mobility are so closely related, maintaining a position is frequently assessed in movement and mobility tools.

Climbing (d4551) was frequently used because of the frequency that stairs and curbs need to be navigated and because climbing can be used broadly for any type of action from climbing up a single step onto a curb to climbing a mountain. It is encouraging to see Moving around using equipment (d465) frequently used, meaning that the measures frequently consider if a person's mobility is being assisted with devices.

Unused Codes. Six of the 18 unused codes were "other specified" or "unspecified" codes. This is to be expected since an "other specified" code is only used if there is concept that fits into the same group as the code but has additional information that precludes it from any other code.

Two of the codes were reflex codes, including Reflexes generated by noxious stimuli (b7501) and Reflexes generated by other exteroceptive stimuli (b7502). Reflexes generated by noxious stimuli (b7501) is not commonly tested since it includes exposing an individual to an unpleasant and potentially harmful stimulus. This is generally only done when testing individuals for the very lowest level of consciousness, such as when determining if an individual is in a coma. Such measures are measures of cognitive function and awareness, thus not included in this scoping review.

Using humans for transportation (d4703), which is described as "being transported by another person, such as being carried in the arms, in a sheet or in a backpack,"[41] is not used because it is more appropriate to children and this scoping review was limited to adults. These are methods that are commonly used to transport children, and while they can be used for adults, such as a soldier who uses a fireman's carry to take a wounded comrade to safety, these are not common occurrences.

Of the unused movement codes, the b761 Spontaneous movements codes (General movements – b7610 and Specific spontaneous movements – b7611) and the d446 Fine foot use were both initially introduced in the Child and Youth version of the ICF and then were incorporated into the ICF updating process.[23] This incorporation was done because it was thought that would also be relevant for the general ICF created for adults.[23] This is particularly true for d446 Fine foot use, which could be a code relevant to adult amputees or adults born with congenital anomalies that affect the use of their arms.

Cross-Cultural Considerations. There are four codes that were not used that are important to subsegments of the population. They are Carrying on shoulders, hip and back (d4303); Carrying on the head (d4304); Using human-powered vehicles (d4700); and Driving animal-powered vehicles (d4752).

Carrying on the shoulders, hips and back is frequently done by recreational hikers, foot soldiers, and school children.[42] This serves practical purposes, including carrying subsistence and shelter or supplies for school. These activities both allow for engagement in recreational, vocational, and educational activities and constitute risk factors for low-back, shoulder, and neck pain.[42]

Carrying on the head is an activity in daily life in some areas. This includes some women from East Africa, particularly the Luo and Kikuyu tribes, who can carry loads between 20 and 60% of their body weight on their head and Nepali porters who carry loads up to 120% of their body weight on their head up and down mountains.[43, 44] The biomechanics of an African woman carrying a load on her head has been analyzed and shows that they use gait mechanisms that allow for pendulum-like conservation of energy, thus reducing the work required to carry the load.[43, 44]

Excluding these types of activities from the body of measurements available ignores sections of the population and activities that have both benefits and challenges. Given that different types of mechanics are used when engaging in these types of carrying than when walking without a load or walking with a load in the hands or arms, they cannot be replaced with a more commonly used code.[42-44]

This concern extends to using human-powered vehicles and driving animal-powered vehicles. Rickshaws and carts drawn by animals may have become novelties and tourist attractions in North America and Western Europe but are still methods of transportation which contribute to mobility in other areas of the world.

While much of the literature surrounding cross-cultural measures focuses on the appropriateness of translation,[45, 46] there should be equal emphasis on ensuring that the content of the measures is culturally appropriate. In this area, the ICF is helpful as two of the four aims of the framework are to establish a common language for describing health and health-related states and to permit comparison across countries, health care disciplines, services, and time.[22]

Antecedents and Consequences. The antecedents and consequences of movement and mobility are fairly regularly used in measures aiming to measure movement and mobility. Tools

likely include antecedents because if there is a deficit in either movement or mobility, a researcher or clinician would want to look at the various concepts that help to contribute to movement or mobility to determine if they are contributing to the deficit. The consequence of movement is mobility; however, the consequences of mobility are also used in measures. This is likely because mobility is such a broad term and difficult to measure. Measuring a person's ability to complete activities, such as recreation and work, is used to determine if a decrease in mobility is having an effect on important aspects of life. Though, it is important to note that when measuring a consequence, the researcher or clinician should keep in mind variables other than mobility which affects those concepts, such as economic and environmental factors. For example, an individual may withdraw from regular recreational activities, such as a monthly community dance, because of interpersonal problems with other members of the community or because they are not able to pay the entry free. These are not mobility-based barriers to participating. However, if the dance is free but the individual cannot attend because they cannot afford taxi or bus fare to get to the dance, this is a barrier due to mobility restrictions.

Selection of Tools. Depending on the clinician's or researcher's purpose for selecting a tool, they may wish to find one that is either broad or specific within one or both of the concepts. As an example, a group of clinicians may need a measure or a set of measures that would assess an individual's ability to walk after surgery. As such, they want to find a measure(s) that use the codes d4500 through d4509. Due to the frequency with which walking is measured, there are 329 tools which measure some aspect of walking. If the clinicians decide the initial focus should be tools that are practical, the number of tools in consideration lowers to 201. Because the clinicians are going to be using this measure on a variety of ages and diagnosis, those designed for a specific diagnosis are removed. For example, if the clinician is not interested in tools specifically

for the elderly, individuals with Parkinson's, stroke or spinal cord injury, there are another 35 possibilities that would be removed. A hand search of the remaining 166 tools is then completed, looking for two sets of attributes: first, that the tool covers as many of the d450 Walking codes as possible and second, that the number of items be as close to the number of walking concepts in it as possible to avoid measuring concepts that are not of interest. The tool that most closely meets these criteria is the Standard Walking Obstacle Course.[47] The Standard Walking Obstacle Course does not use the d4509, Walking, unspecified code or the d4501 Walking long distances code. However, clinicians may decide that the unspecified code is not necessary, given that it does not add any specific information, and upon reviewing the list of practical measures, the clinicians may see that there are no measures from the list that have the d4501 Walking long distances code. Upon considering the logistic difficulty of having a participant walk a kilometre or further for assessment, the decision may be made not to create a new measure and turn to the PROMs that have the d4501 code. The clinician may then look for measures that have as few items as possible to focus on the concept of interest. There is one measure from the list that meets this criteria most closely, the Self-Reported Walking Ability measure which asks of the individual's ability to walk one mile or 8 to 12 blocks.[48] While reliability and validity should be further examined prior to use, the clinicians now have two measures which cover the concepts of interest.

Limitations of the review

This scoping review sought to present an overview of the measures available for the assessment of movement and mobility. Due to the large number of measures assessed, a detailed assessment of each measure or each subgroup of measures was not possible, and no assessment of validity or reliability was assessed for the measures in this review. In addition, this study was

limited to measures used for adults. Measures constructed for the pediatric population may have different qualities. Finally, only measures which were available in English were used. This may limit the international scope of these findings, and it may be advisable to repeat this type of assessment in various languages.

Conclusion

The aim of this scoping review was to gather a comprehensive list of tools that measure either movement or mobility and to assess what concepts these measures truly cover. This was facilitated by comparing each tool to the ICF and the code sets that have been established for movement and mobility.[12] There were 651 tools that were able to be analyzed, resulting in extensive coding. While there are many tools which measure only movement or mobility, there are many which measure a mixture of the defining attributes as well as the antecedents and consequences. The tool name alone should not be considered a guarantee of the concept measured, and tool selection should be done with consideration for which concepts are actually covered by the measure.

Future research should concentrate on subsections of the tool list, such as tools for physical activity. Clinicians should also consider if the tools that are being selected are appropriate for the population of interest. This is particularly important in the international and cross-cultural context, as there are some aspects of movement and mobility, such as the ability to drive animal-powered transportation, which are neglected in the list of tools developed by this review.

Conflicts of interest

The authors declare no conflict of interest.

Implications for practice and research

This study provides a starting point from which clinicians and researchers, including nurses, physiotherapists, and occupational therapists who work with older adults and in rehabilitation, can find tools which measure the concepts that are of interest and importance to their patient population. There are a large number of measures that have already been established and should be considered prior to beginning development of a new tool. While some of the measures found by this scoping review are well established, others are not as frequently referenced. These existing but underutilized and undertested measures should continue to be tested to further establish the validity and reliability of the tools.

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Chapter 5 Operationalizing Movement and Mobility

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Introduction

Human movement and mobility are physical functions which are used to meet basic needs and interact with the world. The importance of these concepts means that when individuals experience problems with movement and mobility, the effects on an individual's life can be far reaching. Mobility disabilities become more common as individuals age. The rates reach up to 90% and 74%, for women and men respectively, by the age of 95.[1] Despite the importance and prevalence of these concepts, they are often confused or used interchangeably in the literature.

In order to address this issue, a concept analysis was performed using the methodology outlined by Walker and Avant to clarify and compare the concepts of movement and mobility.[2] This concept analysis developed defining attributes, antecedents and consequences for movement and mobility, thus establishing conceptual outlines for each of the concepts. It established there are three subtypes of movement: simple involuntary movements, such as a reflex or tremor; simple voluntary movements, such as flexing a finger; and complex voluntary movements, such as diving into a pool.[3] Simple voluntary and involuntary movements 1) occur in a context; 2) have displacement, so a start and an end position; 3) have speed; 4) have velocity; 5) have acceleration; and 6) have force that is generated internally from the individual's muscles.[3] Complex voluntary movements have the additional attributes of 1) being coordinated and 2) being planned.[3] Mobility is described as a spectrum with three reappearing attributes: 1) mobility exists when an individual is moving around; 2) the movement can be accomplished by any means; and 3) mobility is dependent on the environment, which can either act as a facilitator or a barrier.[3]

The concept analysis allows for the first step towards creating of a theoretical definition, which creates meaning by defining a concept in terms of other concepts and introduces the

concept's critical defining attributes.[2, 4] However, to measure a concept, it must first be operationalized. Operationalization is the process of taking a theoretical definition and defining it in a way that allows it to be measured and expressed either quantitatively or qualitatively. Waltz, Strickland, and Lenz outline a method by which a theoretical definition can be transitioned to an operational definition.[4] Their process outlines five distinct steps: 1) develop the theoretical definition; 2) specify variables derived from the theoretical definition; 3) identify observable indicators; 4) develop means for measuring the indicators; and 5) evaluate the adequacy of the resulting operational definition.[4]

While theoretical definitions are abstract, operational definitions not only reflect the theoretical definitions but also have specific means for measuring or testing the concept.[2, 4] Operational definitions are necessary to measure concepts; however, in research and clinical situations, artificial limits are often placed on a concept.[2] These artificial limits allow for the requirements of a particular scenario to dictate the range of the measurements.

The purpose of this paper is two-fold. First to bridge the gap between the conceptual understanding of movement and mobility and the measurement of these concepts, given the complexity of these concepts and the large number of measures that exist. Second to advise on the selection of measures for movement or mobility in clinical practice and research.

The process outlined by Waltz et al. for moving from a theoretical definition to an operational definition will be used.[4] The process of operationalizing movement and mobility will be done for the general concepts. This will then be done for specific example. General considerations for selecting measures will be discussed. Finally, measures for a specific example will be selected.

This discussion of concepts will make use of the International Classification of Functioning, Disability and Health (ICF), a framework developed by the World Health Organization. The ICF was created to provide a unified language and framework to describe health and health-related statuses.[5] There are 1424 codes in the ICF; a number of them have been linked to the defining attributes, antecedents, and consequences of movement and mobility.[3, 5] This framework can also be used to analyse measures of health-related concepts, which should assist in the operationalization of these concepts.[6-8]

From Theoretical to Operational Definitions

Develop the theoretical definitions. The first step of the process developed by Waltz et al. is developing the theoretical definition.[4] A theoretical definition of a concept provides a rich expression of the concept and allows individuals to determine if a particular phenomenon is a part of the concept or not.[2] A theoretical definition of movement and mobility was developed using the concept analysis, *Movement and Mobility: A Concept Analysis*.[3] This initial step is consistent with recommendations from Waltz et al. for establishing a theoretical definition by first finding preliminary definitions, followed by a literature review in which a search for the use of the terms movement and mobility in the literature was completed.[3, 4] Waltz et al. then suggest mapping the meaning of the concepts; this is done after the critical attributes of the concept and the aspects of its meaning are established.[4]

Movement. Figure 5-1 shows a map of the subtypes of human movement and the alphanumeric ICF codes for movement that are associated with each subtype of movement. Movements can either be involuntary or voluntary, and when a movement is voluntary, it can either be simple or complex.

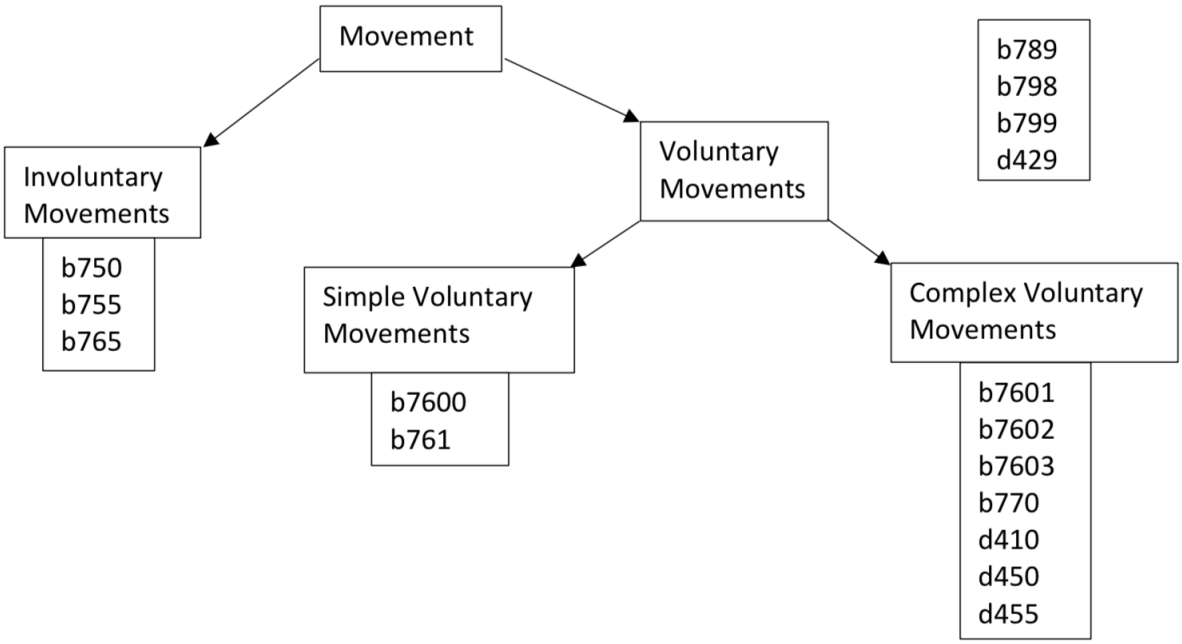

Figure 5-1. Mapping of movement, including ICF codes

A large section of the ICF codes are a part of the complex voluntary movements section. These include: *b7601 Control of complex voluntary movements; b7602 Coordination of voluntary movements; b7603 Supportive functions of arm or leg; b770 Gait pattern functions; d410 Changing basic body position; d450 Walking;* and *d455 Moving around*. This is likely because most of our daily life actions are voluntary and complex, as we choose to move about our environment. Because simple voluntary movements are seldom used alone, there is a single code *b7600 Control of simple voluntary movements* and a code set *b761 Spontaneous movements*. There are three ICF codes sets that fall under the involuntary movements section. These include: *b750 Motor reflex functions; b755 Involuntary movement reaction functions*; and *b765 Involuntary movement functions*. There are also 4 codes set to the side but still under the umbrella of movement. These are "other specified" and "unspecified" codes which could fall under any of the movement subsections depending on what is specified including: *b789*

Movement functions, other specified and unspecified; b798 Neuromusculoskeletal and movement-related functions, other specified; b799 Neuromusculoskeletal and movement-related functions, unspecified; and d429 Changing and maintaining body positions, other specified and unspecified. They are located in the top right corner of the diagram.

Mobility. Figure 5-2 shows a map for the concept of mobility. Because mobility exists as a spectrum, it is represented by a line, with complete mobility on one end and immobility on the other. The arrow pointing to the line indicates the level of mobility of a sample patient, discussed below. This level will change over time as the stressors and supports for mobility change. Supports for mobility are the ability to move, the accessibility of the environment, the availability and use of assistive devices, the will to be mobile and support from others. The stressors that decrease the level of mobility that can be achieved are the presence of illness or injury, the presence of environmental barriers, the financial constraints of the individual or society, and the decline in energy or cognition.

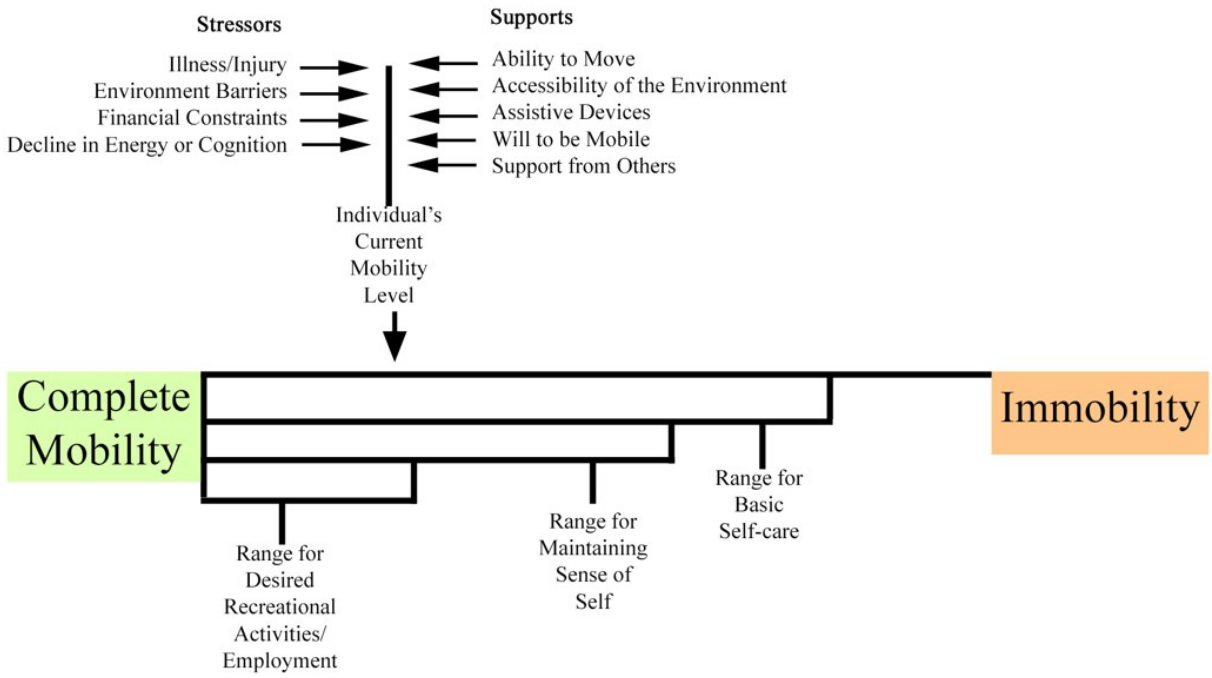

Figure 5-2. Mapping of mobility

Mobility allows individuals to take care of basic self-care needs, maintain a sense of self and engage in employment and recreational activities. For each of these activity sets to be completed, a different range of mobility is needed. The range of mobility in which a person would be able to fulfil these activities is indicated on the bottom of the mobility line. Note, with the possible exception of basic self-care, these ranges are highly personal depending on the individual's desires, expectations, and circumstances. For example, a professional boxer would need a much higher minimum level of mobility to remain employed than a novelist who only requires the ability to type or talk into a recording device.

Sample patient. Bryn is a carpenter who fell down a flight of stairs, resulting in a compound femoral fracture. He can see to his basic needs of preparing meals, grooming, and bathing with appropriate care of the cast so that it stays dry. He is also able to afford a pair of

crutches, so he can get to his local corner store down the street for supplies such as food. Bryn has also maintained his sense of self, as he knows this is a minor setback, and he can continue to live with dignity as he recovers. Unfortunately, his current carpentry job is framing houses for a new subdivision; he will not be able to move around the job site and work safely until his leg has healed. He cannot drive to his favourite recreational activity, playing Dungeons and Dragons (D&D) with his college friends who live in the next town over. As a result, his current level of mobility prevents him from engaging in employment and recreational activities.

The stressors and supports that affect mobility can combine in many ways. For example, with support from another individual, such as one of his D&D friends who would be willing to drive over and pick him up, he would be able to take part in the pastime. He could also conceivably attend D&D if he gained access to a vehicle that was equipped with hand controls or if a public transportation system was established between the two towns.

The ICF codes that cover mobility are easily dividable into three main categories. The first category includes codes that focus on the physical area of the mobility and include *d460 Moving around in different locations*. The second category includes codes that focus on the type of external assistance, often through a device or machine, and includes *d465 Moving around using equipment; d470 Using transportation; d475 Driving; d480 Riding animals for transportation;* and *d489 Moving around using transportation, other specified and unspecified*. The final category includes codes that focus on the individual's interaction with the environment and includes *d430 Lifting and carrying object; d435 Moving objects with lower extremities; d440 Fine hand use; d445 Hand and arm use; d446 Fine foot use;* and *d449 Carrying, moving and handling objects, other specified and unspecified*. There are two codes which are too general

to be grouped into a specific category and they are *d498 Mobility, other specified* and *d499 Mobility, unspecified*.

Definitions. Based on the description of the concepts established above, the following theoretical definitions are proposed.

Movement. Human movement is the displacement of the whole or a part of a person's body using force that is internally generated.

Mobility. Mobility is the ability to move to interact with the environment as an individual wishes in order to accomplish tasks that are important to them and may include assistance from other individuals as well as common devices, such as public or private transportation, or specialized devices, such as wheelchairs or walkers.

Specify variables derived from the theoretical definition. Specifying the variable aspects of a concept furthers the mapping process and is specific to the characteristics of the concept that can assume different values.[4] There are often many variables that could be measured for a given concept. Questions that are helpful with determining if a variable should be included in an operationalization are: 1) Which variables will provide the most useful information to nurses? 2) Which variables have been historically found to be the most important or most helpful in explaining or predicting occurrences of interest to nurses? and, 3) Which variables can be measured, given the present state of knowledge and technology?[4]

Identify observable indicators. Observable indicators are guided by the theoretical definition of the concept and are built on the concept's variables.[4]

Movement variables. The variables of movement that can be assigned a value during measurement are listed in Table 5-1.

Table 5-1. Movement variables

Variable	Indicator
Displacement	The difference between the starting and ending position
Distance	The overall amount of ground covered during movement
Duration	Over what amount of time the movement is done
Speed	The distance traveled over the period of time
Body Part	Which part of the body is moving
Ease	The level of difficulty or ease experienced when moving expressed either on a numeric scale or by description
Frequency	How often the movement is completed
Type	Voluntary or involuntary and what type of involuntary movement

Mobility variables. The variables of mobility that can be assigned a value during measurement are listed in Table 5-2.

Table 5-2. Mobility variables

Variable	Indicator
Ease	The level of difficulty or ease experienced when accomplishing tasks requiring mobility expressed either on a numeric scale or by description
Level of assistance	Were other people or products, either specialized or general, used
Area in which the mobility occurs	Is the mobility specific to an area such as in the home, in buildings other than the home, outside, or between towns
Objects interacted with	The size, shape, and weight of the object or objects that the individual interacts with
Level of satisfaction	Does the level of mobility of the individual meets with their needs and wants
Task completion	What mobility-based tasks can be completed

Develop means for measuring the indicators. The fourth step of Waltz et al.'s process has been well populated, as movement and mobility are concepts for which many measures have been created. A recent scoping review by Moulton et al. compiles a list of 702 individual measures which were intended to measure either movement, mobility, or a combination of the two.[9] The existing measures should be considered in terms of their appropriateness for the situation prior to developing new measures.

Evaluate the adequacy of the resulting operational definition. The final step in operationalization is to assess the adequacy of the measures that have been created.[4] This assessment should be based on the accumulated empirical evidence. This work of assessing existing measures could fill several books. However, any book created for such a purpose would be out of date by the time that is was published. As such, the task of evaluating the adequacy of operational definitions and the measures they produce is a task that must be undertaken on a continual basis by the clinicians and researchers who use these measures. The Moulton et al. scoping review can assist with the assessment of content validity,[9] which is the extent to which the items of a measure match the content of the domain of interest.[4] The scoping review compares movement and mobility measures to the ICF codes to determine which concepts are measured by which measure.[9]

Operationalized Definition for the Example Case

Nurse Josephine works on a medical-surgical floor at a small rural hospital. The community that she lives in has a high percentage of senior citizens, and she has cared for many over the years. Recently her great-aunt fell on the icy sidewalks, was treated on the medical-surgical floor for a broken hip, and eventually returned home. During her weekly visits, Nurse Josephine notices that despite her great-aunt meeting all the criteria for discharge, she has more difficulty getting around than normal. Her great-aunt now rarely leaves the home, except in the company of a relative and has come to prefer sedentary activities. Nurse Josephine is worried and wonders if other patients who have left her floor are having similar difficulties. She decides to study how a patient's movement ability upon leaving the hospital after a broken hip is related to mobility at home.

To measure movement and mobility, Nurse Josephine must first operationalize the concepts of movement and mobility. For movement, when she considers the variables that will provide the most useful information, she decides speed is an appropriate variable because it includes both distance and time. She also thinks it is a good idea to consider which body part is moving because injury and illness will affect different parts of the body. Finally, she believes the ease of movement is an important variable because she notices that the more effort a patient puts into a particular movement, the less likely they are to do it. She knows historically that the timed-up-and-go has been used to determine fitness to return home but does not know if the historic measure is the best, so she is willing to explore other options.

For mobility, she decides that the variables that provide the most useful information are the ease of mobility, the level and type of assistance required, the locations that the individual can access when mobile, and the level of the individual's satisfaction with their mobility. The hospital she works at has not collected information on mobility post release nor can her local home-care agency provide information on measures of mobility in the community. Nurse Josephine believes that these variables can be measured with the current state of knowledge but will need to further examine existing measures to be sure.

Considerations for Selection

Measures have some characteristics, which will determine if the measure will be selected or eliminated. There are positives and negatives characteristics for each characteristic option, and the specific situation that the measure will be used for will help inform what is the best option.

Patient Reported Outcome and Practical Measures. Measures for movement and mobility can be patient reported outcome measures (PROM); practical measures; or, in rare

instances such as the Unified Parkinson's Disease Rating Scale (UPDRS), a combination of the two.[10]

PROMs. PROMs are measures that capture the patients' view of their symptoms, functional status, or health-related quality of life.[11] While initially created for research, they have proved useful in informing clinical decision making, in improving quality of care, in fostering communication, in assessing and comparing the quality of care, and in evaluating practices and policies.[11, 12] Practical advantages of using a PROM are that they can be completed over the phone, online, in person or via mail and can require nothing more than pen and paper. They are often low cost, do not take as much time as practical measures and are not strenuous for the participant to complete. Some of the disadvantages are that the accuracy is dependent on the individuals' literacy level and on their understanding of the language that the measure has been published in if it is not their first language. There is also potential error if the individual underestimates or overestimates their abilities.

Practical. Practical measures are task-based measures, where the participant is asked to complete a task or a set of tasks. The clinician or researcher observes the patient while they complete the task and scores them on a set of pre-defined criterion. This could be amount of time in seconds to complete the task, such as the Timed-Up-and-Go or the 10-meter walk test;[13] the number of tasks completed in an amount of time, such as the Purdue Pegboard;[14] or descriptive qualities, such as the Spiral Drawing test, where the researcher or clinician is asked to rate the quality of the spiral on a scale from 0 (no tremor) to 10 (tremor too severe for spiral drawing to be recognizable).[15]

There are several advantages to the use of a practical measure. When a practical measure is used, the researcher or clinician can see the level of functioning of the individual in the

moment, free from the bias of the individual being tested. The major disadvantages of practical measures are that they can take more time, require space and resources, and must be done in person.

Symptom Assessment. Measures for movement can be specific to a single symptom or symptom type. Measures of a single symptom often cover involuntary movements, which includes measures for tremors and tics. While these are a type of movement, it may not make sense to include measures that are specific to these types of movements for persons or populations that have not had these symptoms. Deciding if a population needs this type of assessment can either quickly remove measures from the list of possibilities or immediately add it to the list of options.

Patient Population. There are many measures that have been created for specific patient populations. Table 5-3 contains a list of medical conditions, symptoms and patient populations which have measures created specifically for them.

Table 5-3. Medical conditions, symptoms, and patient populations with movement and mobility measures

Medical Conditions, Symptoms, and Populations
Vision loss
Wheelchair users
Amputations and prosthetics
Intensive care or critical care unit
Stroke
Back problems
Elderly
Multiple sclerosis
Spinal cord injury
Facial nerve weakness
Hemiplegia
Parkinson's Disease
Huntington's Disease
Dyskinesia
Akathisia
Tics
Freezing
Extrapyramidal side effects
Bradykinesia
Synkinesis
Tremors
Osteoporosis
Amyotrophic Lateral Sclerosis
Arthritis
Intermittent claudication
Hemophilia
Rett Syndrome
Pelvic girdle problems
Pregnant

If searching for a measure for a medical condition, symptom, or population on this list, then the search for possible measures can start with reviewing the specific measures. If the population who is being measures is not on this list or the measure will be used for a variety of populations, then population-specific measures can be removed from the list of possible measures.

Concept coverage. With large concepts, such as human movement and mobility, there is still a range of sub-concepts that can be covered by measures. In Figure 5-1 movement can be subdivided into three types: involuntary movements, simple voluntary movements and complex voluntary movements. These types of movements can be further subdivided, for example, complex movements can include a variety of movements, such as walking, running, climbing, and swimming. Selecting the sub-concepts of interest from ICF codes can then help with the selection of measures, if the group of measures has been analysed with the ICF using the methodology developed by Cieza et al.,[6-8] as measures of movement and mobility have.[9] This coding process allows clinicians and researchers to search for measures that include the codes of interest and exclude measures with unwanted codes.

Validity. Measures are not individually considered to valid.[4] Instead evidence is accrued for the validity of scores when the measure is used for a specific purpose, with a specified population under a certain set of conditions.[4] This means that evidence on the validity of a measure needs to be collected and collated for each new population and situation. When a researcher or clinician is trying to determine if a measure is appropriate for use in their setting, they need to select articles that assess the validity in their setting.

Reliability. The reliability of a measure is usually estimated with test-retest, parallel form, or internal consistency procedure.[4] Test-retest reliability is the stability of the measure over a specific time period. Parallel reliability indicates if the measure assesses the same concept(s) as another measure designed for the same purpose. Internal consistency is consistency of performance of a group of participants across individual items.[4] Reliability must also be accrued for each individual measure.

Measure Selection for the Example Case

Nurse Josephine selects two types of measures for her study. The first type is movement measures to assess patients before they leave the hospital. The second type is mobility measures that can assess a patient's ability to move about in their larger environment. Her first step is to identify the subcomponents of movement and mobility that she wishes to measure. This is based on the breakdown of the concepts presented above by the ICF codes.[3]

Concept code selection. For the concept of movement, Nurse Josephine considers basic movements that are used most often by the seniors in her community and that provide the most information. This narrows her list of code groups to: d410 Changing basic body positions, d420 Transferring oneself, and d450 Walking.

For the concept of mobility, Nurse Josephine considers what levels and types of mobility would allow her patients to see to their daily needs, take part in the work and recreation, and visit with friends and family. This narrows her list of code groups to: d460 Moving around in different locations, d470 Using transportation, and d475 Driving.

Initial measures. A list of measures which assess movement and/or mobility are found in *Measures of movement and mobility used for adults in clinical practice and research: A scoping review* which breaks down the measures by concept type. The data files which break down each measures by ICF code are available for access on the **Queen's University Dataverse** at https://doi.org/10.5683/SP2/76LASW under the file name DA_MoveMob_Frequency.

Movement. The following steps were taken:

1. The data table was limited to the code groups *d410 Changing basic body position, d420 Transferring oneself*, and *d450 Walking*;

2. All measures that did not have a code within this code grouping were eliminated, bringing the number of measures under consideration from 653 to 398;
3. Nurse Josephine decides that since she will have the patients in the hospital for the movement portion of the measurement, she will use practical measures to get the most accurate measure of the patients' movement abilities on the date of their discharge. This reduces the number of measures from 398 to 262;
4. All measures that were for a specific population or medical condition, other than older adults, were removed, bringing the number of measures under consideration from 262 to 215 measures;
5. Nurse Josephine decides to use the timed-up-and-go test, because it is standard practice at the hospital. This means that *d4103 Sitting; d4104 Standing; d4500 Walking short distances;* and *d4508 Walking*, other specified are measured. She then removes all the measures that only has one of these codes. This reduces the number of measures from 215 to 85;
6. She wants to measure the most concepts specific to her codes of interest with the least amount of non-relevant codes as possible so as not to exhaust her patients. She calculates coverage by summing the frequency of the code usage per measure and dividing it by the number of items in the measure. There are 13 measures with a value of 1 for this calculation, all of which have 1 item and cover d4101 Squatting, d4105 Bending, and d4502 Walking on different surfaces. She decides to select a d4101 and a d4105 measure from the list and will compare the reliability and validity of each set of measures;

7. There are 10 measures that are 0.50 or more in their code coverage. Nurse Josephine examines the list of measures with a coverage of 0.50 and selects the four measures that most focused on her area of interest and cover the most codes. The measures selected are as follows:
    - Bed Rise Difficulty (BRD) Score (2 codes), *d4107 Rolling Over,* and *d4108 Changing basic body position, other specified*;
    - Global Mobility Task (GMT) (3 codes), *d4102 Kneeling, d4107 Rolling Over,* and *d4108 Changing basic body position, other specified*;
    - Functional Ambulation Classification (2 codes), *d4501 Walking long distances,* and *d4502 Walking on different surfaces*; and
    - Functional Mobility Assessment Tools (3 codes), *d4200 Transferring oneself while sitting, d4201 Transferring oneself while lying,* and *d4502 Walking on different surfaces*; and
8. There are 10 measures that are 0.50 or more in their code coverage. Nurse Josephine does a manual comparison of the measures, the codes they cover, and the reviews the reliability and validity of the measures before making a decision of which one or ones she will use.

Mobility. The following steps were taken:

1. The data table was limited to the code groups *d460 Moving around in different location, d470 Using transportation,* and *d475 Driving*;
2. All measures that did not have a code within this code grouping were eliminated, bringing the number of measures under consideration from 653 to 111;

3. All measures that were for a specific population or medical condition, other than older adults, were removed, bringing the number of measures under consideration from 111 to 79;
4. Taking a closer look at the codes, Nurse Josephine decides that *d4750 Driving human-powered transportation* and *d4752 Driving animal-powered vehicles* are not activities that older individuals in her community do or need to do on a regular basis. This reduces the number of measures to 63;
5. Looking at the results, Nurse Josephine notices that *d460 Moving around in different location* codes are more common than *d470 Using transportation* and *d475 Driving* codes. She decides to put the emphasis on the *d460 Moving around in different location* codes because they focus on the locations in which a person moves instead of the methods. She looks at the measures in two ways. First, she looks at all the measures which cover *d4600 Moving around within the home, d4601 Moving around within buildings other then home,* and *d4602 Moving around outside the home and other buildings*; there are 12. Second, she evaluates how much of the measure the *d460 Moving around in different location* codes cover by summing the frequency of the code usage and dividing it by the number of items; there are six measures with 0.50 or more in their code coverage. There is no overlap between the two groups; and
6. Nurse Josephine decides to use a questionnaire to assess mobility to keep costs low and, hopefully, increase participation and decides to focus on measures with the highest *d460 Moving around in different location* code coverage to decrease questionnaire burden. This leaves a list of four measures to assess for reliability and validity. They are:

- Life Space Assessment (LSA), *d4600 Moving around within the home* once and *d4602 Moving around outside the home and other buildings* eight times;
- University of Alabama at Birmingham (UAB) study of Aging Life-Space Assessment (LSA) *d4600 Moving around within the home* three times and *d4602 Moving around outside the home and other buildings* twelve times;
- Craig Handicap Assessment and Reporting Technique (CHART) Mobility Subscale, *d4600 Moving around within the home* three times and *d4602 Moving around outside the home and other buildings* twice; and
- Home-Bound Mobility Assessment (HBMA), *d4600 Moving around within the home* four times.

The order in which the components of the measures are considered are highly dependent on what the measure is intended to be used for and how quickly the list of possibilities shrinks.

Conclusion

The purpose of this paper was to bridge the gap between the conceptual understanding of and the measurement of movement and mobility and to advise on the selection of measures. When selecting a measure, it is important to consider if the measure should be symptom or population specific, if it should be practical or a PROM, which ICF codes the measure covers, as well as the reliability and validity of the measures. When narrowing down the measures to use, conceptual coverage should be considered first; followed by logical considerations, such as if a practical or PROM is appropriate. Finally, the validity and reliability of the measures for the specific use need to be investigated.

There are a number of tools available to measure movement and mobility. The scoping review by Moulton et al. identified 702, 651 of which were coded to the ICF.[9] This provides a

large selection of possible measures that can be considered and should be gradually reduced to select the one which most closely meets the needs of the measure. By following a systematic process, existing measures can be used, developed further, and assessed for validity and reliability before new ones are created. Users can also be more confident that they have exhausted the range of possibilities of available and relevant measures.

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Chapter 6 Conclusion

Movement and mobility are concepts that need to be clearly defined and distinguished. They are a fundamental part of physical functioning and can have wide reaching impact on an individual's life as changes in mobility can affect quality of life; wellbeing; independence; social inclusion and participation; sense of self and self-esteem; freedom and autonomy; zest for life; and productivity and leisure occupations.[1-7]

Movements have distinct start and stop points and can be measures in terms of speed and displacement. When referring to human movement, the movements can be involuntary, voluntary and simple, or voluntary and complex.[8] These concepts were linked to the ICF codes. Coding to the ICF allows for statistical analysis of the concepts found within a measure. Challenges arise when the set of measures and codes are extensive but can be addressed using calculations to create summary scores of the concepts covered.[9] A scoping review was completed, using the groundwork from the previous two papers, and provides an assessment of tools which claimed to measure movement or mobility for their conceptual accuracy, some measures that claim to measure movement or mobility actually measure a combination of the concepts and can include antecedents and consequences of the concepts.[10] The breakdown of the concepts covered by each measure can be used in order to assist with the selection of a measure that most closely meets the needs of the situation.

Strengths and Limitations

A key strength of this thesis is the activity of unpacking very basic concepts used in nursing and health care. Movement is one of the basic functions of the human body and mobility is one of the basic ways in which humans interact with their environment. As such, these concepts that are relevant to the humans of all age groups. Movement and mobility are also

functions that can be affected by a wide range of illnesses and injuries including, but not limited to, neurodegenerative diseases, traumatic injuries, stroke, post-surgical recover, childhood disorders such as cerebral palsy, and the aging process. As a result, these concepts are of interest to a wide variety of health care professionals in many areas of practice.

An individual who has difficulties with movement may be at risk for falls or bedsores. Measuring an individual's capacity is the first step in determining if there is an issue and then will be needed to determine if interventions have been successful. An individual who has difficulties with mobility may become home bound or be restricted from activities that they had previously found rewarding. The proper assessment of an individual's mobility level can lead to the individual receiving the proper support services and can avoid dangerous situations.

Another fundamental strength of this thesis is that it makes use of previously published and well-established methods. The concept analysis follows the methodology developed by Walker and Avant[11] and which has been widely used in nursing and health care. The scoping review protocol was developed using the methodology developed by the Joanna Briggs Institute, was peer reviewed and published in the *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* journal prior to completing the scoping review.[12] This allowed for feedback and recommendations from experienced reviewers to be incorporated into the scoping review. The coding of the tools to the ICF in the final portion of the scoping review also made use of a published methodology that was established shortly after the publication of the ICF and reviewed twice.[13-15] During this work, it was discovered that there was no comprehensive discussion in the literature of the methods available to calculate statistics for ICF coding so that the data could be presented in a succinct manner. In order to resolve this issue, an additional paper was added to the thesis to provide an overview of methods that had been used in the

literature, and an expansion of the existing methods with recommendations. This paper informed the decisions for the results section of the scoping review.

The third key strength of this thesis is that it was completed using an emerging design, which allowed the creation of a firm foundation of conceptual definitions to inform the next steps. This process allowed for decisions in the later manuscripts to be based on up to date evidence that had been collected to answer a specific series of questions.

There were limitations to this work. First, best efforts were made to identify all measures that claimed to measure movement or mobility. However, limits had to be placed for logistical reasons to include only measures used in the adult population, those available in English, and those published in accessible databases. Because of the limitation to English measures it is possible that this data set does not represent measures used in non-English speaking populations and that the tools identified may not be appropriate in multi-cultural settings. While the scoping review included the search of five different databases and three grey literature sources, it is possible that some measures that are used but have not been formally published were not identified. There were also some tools that were identified but could not be assessed because a full text of the measure was unavailable. The researcher's best attempts were made to minimize these occurrences; however, in some cases measures were inaccessible, often because they were proprietary or developed by various governments and never published.

The use of the ICF for measure analysis itself also has some limitations. Despite being a well-developed and comprehensive framework, there are limits to the granularity of the coding. For example, the code d4551 indicates the concept being coded is climbing. However, this code is applied equally to the stepping up onto or off a curb, climbing or descending any number of stairs, and rock climbing. A researcher or clinician who wants to find a measure of an

individual's ability to climb a flight of stairs would have to select all the measures which used the d4551 code and then look into the annotations section of the measure analysis or at the measure to determine what type of climbing is being used.

Despite many types of a movement falling into a single code, there are 1424 unique codes in the ICF.[16] The scoping review used 385 of these codes when analyzing the 651 identified measures. This resulted in a larger data set than initially anticipated and difficulty presenting the data in a way that was both comprehensive and coherent. Instead of presenting a count of which codes were used in each of the of the measure summary values were used and group statistics were used to provide an overall understanding of the data.

There was no information collected on the reliability or validity of the measures analyzed. This was because collecting all of the reliability and validity data on a frequently used tool could form a stand-alone systematic review, making a thorough analysis of these aspects for all the tools identified impractical. A researcher or clinician using the data in this thesis to identify appropriate measures for their use would need to select one or more tools from the dataset based solely on the concepts that they measure and other reported attributes such as measure length, if it was a practical or PROM, and the population it was created for. They would then have to research independently the reliability and validity of the measures to decide if the measure was appropriate for their use.

Finally, the initial concept analysis in this thesis identified a set of codes that covered the defining attributes of movement and of mobility. However, there has been no discussion regarding when it is appropriate – if ever – to measure all at once. The clearest example is the *b765 Involuntary movement functions* codes. Assessing an individual for tremors (*b7651*), tics (*b7652*) or stereotypies (*b7653*) when their medical condition or history shows no indication of

involuntary movements may be a misuse of the participant's time and energy. It may be beneficial to identify sections of the movement and mobility codes that are most relevant to certain populations as well as certain codes such as *b7600 Control of simple voluntary movements* that can safely be assumed to exist when another code is assessed, such as *d4500 Walking short distances* which could not be accomplished without control of simple voluntary movements.

Implications for Nursing

Communication is an important part of nursing. Nurses are expected to communicate with patients and their families, other health care professionals, and community partners. In order to communicate properly, nurses need terminology that clearly defined both as an individual concept and in relationship to other similar concepts. This work provides an understanding of important terminology for nurses.

In this thesis, there is a narrative that goes beyond the basic definitions in order to give nurses an understanding of the antecedents and consequences of movement and mobility. By understanding the antecedents of movement and mobility nurses can target specific areas antecedents that are preventing movement and mobility from occurring. Understanding the consequences of movement and mobility allow nurses to assist patients with goal planning. For example, if an individual wishes to engage in sports it can be noted that it is a consequence of mobility rather than a consequence of movement. As a result, the nurse might take into account the individual's ability to interact with the environment over specific movement functions. For an individual with a spinal cord injury, access to an appropriate wheelchair (e1201 Assistive products and technology for personal indoor and outdoor mobility and transportation) is far more important for reengaging in sports than walking again (d4500 Walking short distances). That

does not infer that walking again would not be an important goal for the individual, it simply provides the nurse with a framework to consider what concepts will facilitate engaging in sports if that is the activity that has the most importance to the individual.

This thesis also provides nurses with access to a comprehensive list of measures that assess movement and/or mobility. They can use the information provided on the tools in order to make informed decisions on which measures are most appropriate for their research or clinical purposes. This may bring to their attention tools that are well suited to their purposes but are not yet widely known and used. It will also expose them to all the variations of well-known and often simple tests such as walking, stair climbing and timed-up-and-go tests. By providing a detailed breakdown of the concepts covered by each of the tools listed, nurses can be confident that they are selecting measures that cover the concepts that they are interested in.

In educational settings, the conceptual definitions provide by this work can be used to provide students with a firm grasp of the concepts and their relationships with other concepts through explication of the antecedents and consequences. Understanding how concepts are related to one another in an organized manner is helpful for encouraging students to think critically about their interventions. For example, a nursing student could be working with a patient with a spinal cord injury. If that individual tells the nursing student that his or her primary goal is to return to sports, the nursing student could use the relationships between the concepts to understand that sports is a consequence of mobility. While movement is an antecedent to mobility – and thus walking could contribute to a return to sports – it is not the only antecedent. Exploring other antecedents to mobility, such as access to assistive technologies including wheelchairs designed for sports, could facilitate the individual's return to sports more quickly.

The ICF codes linked to movement, mobility, and their antecedents and consequences provide a framework that could help students consider the many facets.

This work has important implications for the translation of research into clinical practice. The methodological framework provided in this work allows for the quick comparison of many existing measures and may contribute to the understanding of what constructs and concepts are covered by each measure. This effort would lead to more appropriate measure selection. When considering interventions in clinical settings, the ICF codes associated to the concepts of interest could help guide clinicians to interventions that are specific to the need of the patient.

Recommendations for Future Research

This thesis leaves open many possible routes for future research. There are a number of terms and concepts that are used in literature that are used ambiguously or without a clear understanding of how they relate to similar terms and concepts. For example, mobility and movement are related to a number of other concepts. While some were discussed in the concept analysis, there were a few that were commonly mentioned in the articles reviewed during the scoping review. These include functional mobility, life space, physical activity and exercise.

Functional mobility is a compound word in which the terms are somewhat redundant given the definitions proposed in this work. Functional means that something is intended to be practical and useful.[17] Because mobility occurs by the choice of the individual who is moving, it is inherently functional. Movement could be either functional, such as the voluntary movement to stand from a chair, or non-functional, such as involuntary tremors.[18] However, it is simpler and no less precise to say mobility rather than functional mobility.

Life-space is a term that is used to refer to the area through which an individual moves in a set amount of time, usually a day or week.[19] It can be imagined as a set of concentric zones that

gradually increase. While different measures of life-space can vary an example of zones could be being able to move around the bedroom, the rest of the home, the outside of the home in the yard, around the town/city, and to a different town/city. Life-space looks at mobility from a geographical lens. It is specific to the home and town that the individual is living in at the time of the questionnaire. While there is more to mobility than just life-space, it can be a useful lens from which to consider an individual's mobility.

Physical activity is very closely related to movement. It is defined by the WHO as "any bodily movement produced by skeletal muscles that requires energy expenditure."[20] Because human movement has force that is internally generated by the individual's muscles all movement requires energy expenditure. Physical activity is slightly different from movement because it approaches human functioning from the perspective of energy-consumption. It is unclear from the WHO definition of physical activity if it includes actions such as isometric exercises. However, there is a clear difference between physical activity and exercise. Exercise is a subcategory of physical activity that is planned, structured, and is aimed at improving physical fitness.[20] Eventually, a web of all the related concepts in terms would help to clarify definitions and the connections between them.

Another future direction for this work is the development of a framework, based on the ICF codes, to assist with ensuring that measures and concepts align in health care environments. There are many concepts related to functioning, disability, and health which need to be measured: movement and mobility were the exemplars in this work. These concepts can be considered in isolation or in relation to other concepts and delineate the measures that have already been or need to be created.

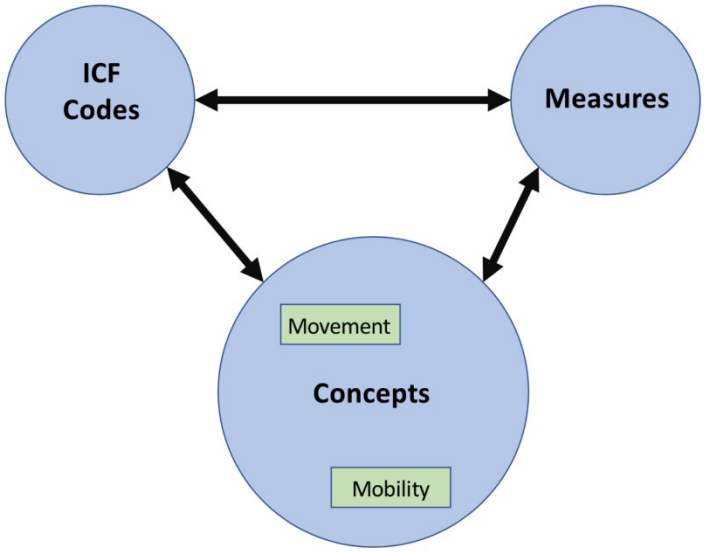

Figure 6-1. Association between concepts, ICF, and measures.

With these three components, shown in Figure 6-1, a researcher or clinician could start at any point and move between the three components. ICF codes can be linked to concepts with a concept analysis, then linked to measures using the methods established by Cieza et al.[13-15] The link between the measures and the concepts can occur in a couple of ways: if there are existing measures for the concepts, these can be systematically collected and measures of interest can be identified. If there are no existing measures, an opportunity exists for creation using both the conceptual definitions and the ICF codes. Researchers and clinicians can start with any component of the framework and build on the others. By moving between the three components they can strengthen the conceptual basis of the measures being used.

Some of the methods of calculating ICF codes discussed in the second manuscript are relatively new. As a result, they should be reassessed in the next few years in order to determine if they meet the needs of researchers and the readers. It may be necessary to explore further methods of data presentation. There are many variations on how the data from the ICF can be

calculated and continued discussion on this subject will help maintain a standardized language for all the possible variations.

Given its size, the database created in the scoping review can be further explored. The discussions in the scoping review were predominantly focused on the overall dataset. It can now be broken down into smaller sets for more detailed analysis. For example, separate analysis could be done for physical activity measures, wheelchair measures, amputee specific measures, and disease specific measures. Since it is likely that researchers and clinicians will need a specific type of measure for their population, they would find more relevant information in these tool subsections. The smaller datasets would also allow more detailed data to be presented than is practical in the full data set report.

Further research would allow researchers to address some of the limitations that have been previously discussed. This thesis can be built on by completing further scoping reviews that use the same methods to assess measures that are used in the paediatric population or that are published in different languages.

In order to increase the usability of the data set generated by the scoping review it would be ideal to create a searchable database that is available for public use. From this database a researcher or clinical would be able to limit their search by measure characteristics such as if it is a practical or PROM, if it was initially created for a certain population, and length of the tool. They would also be able to select codes that the measure must include or that it may not include. The database would provide the names and citations for the measures that meet the user's criteria.

The relationship between the concepts of movement and mobility are both important and complicated. In order to further understand how they are related, the measure batteries developed

in the fifth manuscript should be collected from individuals with varying levels of movement and mobility and different types of impairments. By further understanding the relationship between these two concepts, recommendations can be made concerning what types measures can predict how mobile a patient will be at home after being released from hospital and what aspects of movement and mobility should receive treatment and rehabilitation efforts.

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Appendix A Measures of Movement and Mobility Used in Clinical Practice and Research: a scoping review protocol

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Introduction

This review will scope the literature of measures of movement and mobility used in clinical practice and research. The measures that are found will be assessed to determine how closely they design to the concepts, movement or mobility that they aim to capture, using the methodology developed by Cieza *et al*.[1-3]

Humans do no react passively to their environment; instead they develop ways to avoid unpleasant experiences while maximizing exposure to positive experiences.[4] Being able to move and having mobility are essential to humanity's ability to maximize their interaction with their environment. However, mobility disability is a common problem, particularly in older adults. The prevalence for mobility disability at the age of 65 is 16% for women and 14% for men; these numbers rise to 90% and 74% by the age of 95.[5]

The concepts of movement and mobility are frequently used together in the literature. While they are related, when used in the context of the human body they have distinct meanings. Movement is a change in the place or position of a part of the body or of the whole body.[6] Mobility is derived from movement and is defined as the ability to move with ease.[7]

Movement is often discussed in the context of symptoms, with problems arising when movement becomes difficult or voluntary control is lost.[8-11] Movement often refers to a single body part[11] or a single joint.[10] Due to the fact that movement is concrete and often specific to a single part of the body, it has a finite existence with defined start and stop points that allow for easy measurement.[9] There are three types of movements: simple involuntary movements, such as a reflex or tremor; simple voluntary movements, such as flexing a finger; and complex voluntary movements, such as diving into a pool. The attributes of movement are they: i) occur in a context; ii) have displacement, with both a start and end position; iii) have speed; iv) have

velocity; v) have acceleration; and vi) have force that is generated internally from the muscles. Complex voluntary movements also have the following attributes: i) they are coordinated and ii) they have been planned.[12] In addition to knowing the attributes of a concept, it is important to understand the antecedents, which are the systems that need to be functional (such as the bones, joints and muscles) and the consequences, which are the results (such as being able to interact with the environment) of the concept.[12]

Mobility is described as a state of being or a spectrum with complete mobility existing at one end and complete immobility existing at the other.[8, 13-18] There are three parts that reappear in most definitions of mobility: mobility exists when an individual is moving around; the movement can be accomplished by any means including, walking, driving, or public transportation and can be facilitated by equipment; and mobility is dependent on the environment which can either be a facilitator or a barrier.[12] Mobility is often used in a general sense; however, it can be specific to a particular environment such as a level plane, stairs or a bed.[16, 19, 20] For example, bed mobility can be measured by determining if an individual can roll and sit up when laying in a bed.[20] Because mobility is affected by the environment that the person is trying to navigate, simplifying the environment to a level plane rather than multiple surface types makes measuring simpler, but the results less generalizable.

A variety of tools have been developed that claim to measure movement and mobility. These tools can include both Patient Reported Outcome Measures (PROMs), which capture the patient's view of their symptoms, or functional status,[21] and practical measures, which are generally task based and scored on a pre-defined criterion.

The concepts of movement and mobility are distinct and the differences are important to patient care. In a phenomenological study of the experience of living with Parkinson's Disease

both the concepts of movement and mobility were used.[13] The concept of movement was used in the Study Background section where it described the symptoms of Parkinson's, particularly bradykinesia which is slowness of movement. The concept of mobility was introduced in the Results section where patients discussed their experience with the disease. For example, one couple had moved to an apartment because of their mobility concerns, while others described difficulty in completing daily activities or continuing social relationships because of impaired mobility.[13] This contrast in the use of concepts shows that while movement is useful in the description of symptoms, impaired mobility is the concept that interferes with patients' daily functioning.

Because movements have distinct start and stop points they are much easier to measure. For example, using a motion capture system, such as the Qualisys™ camera system (Qualisys, Göteborg, Sweden), allows researchers to record changes in position with sub-millimeter and millisecond accuracy, and calculate variables such as stride length and cadence. Since mobility is often measured with patient reported outcomes to determine the patient's perception of their ability, it is difficult to compare between measures as different measures may focus on different areas of mobility.

Researchers and clinicians need to understand the difference between the concepts of movement and mobility to ensure that they are measuring the outcome of interest. For example, interventions that target specific symptoms are better assessed with measures of movement. On the other hand, interventions which are designed to have an impact on what the individual can accomplish in their daily lives are better assessed with measures of mobility.

When selecting and using tools to measure a patient's movement or mobility, before considering validity and reliability, it is important that clinicians and researchers are confident

the tool measures the concept of interest. Tools can be assessed to determine what concepts they measure using the International Classification of Functioning, Disability and Health (ICF).[22]

The ICF is a classification system that was developed by the World Health Organization (WHO). The goals of the ICF are to: provide a scientific basis for understanding health; provide a common language for the description of health and health-related states; allow comparison across countries, health-care disciplines and time; and provide a systematic coding scheme for health information.[22] The ICF has four main components for coding: i) body functions and structures, ii) activities and participation, iii) environmental factors, and iv) personal factors.[22] There is also an ICF code set created specifically for children and youth, in order to address the complexities that are associated with childhood development, as they cause differences in the manifestations of disability and health.[23] Because of the complexities associated with childhood development, this scoping review will be limited to tools used in the adult population. This population includes older adults who have a high prevalence of mobility disability.

Guidelines have been created that allow the linking of health-status measures to the ICF codes.[1-3] Once the tools are linked to the level 2 ICF codes it can be determined: i) what concepts the tool actually measures and ii) what percentage of the codes associated with movement and/or mobility are covered by the tool. This information can be used to help inform which tools cover which aspects of movement and mobility. While researchers and clinicians will have to compare the validity and reliability of the tools in order to decide which ones best fit their needs, they can use the compiled information to understand which tool/s measure the concepts they are interested in. A researcher or clinician may use the table to choose to use more than one tool in order to cover all the aspects of movement or may decide that they are interested only in tools that consider mobility and select only from that section.

An example of this process can be seen in the paper "Generic patient-reported outcomes in child health research: a review of conceptual content using World Health Organization definitions".[24] This paper uses the WHO definitions of functioning, disability and health and quality of life (QOL) in conjunction with the ICF codes to determine which concepts the health measures were associated with. Some of the content analysis found complete agreement with the concept they measured, such as the Functional Disability Inventory and the Satisfaction with Life Scale, while most were split between the two concepts, for example, the General Health Questionnaire linking 42.9% of the time with QOL and 57.1% of the time with functioning, disability and health. They determined that instrument users have to be able to identify the concept that they are seeking to measure and the concept that the tool assesses in order to properly select an instrument.[24] Completing a similar assessment of movement and mobility tools will provide researchers and clinicians with an accurate picture of which tools are linked to the concept that they wish to assess.

A search for existing scoping reviews on the topic of measures of movement and mobility has been conducted in *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports*, Cochrane Database of Systematic Reviews, Cumulative Index to Nursing and Allied Health (CINAHL) and PubMed Central, but no reviews were found. There were four systematic reviews found that have similar goals. The study that is most similar to the goals of this scoping review searched for patient-reported mobility measures, as opposed to any type of measure for both movement and mobility, and is the only study to link the measures identified to ICF codes.[25] The second systematic review includes only mobility measures that are not disease specific and uses the ICF definition for mobility instead of ICF codes.[26] The final two

reviews are disease specific, one for patients with spinal cord injuries and one for stroke survivors, neither of which use ICF codes and one of which only uses walking ability.[27, 28]

Identifying what concepts are being measured by each tool will provide clinicians and researchers with a map of the tools that are available to measure the outcomes of interest for their patient population. Researchers and clinicians can then compare the validity and reliability of tools that have been established as measuring the concept of interest in order to select the tool that best suits their needs. A scoping review has been selected because the focus of the review is to map the extent of the tools available and indicate if they measure movement or mobility, rather than assessing the effectiveness of the tools.

Inclusion criteria scoping review

Participants. This scoping review will consider studies that includes participants that are adults (aged 19 and over) with any level of ability or disability. Studies that are specific to children (aged 18 and under) will be excluded.

Concept. The concepts of interest are tools that measure movement or mobility relative to the human body, as discussed in the Introduction. These tools can include both PROMs[21] and practical measures. All tools that claim to measure movement or mobility will be included.

Context. This scoping review will consider studies from any context. Studies will be included regardless of country of origin, healthcare setting or sociocultural setting.

Study types. This review will consider both experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational

study designs including case series, individual case reports, descriptive cross-sectional studies, and validation studies for inclusion.

Studies published in English will be included. Studies published since the inception of the searched databases will be included as the goal is to include all tools that are used in research or clinic.

Search strategy. The search strategy will aim to find both published and unpublished articles. A three-step search strategy will be used in this review.

Stage 1. This stage will involve an initial limited search of the Health and Psychosocial Instrument database (HAPI) (established in 1985) and CINAHL (established in 1981) which has been undertaken and followed by an analysis of the text words contained in the title and abstract and of the index terms used to describe relevant article. The keywords from relevant articles were used to build the searches for Stage 2 which were designed to identify all of the tools that measure movement or mobility. Once a tool has been identified it is not the goal to identify every article that uses the tool.

Stage 2. The text words contained in the title and abstract of relevant articles, along with the controlled language index terms used to describe the papers will then be analyzed to develop keywords for Stage 2. A second extensive search will then be undertaken of all keywords and index terms identified as relevant to the review across all included databases. Individual search strategies will be tailored for each information source. A full search strategy for CINAHL is detailed in Appendix C. Full search strategies for the remaining data bases will be included in the final paper.

Stage 3. The reference list of all studies selected for tool classification will be screened for additional studies for the final stage of the process.

Information sources

The databases to be searched include: CINAHL, HAPI, MEDLINE, Embase and PEDro.

The sources to be searched for relevant unpublished materials will be: Open Grey, Dissertation Abstracts International and Google Scholar.

Study selection. Following the search, all identified citations will be collated and uploaded into EndNote X7 (Clarivate Analytics, PA, USA) and duplicates removed. Titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Studies that may meet the inclusion criteria will be retrieved in full and their details imported into Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI) (Joanna Briggs Institute, Adelaide, Australia). The full text of selected studies will be retrieved and assessed in detail against the inclusion criteria. Full text studies that do not meet the inclusion criteria will be excluded and reasons for exclusion will be provided in an appendix in the final systematic review report. The results of the search will be reported in full in the final report and presented in a PRISMA flow diagram. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer.

Data extraction. Data will be extracted from papers included in the review using a custom data extraction tool by two independent reviewers. The data extracted will include specific details such as: the tool's name, authors' names, year of publication, aim of the tool, if the tool is disease or symptom specific, and if the tool is a PROM or practical test. The study data extraction table to be used can be seen in Appendix E. The data will be extracted from each of the tools by two reviewers and will include: verbatim health information, perspective, response options, classification of response options, main concept, additional concepts, ICF

category of main concept, ICF category of other concepts, and annotations. This is based on the linking rules created for the ICF and health measures.[1-3] The tool data extraction table to be used can be seen in Appendix F. For example, assessing a practical measure such as a camera system that is measuring stride length and cadence as an individual walks three meters along a flat clear path, would be assigned the codes B770 Gait pattern functions and D450 Walking. These two codes are two of the 14 ICF movement codes, or 14% of all the movement codes. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

Data synthesis. The tools that have been found will be presented as a list that is grouped by type, such as PROMs and practical measures; upper and lower limbs; and by duration of the measure.

A table will be created that shows the percentage that each tool measures the following: mobility, movement, antecedents of movement, consequences of movement; and the percentage of ICF codes of movement and mobility that each tool covers.

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Appendix B ICF Linking Protocol Overview

The ICF can also be used to code health care data. In particular, it has been used to assess content validity of measures by linking items in the measure to specific ICF codes. Linking to the ICF is a powerful tool because it can provide a succinct summary of large sets of information that can be quickly contextualized. For example, Stamm et al. used the ICF to analyse and compare the content of questionnaires used to assess functioning in patients with hand osteoarthritis.[1]

A set of ten rules for linking ICF codes to health-status measurements was first published in 2002 by Cieza et al. to provide a standardized method for linking.[2] The rules were redefined and simplified in 2005 when it was found that they were being applied beyond the scope they were initially created for.[3] The rules were subsequently returned to ten rules in 2016 after a decade of use outlined challenges that remained in the linking process.[3, 4]

The most recent iteration of ICF linking rules dictates that researchers follow this process listed below.[4] A selection of items from physical activity measures have been collated in Table B-1 to show the end result of the linking process.

1) Acquire a good knowledge of the conceptual and taxonomical fundamentals of the ICF;
2) Ask "What is this piece of information about?" or "What is this item about?" to identify the main concept – in Table B-1 the main concept of question 20 of the Long International Physical Activity Questionnaire is highlighted in yellow both in the question itself and in the main concept;[2]

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[2] The term concept was used in the published linking rules for rules two and three. Given that a concept is an agreed upon definition that is often abstract and not operationalized, we would argue that the data generated by these questions of the measure are constructs. Constructs are more specific and less abstract. For example, 'mobility' is a

3) Identify all additional concepts that are appropriate – in Table B-1 the additional concepts are highlighted in green, the additional concepts are found in the section header and in the question itself;
4) Identify the perspective of the piece of information, for example *performance* describes what an individual does in their environment, *capacity* describes an individual's ability to do an action in a "standardized" environment, and *need or dependency* describes an individual's kind or level of needs – in Table B-1 the perspective is noted in column two and is performance because it asks the participant to describe what they do in their daily life;
5) Identify the category of the response options, for example *duration* describes a response option that asks "how long?" and *confirmation or agreement* describes a yes/no option – in Table B-1 the classification is in the fourth column and is based on the response options that were in the questionnaire and were listed verbatim in column three;
6) Link the concepts identified in steps 2 and 3 to the most precise ICF category – in Table B-1 the concept of walking 10 minutes was coded as *d4500 Walking short distances* and the concept of recreation, sport, exercise or leisure was coded as *d9208 Recreation and leisure, other specified*;
7) Use "other specified" and "unspecified" as appropriate. Other specified should be used when the concept fits within a chapter but the details provided do not fit with any of the other specific categories. Unspecified should be used when the concept fits

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concept but 'getting to the store' is construct. While it is possible for a measure to ask about mobility, it is far more likely for the measure to look at constructs. This thesis will continue to use the term 'concept' in order to remain consistent to the published linking rules. However, the distinctions should be understood and kept in mind.

within a chapter but there is insufficient information to link it to a specific category – in Table B-1 the code *d9208 Recreation and leisure, other specified* was used because the concept was specified as walking while doing recreation and leisure activities but the other available level four codes such as *d9200 Play* and *d9205 Socializing* do not match the concept;

8) Use the code *not definable* (*nd*) when the information on the concept is insufficient for making a link to a specific code. *nd* can be made more specific by using *nd-gh* (*not definable-general health*), *nd-ph* (*not definable-physical health*), *nd-mh* (*not definable-mental health*), *nd-dis* (*not definable-disability*), *nd-func* (*not definable-functioning*), and *nd-dev* (*not definable-child's development*) – in Table B-1 an example of a not definable code is seen in the Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) questionnaire where the question is with regards to the first activity an individual does upon waking which does not have enough detail to link to a specific code;
9) Use *personal factor* (*pf*) when the concept is a personal factor as defined by the ICF – in Table B-1 an example of a personal factor is seen in the PARA-SCI questionnaire where the question pertains to changes in the individual's personal routine;
10) Use the code *not covered* (*nc*) when the concept does not fall under the purview of the ICF. *nc* can be further specified with *not covered-health condition* (*nc-hc*) and *not covered-quality of life* (*nc-qol*) – in Table B-1 an example of a concept that is not covered by the ICF is in Transport and Physical Activity Questionnaire (TPAQ) where the question concerns the actions about another person.[4]

Table B-1. Sample of ICF linking rules

International Physical Activity Questionnaire – Long [5]								
Verbatim health information	**Perspective**	**Response options**	**Classification**	**Main concept**	**Additional concepts**	**ICF category of main concept**	**ICF category of other concepts**	**Annotations**
Part 4: Recreation, sport, and leisure-time physical activity This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.								
20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?	Performance	Days per week No walking in leisure time -> Skip to question 22	Frequency	Walk, 10 mins	For recreation, sport, exercise or leisure	D4500 Walking short distances	D9208 Recreation and leisure, other specified	
Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI) [6]								
After you opened your eyes what was the first thing you did?	Performance	Activity Type	Qualitative	First activity		Nd-func		
Compared with the morning/evening routine you just described (day 1), were there any differences in your morning/evening routine (day 2 and day 3)? *If no differences, do not go through the morning or evening routine again.* Indicate on recording sheet same as day 1.	Performance			Differences in routine		pf		
Transport and Physical Activity Questionnaire (TPAQ) [7]								
i. I see people in my neighbourhood walking for travel.	N/A	Strongly agree to Strongly disagree	Agreement / Intensity	Others walking		Nc		

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Appendix C Scoping Review Search strategies

Initial search

Cumulative Index of Nursing and Allied Health Literature

Database inception was 1981 with the Search being conducted on the 23rd March 2018

Search	Query
#1	(MH "Reliability and Validity+") (147,230)
#2	"Reliability" (66,880)
#3	"Validity" (63,167)
#4	(MH "Instrument Construction+") (11,086)
#5	"Instrument Construction" (10,303)
#6	S1 OR S2 OR S3 OR S4 OR S5 (173,991)
#7	(MH "Movement+") (63,344)
#8	"Movement" (30,995)
#9	(MH "Movement Disorders+") (14,046)
#10	"Movement Disorder*" (2,731)
#11	(MH "Physical Mobility Impairment (Saba CCC)") (1)
#12	(MH "Impaired Physical Mobility (NANDA)+") (72)
#13	(MH "Mobility (Iowa NOC)+") (15)
#14	"Mobility" (21,883)
#15	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 (109,101)
#16	S6 AND S15 (11,661)
Limit to english language, human, adult (7,121)	

Full search

Cumulative Index of Nursing and Allied Health Literature

Database inception was 1981 with the Search being conducted on the 17th of June 2018

Search	Query
#1	(MH "Reliability and Validity+") (149,361)
#2	"Reliability" (67,738)
#3	"Validity" (64,227)
#4	(MH "Instrument Construction+") (11,330)
#5	"Instrument Construction" (10,542)
#6	S1 OR S2 OR S3 OR S4 OR S5 (176,534)
#7	(MH "Movement+") (64,783)
#8	"Movement" (31,604)
#9	(MH "Movement Disorders+") (14,270)
#10	"Movement Disorder*" (2,792)
#11	(MH "Physical Mobility Impairment (Saba CCC)") (1)
#12	(MH "Impaired Physical Mobility (NANDA)+") (73)
#13	(MH "Mobility (Iowa NOC)+") (15)
#14	"Mobility" (22,304)
#15	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 (111,208)
#16	S6 AND S15 (11,661)
Limit to english language, human, adult 19 years and over (7,214)	

Health and Psychosocial Instruments

Database inception was 1985 with the Search being conducted on the 17th of June 2018

Search	Query
#1	reliability.mp (3,121)
#2	validity.mp (3,986)
#3	movement.mp (590)
#4	mobility.mp (489)
#5	movement Disorder*.mp (254)
#6	1 OR 2 (5,439)
#7	3 OR 4 OR 5 (1,198)
#8	6 AND 7 (74)
Limit to english language (53)	

MEDLINE

Database inception was 1946 with the Search being conducted on the 17th of June 2018

Search	Query
#1	exp "REPRODUCIBILITY OF RESULTS"/ (356,188)
#2	"Reliability.mp" (140,131)
#3	"Validity.mp" (149,423)
#4	"Instrument Construction.mp" (45)
#5	1 OR 2 OR 3 OR 4 (525,285)
#6	Exp MOVEMENT/an, co, is, ph [Analysis, Complications, Instrumentation, Physiology] (171,531)
#7	"Movement.mp" (366,679)
#8	exp MOVEMENT DISORDERS/ci, co, cn, di, nu, ph, pp [Chemically Induced, Complications, Congenital, Diagnosis, Nursing, Physiology, Physiopathology] (60,986)
#9	"Movement Disorder*.mp" (26,636)
#10	Exp MOBILITY LIMITATION/ (3,839)
#11	"Mobility.mp" (147,261)
#12	6 OR 7 OR 8 OR 9 OR 10 OR 11 (663,051)
#13	S5 AND S12 (20,345)
Limit to english language, human, adult 19 years and over (10,326)	

Excerpta Medica Database (EMBASE)

Database inception was 1947 with the Search being conducted on the 17th of June 2018

Search	Query
#1	exp reliability/ (154,787)
#2	reliability.mp (235,823)
#3	exp validity/ (80,813)
#4	validity.mp (203,234)
#5	Instrument Construction.mp (54)
#6	1 OR 2 OR 3 OR 4 OR 5 (386,177)
#7	exp "movement (physiology)"/ (395,289)
#8	Movement.mp (383,097)
#9	exp motor dysfunction/co, cn, di, dm, si [Complication, Congenital Disorder, Diagnosis, Disease Management, Side Effect] (161,677)
#10	movement disorder*.mp (32,116)
#11	mobility.mp (196,471)
#12	7 OR 8 OR 9 OR 10 OR 11 (931,559)
#13	6 AND 12 (20,200)
Limit to english language, human, adult <18 to 64 years> or aged <65+ years> (9,549)	

Open Grey

Database inception was 2011 with the Search being conducted on the 21st of November 2018

Search	Query
#1	(Movement OR Mobility) AND (reliability OR Validity)
Limit to english language, Non-thesis (1)	

Dissertation Abstracts International

Database inception was 1861 with the Search being conducted on the 21st of November 2018

Search	Query
#1	(Movement OR Mobility) AND (Reliability OR Validity)
Limit to english language (18)	

Google Scholar

Search was conducted on the 21st of November 2018

Search	Query
#1	(Movement OR Mobility) AND (Reliability OR Validity)
First 50 searched, 14 articles were relevant, 13 were duplicates, No further searching completed	

Appendix D Studies Excluded at the Full Text Review

Table D-1. Reason for article exclusion

Reason for exclusion	**n**
Assesses Technology	121
Does not assess a specific measure	80
Focused on Activities of Daily Living	70
Assesses Fitness (Physical / Aerobic / Cardiopulmonary)	65
Focuses on falls	57
Measures Range of Motion	44
Measures Symptoms	36
Measures Risk of or Recovery from Injury	28
Clinical Examination	26
Full Text not Available	23
Measures Strength	19
Measures Cognition	13
Measures General Disability, Health or Quality of Life	11
Uses Pediatric Population	11
Measures Emotions, Attitudes or Confidence	6
Measures Sport Technique or Readiness to Return to Sports	5
Measures Movement Imagery	5
Full text no available in English	4
Measures Agoraphobia	3
Measures Capability to Return to Work	3
Assesses the Environment	3
Measures Coordination	3
Measures Sitting / Posture	3
Measures Consciousness of Movement	2
Measures Caregiver Burden	1
Measures Behavioral Flexibility	1

Measures Purpose for Being Active	1
Measures Assistive Device Use	1
Measures Social Capacity	1
Total	646

Appendix E Study Data Extraction Table

Table E-1. Study data extraction table

Review #	Tool Name	Author(s)	Year of pub.	Aim	Disease/ Symptom Specific	Practical / Pt Report

Appendix F Tool Data Extraction Table

Table F-1. Tool data extraction table

Tool Name:								
Verbatim health information	Perspective	Response Options	Classification of response options	Main Concept	Additional Concepts	ICF category of main concept	ICF category of other concepts	Annotations

Appendix G Equations Used

The equations used in this paper have been discussed in detail in *Methods for reporting data obtained from linking health measures to the International Classification of Functioning, Disability and Health codes: historical and proposed methods*.[1]

General Equation for Measure Coverage by Code Set

$$Measure\ Coverage\ by\ Code\ Set = \frac{Number\ of\ items\ in\ the\ measure\ covered\ by\ the\ code\ set}{Number\ of\ items\ in\ the\ measure} * 100\%$$

The amount of the measure that is covered by a code set describes is the fidelity of the tool to the concept, or set of concepts, that are desired. This was used for the defining attributes of movement and mobility, the antecedents of movement and mobility, and the consequences of mobility. The equations, specific to the code sets, are listed below.

Equation for Measure Coverage by Defining Attributes of Mobility

$$Measure\ Coverage\ by\ Defining\ Attributes\ of\ Mobility = \frac{Number\ of\ items\ with\ a\ defining\ attributes\ of\ mobility\ code}{Number\ of\ items\ in\ the\ measure} * 100\%$$

This equation has the number of items with a mobility defining attribute code in the numerator and the number of items in the measure in the denominator. The number of items with a mobility defining attribute code were counted by hand.

$$Measure\ Coverage\ by\ Defining\ Attributes\ of\ Movement = \frac{Number\ of\ items\ with\ a\ defining\ attributes\ of\ movement\ code}{Number\ of\ items\ in\ the\ measure} * 100\%$$

This equation has the number of items with a movement defining attribute code in the numerator and the number of items in the measure in the denominator. The number of items with a movement defining attribute code were counted by hand.

$$Measure\ Coverage\ by\ Antecedents\ of\ Movement = \frac{Number\ of\ items\ with\ an\ antecedent\ of\ movement\ code}{Number\ of\ items\ in\ the\ measure} * 100\%$$

This equation has the number of items with an antecedent of movement code in the numerator and the number of items in the measure in the denominator. The number of items with an antecedent of movement code were counted by hand.

$$Measure\ Coverage\ by\ Antecedents\ of\ Mobility = \frac{Number\ of\ items\ with\ an\ antecedent\ of\ mobility\ code}{Number\ of\ items\ in\ the\ measure} * 100\%$$

This equation has the number of items with an antecedent of mobility code in the numerator and the number of items in the measure in the denominator. The number of items with an antecedent of mobility code were counted by hand.

$$Measure\ Coverage\ by\ Consequences\ of\ Mobility = \frac{Number\ of\ items\ with\ a\ consequences\ of\ mobility\ code}{Number\ of\ items\ in\ the\ measure} * 100\%$$

This equation has the number of items with a consequence of mobility code in the numerator and the number of items in the measure in the denominator. The number of items with a consequence of mobility code were counted by hand.

General Equation for Code Set Representation

$$Code\ Set\ Representation = \frac{Number\ of\ codes\ from\ the\ code\ set\ used\ in\ the\ measure}{Number\ of\ codes\ in\ the\ group} * 100\%$$

The amount of the code set covered by the tool describes how comprehensively the tool measures the code set, and thus concepts of interest. This was used for the defining attributes of movement and mobility. The equations, specific to the code sets, are listed below.

Equation for Movement Code Set Representation

Movement Code Set Representation

$$= \frac{\begin{array}{c} b7500 + b7501 + b7502 + b7508 + b7509 + b755 + b7600 + b7601 + b7602 + b7603 + \\ b7608 + b7609 + b7610 + b7611 + b7618 + b7619 + b7650 + b7651 + b7652 + b7653 + \\ b7658 + b7659 + b770 + b789 + b798 + b799 + d4100 + d4101 + d4102 + d4103 + \\ d4104 + d4105 + d4106 + d4107 + d4108 + d4109 + d4200 + d4201 + d4208 + d4209 + \\ d429 + d4500 + d4501 + d4502 + d4503 + d4508 + d4509 + d4550 + d4551 + d4552 + \\ d4553 + d4554 + d4558 + d4559 + d469 \end{array}}{55} * 100\%$$

The numerator contains all of the codes that belong to the movement code set, and the denominator contains the number of the codes from the numerator (55). This code set is primarily composed of level 3 codes and only uses level 2 codes that do not have any level 3 codes beneath them.

Equation for Mobility Code Set Representation

Mobility Code Set Representation

$$= \frac{\begin{array}{c} d4300 + d4301 + d4302 + d4303 + d4304 + d4305 + d4308 + d4309 + d4350 + \\ d4351 + d4358 + d4359 + d4400 + d4401 + d4402 + d4403 + d4408 + d4409 + \\ d4450 + d4451 + d4452 + d4453 + d4454 + d4455 + d4458 + d4459 + d446 + d449 + \\ d4600 + d4601 + d4602 + d4608 + d4609 + d465 + d4700 + d4701 + d4702 + d4703 + \\ d4708 + d4709 + d4750 + d4751 + d4752 + d4758 + d4759 + d480 + d489 + d498 + d499 \end{array}}{49} * 100\%$$

The numerator contains all of the codes that belong to the mobility code set, and the denominator contains the number of the codes from the numerator (49). This code set is primarily composed of level 3 codes and only uses level 2 codes that do not have any level 3 codes beneath them.

Content Density

$$Content\ density = \frac{Number\ of\ ICF\ codes\ in\ the\ measure}{Number\ of\ items\ in\ the\ measure}$$

Content density is an expression of how many codes are used for each measure.[1-3]

Content Diversity

$$Content\ diversity = \frac{Number\ of\ unique\ ICF\ categories\ used\ during\ the\ linkage}{Number\ of\ total\ ICF\ codes\ used\ in\ the\ measure}$$

Content diversity is an indication of if the concepts in a measure are repetitive of different.[1-3]

References

1. Moulton E, Wilson R, Goldie C, Medves J, Deluzio K. Methods for reporting data obtained from linking health measures to the International Classification of Functioning, Disability and Health codes: historical and proposed methods. 2020.
2. Stamm T, Geyh S, Cieza A, Machold K, Kollerits B, Kloppenburg M, et al. Measuring functioning in patients with hand osteoarthritis--content comparison of questionnaires based on the International Classification of Functioning, Disability and Health (ICF). Rheumatology (Oxford, England). 2006;45(12):1534-41.
3. Geyh S, Cieza A, Kollerits B, Grimby G, Stucki G, Institutionen för neurovetenskap och fysiologi sfknor, et al. Content Comparison of Health-Related Quality of Life Measures Used in Stroke Based on the International Classification of Functioning, Disability and Health (ICF): A Systematic Review. Quality of Life Research. 2007;16(5):833-51.

Appendix H Content Density, Content Diversity, and Code Coverage

Pract_PROM = Practical and Patient Reported Outcome Measures; 0 means that it is a practical measure, 1 means that it is a PROM, and 2 means that it is a combination of the two
MovCodeCover = The percentage of movement codes covered by the measure
MobCodeCover = The percentage of mobility codes covered by the measure
Percent_DA_Move = The percentage of items in a measure that contain the defining attributes of movement
Percent_DA_Mob = The percentage of items in a measure that contain the defining attributes of mobility
Percent_Ant_Move = The percentage of items in a measure that contain the antecedents of movement
Percent_Ant_Mob = The percentage of items in a measure that contain the antecedents of mobility
Percent_Cons_Mob = The percentage of items in a measure that contain the consequences of mobility

Measures with the word 'movement' in the name are **bolded**.
Measures with the word 'mobility' in the name are *italicized*.

Table H-1. Content Density, Content Diversity, and Code Coverage

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
"6-Clicks" Inpatient Basic Mobility Short Form	*1*	*6*	*1.17*	*0.86*	*10.91*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
10-feet Fast	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
10-feet Normal	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
10-meter Fast Walk	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
10-meter Walk on Carpet and Parquet	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
10-meter Walk Test (10MWT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
10-s Step Test	0	1	3.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
100-foot Walk	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
11-Step Stair Ascend/Descend Test (STTotal-11)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
12-Item Walking Scale (Walk-12G)	1	12	1.33	0.63	7.27	8.16	75.00	16.67	0.00	16.67	0.00
12-Minute Walk Test (12MWT)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
13-meter Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
18-item Obstacle Course	0	6	1.50	0.78	9.09	4.08	100.00	16.67	0.00	0.00	0.00
2-minute Walk Test (2MinWT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
20-foot Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
20-meter Run	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
20-meter Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
200-meter Fast Walk Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
25-question Geriatric Locomotive Function Scale	1	25	1.16	0.86	10.91	8.16	40.00	16.00	0.00	0.00	28.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
3 Question Self-Reported Mobility	*1*	*3*	*1.33*	*0.75*	*3.64*	2.04	*100.00*	*33.33*	*0.00*	*0.00*	*0.00*
3-meter Walk Test	0	1	2.00	1.00	1.82	2.04	100.00	100.00	0.00	0.00	0.00
30 Degree Squat	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
30 minute Walk Test (30MW)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
30-Foot Maximum Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
30-Foot Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
30-meter Timed Walk (30TW)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
30-Second Chair Stand Test (30CST)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
360-degree Turn	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
4 cm High Obstacle Course	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
4 Hand Test Set	0	4	1.00	0.25	0.00	2.04	0.00	100.00	0.00	0.00	0.00
4 Hop Tests	0	4	1.50	0.50	5.45	0.00	100.00	0.00	0.00	0.00	0.00
4 Motor Task Run Predictor	0	4	1.25	1.00	7.27	0.00	75.00	0.00	0.00	25.00	0.00
4-meter Gait Speed	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
400-meter Fast Walk Test (400mWT)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
400-meter Walk Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
5 Jump Tests	0	5	1.60	0.50	7.27	0.00	100.00	0.00	0.00	0.00	0.00
5-meter Fast Walk Test (5mFWT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
5-meter Walk	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
5-meter Walk with Aid	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	100.00	0.00
5-minute Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
50-foot Fast Walk Test (50FFWT)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
50-foot Walk Test (50FWT)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
50-meter Walk Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
6-meter Maximum Walking Speed	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
6-meter Walk Test (6MWT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
6-Minute Pegboard and Ring Test (6PBRT)	0	1	4.00	1.00	0.00	8.16	0.00	100.00	0.00	0.00	0.00
6-minute Walk Test (6minWT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
6-minute walking energy cost teat (WECT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
60 Degree Squat	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
7-day Physical Activity Recall	1	6	1.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	16.67
8 Feet Up and Go Test	0	3	1.67	0.80	7.27	0.00	100.00	0.00	0.00	0.00	0.00
8-foot Walk	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
9-Step Stair Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
90 Degree Sidestep Cutting Task	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
A-test	0	10	1.00	1.00	10.91	2.04	60.00	10.00	0.00	20.00	10.00
ABILHAND	1	23	1.00	0.26	0.00	8.16	0.00	86.96	0.00	0.00	13.04

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Abnormal Involuntary Movement Scale	**0**	**7**	**1.00**	**0.14**	**1.82**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Abridged Physical Activity Questionnaire / Vetrans Physical Activity Questionnaire (VAPAQ)	1	6	1.17	0.86	3.64	0.00	50.00	0.00	0.00	0.00	33.33
Active People Survey	1	101	1.29	0.16	5.45	2.04	5.94	8.91	0.00	0.00	28.71
Activities Measure for Upper Limb Amputees (AM-ULA)	0	18	1.61	0.52	0.00	10.20	0.00	33.33	0.00	0.00	61.11
Activity Measure for Post Acute Care (AM-PAC)	1	52	1.15	0.60	10.91	10.20	17.31	13.46	0.00	0.00	26.92
ACTIVLIM-Stroke scale	1	20	1.10	0.86	9.09	12.24	35.00	35.00	0.00	5.00	35.00
ADL-Oriented Assessment of Mobility	*0*	*18*	*1.00*	*0.39*	*10.91*	*0.00*	*72.22*	*0.00*	*0.00*	*27.78*	*0.00*
Adult Tic Questionnaire	1	27	1.00	0.04	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Aggregated Locomotor Function (ALF) Score	0	3	1.67	0.80	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Akathisia Ratings of Movement Scale (ARMS)	**0**	**10**	**1.00**	**0.20**	**3.64**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Alderson-McGall Hand Function Questionnaire	1	10	1.00	0.70	0.00	10.20	0.00	80.00	0.00	0.00	20.00
ALS Functional Rating Scale-Revised (ALSFRS-R)	1	12	1.33	0.81	5.45	2.04	23.08	15.38	0.00	0.00	7.69
Alternate Step	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Ambient Timed Up & Go (aTUG)	0	8	1.00	0.75	9.09	0.00	87.50	0.00	0.00	12.50	0.00
Ambulatory Capacity Measure (ACM) / Postural Instability - Gait Disturbance (PIGD)	0	5	1.60	0.88	9.09	0.00	100.00	0.00	0.00	20.00	0.00
Ambulatory Self-Confidence Questionnaire (ASCQ)	1	22	1.23	0.41	10.91	6.12	95.45	18.18	0.00	9.09	0.00
Amputee Activity Score	1	35	1.31	0.52	3.64	10.20	21.21	21.21	3.03	3.03	15.15
Animated Activity Questionnaire (AAQ)	1	7	1.57	0.55	7.27	2.04	100.00	28.57	0.00	0.00	28.57
Antigravity Tests	0	4	1.00	0.75	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Apraxia Screen of TULIA (AST)	0	12	1.00	0.25	0.00	6.12	0.00	100.00	0.00	0.00	0.00
Arm Motor Ability Test (AMAT)	0	13	1.00	0.62	0.00	10.20	0.00	69.23	0.00	0.00	23.08
Arthritis Hand Function Test (AHFT)	0	11	1.00	0.45	0.00	8.16	0.00	72.73	27.27	0.00	0.00
Arthritis Impact Measurement Scales 2 (AIMS)	1	101	1.17	0.53	10.91	32.65	13.86	15.84	0.00	0.00	18.81
Assessment of Physical Activity in Frail Older People (APAFOP)	1	14	1.64	0.39	5.45	2.04	85.71	21.43	0.00	14.29	42.86
AUSCAN Osteoarthritis Hand Index	1	15	1.27	0.42	0.00	12.24	0.00	86.67	0.00	0.00	0.00
Automatic Facial Landmark Tracking	0	3	2.00	0.33	1.82	0.00	100.00	0.00	100.00	0.00	0.00
Babinski-Weill test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Back Performance Scale (BPS)	0	5	1.20	0.67	3.64	4.08	80.00	40.00	0.00	0.00	0.00
Backward Walking	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Baltimore Activity Scale for Intermittent Claudication (BASIC)	1	5	1.20	0.83	7.27	0.00	80.00	0.00	0.00	0.00	0.00
Barcelona Health Interview Survey measureing leisure-time physical activity	1	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Barnes Akathisia Scale (BAS)	0	4	1.00	1.00	3.64	0.00	50.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Barthel Index - Transfer and Locomotion	0	2	1.00	1.00	1.82	2.04	50.00	50.00	0.00	0.00	0.00
Basic Amputee Mobility Scale (BAMS)	*0*	*4*	*1.00*	*1.00*	*5.45*	*2.04*	*75.00*	*25.00*	*0.00*	*0.00*	*0.00*
Basic Mobility Scale (BMS)	*0*	*18*	*1.00*	*0.33*	*7.27*	*0.00*	*61.11*	*0.00*	*0.00*	*38.89*	*0.00*
Bath Assessment of Walking Inventory	1	11	1.00	0.27	3.64	2.04	90.91	9.09	0.00	0.00	0.00
Baude Battery	0	6	2.00	0.17	1.82	0.00	100.00	0.00	100.00	0.00	0.00
Bed Rise Difficulty (BRD) score	0	12	1.00	0.25	3.64	2.04	75.00	25.00	0.00	0.00	0.00
Black Women's Health Study (BWHS) self-report physical activity questionnaire (PAQ)	1	14	1.36	0.26	3.64	0.00	64.29	0.00	0.00	28.57	42.86
Box and Block Test	0	1	5.00	1.00	0.00	10.20	0.00	100.00	0.00	0.00	0.00
Bradykinesia-Akinesia Incoordination (BRAIN) Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Breathing Movement Scale (BMS)	**0**	**2**	**1.00**	**0.50**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Brief Physical Activity Assessment Tool	1	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Brostz Hand Test (BzH)	0	7	1.14	0.75	1.82	8.16	14.29	85.71	0.00	0.00	14.29
Brunel Physical Activity Questionnaire	1	9	1.00	0.33	1.82	0.00	22.22	0.00	0.00	0.00	66.67
Brunnstrom Recovery Stages (BRS)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Button Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Chair & Bed Rise	0	17	1.00	0.12	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Chair Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Chamorro Assisted Gait Scale (CHAGS)	0	10	1.00	0.30	3.64	2.04	60.00	40.00	0.00	0.00	0.00
Change of Direction 45 Degrees	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Charite Mobility Index	*1*	*1*	*1.00*	*1.00*	*0.00*	*2.04*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*
Chedoke Arm and Hand Activity Inventory (CAHAI)	0	13	1.08	0.71	1.82	14.29	7.69	84.62	0.00	0.00	7.69
Chedoke-McMaster Stroke Assessment (CMSA)	0	15	1.20	0.61	12.73	6.12	93.33	13.33	0.00	6.67	0.00
Chest Wall Mobility Measure	*0*	*1*	*1.00*	*1.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
Classifier Oriented Gait Score	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Climbing a Stool	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Clinical Assessment Test of 180-degree Standing Turn Strategy (CAT-STS)	0	7	1.00	0.43	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Clinical Outcome Variables Scale (COVS)	0	13	1.23	0.44	7.27	4.08	69.23	30.77	0.00	7.69	0.00
Coin Rotation Task (CRT)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
College Alumnus Questionnaire Physical Activity Index (CAQ-PAI)	1	3	1.33	1.00	3.64	0.00	66.67	0.00	0.00	0.00	33.33
Community Ambulatory Physical Performance Scale (CAPPS)	0	14	1.43	0.70	10.91	4.08	64.29	28.57	0.00	7.14	21.43
Community Balance and Mobility Scale (CB&M)	*0*	*13*	*1.23*	*0.81*	*18.18*	*2.04*	*84.62*	*7.69*	*0.00*	*7.69*	*0.00*
Community Health Activities Model Program for Seniors (CHAMPS)	1	41	1.02	0.48	7.27	4.08	14.63	4.88	0.00	0.00	70.73

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Component Timed-Up-and-Go Test	0	5	1.00	0.80	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Constrained-time Task	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Continuing Care Activity Measure (CCAM)	0	16	1.13	0.72	14.55	8.16	62.50	25.00	0.00	18.75	0.00
Continuous Summary Physical Performance Score (CSPPS)	0	7	1.71	0.92	5.45	10.20	42.86	42.86	14.29	14.29	14.29
Countermovement Jump	**0**	**1**	**1.00**	**1.00**	**1.82**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Counting Arm Movement Tests (CAM test)	**0**	**1**	**2.00**	**1.00**	**0.00**	**4.08**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**
Craig Handicap Assessment and Reporting Technique (CHART) Mobility Subscale	*1*	*9*	*1.00*	*0.33*	*0.00*	*6.12*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*
Crossover Hop for Distance	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Cumulative Analogue Joint Involvement Scale (CAJIS)	0	19	1.00	0.21	1.82	2.04	5.26	5.26	78.95	0.00	10.53
de Morton Mobility Index (DEMMI)	*0*	*15*	*1.27*	*0.79*	*14.55*	*4.08*	*66.67*	*13.33*	*0.00*	*33.33*	*0.00*
De Souza et al. Method	0	30	1.00	0.33	0.00	10.20	0.00	56.67	26.67	0.00	3.33
Dexterity Questionnaire 24 (DextQ-24)	1	24	0.96	0.57	0.00	4.08	0.00	41.67	0.00	0.00	33.33
Direct Measure of Physical Performance	0	10	1.20	0.75	5.45	4.08	30.00	20.00	20.00	30.00	0.00
Directional Translation Protocol (DTP)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Disabilities of the Arm, Shoulder and Hand (DASH)	1	40	1.30	0.60	0.00	16.33	0.00	22.50	2.50	0.00	42.50
Dreiser's Functional Hand Index (DFI)	1	10	1.00	0.60	0.00	10.20	0.00	90.00	0.00	0.00	0.00
Duke Activity Status Index	1	12	1.33	0.75	7.27	6.12	33.33	25.00	0.00	0.00	58.33
Duruoz Hand Index	1	18	1.00	0.44	0.00	14.29	0.00	88.89	0.00	0.00	0.00
Dynamic Gait Index (DGI)	0	8	1.00	0.50	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Dynamic Parkinson Gait Scale (DYPAGS)	0	8	1.00	0.25	3.64	0.00	100.00	0.00	0.00	0.00	0.00
DynaPort Knee Test	0	23	1.26	0.28	9.09	6.12	86.96	30.43	0.00	0.00	0.00
Dyskinesia Identification System: Condensed User Sclae (DISCUS)	0	21	1.00	0.33	7.27	0.00	100.00	33.33	0.00	5.56	0.00
Dyskinesia Impairment Scale (DIS)	0	72	2.22	0.09	12.73	8.16	76.19	0.00	0.00	0.00	0.00
Early Cycling Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Early Functional Abilities Scale (EFA)	0	20	1.05	1.00	3.64	2.04	10.00	5.00	5.00	20.00	10.00
Early Mobility Impairment Questionnaire (EMIQ)	*1*	*15*	*1.00*	*0.87*	*10.91*	*6.12*	*53.33*	*20.00*	*0.00*	*0.00*	*20.00*
Early Physical Functioning (EPF)	0	51	1.14	0.29	16.36	6.12	62.75	29.41	0.00	7.84	7.84
Edinburgh Gait Score (EGS)	0	17	1.00	0.06	1.82	0.00	100.00	0.00	0.00	0.00	0.00
EG Motor Index Scoring System / Rating Scale for Assessment of Mobility after Stroke	*0*	*29*	*1.28*	*0.46*	*18.18*	*6.12*	*51.72*	*37.93*	*0.00*	*37.93*	*0.00*
Elderly Mobility Scale	*0*	*7*	*1.14*	*1.00*	*10.91*	*2.04*	*85.71*	*14.29*	*0.00*	*14.29*	*0.00*
Emory Functional Ambulation Profile (E-FAP) Protocol	0	5	1.40	0.71	9.09	0.00	100.00	0.00	0.00	0.00	0.00
Emory Motor Function Test	0	16	1.00	0.38	0.00	12.24	100.00	0.00	0.00	0.00	0.00
Endurance Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Environmental Analysis of Mobility Questionnaire	*1*	*41*	*1.00*	*0.27*	*10.91*	*8.16*	*43.90*	*51.22*	*0.00*	*4.88*	*0.00*
EPIC Physical Activity Questions	1	7	2.14	0.93	5.45	2.04	57.14	14.29	0.00	0.00	57.14
Ergos Work Simulator	0	7	1.00	0.57	0.00	4.08	0.00	28.57	57.14	0.00	0.00
Estimation of Ambulatory Capacity by History-Questionnaire (EACH-Q)	1	4	1.00	0.50	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Expanded Timed Get-up-and-Go (ETGUG) test	0	6	1.00	0.83	7.27	0.00	83.33	0.00	0.00	16.67	0.00
Facial Asymmetry Measure	0	2	2.00	0.50	1.82	0.00	100.00	0.00	100.00	0.00	0.00
Fahn's Tremor Rating Scale (FTRS)	0	24	1.17	0.11	1.82	4.08	91.67	25.00	0.00	0.00	0.00
Fast Gait Speed	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Figure-of-Eight Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Finger Individual Movement Test	**0**	**1**	**2.00**	**1.00**	**1.82**	**2.04**	**100.00**	**100.00**	**0.00**	**0.00**	**0.00**
Finger Motor Impairment Score	0	1	2.00	1.00	1.82	2.04	100.00	100.00	0.00	0.00	0.00
Finger Tapping	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Finger Tapping Test (FTT)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Finger-to-Nose	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Five Times Sit to Stand Test (FTSST)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Flexilevel Scale of Shoulder Function (FLEX-SF)	1	33	1.06	0.34	0.00	18.37	0.00	93.94	0.00	0.00	6.06
Foot and Ankle Ability Measure (FAM)	1	32	1.00	0.56	20.00	0.00	65.63	0.00	0.00	3.13	12.50
Foot Tapping	0	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Forward Lunge	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Forward-Step-Down Test	0	1	3.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Four Hops, Three Contacts (4H3C)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Four-Bound Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Four-week Physical Activity History Survey (FWH) - Modified Minnesota Leisure Time Physical Activity	1	62	1.03	0.23	10.91	4.08	17.74	3.23	0.00	0.00	79.03
Freezing Assessment Course	0	7	1.43	0.70	9.09	2.04	100.00	14.29	0.00	14.29	0.00
Freezing of Gait Questionnaire (FOGQ)	1	6	1.50	0.44	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Friedreich's Ataxia Impact Scale	1	126	1.19	0.47	32.73	30.61	27.78	15.08	3.17	3.97	7.94
Friedreich's Ataxia Rating Scale (FARS)	0	35	1.34	0.66	14.55	12.24	34.29	20.00	14.29	17.14	5.71
Fugl-Meyer Assessment	0	65	1.08	0.14	3.64	6.12	6.25	46.88	31.25	0.00	0.00
Functional Abilities Confidence Scale	1	15	1.40	0.76	10.91	12.24	46.67	46.67	0.00	13.33	0.00
Functional Ability Test (FAT)	0	4	1.00	0.25	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Functional Ambulation Classification of the Hospital at Sagunto	0	5	2.00	0.70	9.09	4.08	100.00	33.33	0.00	0.00	0.00
Functional Arm Activity Behavioural Observation System (FAABOS)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Functional Assessment (FA) Test	0	7	1.00	0.71	9.09	0.00	100.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Functional Capacity Evaluation-One Handed (FCE-OH)	0	4	2.75	0.64	0.00	14.29	0.00	100.00	0.00	0.00	0.00
Functional Capacity Scale	1	12	1.17	0.93	1.82	0.00	8.33	0.00	0.00	0.00	25.00
Functional Dexterity Test (FDT)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Functional GAit Assessment	0	10	1.10	0.36	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Functional Impairment Test-Hand and Neck/Shoulder/Arm (FIT-HaNSA)	0	3	1.00	1.00	0.00	6.12	0.00	100.00	0.00	0.00	0.00
Functional Independence Measure - Motor	1	12	1.08	0.85	5.45	2.04	30.77	7.69	0.00	0.00	61.54
Functional Mobility Assessment Tools	*0*	*8*	*1.00*	*0.63*	*5.45*	*4.08*	*50.00*	*50.00*	*0.00*	*0.00*	*0.00*
Functional Rating Index	1	10	1.60	0.63	1.82	4.08	10.00	20.00	0.00	10.00	20.00
Functional Status Score for the Intensive Care Unit (FSS-ICU)	0	5	1.00	1.00	7.27	0.00	80.00	0.00	0.00	20.00	0.00
Functional Test for the Hemiplegic/Paretic Upper Extremity	0	17	1.18	0.40	0.00	16.33	0.00	100.00	0.00	0.00	0.00
Functioning Everyday With a Wheelchair (FEW)	1	10	1.10	0.91	1.82	12.24	10.00	50.00	0.00	20.00	20.00
Gait and Balance Scale (GABS)	0	34	1.21	0.34	12.73	4.08	79.41	2.94	0.00	11.76	2.94
Gait Assessment and Intervention Tool (G.A.I.T.)	0	37	1.00	0.03	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Classification System	0	2	1.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Gait Deviation	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Deviation Index (GDI)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Evaluation Tool	0	61	1.00	0.08	3.64	2.04	98.28	5.17	0.00	0.00	0.00
Gait Profile Score	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Speed	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Variability	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gait Variability Index (GVI)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Gallon-Jug Shelf-Transfer (GJST) Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
General Practice Physical Activity Questionnaire	1	6	1.67	0.90	3.64	2.04	42.86	14.29	0.00	0.00	42.86
Get Up and Go (GUG) test	0	3	1.00	1.00	3.64	0.00	66.67	0.00	0.00	33.33	0.00
Gillette Gait Index (GGI) / Normalcy Index	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Global Body Examination	0	13	1.00	0.38	3.64	0.00	15.38	0.00	76.92	7.69	0.00
Global Gait Asymmetry Index	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Global Mobility Task (GMT)	*0*	*5*	*1.00*	*0.80*	*7.27*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Global Physical Activity Questionnaire version 2 (GPAQv2)	1	16	1.88	0.27	3.64	2.04	56.25	18.75	0.00	6.25	37.50
Global Physiotherapeutic Muscle Examination (GPM) - Movement Section	**0**	**24**	**1.00**	**0.25**	**3.64**	**2.04**	**54.17**	**12.50**	**12.50**	**20.83**	**0.00**
Godin Leisure-Time Exercise Questionnaire/Godin-Shephard Leisure-Time Physical Activity Questionnair	1	4	2.00	0.25	1.82	0.00	100.00	0.00	0.00	0.00	100.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Grasp and Release Test	0	6	4.00	0.17	0.00	8.16	0.00	100.00	0.00	0.00	0.00
Grooved Pegboard Test	0	1	4.00	1.00	0.00	8.16	0.00	100.00	0.00	0.00	0.00
Gross Motor Function Assessment Scale (GMF)	2	16	1.38	0.59	12.73	10.20	38.10	57.14	0.00	4.76	0.00
Hand Mobility in Scleroderma (HAMIS) Test	*0*	*9*	*1.00*	*0.33*	*0.00*	*6.12*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*
Hand Pronation and Suppination Test (HPST)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Hand Tapping	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Hand Tapping Device	0	1	2.00	1.00	0.00	4.08	0.00	100.00	0.00	0.00	0.00
Hand-to-Mouth Evaluation Method	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Hand-to-Neck and Hand-to-Scapula	0	2	1.00	0.50	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Handwriting and Drawing Movements	**0**	**4**	**2.00**	**0.25**	**1.82**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Handwriting Kinematics	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Handwriting Test	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Hannover Functional Ability Questionnaire	1	10	1.40	0.79	5.45	6.12	50.00	40.00	0.00	20.00	20.00
Hauser Ambulation Index (AI)	0	9	2.00	0.33	5.45	0.00	90.00	0.00	0.00	60.00	20.00
Hemiplegic Gait Analysis Form	0	62	1.00	0.05	3.64	2.04	98.39	1.61	0.00	0.00	0.00
Hemophiliac Activity List (HAL)	1	44	1.05	0.80	20.00	16.33	31.82	18.18	0.00	11.36	38.64
Hierarchical Assessment of Balance and Mobility (HABAM)	*0*	*22*	*1.18*	*0.42*	*9.09*	*6.12*	*63.64*	*22.73*	*0.00*	*27.27*	*0.00*
Hierarchical Scale of Activity Limitations	1	15	1.13	0.12	1.82	2.04	100.00	13.33	0.00	0.00	0.00
High level mobility assessment tool (HiMAT)	*0*	*16*	*1.00*	*0.50*	*10.91*	*0.00*	*81.25*	*0.00*	*0.00*	*0.00*	*0.00*
Hill Assessment Index (HAI)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Hillside Akathisia Scale	2	19	1.00	0.21	3.64	0.00	83.33	0.00	0.00	0.00	0.00
Historical & Current Physical Activity	1	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Home Environment Battery	1	12	1.08	0.46	3.64	4.08	50.00	41.67	0.00	0.00	0.00
Home-Bound Mobility Assessment (HBMA)	*1*	*5*	*1.00*	*0.40*	*0.00*	*2.04*	*0.00*	*80.00*	*0.00*	*20.00*	*0.00*
Home-Heart Walk	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Horizontal and Vertical Drop Jumps (HDJ) (VDJ)	0	2	2.00	0.50	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Horizontal Jump Assessment (HSJ)	0	6	1.00	0.17	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Horizontal Leap Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Houghton Scale	1	4	2.00	0.50	3.64	2.04	75.00	25.00	0.00	0.00	0.00
House Brackmann Facial Nerve Grading System	0	6	3.00	0.17	3.64	0.00	100.00	0.00	100.00	0.00	0.00
ICF Mobility and Walking Scale	*0*	*8*	*1.00*	*1.00*	*7.27*	*4.08*	*50.00*	*25.00*	*0.00*	*25.00*	*0.00*
ICU Mobility Scale	*0*	*11*	*1.27*	*0.50*	*7.27*	*0.00*	*81.82*	*0.00*	*0.00*	*36.36*	*0.00*
Incidental and Planned Exercise Questionnaire	1	11	1.09	0.42	1.82	0.00	36.36	0.00	0.00	9.09	54.55
Independent Mobility Questionnaire (IMQ)	*1*	*35*	*1.00*	*0.34*	*7.27*	*8.16*	*62.86*	*17.14*	*0.00*	*0.00*	*2.86*
Index of Mobility-Related Limitations (MOBLI)	*0*	*5*	*1.00*	*0.80*	*5.45*	*0.00*	*80.00*	*0.00*	*0.00*	*0.00*	*0.00*
Instrumental Assessment of Bradykinesia	0	7	1.00	0.71	3.64	6.12	28.57	71.43	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Instrumented Sit-to-Stand (iSTS)	0	8	1.00	0.50	3.64	0.00	75.00	0.00	0.00	25.00	0.00
Instrumented Timed Up and Go (iTUG)	0	7	1.00	0.71	7.27	0.00	85.71	0.00	0.00	14.29	0.00
International Co-operative Ataxia Rating Scale	0	19	1.32	0.52	9.09	6.12	75.00	0.00	0.00	25.00	0.00
International Physical Activity Questionnaire - Elderly - Short	1	4	1.00	0.75	3.64	0.00	42.11	26.32	0.00	26.32	0.00
International Physical Activity Questionnaire - Long	1	27	1.74	0.21	5.45	6.12	74.07	14.81	0.00	7.41	44.44
International Physical Activity Questionnaire - Short	1	7	1.00	0.57	5.45	0.00	85.71	0.00	0.00	14.29	0.00
Item Bank to Measure Mobility	*1*	*35*	*1.11*	*0.44*	*16.36*	*14.29*	*74.29*	*22.86*	*0.00*	*2.86*	*0.00*
Jacket Test	0	1	2.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Jaw Movements	**0**	**3**	**2.00**	**0.33**	**1.82**	**0.00**	**100.00**	**0.00**	**100.00**	**0.00**	**0.00**
Jebsen Hand Function Test	0	7	1.00	0.57	0.00	4.08	0.00	71.43	0.00	0.00	14.29
Jump-landing Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Keyboard Personal Computer Style Instrument (KPeCS)	0	19	1.00	0.16	0.00	4.08	0.00	84.21	0.00	15.79	0.00
Knee Bendings per 30 s	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
L Test	0	5	1.00	0.80	7.27	0.00	100.00	0.00	0.00	0.00	0.00
L Test Dual-Task	0	8	1.00	0.63	7.27	0.00	87.50	0.00	0.00	0.00	0.00
Late-Life Function and Disability Instrument (LLFDI)	1	48	1.13	0.67	14.55	22.45	41.67	27.08	0.00	0.00	29.17
Lateral-Mobility (LATMOB) Task	*0*	*4*	*1.00*	*0.75*	*5.45*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Leeds Disability Questionnaire	1	19	1.11	0.86	9.09	6.12	31.58	10.53	0.00	15.79	36.84
Leisure Time Physical Activity Questionnaire from People with Spinal Cord Injury (LTPAQ-SCI)	1	3	1.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Life Space Assessment (LSA)	1	9	1.00	0.22	0.00	4.08	0.00	100.00	0.00	0.00	0.00
Lindop Parkinson's Disease Mobility Assessment	*0*	*10*	*1.10*	*0.64*	*10.91*	*0.00*	*90.00*	*0.00*	*0.00*	*10.00*	*0.00*
Line Drawing Task	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Loaded and Unloaded Reach	0	2	1.50	0.67	0.00	4.08	0.00	100.00	0.00	0.00	0.00
Locomotion Score	0	42	1.60	0.48	5.45	10.20	7.14	14.29	50.00	2.38	14.29
Locomotor Capability Index-5 (LCI-5)	1	14	1.21	0.59	10.91	8.16	92.86	28.57	0.00	0.00	0.00
Locomotor Disability Scale (LDS)	1	19	1.05	0.95	10.91	4.08	36.84	10.53	0.00	10.53	42.11
Locomotor Stages in Spinal Cord Injury (LOSSCI)	0	5	1.60	0.88	7.27	2.04	60.00	20.00	0.00	40.00	0.00
Longitudinal Ageing Study Amsterdam Physical Activity Questionnaire (LAPAQ)	1	26	1.04	0.33	5.45	4.08	19.23	23.08	0.00	0.00	53.85
Lower Back Physical Performance Test	0	8	1.25	0.80	9.09	4.08	75.00	25.00	0.00	0.00	12.50
Lower Extremity Activity Scale (LEAS)	1	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Lower Extremity Functional Scale (LEFS)	1	20	1.20	0.88	16.36	6.12	55.00	15.00	0.00	10.00	30.00
Lower Extremity Gain Scale (LEGS)	0	9	1.00	0.67	9.09	0.00	77.78	0.00	0.00	0.00	22.22
Lower Extremity Measure (LEM)	0	29	1.17	0.71	12.73	10.20	41.38	13.79	0.00	6.90	44.83
Lower Extremity Motor Coordination Test (LEMOCOT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Lower Extremity Motor Scores (LEMS)	0	5	1.00	0.20	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Lower Limb Functional Index-10	1	13	1.15	0.87	9.09	0.00	23.08	0.00	0.00	7.69	30.77
Lower Limb-Function Assessment Scale	2	60	1.17	0.21	14.55	12.24	85.00	13.33	0.00	15.00	0.00
Lower-Limb Task Questionnaire	1	10	1.20	0.83	9.09	8.16	60.00	20.00	0.00	20.00	0.00
Manual Ability Measure	1	16	1.00	0.50	0.00	8.16	0.00	75.00	0.00	0.00	12.50
Marching on the Spot Test (MOS)	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Maryland Psychiatric Research Center Involuntary Movement Scale (MPRC scale)	**1**	**31**	**1.00**	**0.35**	**10.91**	**0.00**	**74.19**	**0.00**	**19.35**	**0.00**	**0.00**
Maximal 4-meter Gait Speed	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Mentzel Battery	0	11	1.09	0.50	5.45	4.08	27.27	63.64	0.00	0.00	0.00
Mini Motor Test (MMT)	0	20	1.00	0.55	14.55	0.00	75.00	0.00	0.00	25.00	0.00
Mini Physical Performance Test (Mini-PPT)	0	4	1.50	1.00	7.27	2.04	75.00	0.00	0.00	25.00	0.00
Minnesota Manual Dexterity Test (MMDT)	0	2	1.00	0.50	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Mobile Phone Physical Activity (MobilPAL) Questionnaire	1	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Mobility Activities Measure for Inpatient Rehabilitation Settings (MOBAM-IN)	*1*	*30*	*1.10*	*0.64*	*21.82*	*14.29*	*53.33*	*43.33*	*0.00*	*3.33*	*0.00*
Mobility Assessment Tool for Walking	*1*	*2*	*1.00*	*1.00*	*3.64*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Mobility Classification Tool	*0*	*5*	*1.00*	*0.80*	*5.45*	*0.00*	*80.00*	*0.00*	*0.00*	*20.00*	*0.00*
Mobility Obstacle Course	*0*	*7*	*1.14*	*0.63*	*5.45*	*4.08*	*71.43*	*28.57*	*0.00*	*0.00*	*0.00*
Mobility-Disability Severity Questionnaire	*1*	*17*	*1.00*	*0.12*	*0.00*	*4.08*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*
Modernized Activity Subjective Survey (MASS07)	1	10	1.00	0.70	0.00	4.08	0.00	30.00	0.00	0.00	10.00
Modifiable Activity Questionnaire	1	41	1.00	0.37	9.09	6.12	14.63	7.32	0.00	2.44	75.61
Modified 2-minute Walk Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Modified 30-s Sit-to-Stand	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Modified Battery From Established Population for the Epidemiologic Studies of Elderly (EPESE)	0	3	1.33	1.00	5.45	0.00	66.67	0.00	0.00	33.33	0.00
Modified Bradykinesia Rating Scale	0	3	1.00	1.00	0.00	6.12	0.00	100.00	0.00	0.00	0.00
Modified Dynamic Gait Index (mDGI)	0	8	1.00	0.50	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Modified Dyskinesia Rating Scale (version 2.0)	0	4	2.00	0.63	3.64	2.04	100.00	25.00	0.00	0.00	50.00
Modified Elderly Mobility Scale	*0*	*8*	*1.13*	*1.00*	*12.73*	*2.04*	*87.50*	*12.50*	*0.00*	*12.50*	*0.00*
Modified Finger-Nose-Finger (mFNF) Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Modified Functional Ambulation Classification	0	7	1.29	0.67	7.27	0.00	71.43	0.00	0.00	28.57	0.00
Modified Gait Abnormality Rating Scale	0	7	1.00	0.14	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Modified Jebsen Test of Hand Function (MJT)	0	3	1.00	0.33	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Modified Motor Assessment Chart According to Lindmark	0	63	1.00	0.25	14.55	6.12	33.33	33.33	0.00	9.52	0.00
Modified RESIDE Physical Activity Questionnaire	1	16	1.00	0.44	3.64	4.08	56.25	12.50	0.00	0.00	31.25

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Modified Rivermead Mobility Index	*0*	*8*	*1.25*	*1.00*	*10.91*	*4.08*	*75.00*	*12.50*	*0.00*	*25.00*	*0.00*
Modified Shuttle Walk Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Modified Spinal Function Sort (M-SFS)	0	20	1.00	0.60	5.45	8.16	25.00	40.00	0.00	20.00	15.00
Modified Timed Up and Go Test (mTUG)	0	4	3.00	0.50	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Modified Webster Step Second Test (WSST)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Morgenstern Physical Activity Questionnaire (PAQ-M)	1	12	1.83	0.68	1.82	0.00	41.67	0.00	0.00	8.33	58.33
Motion Energy Analysis (MEA)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Motor Activity Log 30 (MAL-30)	1	30	1.00	0.57	1.82	14.29	58.62	24.14	0.00	20.69	0.00
Motor Activity Rating Scale (MARS)	0	29	1.10	0.44	10.91	6.12	6.67	56.67	0.00	0.00	33.33
Motor Agitation and Retardation Scale (MARS)	0	19	1.00	0.63	3.64	2.04	21.05	5.26	5.26	5.26	0.00
Motor Assessment Scale (MAS)	0	10	2.10	0.71	9.09	14.29	40.00	50.00	10.00	10.00	0.00
Motor Capacity Scale (MCS)	0	42	1.00	0.21	9.09	6.12	30.95	66.67	0.00	2.38	0.00
Motor Evaluation for Upper Extremity in Stroke Patients (MESUPES)	0	17	1.00	0.29	0.00	10.20	0.00	100.00	0.00	0.00	0.00
Motor Fitness Scale	1	14	1.07	0.87	10.91	8.16	57.14	28.57	0.00	7.14	7.14
Motor Function Measure (MFM)	0	32	1.03	0.58	18.18	10.20	53.13	34.38	0.00	12.50	0.00
Motor Status Score (MSS)	0	44	1.11	0.10	1.82	6.12	27.27	72.73	0.00	11.36	0.00
Motricity Index	0	6	1.00	0.50	1.82	4.08	50.00	50.00	0.00	0.00	0.00
Movement Ability Measure (MAM)	**1**	**24**	**1.08**	**0.54**	**7.27**	**0.00**	**29.17**	**0.00**	**62.50**	**0.00**	**0.00**
Movement and Activity in Physical Space (MAPS)	**0**	**1**	**1.00**	**1.00**	**0.00**	**2.04**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**
Multifeature GAit Score (MGS)	0	10	1.00	0.10	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Multiple Sclerosis Walking Sclae-12 (MSWS-12)	1	12	1.33	0.69	9.09	8.16	100.00	0.00	0.00	0.00	0.00
Multipledirectional Jump Assessment	0	1	1.00	1.00	1.82	0.00	75.00	16.67	0.00	16.67	0.00
Nagi's Physical Function (Self-Report) Scale	1	7	1.14	1.00	7.27	6.12	42.86	42.86	0.00	14.29	0.00
Neck Movement with the Fly	**0**	**1**	**1.00**	**1.00**	**1.82**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Neighborhood Physical Activity Questionnaire (NPAQ)	1	21	1.14	0.17	3.64	2.04	80.95	19.05	0.00	0.00	14.29
Neuromuscular Recovery Scale (NRS)	0	11	1.00	0.73	10.91	0.00	63.64	0.00	0.00	36.36	0.00
New Freezing Of Gait Questionnaire	1	9	1.22	0.27	3.64	0.00	100.00	0.00	0.00	0.00	0.00
New Zealand Physical Activity Questionnaire - Long Form	1	20	1.20	0.63	10.91	6.12	47.37	42.11	0.00	5.26	15.79
New Zealand Physical Activity Questionnaire - Short Form	1	17	1.00	0.29	5.45	2.04	70.59	11.76	0.00	0.00	17.65
Newcastle 85+ Physical Activity Measure	1	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
NHANES - Physical Functioning Questionnaire	1	16	1.38	0.86	10.91	10.20	37.50	25.00	0.00	12.50	37.50
Nine-Hole Peg Test (NHPT)	0	1	4.00	1.00	0.00	8.16	0.00	100.00	0.00	0.00	0.00
Nordic Mobility-related Participation Outcome Evaluation of Assistive Device Intervention (NOMO 1.0)	*1*	*28*	*1.18*	*0.73*	*3.64*	*10.20*	*7.14*	*35.71*	*0.00*	*0.00*	*39.29*

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Northwestern University Disability Scale	1	5	1.40	0.86	1.82	0.00	16.67	0.00	0.00	0.00	66.67
Norwegian Women and Cancer Physical Activity Questionnaire (NOPQ)	1	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Nurses' Health Study Physical Activity Questionnaire II (NHSPAQ)	1	6	1.33	0.50	3.64	2.04	83.33	16.67	0.00	33.33	0.00
Objective Evaluation of Fine Motor Manipulation	0	3	1.00	0.33	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Obstacle Course Assessment of Wheelchair User Performance (OCAWUP)	0	10	1.00	0.10	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Occupational Sitting and Physical Activity Questionnaire (OSPAQ)	1	6	1.00	0.83	3.64	0.00	33.33	0.00	0.00	33.33	0.00
One-leg Hop for Distance (OLHD)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
One-minute stair-climb	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
OSCAR Scaling System	0	5	2.60	0.31	3.64	0.00	80.00	0.00	100.00	0.00	0.00
Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL) Instrument	**0**	**57**	**1.04**	**0.49**	**25.45**	**14.29**	**52.63**	**21.05**	**0.00**	**10.53**	**0.00**
Past Week Activity (PWA) Interview	1	9	1.00	0.33	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Patient-Reported Outcomes Information System Physical Function Item Bank (PROMIS)	1	124	1.36	0.36	29.09	30.61	31.45	33.87	0.00	7.26	26.61
Pelvic Girdle Questionnaire	1	25	1.04	0.81	18.18	6.12	36.00	20.00	0.00	16.00	12.00
Perme Intensive Care Unit Mobility Score	*0*	*15*	*1.20*	*0.78*	*7.27*	*0.00*	*33.33*	*0.00*	*13.33*	*13.33*	*6.67*
Physical Ability Scale (PAS)	1	5	1.20	0.67	5.45	0.00	80.00	10.00	0.00	0.00	10.00
Physical Activity Adult Questionnaire (PAAQ)	1	13	1.23	0.31	3.64	2.04	100.00	0.00	0.00	20.00	0.00
Physical Activity Questionnaire for Elderly Japanese	1	14	1.14	0.31	1.82	2.04	30.77	23.08	0.00	0.00	7.69
Physical Activity Questionnaire used by the Cadbury study	1	7	1.14	0.75	3.64	2.04	14.29	14.29	0.00	0.00	85.71
Physical Activity Rating Scale	1	1	1.00	1.00	1.82	0.00	42.86	14.29	0.00	0.00	42.86
Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI)	1	21	1.14	0.42	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Physical Activity Scale 2 (PAS 2)	1	8	1.13	0.78	3.64	2.04	33.33	0.00	0.00	0.00	14.29
Physical Activity Scale for Persons with Physical Disabilities	1	31	1.35	0.31	0.00	2.04	50.00	12.50	0.00	25.00	12.50
Physical Activity Scale for the Elderly	1	26	1.46	0.32	3.64	2.04	0.00	6.45	0.00	6.45	80.65
Physical Activity Survey in Long-Term Care (PAS-LTC)	1	75	1.32	0.36	10.91	10.20	7.69	3.85	0.00	7.69	73.08
Physical Disability Index	0	34	1.00	0.35	12.73	0.00	18.67	29.33	0.00	2.67	57.33
Physical Function ICU Test (PFIT)	0	4	1.00	0.75	3.64	0.00	26.47	0.00	58.82	14.71	0.00
Physical Function Scale of the Swiss Spinal Stenosis Questionnaire	1	5	1.80	0.67	3.64	6.12	50.00	0.00	50.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Physical Function Scale of the Western Ontario and McMaster University (WOMAC) Questionnaire	1	17	1.06	0.83	10.91	2.04	47.06	5.88	0.00	17.65	29.41
Physical Functioning Scale of the 36-Item Short-Form Health Survey	1	10	1.30	0.77	10.91	4.08	80.00	60.00	0.00	0.00	0.00
Physical Mobility Scale	*0*	*8*	*1.00*	*0.88*	*7.27*	*2.04*	*62.50*	*12.50*	*0.00*	*25.00*	*0.00*
Physical Performance and Mobility Examination (PPME)	*0*	*6*	*1.00*	*1.00*	*9.09*	*0.00*	*83.33*	*0.00*	*0.00*	*16.67*	*0.00*
Physical Performance Battery	0	7	1.43	0.90	10.91	4.08	85.71	14.29	0.00	14.29	0.00
Physical Performance Examination (PPE)	0	3	1.33	1.00	5.45	0.00	66.67	0.00	0.00	33.33	0.00
Physical Performance Test	0	9	1.33	0.92	9.09	4.08	55.56	22.22	0.00	0.00	22.22
Physiotherapy Functional Mobility Profile (PFMP)	*0*	*9*	*1.00*	*1.00*	*10.91*	*2.04*	*66.67*	*11.11*	*0.00*	*22.22*	*0.00*
PhyStat7	0	7	1.14	0.88	7.27	0.00	42.86	0.00	14.29	14.29	0.00
Posturo-Locomotion-Manual (PLM) test	0	3	1.00	1.00	3.64	2.04	66.67	33.33	0.00	0.00	0.00
Power-Mobility Community Driving Assessment (PCDA)	*0*	*30*	*1.77*	*0.15*	*0.00*	*14.29*	*0.00*	*100.00*	*0.00*	*26.67*	*0.00*
Progressive Isoinertial Lifting Evaluation (PILE)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Prosthesis Evaluation Questionnaire - Mobility Section (PEQ-MS)	*1*	*12*	*2.00*	*0.29*	*9.09*	*2.04*	*100.00*	*8.33*	*0.00*	*100.00*	*0.00*
Prosthetic Limb Users Survey of Mobility (PLUS-M)	*1*	*12*	*1.33*	*0.56*	*10.91*	*6.12*	*83.33*	*33.33*	*0.00*	*0.00*	*0.00*
Prosthetic Observational Gait Score (POGS)	0	16	1.00	0.06	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Prosthetic Profile of the Amputee Locomotor Capabilities Index (PPA-LCI)	1	14	1.21	0.53	9.09	8.16	92.86	28.57	0.00	0.00	0.00
Purdue Pegboard	0	1	4.00	1.00	0.00	8.16	0.00	100.00	0.00	0.00	0.00
Question for "past month" recall period	1	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	100.00
Question for "past week" recall period	1	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	100.00
Questionnaire for Physical Activity Decline in pain	1	21	1.00	0.95	5.45	6.12	14.29	14.29	0.00	4.76	47.62
Questionnaire of Functional Ability	1	11	1.45	0.81	7.27	6.12	45.45	36.36	0.00	0.00	45.45
Questionnaire Rising and Sitting Down (QR&S)	1	42	1.40	0.07	3.64	2.04	100.00	21.43	0.00	0.00	19.05
Questions on Mobility	*1*	*3*	*1.00*	*1.00*	*5.45*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
QuickDASH	1	21	1.38	0.48	0.00	6.12	0.00	14.29	0.00	0.00	42.86
Rankin Focused Assessment - Ambulation (RFA-A)	0	11	1.27	0.86	1.82	4.08	9.09	18.18	0.00	0.00	54.55
Rating of Everyday Arm-Use in the Community and Home (REACH) Scale	0	2	1.00	0.50	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Rating Scale for Gait Evaluation in Parkinson's Disease	0	23	1.09	0.76	14.55	4.08	56.52	8.70	8.70	4.35	8.70
Rating Scale for Postural Tremor	0	6	1.00	0.17	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Rating Scale for Psychogenic Movement Disorders	**0**	**19**	**2.79**	**0.09**	**7.27**	**0.00**	**94.74**	**0.00**	**0.00**	**0.00**	**0.00**
Rating Scales of Time and Distance Walked	1	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Reach to Target / Reach to Grasp	0	2	1.50	0.67	0.00	4.08	0.00	100.00	0.00	0.00	0.00
Reachable Workspace Volume (RWV)	0	2	1.00	1.00	0.00	4.08	0.00	100.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Reaching Evaluation Method	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Reaching Movements with KINARM	**0**	**1**	**1.00**	**1.00**	**0.00**	**2.04**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**
Reaching Performance Scale (RPS)	0	6	1.00	0.67	0.00	6.12	0.00	83.33	0.00	16.67	0.00
Recent Physical Activity Questionnaire (RPAQ)	1	62	1.26	0.33	12.73	8.16	20.97	9.68	0.00	19.35	45.16
ReJoyce Arm and Hand Function Test (RAHFT)	0	8	1.00	0.50	0.00	8.16	0.00	100.00	0.00	0.00	0.00
Repeated Trunk Flexion	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Rett Syndrome Gross Motor Scale (RSGMS)	0	15	1.00	0.53	10.91	0.00	60.00	0.00	0.00	40.00	0.00
Revised Foot Function Index (FFI-R)	1	68	1.06	0.40	18.18	14.29	22.06	14.71	0.00	2.94	16.18
Revised Version of the Ability for Basic Movement Scale (ABMS II)	**0**	**5**	**1.00**	**1.00**	**5.45**	**0.00**	**60.00**	**0.00**	**0.00**	**40.00**	**0.00**
Rise from Bed Time (RBT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Rise-to-Walk (RTW) Task	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Rising from Lying Supine	0	4	1.00	0.75	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Rivermead Mobility Index (RMI)	*2*	*15*	*1.67*	*0.76*	*20.00*	*10.20*	*80.00*	*33.33*	*0.00*	*13.33*	*6.67*
Rivermead Motor Assessment (RMA)	0	38	1.39	0.49	21.82	18.37	52.63	42.11	2.63	13.16	2.63
Rivermead Visual Gait Assessment (RVGA)	0	24	1.00	0.13	1.82	0.00	91.67	0.00	8.33	0.00	0.00
Scale for the Assessment and Rating of Ataxia (SARA)	0	8	1.25	0.90	7.27	4.08	50.00	37.50	0.00	25.00	0.00
Scottish Physical Activity Questionnaire (SPQAQ)/Scottich Physical Activity Screening Questionnaire	1	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Self-efficacy for Reaching Movements	**0**	**1**	**1.00**	**1.00**	**0.00**	**2.04**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**
Self-Reported Ability to Walk, Run, and Lift Objects	1	16	1.00	0.25	5.45	2.04	62.50	37.50	0.00	0.00	0.00
Self-Reported Maximal Walking Distance (SR-MWD)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Self-Reported Measure of Function - Mobility Domain	*1*	*3*	*1.00*	*1.00*	*3.64*	*2.04*	*50.00*	*0.00*	*0.00*	*50.00*	*0.00*
Self-reported Measure of Lowere Extremity Function	1	4	1.00	1.00	3.64	0.00	66.67	33.33	0.00	0.00	0.00
Self-reported Physcial Activity (SR-PA)	1	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Self-reported Physical Functioning Developed by Simonsick	1	10	1.10	0.55	9.09	2.04	80.00	20.00	0.00	0.00	0.00
Self-reported Stair Climbing from the European Prospective Investigation into Cancer and Nutrition	1	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Self-Reported Walking Ability	1	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Senior Fitness Test	0	7	1.29	0.67	7.27	4.08	57.14	42.86	0.00	0.00	0.00
Sensory-Oriented Mobility Assessment Instrument (SOMAI)	*0*	*10*	*1.00*	*0.70*	*10.91*	*2.04*	*90.00*	*10.00*	*0.00*	*0.00*	*0.00*
Sequential Occupational Dexterity Assessment (SODA)	0	12	1.00	0.67	0.00	10.20	0.00	75.00	0.00	0.00	16.67
Shape Tracing Task	0	2	2.00	0.50	1.82	2.04	100.00	100.00	0.00	0.00	0.00
Shaw Gait Assessment Tool (SGA)	0	5	1.00	0.20	1.82	0.00	100.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Short and Graphic Ability Score	0	2	2.50	1.00	1.82	8.16	50.00	50.00	0.00	0.00	0.00
Short Parkinson's Evaluation Scale (SPES)/SCales for Outcome in Parkinson's disease (SCOPA)	0	21	1.19	0.80	14.55	2.04	61.90	0.00	4.76	0.00	14.29
Short Physical Performance Battery	0	5	1.00	0.80	3.64	0.00	40.00	0.00	0.00	60.00	0.00
Short-form Mobility Assessment Tool	*1*	*10*	*1.20*	*0.50*	*9.09*	*2.04*	*100.00*	*20.00*	*0.00*	*0.00*	*0.00*
Shortened (seven-item) Screening Questionnaire for ET	1	7	1.29	0.56	1.82	2.04	71.43	0.00	0.00	0.00	0.00
Shoulder Activity Scale	1	7	1.00	0.57	0.00	6.12	0.00	57.14	0.00	0.00	42.86
Shuttle Walk Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Sickness Impact Profile (SIP68) Motor Control subscale	1	12	1.33	0.81	14.55	6.12	66.67	33.33	0.00	8.33	8.33
Sideways Walking	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
SIGMA Mobiilty Gradew Questionnaire	1	23	1.91	0.25	7.27	6.12	30.43	43.48	0.00	43.48	0.00
Simple Shoulder Test (SST)	1	12	1.00	0.67	0.00	8.16	0.00	66.67	0.00	0.00	8.33
Simpson Extrapyramidal Side Effect Scale	0	10	1.00	0.70	3.64	2.04	20.00	10.00	50.00	0.00	0.00
Single Leg Landing (SLL)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Single Leg Squat	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Single Limb Mini-Squat Test (SLMS)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Single-leg Wall Slide	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Sit to Stand (STS) Score	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Sit-and-Reach Test (SRT)	0	1	3.00	1.00	1.82	2.04	100.00	100.00	0.00	0.00	0.00
Sitting to Standing	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Six Physical Performance Tests (PPTs)	0	6	1.17	0.43	3.64	2.04	66.67	50.00	0.00	0.00	0.00
Six-minute Step Test (6MST)	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Sock Test	0	1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Sollerman Test of Hand Grip	0	20	1.00	0.35	0.00	12.24	0.00	95.00	0.00	0.00	0.00
Southampton Mobility Assessment	*0*	*18*	*1.00*	*0.39*	*10.91*	*0.00*	*72.22*	*0.00*	*0.00*	*27.78*	*0.00*
Spatiotemporal Gait Parameters	0	35	1.00	0.03	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Spatiotemporal Jaw Parameters	0	2	2.00	0.50	1.82	0.00	100.00	0.00	100.00	0.00	0.00
Spinal Cord Independence Measure (SCIM II)	0	3	2.33	0.71	1.82	6.12	33.33	66.67	0.00	100.00	0.00
Spinal Cord Injury Functional Ambulation Profile	0	6	1.17	0.86	7.27	4.08	83.33	16.67	0.00	0.00	0.00
Spinal Cord Injury Functional Index (SCI-FI)	1	5	1.60	1.00	3.64	6.12	40.00	60.00	0.00	40.00	20.00
Spiral Drawing	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Sprint Time	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Squat Movement Screen	**0**	**11**	**1.00**	**0.27**	**1.82**	**0.00**	**72.73**	**0.00**	**0.00**	**18.18**	**0.00**
Squat up to 90 degrees	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair Ascent / Decent - 4 Steps	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair Ascent / Decent - 8 Steps	0	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair Measure (ST)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Stair Negotiation	0	4	1.00	0.25	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair Test / Timed Stair Climbing Test (TSC)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair up (ascend) test (STUp-11)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stair-Climb Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stand-Up Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Standard Walking Obstacle Course	0	10	1.10	0.64	10.91	0.00	100.00	0.00	0.00	0.00	0.00
Standford 7-day Physical Activity Recall	1	17	1.00	0.35	1.82	0.00	56.25	0.00	0.00	0.00	12.50
Stanford Brief Activity Survey	1	2	2.00	0.75	1.82	0.00	100.00	0.00	0.00	0.00	50.00
Step Quick Turn (SQT) Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Step Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Stepping Response Time (SRTs)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Steultiens 1999 Obstacle Course	0	4	1.50	1.00	7.27	4.08	75.00	25.00	0.00	0.00	0.00
Stopwatch Thumb-Movement Time	**0**	**1**	**1.00**	**1.00**	**0.00**	**2.04**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**
Stroke Activity Scale (SAS)	0	5	1.20	1.00	5.45	2.04	60.00	20.00	0.00	20.00	20.00
Stroke Rehabilitation Assessment of Movement (STREAM)	**0**	**30**	**1.30**	**0.38**	**16.36**	**10.20**	**45.00**	**50.00**	**0.00**	**5.00**	**0.00**
Stroke Upper Limb Capacity Scale (SULCS)	0	10	1.10	0.91	0.00	14.29	0.00	80.00	0.00	0.00	20.00
Sunnybrook facial grading system	0	13	1.77	0.22	3.64	0.00	76.92	0.00	76.92	0.00	0.00
Supine to Sitting (SST) & Table to a Chair (TTCT)	0	2	1.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Supine to Standing	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Swallowing Function Measures	0	12	1.08	0.54	1.82	0.00	8.33	0.00	0.00	0.00	0.00
Swedish Mammography Cohort Physical Activity Questionnaire	1	5	1.40	1.00	3.64	2.04	40.00	20.00	0.00	0.00	60.00
Sydney Facial Grading System	0	6	3.00	0.17	3.64	0.00	100.00	0.00	100.00	0.00	0.00
Synkinesis Assessment Questionnaire (SAQ)	1	10	1.10	0.18	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Table Tapping	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Tandem Gait	0	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Tardive Dyskinesia Videotape Rating Technique	0	31	2.00	0.18	3.64	0.00	100.00	0.00	54.84	0.00	0.00
Targeted Box and Block Test (tBBT) / Modified Box and Block Test (mBBT)	0	2	5.00	0.50	0.00	10.20	0.00	100.00	0.00	0.00	0.00
Tegner Score	1	11	1.45	0.31	1.82	0.00	36.36	0.00	0.00	9.09	45.45
Telephone-Based Mobility Assessment Questionnaire (TMAQ)	*1*	*4*	*1.00*	*0.50*	*3.64*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Test Evaluant les Membres Superieurs des Personnes Agees (TEMPA)	0	9	1.33	0.67	0.00	12.24	0.00	88.89	0.00	0.00	11.11
Test of Wheeled Mobility (TOWM)	*0*	*6*	*1.17*	*0.43*	*1.82*	*4.08*	*16.67*	*83.33*	*0.00*	*0.00*	*0.00*
The 26-item Parkinson Disease Dyskinesia Scale	1	26	2.12	0.44	3.64	10.20	100.00	23.08	0.00	19.23	34.62

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
The 30-Rapid-Step Test (30-RST)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
The ABILOCO Questionnaire	1	13	1.23	0.56	9.09	6.12	92.31	15.38	0.00	7.69	0.00
The Action Research Arm Test	0	19	1.58	0.17	0.00	10.20	0.00	100.00	0.00	0.00	0.00
The Active Australia Survey	1	13	1.00	0.38	3.64	0.00	15.38	0.00	0.00	0.00	46.15
The Activity Rating Scale	1	4	1.00	0.50	3.64	0.00	100.00	0.00	0.00	0.00	0.00
The Amputee Mobility Predictor	*0*	*25*	*1.56*	*0.46*	*16.36*	*6.12*	*60.00*	*12.00*	*8.00*	*44.00*	*0.00*
The Amputee Single Item Mobility Measure (AMPSIMM)	*1*	*1*	*1.00*	*1.00*	*1.82*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
The Avlund mobility scales	*1*	*16*	*1.31*	*0.76*	*9.09*	*6.12*	*31.25*	*25.00*	*0.00*	*0.00*	*62.50*
The Bath Ankylosing Spondylitis Functional Index (BASFI)	1	10	1.10	0.91	7.27	4.08	50.00	20.00	0.00	10.00	10.00
The Behavioral Risk Factor Surveillance System (BRFSS) PA questions	1	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	100.00
The Chelsea Critical Care Physical Assessment Tool	0	10	1.30	0.77	9.09	0.00	50.00	0.00	10.00	40.00	0.00
The Click Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
The Comprehensive High-level Activity Mobility Predictor (CHAMP)	*0*	*6*	*1.00*	*0.67*	*3.64*	*0.00*	*50.00*	*0.00*	*33.33*	*16.67*	*0.00*
The Cumulated Ambulation Score (CAS)	0	5	1.60	1.00	9.09	6.12	80.00	40.00	0.00	0.00	0.00
The Four Square Step Test (FSST)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
The Functional Ambulation Categories	0	6	1.17	0.57	7.27	0.00	100.00	0.00	0.00	0.00	0.00
The Functional Ambulation Performance Score (FAPS)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
The Glass Scale	1	1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
The Grip Ability Test (GAT)	0	3	1.00	0.67	0.00	4.08	0.00	100.00	0.00	0.00	0.00
The Groningen Meander Walking Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
The Leeds Movements Performance Index	**0**	**5**	**1.00**	**0.80**	**3.64**	**0.00**	**40.00**	**0.00**	**0.00**	**40.00**	**0.00**
The Leisure Time Physical Activity Instrument (LTPAI)	1	4	1.00	0.50	1.82	0.00	75.00	0.00	0.00	0.00	25.00
The Lie-to-Sit-to-Stand-to-Walk Transfer (LSSWT) test	0	2	1.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
The Lift Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
The Mobility Scale for Acute Stroke Patients	*0*	*5*	*1.00*	*1.00*	*7.27*	*0.00*	*80.00*	*0.00*	*0.00*	*20.00*	*0.00*
The Modified Gait Efficacy Scale (mGES)	1	10	1.00	0.50	9.09	0.00	100.00	0.00	0.00	0.00	0.00
The modified Parkinson Activity Scale (PAS)	0	18	1.67	0.33	14.55	2.04	94.44	11.11	0.00	0.00	0.00
The New Mobility Score	*1*	*3*	*1.00*	*1.00*	*0.00*	*4.08*	*0.00*	*66.67*	*0.00*	*0.00*	*0.00*
The Occupational Physical Activity Questionnaire (OPAQ)	1	7	1.29	0.56	3.64	0.00	57.14	0.00	0.00	28.57	0.00
The Osteoporosis Assessment Questionnaire - Physical Function (OPAQ-PF)	1	15	1.40	0.62	10.91	10.20	66.67	33.33	0.00	13.33	0.00
The Phone-FITT	1	28	1.07	0.57	5.45	2.04	10.71	3.57	0.00	0.00	42.86

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
The Physical Activity at Home or at Work Instrument (PAHWI)	1	8	1.63	0.31	1.82	0.00	50.00	0.00	0.00	12.50	37.50
The Physical Activity at Home or at Work Instrument (PAHWI)	1	8	1.50	0.33	1.82	0.00	37.50	0.00	0.00	12.50	37.50
The Physical Functioning Measure at 3 Months: the F3m	1	44	1.00	0.50	12.73	12.24	38.64	38.64	0.00	6.82	13.64
The Pick-up Test	0	1	2.00	1.00	1.82	2.04	100.00	100.00	0.00	0.00	0.00
The Pregnancy Mobility Index	*1*	*24*	*1.00*	*0.67*	*10.91*	*8.16*	*45.83*	*25.00*	*0.00*	*12.50*	*16.67*
The Revised Upper Extremity Work Demands Scale (UEWD-R)	1	6	1.50	0.78	0.00	14.29	0.00	100.00	0.00	0.00	0.00
The Scales for Outcomes in Parkinson's disease (SCOPA) Diary Card	1	6	1.00	1.00	5.45	2.04	40.00	20.00	0.00	0.00	0.00
The Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH)	1	13	1.00	0.69	5.45	2.04	30.77	15.38	0.00	0.00	38.46
The Simple Test for Evaluation Hand Function (STEF)	0	10	2.00	0.10	0.00	4.08	0.00	100.00	0.00	0.00	0.00
The Simplified Functional Movement Disorders Rating Scale (S-FMDRS)	**0**	**9**	**1.00**	**0.33**	**3.64**	**0.00**	**88.89**	**0.00**	**0.00**	**0.00**	**0.00**
The Six Spot Step Test	0	1	2.00	1.00	1.82	2.04	100.00	100.00	0.00	0.00	0.00
The Sub-Saharan Africa Activity Questionnaire	1	52	1.02	0.49	7.27	6.12	13.46	7.69	0.00	0.00	59.62
The Surgical Intensive Care Unit Optimal Mobility Score	*0*	*4*	*1.75*	*1.00*	*3.64*	*0.00*	*25.00*	*0.00*	*50.00*	*25.00*	*25.00*
The Wheelie Test	0	7	1.00	0.29	0.00	2.04	0.00	71.43	0.00	28.57	0.00
The Yale Global Tic Severity Scale	1	10	1.00	0.10	1.82	0.00	100.00	0.00	0.00	0.00	0.00
The Yale Physical Activity Survey for Older Adults	1	40	1.05	0.62	9.09	4.08	27.50	5.00	0.00	5.00	62.50
Three hundred meter Walk Test in community (300mWT)	0	6	1.33	0.75	7.27	4.08	100.00	33.33	0.00	0.00	0.00
Timed 100-meter Walk Test (T100MW)	0	1	3.00	1.00	3.64	2.04	100.00	100.00	0.00	0.00	0.00
Timed 25-Foot Walk (T25FW)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Timed 8-foot Up-and-Go	0	4	1.00	1.00	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Timed Bed Mobility	*0*	*2*	*1.00*	*1.00*	*3.64*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Timed Belt Tie	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Timed Elevated-arm Task	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Timed Function Tests	0	4	1.25	0.80	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Timed Get-up-and-Go (TGUG)	0	6	1.00	0.83	7.27	0.00	83.33	0.00	0.00	16.67	0.00
Timed Hand Signature	0	1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Timed Large Amplitude Rapid Alternating Movement Patterns (RAMPs)	**0**	**2**	**1.00**	**1.00**	**1.82**	**2.04**	**50.00**	**50.00**	**0.00**	**0.00**	**0.00**
Timed Left Turn / Timed Right Turn	0	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Timed Motor Tests (TMT)	0	15	2.00	0.30	3.64	12.24	13.33	73.33	0.00	0.00	0.00
Timed Movement Battery	**0**	**10**	**1.00**	**0.70**	**12.73**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Timed Stair Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Timed Stand and Walk	0	2	1.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Timed Up and Go - Assessment of Biomechanical Strategies (TUG-ABS)	0	15	1.67	0.28	7.27	0.00	100.00	0.00	0.00	0.00	0.00
Timed Up and Go (TUG)	0	6	1.00	0.67	5.45	0.00	83.33	0.00	0.00	16.67	0.00
Timed up and go with a motor task (TUG motor)	0	6	1.00	0.83	7.27	2.04	83.33	16.67	0.00	0.00	0.00
Timed William's Hand Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Timed-Functional-Movements (TFMs)	**0**	**11**	**1.00**	**0.55**	**10.91**	**0.00**	**100.00**	**0.00**	**0.00**	**0.00**	**0.00**
Timed-stands Test (TST)	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Timed, Repeated Reach-Up	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Timed, repeated sit-to-stand	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Tinetti Performance-Oriented Mobility Assessment (POMA)	*0*	*17*	*1.29*	*0.41*	*9.09*	*0.00*	*76.47*	*0.00*	*0.00*	*29.41*	*0.00*
Tool for Assessing Mobility in Wheelchair Dependent People	*0*	*6*	*1.50*	*0.56*	*5.45*	*4.08*	*50.00*	*50.00*	*0.00*	*0.00*	*0.00*
Tourtellotte's Clinical Quantitative Neurological Examination (CQNE)	0	3	1.00	0.33	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Transferring Time	0	4	1.00	0.75	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Transport and Physical Activity Questionnaire (TPAQ)	1	128	1.30	0.11	5.45	4.08	25.00	35.16	0.00	5.47	2.34
Treadmill Protocol	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Treadmill Walking	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Tremor Research Group (TRG) Essential Tremor Rating Assessment Scale (TETRAS)	0	23	1.09	0.60	1.82	10.20	47.83	21.74	0.00	0.00	13.04
Trunk Impairment Scale (TIS)	0	14	1.00	0.21	5.45	0.00	100.00	0.00	0.00	0.00	0.00
Tufts Assessment of Motor Performance	0	19	1.00	0.63	7.27	6.12	26.32	47.37	0.00	0.00	15.79
Twelve-step Ascend and Descend Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Twenty-four Hour Physical Activity Recall (24PAR) System	1	25	1.20	0.33	1.82	4.08	4.00	36.00	0.00	0.00	24.00
Two-Minute Step Test	0	1	2.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Two-Part Survey Item Cross-Cultural Activity Participation Study (CAPS)	1	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Two-Step Test	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Typing Activity	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Tyson Group of Mobility Tests	*0*	*8*	*1.00*	*0.75*	*5.45*	*6.12*	*37.50*	*62.50*	*0.00*	*0.00*	*0.00*
Unified Dyskinesia Rating Scale (UDysRS)	1	22	1.82	0.58	9.09	0.00	77.27	0.00	0.00	0.00	31.82
Unified Huntington's Disease Rating Scale (UHDRS) Total Motor Score	0	15	1.00	0.73	9.09	4.08	40.00	20.00	13.33	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Unified Parkinson's Disease Rating Scale (UPDRS) motor examination	0	20	1.00	0.55	12.73	4.08	75.00	15.00	5.00	0.00	0.00
United States National Health Interview Survey (USNHIS) walking for exercise items	1	26	1.00	0.35	9.09	2.04	26.92	3.85	0.00	0.00	69.23
University of Alabama at Birmingham (UAB) Study of Aging Life-Space Assessment (LSA)	1	15	1.33	0.15	0.00	6.12	0.00	100.00	0.00	0.00	0.00
University of California Los Angeles (UCLA) activity-level rating	1	10	1.00	0.20	1.82	0.00	60.00	0.00	0.00	0.00	40.00
University of Iowa Level of Assistance Scale	0	5	1.00	1.00	9.09	0.00	100.00	0.00	0.00	0.00	0.00
Unsupported Upper Limb Exercise Test	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Upper Arm Kinematics	0	18	1.00	0.11	1.82	2.04	11.11	88.89	0.00	0.00	0.00
Upper Extremity Capability Questionnaire	1	17	1.06	0.56	1.82	18.37	5.88	100.00	0.00	0.00	0.00
Upper Extremity Function Scale Questionnaire	1	8	1.00	0.88	0.00	8.16	0.00	62.50	0.00	0.00	12.50
Upper Extremity Functional Index	1	20	1.30	0.81	0.00	18.37	0.00	55.00	0.00	0.00	40.00
Upper Extremity Functional Status module of the Orthotics and Prosthetics User Survey (OPUS)	1	23	1.17	0.67	0.00	10.20	0.00	56.52	0.00	0.00	34.78
Upper Extremity Physical Performance Battery (UEPPB)	0	3	1.67	1.00	1.82	4.08	33.33	66.67	0.00	0.00	0.00
Upper Limb Assessment in Daily Living Scale (ULADL)	2	34	1.56	0.21	0.00	18.37	0.00	88.24	0.00	0.00	5.88
Upper Limb Functional Index	1	25	0.92	0.91	3.64	10.20	8.00	40.00	4.00	8.00	28.00
Upper Limb Motion Deviation Index (ULMDI)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Upper Limb Performance Analysis (ULPA)	0	3	1.00	0.33	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Upright Motor Control Tests (UMCT)	0	2	1.00	0.50	1.82	0.00	100.00	0.00	0.00	0.00	0.00
V-cut Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Van Lieshout Test	0	19	1.00	0.58	1.82	16.33	5.26	78.95	10.53	0.00	0.00
Vertical Jump Performance Test (VJPT)	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Vestibular Activities and Participation (VAP) questionnaire	1	34	2.18	0.55	20.00	16.33	29.41	23.53	0.00	0.00	29.41
Video Tapped Assessment of Walking	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Vision Loss Mobility Course	*0*	*2*	*2.00*	*0.75*	*5.45*	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*0.00*
Vision Loss Mobility Questionnaire	*1*	*40*	*1.00*	*0.35*	*7.27*	*8.16*	*57.50*	*15.00*	*0.00*	*0.00*	*0.00*
Walk Ratio	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Walking 10 m between Parallel Lines 17 cm apart	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Walking 2 x 15 m, with One Turn	0	1	2.00	1.00	3.64	0.00	100.00	0.00	0.00	0.00	0.00
Walking Estimated-Limitation Calculated by History (WELCH) Questionnaire	1	4	1.00	0.25	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Walking Impact Scale (Walk-12)	1	12	1.33	0.69	9.09	8.16	75.00	16.67	0.00	16.67	0.00
Walking Impairment Questionnaire (WIQ)	1	16	1.06	0.35	5.45	2.04	87.50	6.25	0.00	0.00	0.00

Tool Name	Pract_ PROM	Number Of Items	Content Density	Content Diversity	MovCode Cover	MobCode Cover	Percent_D A_Move	Percent_D A_Mob	Percent_ Ant_Move	Percent_ Ant_Mob	Percent_ Cons_Mob
Walking InCHIANTI Toolkit (WIT)	0	14	1.29	0.39	7.27	4.08	100.00	14.29	0.00	7.14	0.00
Walking Index for Spinal Injury (WISCI)	0	5	1.00	0.60	1.82	2.04	20.00	60.00	0.00	0.00	0.00
Walking speed 3 flat, real-life environments	0	3	2.00	0.50	1.82	4.08	100.00	100.00	0.00	0.00	0.00
Walking Speed Questionnaire	1	12	1.08	0.31	5.45	2.04	100.00	8.33	0.00	0.00	0.00
Walking While Talking Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Walking, Running, and Jogging (WRJ) recall questionnaire / Questions on Historical Physical Activity	1	9	1.56	0.21	3.64	0.00	55.56	0.00	0.00	0.00	44.44
Weekly PA reporting questions in the WIN study	1	7	1.14	0.63	5.45	0.00	85.71	0.00	0.00	0.00	14.29
Wheelchair Assessment Instrument for people with Multiple Sclerosis (WAMIS)	0	8	1.25	0.30	1.82	2.04	12.50	100.00	12.50	0.00	0.00
Wheelchair Circuit	0	9	1.22	0.36	5.45	2.04	22.22	88.89	0.00	0.00	0.00
Wheelchair Outcome Measure (WhOM)	1	6	1.17	0.71	0.00	4.08	0.00	33.33	0.00	0.00	16.67
Wheelchair Propulstion Test (WPT)	0	10	1.40	0.29	1.82	6.12	41.67	58.33	0.00	0.00	0.00
Wheelchair Skills Test (WST)	0	33	1.00	0.24	1.82	10.20	6.06	51.52	0.00	9.09	33.33
Wheelchair Skills Test Questionnaire (WST-Q)	1	32	1.03	0.24	1.82	10.20	6.06	51.52	0.00	9.09	33.33
Wheelchair-Modified Continuous Scale Physical Functional Performance (WC-PFP) measure	0	11	1.55	0.82	3.64	16.33	9.09	72.73	9.09	0.00	18.18
Wisconsin Gait Scale (WGS)	0	14	1.00	0.14	1.82	2.04	92.86	7.14	0.00	0.00	0.00
Wolf Motor Function Test	0	15	1.20	0.50	0.00	18.37	0.00	100.00	0.00	0.00	0.00
Women's Health Initiative Physical Activity (WHI PA) Questionnaire	1	17	1.12	0.53	3.64	2.04	17.65	17.65	0.00	11.76	70.59
Work Box (formerly Assembly Box)	0	1	1.00	1.00	0.00	2.04	0.00	100.00	0.00	0.00	0.00
Work Related Upper Limb Disorders Functional Capacity Evaluation (WRULD FCE)	0	8	1.00	0.63	0.00	8.16	0.00	62.50	37.50	0.00	0.00
Work-Related Questionnaire for Upper Extremity Disorders (WORQ-UP)	0	17	1.06	0.78	1.82	24.49	5.88	88.24	0.00	0.00	0.00
Zig-zag Pattern Test	0	1	1.00	1.00	1.82	0.00	100.00	0.00	0.00	0.00	0.00
Zutphen Physical Activity Questionnaire	1	10	1.20	0.50	5.45	6.12	60.00	50.00	0.00	0.00	0.00