

**Title: Combining scoping review and concept analysis methodologies to clarify the meaning
of rehabilitation potential after acquired brain injury**

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Abstract

Purpose: Clinicians make judgments about patients' rehabilitation potential because it is considered by many as a prerequisite for referral to rehabilitation. However, the concept is rarely defined. This research aimed to clarify the concept of rehabilitation potential in the context of acquired brain injury patient referral to post-acute rehabilitation.

Method: Literature search (conducted in Medline, CINAHL and Embase) and article selection followed a scoping review methodology while a concept analysis methodology guided data extraction and analysis.

Results: Eighteen documents met inclusion criteria. Findings suggest four defining attributes of the concept. Rehabilitation potential (1) emerges from clinicians' interpretation of patient characteristics and is influenced by the health care environment, (2) involves the prediction of how a patient might improve with rehabilitation interventions, (3) is a multi-level concept and (4) can change over time. The most critical consequence to assessing a patient's rehabilitation potential is the impact on the patient's opportunity to access post-acute rehabilitation services.

Conclusion: Rehabilitation potential is a concept rooted in clinical reasoning. We propose an operational definition and a conceptual model to provide a solid foundation for future research to advance policy and clinical decision-making regarding equitable access to post-acute rehabilitation.

Keywords: Brain injuries; stroke; clinical decision-making; referral and consultation; health services accessibility

Introduction

Access to multidisciplinary inpatient rehabilitation is crucial for people with acquired brain injuries. Inpatient rehabilitation for this population is effective in improving outcomes following stroke or traumatic brain injury (TBI) [1-4]. However, inpatient rehabilitation is a limited resource, not offered to all survivors [5,6]. Patients with good rehabilitation potential stand the best chance of accessing inpatient rehabilitation while those with poor potential may be refused access [6,7].

In some health care service delivery models, acute care clinicians assess and determine rehabilitation potential and refer patients to post-acute rehabilitation. In other instances, post-acute rehabilitation clinicians determine patients' rehabilitation potential and decide if patients are eligible for admission. In some health care systems, a single clinician (usually a physician) determines a patient's rehabilitation potential with varying input from other professionals. In other instances, rehabilitation potential is determined by a multidisciplinary team. The use of standardized assessment tools (e.g. the Functional Independence Measure [8]), or screening tools (e.g. the Stroke Rehabilitation Candidacy Screening Tool [9] or the Assessment for Rehabilitation: Decision-Making tool [10]) has been suggested to better triage stroke patients most likely to benefit from post-acute rehabilitation. Yet, there are persisting variations in patient referral to rehabilitation.

A recent systematic review examined factors influencing clinicians' decisions regarding access to stroke rehabilitation [11]. Findings showed clinicians' decisions as subjective and influenced by patient-related, organizational and clinician-related factors. They also influence referrals to post-acute rehabilitation. Additionally, a scoping review analyzed 14 clinical practice guidelines on post-stroke rehabilitation and found inconsistent recommendations regarding access to inpatient rehabilitation [5]. Some recommend unconditional access while others recommend using inclusion and exclusion criteria. Guidelines from Europe, United States of America (USA),

Canada, and Spain recommend clinicians only refer stroke patients with potential to improve. Hence, clinicians' assessments of patients' rehabilitation potential is pivotal in decision-making regarding access to inpatient rehabilitation [12-14].

Some clinical practice guidelines and rehabilitation programs allude to rehabilitation potential as a prerequisite for admission to post-acute rehabilitation [15-18]. However, the concept has been coined complex [19] and remains poorly defined. Some argue the assessment of rehabilitation potential should be made more explicit [20]. The fuzziness around its meaning leads to uncertainty as to what clinicians should assess. There are currently no standardized assessments of rehabilitation potential, which may partly explain why studies have shown important variations in the selection of rehabilitation candidates [5,18,21,22].

A need thus clearly exists to determine what is known about the concept of rehabilitation potential, an essential first step towards framing what ought to be assessed, and eventually developing an instrument to validly measure this concept [23,24]. Clarifying this concept will provide common knowledge for stakeholders involved in determining access to post-acute rehabilitation and guide the development of future research agendas to advance policy regarding equitable access to post-acute rehabilitation.

This paper therefore aims to clarify the concept of rehabilitation potential of people with acquired brain injury, i.e., stroke or TBI. More specifically, we examine how the term rehabilitation potential has been used in the literature to obtain a better understanding of its meaning in the context of decisions made about patient access to post-acute inpatient rehabilitation.

Methods

Combining scoping review and concept analysis methodologies

Though both scoping reviews and concept analysis have been previously used to clarify and analyze concepts not readily observable, each method has strengths and shortcomings. We therefore combined methodological elements from both methodologies to overcome their respective limitations.

Scoping reviews map key concepts underlying broad research areas and examine the amount, range and nature of available evidence [25-27]. A six-stage methodological framework was initially described by Arksey and O'Malley (2005) (see table 1) and further clarified by Levac et al. (2010) [26]. Of note, Levac et al. (2010) recommend a systematic and rigorous procedure to identify and select relevant publications, limiting bias in the choice of papers included in the review. They provide guidelines for data extraction, recommending variables be identified in a continuous fashion, but fail to detail how data extraction aimed at concept clarification should be conducted. In scoping reviews, data analysis involves a numerical and a qualitative analysis of included studies. The former provides information on the extent, nature and distribution of papers included in the review while the latter identifies underlying themes. However, few guidelines are provided regarding how to qualitatively analyse data. Hence, scoping reviews used to clarify concepts often omitted to report how data were qualitatively analyzed [28-30].

Concept analysis methodologies, on the other hand, examine the current state of knowledge of a concept [24]. Walker and Avant (2011) published a highly cited methodology specifically aimed at concept clarification. It provides clear structural guidelines on the type of data to extract from the literature [31,32]. Information is extracted on the concept's structure (definition) and function (uses). A key step of this methodology is the extraction of the concept's defining attributes

(see table 1). Antecedents as well as consequences related to the concept are also considered in order to frame the concept's essential attributes. Empirical referents (i.e., observable phenomena by which defining attributes can be recognized in the real world) are also identified. However, as with many other concept analysis methodologies, this methodology lacks a systematic procedure to identify and select pertinent publications in the review.

Hence, in this study, we combined the use of scoping review and concept analysis approaches to strengthen the overall methodology. A scoping review methodology was used to identify and select relevant publications as well as to conduct numerical analysis. Concept analysis methodology was used to chart and analyze data (see table 1).

Identifying relevant publications

Following scoping review methodology, we performed a systematic database search in MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and EMBASE (1946 through December 2018) with a university librarian. The keywords 'rehabilitation potential' and 'potential for rehabilitation' served to target publications where authors used these terms to discuss the concept of rehabilitation potential. Other search terms (e.g., terms related to acquired brain injury or adult population) were not used since a pilot search with the librarian revealed some publications known to the researchers were not identified when these terms were added.

Selecting publications

After conducting a broad database search, we refined the publication selection using the following inclusion criteria: (1) relevant to the target population - adults with stroke or TBI, (2) authors use the term rehabilitation potential in a manner relevant to the context of referral from acute care to post-acute inpatient rehabilitation and (3) published in English or French. We excluded

publications in which the term rehabilitation potential was used only once and provided no information to clarify its meaning. The first author and two other reviewers independently applied these criteria to 10% of randomly selected abstracts. Agreement between reviewers was high, ranging between 80%-90%. Two reviewers then independently applied the criteria to all remaining titles and abstracts. When it was unclear if a publication should be included or not, a full-text review was conducted by the same two reviewers. The reviewers met regularly to discuss uncertainties regarding the process. All cases of disagreement were discussed, and inclusion/exclusion criteria were re-examined until consensus was achieved.

Charting and analyzing the data

The first author developed a data charting form to extract characteristics of included publications (i.e., reference, authors' country, year and type of publication, target patient population, professional groups involved), which were used for numerical analysis. This form was also used to extract data congruent with Walker and Avant's [31] approach to concept analysis (i.e., uses of the concept, defining attributes, antecedents and consequences as well as empirical referents to assessing rehabilitation potential). A senior research team member reviewed the form to ensure that variables extracted were congruent with the aim of the concept analysis. The first author then extracted all content referring to the concept of rehabilitation potential regardless of the section where the concept was mentioned in the publications or how much was written about it.

Results

The searches yielded 1289 records. Figure 1 details the selection process and indicates that 823 records were reviewed but only 18 publications complied with inclusion and exclusion criteria.

Numerical analysis results

The term rehabilitation potential was used in publications dating back to 1950 (see table 2). However, 12 of the 18 documents were published this decade suggesting a growing interest. Authors from various countries used the term rehabilitation potential in the specific context of post-acute brain injury rehabilitation with an interest for the meaning of the concept of rehabilitation potential from authors in the United Kingdom (UK), the USA, Canada and Norway. Of note, the UK, Canada and Norway have a publicly funded universal health care system whereas the USA provides a combination of private and publicly funded programs.

Two types of publications were found; eight articles were opinion papers [20,33-39] and ten reported original research studies [7,12,13,19,40-45]. Only three opinion papers focused specifically on the concept of rehabilitation potential [20,34,39]. Three studies used a qualitative approach to investigate clinicians' meaning of the concept of rehabilitation potential or to examine factors influencing their decision-making about ongoing rehabilitation for stroke or TBI patients [12,13,19]. Seven quantitative studies [7,40-45] were not aimed specifically at studying patients' rehabilitation potential but the term rehabilitation potential was used and the latter provided information that could be extracted to better understand the term.

Concept analysis results

Uses and definitions of the concept of rehabilitation potential

The online Oxford English Dictionary defines potential as “possible as opposed to actual; having or showing the capacities to develop into something in the future” [46]. It defines ‘rehabilitation’ as the “restoration of a person to health or normal activity after injury, illness, disablement, or addiction by means of medical or surgical treatment, physical and occupational therapy,

psychological counselling, etc.” [46]. The World Health Organization defines rehabilitation as a “set of measures that assist individuals, who experience or are likely to experience disability, to achieve and maintain optimum functioning in interaction with their environment” [47]. Put together, these definitions suggest that rehabilitation potential after an injury has to do with estimating the patient’s capacity to achieve a certain level of functioning by means of a set of health care interventions. The definitions differ, however, regarding the nature of the improvement expected as the former suggests restoring a person to health or normal activity, whereas the latter places emphasis on achieving and maintaining optimal functioning.

The use of the term rehabilitation potential in the literature has evolved over time. In the mid-20th century, authors used the term when discussing the extent to which patients were likely to benefit from rehabilitation interventions [48]. The assessment of rehabilitation potential was perceived as a way of estimating “the level of functioning a patient is capable of reaching with rehabilitation” [49]. Authors used the term in publications targeting various patient populations and different rehabilitation settings. When selecting elderly candidates for post-acute rehabilitation, Rentz [50] suggested the following definition of rehabilitation potential:

“a prognostic indicator of how the patient will perform within a standard rehabilitation program. The assessment of rehabilitation potential estimates the individual's capability of cooperating with a rehabilitation program and making measured functional gains in ambulation and self-care.” [50]

This definition suggests that rehabilitation of the elderly in the '90s particularly targeted ambulation and self-care, placing less importance on outcomes such as participation and quality of life.

As for publications included in this review and specifically targeting acquired brain injury population, the oldest publication including the term rehabilitation potential dates back to 1950.

Here, Whiting [39] presents his perspective regarding a graded method of classifying patients according to their rehabilitation potential using five hierarchical levels of ‘physical rehabilitation potential’: Class I (return to productive community life expected), Class II (return home expected but incapable of productive life), Class III (institutional life expected), Class IV (institutional life expected with assistance for some self-care activities), Class V (rehabilitation is not appropriate because the disease is rapidly progressing). Whiting also presents patient characteristics (e.g., diagnosis, motor ability, family support) clinicians should consider when predicting level of rehabilitation potential.

Two other articles from the 20th century [36,38], echo Whiting’s perspective of the rehabilitation potential of brain-injured individuals. Stonnington [38] underscores the importance of assessing rehabilitation potential, citing it as “an estimation of the potential for rehabilitation (that) will influence the structure of the therapeutic program and should give a realistic background to the setting of goals”. Peszczyński [36] and Stonnington [38] describe detailed patient characteristics that should be considered when clinicians judge a stroke patient’s rehabilitation potential and candidacy for rehabilitation. These early publications suggest rehabilitation potential relates to clinicians predicting an individual patient’s response to rehabilitation interventions (i.e., outcome).

The use of the term rehabilitation potential grew over time with 15 of the 18 studies targeting stroke or TBI patients published since 2000. Two different uses of the term rehabilitation potential can be found. First, rehabilitation potential continues to be used in reference to a prediction of the extent to which a patient is likely to improve with rehabilitation interventions [7,12,13,19,20,34,35,41,42,45]. Three separate definitions of rehabilitation potential consistent with the notion of prediction were found (see table 3).

The first two definitions suggest various factors influence rehabilitation potential, some being intrinsic to the person, whereas others consider external resources possibly affecting patient's rehabilitation potential. The definition in Bisson et al.'s [34] article refers to the patient recovering as near to baseline functioning whereas Johansen et al.'s [41] definition denotes restoring, keeping or even developing the best possible level of function and quality of life. Bisson et al.'s [34] definition also expands the nature of expected recovery since it refers not only to self-care or productive activities but also to social and academic functioning.

The second use of rehabilitation potential in documents published in the last two decades relates to patients' actual performance (or outcome) following rehabilitation interventions. Here authors suggest ways to optimize rehabilitation potential during rehabilitation [33] or discuss patient recovery with rehabilitation [37]. Other authors refer to rehabilitation potential as an indication of the effectiveness of therapy where rehabilitation potential is the measured improvement from admission to discharge. Here, authors suggest the rate of improvement from baseline is indicative of greater potential for rehabilitation [43]. Lin et al. [44] and Badriah et al. [40] further suggest the rate of improvement can be measured by calculating a ratio based on the Functional Independence Measure score at admission and discharge from inpatient rehabilitation.

In sum, the two uses of the term rehabilitation potential in recently published articles reflect two different concepts, the first focusing on predictions of how a patient will benefit from rehabilitation. Such predictions made by clinicians prior to admission to inpatient rehabilitation are used to determine patients' candidacy for rehabilitation and to set realistic rehabilitation goals. The second focuses on actual improvement observed after a patient receives inpatient rehabilitation interventions and is more closely related to the concepts of rehabilitation effectiveness and rehabilitation outcome. In a study investigating the meaning of rehabilitation potential from

clinicians' point of view, Burton et al. [12] warns that rehabilitation potential "differs from rehabilitation outcome which is dependent on the availability and receipt of clinically effective interventions". Furthermore, looking back at the initial dictionary definition, potential refers to what is *possible* as opposed to the *actual*. One might argue that using the term rehabilitation potential would be more appropriate when predicting improvement in the context of referral to post-acute brain injury rehabilitation than measuring actual improvement in the context of inpatient rehabilitation interventions. Hence, in this concept analysis we refer to rehabilitation potential as clinicians' prediction of the extent to which a patient will benefit from rehabilitation interventions.

Defining attributes

Defining attributes are characteristics commonly encountered in the concept's definitions or frequently used to describe it [31]. The following defining attributes of rehabilitation potential were extracted from publications included in our analysis.

- 1. The concept of rehabilitation potential emerges from the clinician's interpretation of a patient's characteristics and the characteristics of the health care environment in which the clinician is working.*** Publications reviewed suggest that determining rehabilitation potential is based on clinicians' interpretations, i.e., clinicians' analysis of empirical information gathered during assessment [12,13,19,20,34,36,38,41,42]. Unsurprisingly, patient characteristics (e.g., severity of the injury, family support) are always reported to influence clinicians' judgments. Some authors also point to the influence of the health care environment and clinicians' characteristics[12,13,19,20,34]. However, publications in this review provide little information on how clinicians interpret these factors to draw conclusions on a patient's rehabilitation potential (i.e., the clinicians' thought processes).

2. ***Clinicians' interpretations aim to predict how a patient will improve with rehabilitation.***

For a patient to be considered as having rehabilitation potential, improvement is generally expected at the level of body functions and at the level of daily activities [12,13,34]. However, Enderby et al. [20] call for caution as “there may be confusion between predicting natural unassisted recovery and predicting responsiveness to targeted rehabilitation”. Determining rehabilitation potential should therefore not only consider the possibility of spontaneous recovery but also clinicians' predictions regarding the type of rehabilitation interventions most likely to assist patients in achieving optimal functioning. Authors therefore often report that determining rehabilitation potential involves identifying appropriate rehabilitation goals patients can be expected to achieve with rehabilitation interventions.

3. ***Rehabilitation potential is a multi-level concept.*** In 1950, Whiting argued that clinicians

should attempt to classify a patient's rehabilitation potential on a graded scale [39]. Oyeyemi et al. [45] also describe a hierarchical way of classifying patients (low, intermediate, high, higher level) while Johansen et al. [41] mention that a certain level of rehabilitation potential is required for patients to be admitted to an inpatient rehabilitation facility. These findings suggest rehabilitation potential is not dichotomous i.e., it has more than two dimensions and it may therefore be misguided to simply report a patient as having or not having rehabilitation potential. It may be more relevant to report a patient's level of rehabilitation potential on a hierarchical scale with each level falling along a continuum.

4. ***Rehabilitation potential can change over time.*** Some authors mention that the level of

rehabilitation potential can change over time depending on recovery or changes in medical status. For example, patients with more severe injuries may initially present with poor rehabilitation potential but their potential may emerge or improve over time [12,19,20].

Early prediction has been said to be difficult in some cases [19] and opportunity for re-assessment of rehabilitation potential should be possible, as well as flexibility in the timing of rehabilitation as the person's condition evolves over time [20].

Antecedents and consequences of the concept

Walker & Avant [31] describe antecedents as events occurring or in place before the concept can emerge whereas consequences are events that are the results of the concept. These must be distinguished from defining attributes. This step can help better frame the concept and shed light on the social context in which the concept occurs. Below we describe antecedents followed by consequences extracted from the literature reviewed.

For the concept of rehabilitation potential to emerge, it requires at least two people: someone with a brain injury with impaired body functions and limitations in activities or participation and a clinician conducting an assessment and providing recommendations regarding referral to post-acute rehabilitation. Another antecedent is the local health care environment in which assessments are conducted and rehabilitation interventions are offered (see figure 2). Many patient characteristics influence level of rehabilitation potential. These include, but are not limited to age, type of injury, comorbidities, mood, motivation, mental functions, endurance, observed improvement, pre-injury level of independence in activities, personality, home environment, family support, and the patient's ability to carry-over what is taught [7,12,13,20,35,36,38,39,51]. Clinicians' characteristics also influence their interpretation of rehabilitation potential. These include their professional field of expertise, experience working with ABI patients and knowledge of scientific evidence [12,13,19]. Furthermore, the health care system (e.g., the availability and accessibility of post-acute rehabilitation services in the continuum of care) in which clinicians practice also influences their assessment and interpretation of rehabilitation potential

[12,13,19,20,34]. In the context of cost-effectiveness in health care, limited post-acute rehabilitation services force clinicians to select patients thought to have the most rehabilitation potential and who are the most likely to improve with rehabilitation services.

Regarding consequences, clinicians' interpretations of rehabilitation potential impact the patient, the clinician and society in general. The most obvious consequence is the impact on the patient as he/she may be offered or refused access to post-acute rehabilitation. Some authors also mention that assessment of rehabilitation potential can guide the planning of appropriate rehabilitation interventions (e.g., setting realistic rehabilitation goals, determining when interventions will start and their intensity) [12,19,20]. Clinicians report that determining rehabilitation potential involves trying to provide rehabilitation to everyone who needs it without wasting limited resources [13]. Therefore, assessing and determining rehabilitation potential can lead to clinicians feeling emotional strain (e.g., feeling torn if the patient is considered as having poor rehabilitation potential and therefore refused access to post-acute rehabilitation) [12,19]. A more global consequence is the impact on society. From an economic perspective, some authors point to long-term cost savings if rehabilitation potential is assessed adequately and appropriate patients are given the opportunity of access to post-acute rehabilitation [20,39].

Figure 2 provides an illustrated summary of the antecedents, defining attributes and consequences of rehabilitation potential.

Identifying empirical referents

Empirical referents consist of observable phenomena by which defining attributes are recognized. These can be useful for eventual tool development but are not tools in themselves; they are means by which one can recognize the defining attributes [31]. Regarding tool development, no

standardized tools were found in the literature specifically assessing the concept of rehabilitation potential.

Identifying empirical referents for the concept of rehabilitation potential is challenging because the defining attributes cannot be directly observed or measured, but rather refer to interpretations occurring in clinicians' thought processes. This suggests that rehabilitation potential is a concept rooted in clinical reasoning. In medical and rehabilitation literature, clinical reasoning has often been illustrated by decision trees (i.e. algorithms) developed, for example, to standardize rehabilitation assessments [52]. Therefore, we purport that a standardized assessment of rehabilitation potential could take the form of an algorithm, but it would have to explicitly illustrate the type of patient and the characteristics of the local health care environment to be considered. These elements are antecedents to the concept of rehabilitation potential and they need to be clearly identified given their influence on clinicians' interpretations. Because of important variations in local health care environments, illustrating important elements of this environment (e.g., local admission criteria for inpatient rehabilitation) is essential. The algorithm should also include the nature of expected improvement with rehabilitation (e.g., improved independence in self-care or mobility vs improved independence in managing household tasks vs social participation). Finally, the algorithm would have to lead to a decision about the patient's level of rehabilitation potential illustrated on a hierarchical scale.

An operational definition of rehabilitation potential

Given findings from this concept analysis illustrated in Figure 2, we suggest the following operational definition of rehabilitation potential: "Rehabilitation potential consists of a clinician's prediction of a patient's expected improvement with rehabilitation interventions. Clinician prediction is based on patient characteristics as well as the local health care environment and is

shaped by the clinician's personal characteristics. Rehabilitation potential falls along a continuum and can change over time".

Discussion

Using scoping review and concept analysis methods, it was possible to gain a better understanding about the evolution of the concept of rehabilitation potential enabling us to propose a tentative operational definition. Findings suggest that rehabilitation potential is a concept rooted in clinical reasoning that appears to be influenced by patients' characteristics and elements related to how health care services are organized. Foster and Tilse presented in 2003 a conceptual model for understanding post-acute care referral following TBI [14]. Although they do not use the term rehabilitation potential, their model illustrates how patient characteristics and characteristics of the context of care influence clinicians' referral decisions and how clinicians' interpretation of these factors is at the heart of referral decisions. Our findings are consistent with Foster and Tilse's (2003) model but further suggest that clinician interpretation is aimed at predicting how patients might improve with post-acute rehabilitation. However, much remains unknown regarding how clinicians interpret these factors when attempting to predict if patients will benefit from rehabilitation interventions. How do clinicians select and prioritize patient characteristics to assess when determining rehabilitation potential? How do characteristics of the health care environment impact clinicians' interpretation of rehabilitation potential? These questions should be addressed in future research to enable the development of a standardized algorithm illustrating clinical reasoning underlying the assessment and determination of rehabilitation potential.

Findings from this work further suggest that rehabilitation potential is not a dichotomous concept but rather a continuous one most likely involving a few hierarchical levels. Consequently,

it may not be appropriate to say a patient has or does not have rehabilitation potential as patients may demonstrate varying levels of rehabilitation potential. Oyeyemi & Sedenu [45] suggested a multi-level scale illustrating patients' potential for improvement and each level is matched with a set of appropriate interventions. For example, patients considered to have higher levels of potential for improvement would be offered interventions addressing complex activities such as managing community travel, whereas interventions such as range of motion exercises would be offered to patients considered to have low potential for improvement. If rehabilitation potential is recognized along a continuum, then targeted rehabilitation services could be offered and matched to patients' level of rehabilitation potential in a patient-centered way. Severely disabled patients' access to post-acute rehabilitation services would be adapted to their conditions. Such services are lacking in many health care systems despite a growing literature demonstrating these patients can improve on various levels [6,7] and that rehabilitation of severely disabled patients is cost-effective, generating billions of dollars in long-term savings [53]. Furthermore, one could question if improved independence in daily activities should be the sole goal of post-acute rehabilitation. In the borderline case example presented above, rehabilitation goals related to participation and quality of life are presented as worthwhile goals to pursue with patients with low levels of rehabilitation potential. These reflections can be extended to patients with prolonged disorders of consciousness or locked-in syndromes who do not have the potential to improve in terms of independence in daily activities but may benefit from rehabilitation to enhance participation and quality of life. Viewing rehabilitation potential along a continuum may therefore reconcile this concept with the World Health Organization's definition of rehabilitation which considers "a set of measures that assist individuals who experience, or are likely to experience, disability to achieve and maintain optimal functioning in interaction with their environments"[47]. Findings also suggest rehabilitation potential can change over time depending on recovery or changes in medical

status. Clinicians should thus consider the possibility of reassessing rehabilitation potential and modifying recommendations regarding appropriate rehabilitation interventions accordingly. As Enderby et al. [20] argue, clinicians should focus on “what type of rehabilitation is indicated, at what intensity, by whom, where and when”?

With the ageing of the population, the number of brain injuries is expected to rise. Pressure for access to post-acute rehabilitation will continue to increase, exerting growing pressure on clinicians assessing rehabilitation potential and determining which patients are appropriate candidates for rehabilitation. It is therefore not surprising that the term rehabilitation potential has been used more frequently in publications over the last decade. The concept of rehabilitation potential becomes more relevant as demand placed on the system and cost-effectiveness issues rise. In countries purporting to have a universal public health care system, patients might expect the right to access services they need. But in reality, in places where inpatient rehabilitation is the only post-acute rehabilitation service available, we would argue that universal accessibility to post-acute rehabilitation does not truly exist as not all patients have access to such high-cost services. It may be utopic to think that all brain-injured patients will have access to inpatient rehabilitation and that intensive rehabilitation is best suited to meet the needs of all patients. Researchers, policy-makers and service providers need to explore more creative and cost-effective solutions if access to rehabilitation is to become more equitable. Recognizing rehabilitation potential as a multi-level concept falling along a continuum might help in considering that different levels or intensity of rehabilitation services are required to meet the needs of all or most patients.

Finally, the term rehabilitation potential is sometimes used when referring to rehabilitation outcome. However, our analysis suggests rehabilitation potential and rehabilitation outcome should be viewed as two distinct concepts. Rehabilitation potential should be used when referring to the clinician’s prediction of expected improvement with post-acute rehabilitation whereas

rehabilitation outcome should be used when referring to the measurable improvement a patient makes after receiving a certain type of rehabilitation intervention. Numerous studies have investigated various types of rehabilitation outcomes after brain injury rehabilitation and many assessment tools have been developed to measure rehabilitation outcomes. However, fewer studies have investigated the concept of rehabilitation potential itself. In the context of patient referral to post-acute rehabilitation, where acute-care clinicians or rehabilitation consultants are asked to predict if a particular patient will benefit from rehabilitation, developing an algorithm that considers the defining attributes of rehabilitation potential, as presented in this article, may lead to improved and more standardized clinical decision making regarding referral to post-acute rehabilitation.

Limitations

A general critique about concept analysis methods has been the lack of depth in the analysis of concepts. Some have even questioned the place of concept analysis in advancing knowledge influencing clinical practice [54]. However, clarifying the current knowledge about a concept remains an initial step in framing what clinicians should be assessing, and for eventually developing instruments to validly measure intangible or not readily observable concepts [23,24]. We chose to use a concept analysis methodology because initial engagement with relevant literature led us to believe that, although the concept of rehabilitation potential is commonly referred to in clinical practice, few authors have defined this concept and researchers have not empirically tested it, making an in-depth analysis (e.g. quality appraisal of studies) inappropriate at the present time. However, results of this concept analysis should not be viewed as a definitive end product but rather a call for continued clarification of what clinicians should be assessing when

determining rehabilitation potential and deciding which patients should access post-acute rehabilitation. Furthermore, we deliberately omitted to include case studies in this publication of our concept analysis. Case studies in concept analysis have been criticized because they generally lack rigor and are not developed based on an adequate data base [32]. We therefore felt they were not suitable for the scientific perspective of this publication. We however acknowledge that they may be of pedagogical interest for publication of a more academic nature. Although we searched three of the most comprehensive databases in health sciences, some references or information might also have been overlooked as we did not conduct a grey literature search. Also, though we did not conduct the optional consultation exercise suggested in scoping review methodology, we recognize that further research addressing how rehabilitation potential is conceptualized by clinicians and policy-makers might help in further clarifying the concept in particular health care environments. Though we recognize this work is an initial step towards conceptualizing rehabilitation potential, and that the end product is tentative, we are nonetheless convinced of its importance in advancing this field of inquiry.

Conclusion

This research proposes a current conceptualization of rehabilitation potential for stroke and TBI patient referral to post-acute rehabilitation. The proposed operational definition suggests four defining attributes of rehabilitation potential which should be considered in clinical decision-making when determining a patient's rehabilitation potential and recommending appropriate post-acute rehabilitation interventions. Further research is required to continue investigating how clinicians assess rehabilitation potential and to eventually develop a standardized assessment of rehabilitation potential that may assist in more equitable access to post-acute rehabilitation.

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Declaration of interest

The authors report no conflicts of interest.

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Table 1. Combining scoping review and concept analysis methodologies

Scoping review	Concept analysis	Combined methodology
Stage 1: Identifying the research question	Step 1: Select a concept Step 2: Determine the aims or the purposes of the analysis	Selecting a concept and determining the aim of the analysis (reported in the introduction)
Stage 2: Identifying relevant studies		Identifying relevant publications
Stage 3: Study selection		Selecting publications
Stage 4: Charting the data	Step 3: Identify all uses of the concept	Charting and analyzing the data
Stage 5: Collating, summarizing and reporting the results	Step 4: Determine the defining attributes	<ul style="list-style-type: none"> Numerical analysis: country, year of publication, type of publication, target patient population, professional groups involved in assessing rehabilitation potential
<ul style="list-style-type: none"> Descriptive numerical analysis Qualitative thematic analysis 	Step 5: Identify a model case	<ul style="list-style-type: none"> Concept analysis: uses of the concept, defining attributes, antecedents and consequences, empirical referents
	Step 6: Identify additional cases	
	Step 7: Identify antecedents and consequences	
	Step 8: Define empirical referents	
Stage 6: optional consultation exercise		

Figure 1. Process of publication selection

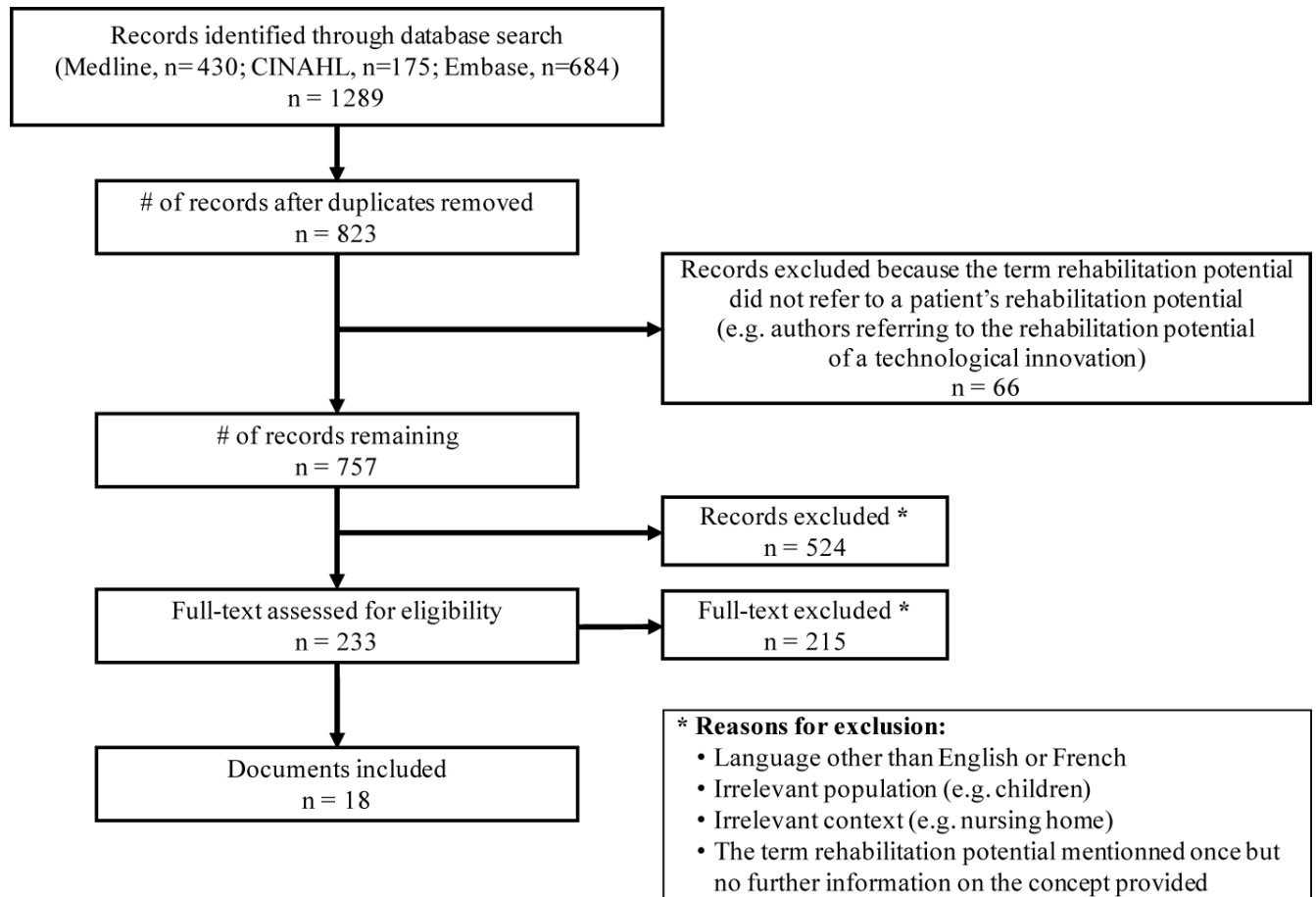


Table 2. Summary of the characteristics of the included publications

Type of data	Characteristics
Authors' country	United Kingdom (n=5) United States of America (n=4) Canada (n=3) Norway (n=3) Japan (n=1) Germany (n=1) Taiwan (n=1)
Year of publication	1950 – 1970 (n=2) 1970 – 1999 (n=1) 2000 – 2009 (n=3) 2010-2018 (n=12)
Type of publication	Perspective article (n=8) Original research study (n=10) <ul style="list-style-type: none">• Qualitative (n=3)• Quantitative (n=7)
Target patient population	Stroke (n=13) TBI (n=2) ABI (stroke and TBI) (n=1) Other (including stroke or TBI) (n=2)
Professional groups involved in assessing patients' rehabilitation potential as reported by authors	Physician (n=7) Physiotherapist (n=7) Occupational Therapist (n=6) Nurse (n=4) Speech Language Pathologist (n=3) Neuropsychologist/psychologist (n=2) Rehabilitation assistant (n=1) Interdisciplinary team (not all professionals specified) (n=5)

Table 3. Definitions of the term “rehabilitation potential” in the context of referral to post-acute brain injury rehabilitation

Authors	Proposed definition of rehabilitation potential
Bisson et al. [34]	A set of intrinsic and extrinsic resources that a patient possesses in order to recover, as soon as possible, a level of personal, social, academic or professional functioning that is as close as possible to the patient’s level of function prior to the accident and that can be maintained over the long term.
Johansen et al.[41]	The physiological and psychological possibilities of the patient to restore, keep or develop the best possible level of function and quality of life.
Lam Wai Shun et al. [13]	Estimate which takes into account a set of factors that enable a person with a disability following an ABI to participate in a rehabilitation program and to demonstrate measurable functional gains during the rehabilitation episode of care.

Figure 2. Illustration of the antecedents, defining attributes and consequences of the concept of rehabilitation potential

