**Title:** Factors influencing clinicians' decisions to refer or admit acquired brain injury patients to post-acute rehabilitation: A Scoping Review

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**Factors influencing clinicians' referral or admission decisions for post-acute stroke or traumatic brain injury rehabilitation: A Scoping Review**


## Abstract

Demand for post-acute stroke and traumatic brain injury (TBI) rehabilitation outweighs resource availability. Every day, clinicians face the challenging task of deciding which patient will benefit or not from rehabilitation. The objectives of this scoping review were to map and compare factors reported by clinicians as influencing referral or admission decisions to post-acute rehabilitation for stroke and TBI patients, to identify most frequently reported factors and those perceived as most influential. We searched four major databases for articles published between 1946 and January 2021. Articles were included if they reported clinician's perceptions, investigated referral or admission decisions to post-acute rehabilitation and focused on stroke or TBI patients. Twenty articles met inclusion criteria. The International Classification of Functioning, Disability and Health framework was used to guide data extraction and summarizing. Patient-related factors most frequently reported by clinicians were patient's age, mental status prior to stroke or TBI and family support. The two latter were ranked amongst the most influential by clinicians working with stroke patients, whereas age was ranked of low importance. Organizational factors were reported to influence decisions (particularly availability of post-acute care services) as well as clinicians' characteristics (e.g., knowledge). Moreover, clinicians' prediction of patient outcome ranked amongst the most important driver of referral or admission

decisions by clinicians working with stroke patients. Findings highlight the complex nature of decision-making regarding patient selection for rehabilitation and provide insight on important factors frontline clinicians need to consider when having to make rapid decisions in high-pressured acute care environments.

**Keywords**

stroke, traumatic brain injury, rehabilitation, clinical decision-making, referral and consultation, health services accessibility

## Introduction

With an estimated 86 million individuals having sustained a stroke worldwide and 49 million a traumatic brain injury (TBI), these two populations represent the most common acquired brain injuries[1] and are leading causes of severe disability in adults[2]. Survivors face a myriad of consequences including physical disability, cognitive impairments, communication difficulties, fatigue, and depression. Rehabilitation is key to helping patients achieve optimal functioning and live meaningful lives following injury[3], and a right according to the United Nations's Convention on the Rights of Persons with Disabilities[4]. However, the demand for post-acute rehabilitation appears to outweigh resource availability and only a certain number of patients are considered appropriate candidates for post-acute rehabilitation. With the aging population and the projected increase in the incidence of stroke and TBI over the next decades[5,6], pressure on post-acute rehabilitation services is expected to rise and clinicians will continue to be asked to make important decisions regarding allocation of limited rehabilitation services.

Many data-driven studies have investigated factors most predictive of discharge destination after acute hospitalization. Two systematic reviews suggest that greater age, severity of injury, and lower functional status post-stroke or post-TBI are associated with discharge to rehabilitation[7,8]. Other predictive factors include cognitive level post-stroke, presence of hemiparesis and urinary incontinence for stroke patients[8], and ethnicity, insurance coverage and acute care length of stay for TBI patients[7]. A systematic review of admission criteria to rehabilitation also found age, as well as pre and post-stroke functional level, to be consistently associated with patient selection for rehabilitation[8].

Although these reviews help us understand discharge patterns, important variations in access to post-acute rehabilitation persist[9-13] even when data-driven predictors of discharge disposition are taken into consideration[14]. Models of access to healthcare, such as the Behavioral Model of Health Services Use, posit that access cannot be solely explained by patient-related factors but rather the relationship between these factors and characteristics of the health care system[15]. However, these models provide limited explanation regarding the impact of clinicians' decision-making in the allocation of services. Clinicians' assessments and decisions are essential to referral or admission to post-acute rehabilitation. Therefore, gaining further knowledge of factors perceived by clinicians (i.e., acute care clinicians referring patients to rehabilitation as well as those admitting patients to rehabilitation) to influence patient selection for rehabilitation may provide insight into additional factors driving clinical decision-making. Furthermore, as referral decisions are often made in high-pressured acute care environments, a review of factors influencing referral or admission decisions may help clinicians prioritize assessments that can support early discharge planning while ensuring an equitable allocation of rehabilitation services.

This paper reports findings from a scoping review aiming to: (1) map and compare factors perceived by clinicians as influencing their decisions to refer or admit stroke and TBI patients to post-acute rehabilitation, (2) identify most frequently reported factors and (3) identify factors perceived as most influential.

## Methods

The initial research question was "What factors are perceived by clinicians to influence their decision to refer or admit adults with a stroke or TBI to post-acute rehabilitation?" This broad question was well suited to scoping review methodology since this methodology provides an overview of available evidence by mapping knowledge in a particular field of research[16]. Following Arksey and O'Malley's methodological framework[17] and Levac's et al. later recommendations[18], we systematically searched, selected, and synthesized current evidence. Methods and findings are reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews checklist[19].

***Research questions***

More specific questions raised during the iterative process embedded in the scoping review methodology were: (1) What are the similarities and differences in factors considered by clinicians working with stroke compared to TBI patients?; (2) What factors are most frequently reported?; (3) What factors are reported as being most influential?

***Searching for relevant articles***

Prior to the database search, two researchers, independent of our team but known experts in stroke and TBI rehabilitation, identified alternate search terms the team might have forgotten (i.e., 'eligibility for rehabilitation'). A pilot search was conducted in MEDLINE with a university rehabilitation science librarian (MG). A systematic search was then

conducted (1946 through January 2021) in the most comprehensive databases relevant to rehabilitation: MEDLINE, CINAHL, EMBASE and COCHRANE. MeSH terms and free-text terms were combined to search for articles pertaining to three key concepts: brain injuries AND referral or admission AND rehabilitation (see table 1 for combination of MeSH terms and see appendix for complete search strategies for all databases). The reference lists of articles that met inclusion criteria were also screened for additional articles.

*<Insert table 1 about here>*

***Article selection***

Articles were included if they: (1) were full-text articles written in English or French, (2) examined clinicians' perceptions and (3) focused on decisions related to the referral or admission of adult stroke or TBI patients from acute care to post-acute rehabilitation (i.e., inpatient rehabilitation including skilled nursing facility, outpatient rehabilitation, home or community rehabilitation). Articles reporting various types of research designs were included. Study selection process involved four steps. First, three reviewers (PL, SD, CM) independently screened titles and abstracts of a first set of 5% of randomly selected articles and discussed their choices as well as discrepancies to refine inclusion and exclusion criteria. Second, SD and CM independently applied the refined set of criteria to a second (5%) and third (5%) set of randomly selected abstracts until their agreement achieved 94% with a kappa of 0.71 (i.e., substantial agreement)[20]. Third, SD and CM independently

reviewed all remaining abstracts. Again, discrepancies were discussed, and in cases where agreement could not be reached, PL was consulted. In the final step, PL and SD proceeded to full-text review for final selection of included articles (see figure 1) .

***Data charting***

A data charting form was used to extract the following information: first author, year of publication, country where study was conducted, patient population studied, research objective relevant to the review question, research method. We also recorded which professionals participated in the studies and the clinical setting in which studies were conducted. We then extracted factors perceived as influencing clinicians' decisions to refer or admit stroke or TBI patients to post-acute rehabilitation. PL and SD independently extracted data from selected articles. The team met twice to compare findings, discuss discrepancies and update the data charting form. Early on, consistent data charting was challenging as study authors used many terms that could not easily be combined or summarized. We subsequently used the International Classification of Functioning, Disability and Health (ICF) to guide data extraction and analysis[21]. Use of the ICF enhanced the meaningfulness of groupings of factors while minimizing the risk of researcher bias when summarizing data. The ICF also provides a common language understood and used by clinicians and researchers from multiple disciplines.

***Data summary and synthesis***

This step involved three phases. First, a numerical analysis provided a descriptive summary of the extent, nature and distribution of articles. Second, a thematic analysis inspired by Braun and Clarke's methodology[22] was used to analyze and interpret data extracted from the articles. PL and SD read the full-text articles and generated initial codes using the ICF terminology. When data did not correspond to ICF components, they were given initial codes best reflecting data extracted. Codes were then grouped according to potential themes. Following several iterations and meetings with the research team's senior researchers, a summary of findings for each theme was produced. The third phase involved a frequency count (i.e., we counted the number of studies reporting each identified factor). A review article included in the thematic analysis was excluded from the frequency count because this review reported previously counted individual studies. We further examined a subsample of studies in which clinicians ranked factors according to the level of influence of these factors on their referral or admission decisions to obtain more insight on factors perceived most influential or important.

In accordance with recent scoping review methodology guidelines, and given the purpose of this review, quality appraisal of included studies was not indicated[16,19].

## Results

### *Nature and distribution of studies*

The database search yielded 5825 references. Once duplicates removed, 4669 references were screened for eligibility. Fifty-six eligible articles were read in full of which 18 met

inclusion criteria. Reference lists of these articles were also screened and two additional articles were identified for a total of 20 articles (see figure 1 for the flow chart and exclusion criteria).

*<Insert figure 1 about here>*

Table 2 provides descriptive information about the 20 articles. Findings suggest an international interest in the topic: Europe (8), Australia (6), United States of America (USA) (4) and Canada (2). The interest is quite recent as 15 of the articles were published between 2012 and 2019. Fourteen articles focused specifically on stroke, five on TBI and one on both populations. Nine primary research studies used qualitative methods (e.g., interviews), nine used quantitative methods (e.g., surveys), one used mixed-methods and one article was a systematic review. The perception of physicians was most frequently investigated as they participated in 14 of the 19 primary research studies. However, the perception of other clinicians involved in referral or admission to rehabilitation was also examined: nurses (9), occupational therapists (8), physical therapists (8), social workers (6) and speech-language pathologists (5). Thirteen articles focused on patient referral or admission to inpatient rehabilitation and seven on outpatient, home or community rehabilitation settings.

*<Insert table 2 about here>*

***Thematic analysis results***

Numerous factors influence clinicians' decisions to refer or admit stroke and TBI patients to post-acute rehabilitation. Guided by the ICF framework, three overarching themes emerged: patient-related, organizational, and clinician-related factors. Tables 3 to 5 provide comprehensive lists of factors included in these themes. Factors are categorized according to the ICF framework and frequency counts are provided. Data that could not be categorized using the ICF led to a fourth, more integrative theme relating to clinicians' predictions of patient outcome (seeTable 6). The text below focuses on the most frequently reported factors for each theme. Unfortunately, most studies did not specify if a factor had a positive or negative impact on decisions. However, in instances where some indication is provided, this is highlighted in the text. A final section presents findings extracted from the subgroup of studies investigating clinicians' ranking of factors perceived as most influential.

*Theme 1. Patient-related factors*

This was the most frequently encountered theme as clinicians in all studies reported patient characteristics influencing their decisions (see table 3). Clinicians working with stroke patients reported many pre-stroke patient characteristics influencing their decisions while patients' health prior to injury was the only pre-TBI characteristic reported. All studies reported numerous post-stroke or post-TBI patient characteristics..

*Pre and post-stroke characteristics*

Clinicians frequently considered *pre*-stroke body functions, particularly mental functions, in their decisions to refer or admit patients to post-acute rehabilitation. Few details are provided, but dementia was given as an example. Patients with pre-existing dementia are generally considered to have poorer capacity to change, limiting their potential to benefit from post-acute rehabilitation[23-26]. In more than a third of studies, clinicians also reported being influenced by patients' home environments. Hakkennes et al.[27] report that patients living at home with support are more likely to be perceived as candidates for inpatient rehabilitation, whereas Hayward et al.[28] mention that living in a residence with a high level of care prior to the injury is perceived as unfavorable for admission to inpatient rehabilitation.

With regard to *post*-stroke characteristics, level of support patients could receive at home after discharge from rehabilitation was the most frequently reported factor influencing referral or admission decisions[10,23,25,27-34]. Some studies more specifically indicated that supportive family members can facilitate eventual discharge home after rehabilitation and this usually favors admission to rehabilitation[10,23,32].

Patients' mental status [23,25,27-30,32-35] as well as patients' energy and drive (e.g., motivation)[10,23,25,27-30,32,34,35] are other frequently reported factors. Both affect patients' ability to engage in rehabilitation and make functional gains[23,25,32]. Regarding mental status, some authors reported more specific factors such as patients' level of insight[23,27,28,34], neglect[28,33,34], apraxia [28,33,34], orientation[10,33], attention[23,34], memory[34] or executive functions[34]. Lack of insight is perceived as limiting patients' potential to benefit from rehabilitation[23] whereas patients' acceptance of prognosis and of the goal of rehabilitation favors decisions regarding admission to inpatient rehabilitation[28]. Severe

neglect or apraxia disfavors admission to inpatient rehabilitation[28].

Other factors reported in about half of the studies include age[27-29,31-35], severity or type of stroke[23,25,28-30,32,33,35] and family members' attitudes (e.g., family expectations or advocacy)[10,25,27,28,32,34,35]. Regarding patients' age, younger patients are thought to be more suitable candidates for rehabilitation than older patients[28,32,33]. However, Luker et al.[32] indicate that age per se is not as key as other patient characteristics associated with age such as level of function prior to admission. As for stroke severity and type (ischemic vs. hemorrhagic), Luker et al.[32] reported people with milder stroke had better chances of receiving rehabilitation, and Lynch et al.[25] indicated patients with severe stroke with reduced alertness, hemiparesis and dysphagia tended not to be recommended for post-acute rehabilitation. Finally, family members' attitude also impacts referral or admission decisions. Patients whose families are assertive and advocate for rehabilitation are most likely to be discharged to post-acute rehabilitation[10,25,27,32]. Family members' expectations regarding what can be achieved in rehabilitation[28,34] and family preferences (e.g., proximity of rehabilitation to home)[35] also influence clinicians' decisions.

*Pre and post-TBI characteristics*

Only one *pre*-TBI characteristic was reported to influence clinicians' decisions: patient's health prior to injury. For example, history of pre-existing conditions such as behavior disorder, psychiatric illness or substance abuse disfavored referral and admission to post-acute rehabilitation[36-38].

Similar to stroke patients, age, mental status and family support were amongst the most frequently reported *post*-TBI patient characteristics influencing decisions. Again,

older patients' potential for improvement is regarded as poorer, and clinicians report these patients as less likely to access post-acute rehabilitation[11,36,39]. In four of the six studies, clinicians reported considering patients' mental status[34,36,38,39]. However, little detail is provided except for Foster et al.[39] mentioning that patients' ability to learn reflects patients' cognitive functioning which favors referral to post-acute rehabilitation. Swaine et al.[36] report learning ability as a factor influencing referral or admission to post-acute rehabilitation. Consistent with studies on stroke patients, family support also influences clinical decisions regarding TBI patients[34,37-39]. A supportive family willing and capable of caring for the individual after rehabilitation facilitates clinicians' decisions[39]. Furthermore, more than half of the studies on TBI patients reported patients' medical status to be a key factor. Medical instability was a perceived barrier to referral or admission to rehabilitation[34,36-38].

*<Insert table 3 about here>*

*Theme 2. Organizational factors*

All 20 articles mention the influence of at least one factor related to the organization of health care services on clinicians' decision-making. Clinicians' decisions are made within the boundaries of available services. Table 4 presents organizational factors found to influence decision-making grouped in two general ICF-related categories: health care services and health care system. Sub-themes concern the impact of acute care services or post-acute rehabilitation services on decision-making.

*Health care services for stroke patients*

In half of the studies on stroke patients, clinicians working in acute care reported that the involvement of professionals from different disciplines influenced their referral or admission decisions[23-25,27,32,34,40]. While some clinicians mention that a multidisciplinary approach facilitates decision-making[34], others report that the lack of understanding of each professional's role and the lack of a collaborative approach made decision-making difficult[23,24]. In about a third of studies, clinicians reported that pressure for rapid bed turnover in acute care impacts referral decisions[23,24,32,34]. Clinicians in Burton et al.'s[23] study mention that pressure to discharge patients from the hospital can be a barrier to discussing issues relating to patients' rehabilitation potential. Clinicians also report limited time for assessment in acute care[24,34]. Various aspects relating to service organization within acute care further influence referral decisions[10,23,31,32,34]. For example, participants reported that poorly developed referral systems to allied health professionals in acute care can lead to long delays before patients are assessed and decisions about recommended care made[32].

The availability of post-acute rehabilitation services across the stroke continuum was reported in half of the studies. Six studies specifically mentioned the influence of inpatient stroke rehabilitation bed availability on decision-making[25,27,28,32,34,35]. While some clinicians reported that inpatient bed availability influences how they prioritize patients for referral to post-acute rehabilitation[32], others rated this factor of low importance[27], or reported it neither favored nor disfavored rehabilitation admission[28]. Geographic proximity between the rehabilitation facility and the patient's home was

reported to influence decisions in a majority of studies[10,23,28-31,35,40]. Patients living in rehabilitation facilitys' catchment areas facilitates referral or admission decisions. The network (i.e., relationship) between the acute care hospital and the rehabilitation facility was also reported as influencing decisions in about a third of the studies[10,29,30,35,40].

*Health care services for TBI patients*

Similar organizational factors influence decision-making of clinicians working with TBI patients. Clinicians working in acute care frequently reported pressure for bed turnover[34,37,39] and a multidisciplinary approach[34,39] having an impact on decisions related to referral to post-acute rehabilitation. Moreover, the lack of availability of post-acute care rehabilitation services to meet patients' needs was also reported as an important factor that can result in inappropriate discharge decisions[11,34,37,39]. Competence of the post-acute rehabilitation care providers to deliver specialized services (e.g., tracheostomy care) was also mentioned as influencing referral[11,34].

*Health care system for stroke and TBI patients*

Overall, factors related to the general health care system were less often reported by clinicians. However, issues related to insurance coverage (e.g., insurance provider determining threshold for rehabilitation admission) was said to impact clinicians' decisions in four studies (three were conducted in the USA[33,35,38] and one in Germany[10]).

*<Insert table 4 about here>*

*Theme 3. Clinician-related factors*

There is emerging evidence that clinicians' personal characteristics influence decisions for post-acute rehabilitation (see table 5 for a complete list).

*Professional field of practice*

Clinicians' professional field of practice shapes their assessment of patients' rehabilitation potential and consequently influences their recommendations for post-acute rehabilitation[26,34]. Occupational therapists in Lam Wai Shun et al.'s (2017) study mentioned that knowing the strengths and limits of their expertise guided them to focus on assessing factors within their field of practice. However, clinicians reported that decision-making can be challenging when professionals from various disciplines have different attitudes about rehabilitation potential[24]. Also, some professional groups may have more influence than others on post-acute care discharge decisions[35].

*Knowledge*

Clinicians possess various forms of knowledge influencing decisions for post-acute rehabilitation[26]. Experiential knowledge, such as clinicians' prior experiences working with brain-injured patients, influences assessment of patients' rehabilitation potential[24,34]. Clinicians have also voiced that considerable clinical experience is required to predict discharge destination from acute care[32]. Knowledge of scientific evidence (e.g., awareness of evidence-based practices or clinical practice guidelines) and of services in the continuum also influence recommendations for post-acute rehabilitation[32,34]. For example, clinicians

reported they must be cognizant of the admission criteria of inpatient rehabilitation facilities to judge if a patient is a suitable candidate[34].

*Ethical sensitivity*

Clinicians' sense of ethics was found in a few studies to influence decisions[25,32,34] and was often expressed as a tension between recommending rehabilitation to those who need it, or deserve it, while also being aware that limited rehabilitation resources force clinicians to triage patients.

*<Insert table 5 about here>*

*Theme 4. Clinicians prediction of patient outcomes based on an analysis of patients' characteristics and organizational factors.*

Below are factors that could not be categorized in previous themes nor in any ICF category (see table 6).

*Predicting recovery*

In half of the studies, patient likelihood of recovery influences referral or admission decisions for stroke[24,25,29-31,34,35,40] and for TBI patients[34,37,39]. Clinicians' perception of patients' potential to recover has been associated with clinicians' interpretation of patient factors (e.g., functional status and time since injury)[39]. However, clinicians also report feeling organizational pressures influence how they assess and perceive patients' potential to recover (e.g., limited time for assessment because of pressure to free up beds)[34,39].

Further, clinicians predict patient outcomes based on their past experiences or knowledge of scientific evidence[34]. Naturally, clinicians more consistently discuss referral to rehabilitation when patients are expected to recover[25].

*Predicting discharge destination after rehabilitation*

In half of the studies on stroke patients and in one TBI study, clinicians reported referral or admission to rehabilitation was influenced by clinicians' prediction of patients' discharge destination after rehabilitation[10,25,29-32,35,40]. Stroke patients expected to return home or to a community-based environment after rehabilitation are usually considered better rehabilitation candidates[25,30,31,35].

*<Insert table 6 about here>*

*Most influential factors*

*Studies focusing on stroke patients*

In three studies, authors presented 15 predetermined factors to clinicians from different disciplines who ranked the influence of each factor on their decisions [29,30,35]. Table 7 describes study participants and lists the 15 factors, as well as their rankings.

Clinicians' prognosis of patient's functional outcome is the only factor rated in the top five most influential factors across all studies. Physiatrists, occupational therapists and physical therapists ranked this factor as the single most important factor influencing their decisions. Pre-stroke functional status and stroke severity are other factors frequently

ranked in the top five. Although these findings provide insight into important factors to consider when determining patients' candidacy for post-acute rehabilitation, authors do not define "functional outcome" or "functional status". It is unclear if authors and clinicians refer to these terms in relation to body functions or to patients' ability to perform activities such as mobility or self-care.

Two studies investigated clinicians' perceptions of the most influential factors by asking them to rank factors that favor or disfavor admission to inpatient stroke rehabilitation[27,28]. Hakkennes et al.[27] included 15 predetermined factors in their questionnaire to rehabilitation assessors (i.e., consultants, registrars and geriatricians) whereas Hayward et al.[28] included 54 predetermined factors in their questionnaire to consultant medical officers (i.e., geriatricians, rehabilitation physicians and medical physicians). Table 8 lists the top five factors perceived as favoring and disfavoring admission to stroke inpatient rehabilitation.

Findings from the two studies suggest that pre-stroke mental functions as well as home environment are very influential. Hayward et al.[28] more specifically indicated that patients having no pre-morbid cognitive impairments are more likely to be admitted to inpatient rehabilitation. Their results also indicate that patients living in high-level residential care are less likely to be admitted to inpatient rehabilitation.

*Studies focusing on TBI patients*

One study asked physicians working with TBI patients to rank the importance of five organizational factors on patient referral decisions[11]. Distance of the post-acute facility from patients' homes was the most important organizational factor followed by availability

of post-acute facilities at short notice, availability of specialized neurorehabilitation, quality of care and institutional funding.

*<Insert table 7 about here>*

*<Insert table 8 about here>*

## Discussion

Clinicians report numerous factors influencing their decisions to refer or admit stroke and TBI patients to post-acute rehabilitation. Although patient characteristics are, unsurprisingly the most often reported factors considered, other elements related to the organizational context and clinicians' own characteristics also influence their decisions. Results are consistent with prior research investigating patient access to post-acute rehabilitation[26,41]. However, our findings highlight a fourth factor of importance rarely included in data-driven prediction studies or in literature on access to rehabilitation, i.e., clinicians' prediction of patient outcomes. Physiatrists, occupational therapists and physical therapists ranked this factor as the single most important factor influencing decisions[29,30]. In their review, Longley and al.[26] also reported this factor, calling it ″predictions about recovery/discharge″ and classified it within patient-related factors without providing the rationale for this categorization. Using the ICF to identify and group factors, we observed that data pertaining to predictions about patient outcome did not fit within ICF categories. This finding suggests that predictions about patient outcome cannot solely be considered a patient-related factor. We therefore argue that, in order to predict

outcome, clinicians interpret patient characteristics guided by the knowledge they possess and are influenced by the characteristics of the organization in which they practice[34,42,43]. For example, clinicians, cognizant of evidence-based rehabilitation interventions, will consider this knowledge in their prediction of what a patient may be able to achieve with rehabilitation. Clinicians' predictions are also influenced by the organizational context such as the type and availability of post-acute rehabilitation services within the continuum of care. For example, in a context where slow stream rehabilitation is not available, clinicians' predictions of outcome for patients with significant disability might be less optimistic and clinicians might feel these patients do not meet intensive inpatient rehabilitation admission criteria. In line with Foster et al.'s conceptual model of post-acute care referral, clinicians' interpretations of patient and organizational factors appear to be key in explaining referral patterns to post-acute rehabilitation[42]. Findings highlight the complex nature of decision-making and the pivotal role of clinical reasoning in decisions regarding allocation of rehabilitation services.

As for patient-related factors, age was frequently reported to influence decision-making by clinicians working with stroke and TBI patients. However, age was not ranked amongst the most important factors influencing decision-making for stroke patients. Pre-stroke function (and more specifically mental function) was frequently reported and highly ranked by clinicians. Therefore, age per se might not be of central importance but rather factors associated with aging, such as mental function or level of activity prior to injury. In contrast, clinicians working with TBI patients did not report pre-TBI function as a factor of influence. Given that TBI patients are on average much younger, clinicians working with TBI patients less often encounter patients with impaired pre-TBI function that pose a

significant barrier to rehabilitation.

Patients' mental functions after injury was frequently reported as influencing clinicians' decisions. However, there is no consensus regarding the importance of this factor on decision-making as clinicians in three studies ranked mental status post-stroke of low importance[29,30,35] whereas another study found post-stroke mental function to be the second most influential factor disfavoring admission to inpatient rehabilitation of severe stroke patients[28]. Nonetheless, there is strong evidence that various aspects of mental function can improve with rehabilitation in stroke and TBI[44]. Improved level of independence has been observed secondary to post-acute rehabilitation even in patients with the most impaired mental functions. This may partly explain why some clinicians do not consider this factor to greatly influence their referral or admission decisions, as impaired mental functions are considered by many as "treatable", even in the most severe cases.

A third factor frequently reported to influence clinicians' decisions is the availability and capacity of the family to care for the patient following rehabilitation. This was reported by clinicians working with stroke and TBI and was ranked among the top 5 factors most important to consider by clinicians working with stroke patients. However, to our knowledge, most tools and algorithms seeking to determine patient candidacy for rehabilitation fail to consider the contribution of family support[45,46], a factor we suggest should be systematically addressed and considered when making referral or admission decisions.

Availability of post-acute rehabilitation services (in particular inpatient stroke rehabilitation bed availability) was the single most frequently reported organizational

factor influencing clinicians' decisions for both stroke and TBI. This is congruent with Buntin et al.'s (2005) findings suggesting that availability of inpatient rehabilitation or skilled nursing facilities in the USA is a major determinant of post-acute care use[47]. However, in this scoping review, clinicians in some studies rated bed availability as being of low importance. This finding may be partly explained by studies in this review having been conducted in different countries, in different practice settings and with varying health care systems (e.g., public vs private health care). However, results suggest that clinicians need an accurate understanding of the organizational context in which post-acute rehabilitation services are delivered within their clinical context to make appropriate referrals. In future studies, authors should provide more extensive information regarding the organization of services in which their studies are conducted, so readers can decide if results apply to their own clinical settings.

Findings from data-driven predictive studies suggest that insurance coverage and ethnicity are among the main predictors of discharge to post-acute rehabilitation for TBI patients[7]. However, in this scoping review, insurance was seldom reported as influencing decisions. Most studies were conducted in countries with universal health care, where access to post-acute rehabilitation does not depend on insurance coverage. In countries where rehabilitation services are covered in part by private insurance, clinicians report that insurance coverage influences their decisions and can hinder access to rehabilitation [33,35,38]. Furthermore, data-driven prediction studies, as well as studies of clinicians' perception of factors influencing referral or admission to post-acute rehabilitation, seldom reported payment policy as affecting clinical decision-making. However, in the USA, payment policy changes have been shown to affect practice patterns for post-acute care use[47]. It

remains unclear as to whether clinicians are aware of the impact of payment policy on their day-to-day decisions or how they perceive the influence of payment policy on their clinical decision-making. As for ethnicity, clinicians alluded to this factor in only one study conducted in an Australian hospital delivering services to indigenous patients[39]. Further research examining social and cultural determinants that prevent equitable access to post-acute rehabilitation is needed if we are to promote shared decision-making that considers the perspective of patients and families from various socio-cultural backgrounds.

***Limitations***

Finer comparisons of the findings (e.g. between countries, practice settings or professionals) were not performed because of the limited number of studies within each category, and because it was not possible in many studies to differentiate results within each category. Therefore, this scoping review provides general conclusions and trends that can serve as a first step in recognizing the multitude of factors affecting clinical decision-making; further research is required to make finer comparisons between different contexts. Also, studies included in the review were published between 1999 and 2019. Within these twenty years, major shifts in health care policies in many countries changed referral patterns to post-acute care (for example, the Balanced Budget Act of 1997 and the IMPACT Act of 2014 in the USA[48,49]). Clinicians' perceptions of how policies shape their decisions remain unclear as this factor was not reported in studies included in this scoping review. Also, because this scoping review examined studies investigating clinicians' perceptions, we did not consult stakeholders (as suggested by Arksey and O'Malley's [17])

as it would have been redundant to consult clinicians again. However, research examining program managers and policy-makers' perceptions may have provided more insight. More research is needed to gain insight into the perspective of patients and their families in regards to factors influencing their decision to engage or not in post-acute rehabilitation processes.

## Conclusion

Determining which patients are likely to benefit from post-acute rehabilitation is a highly complex decision for clinicians and a crucial one for patients. Students, novices and even experienced clinicians sometimes find such decision-making a daunting task. Findings suggest that some patient-related and organizational factors bear more weight in clinicians' decisions regarding referral or admission to post-acute rehabilitation. Clinicians' predictions of patient outcome is a key factor in decision-making but little is known regarding how clinicians make such predictions. Future research should clarify how frontline clinicians from various disciplines assess (e.g., measurement tools used) and interpret factors (i.e., clinical reasoning) when making rapid referral decisions in high-pressured acute care environments so that patients' opportunities for a fair chance at rehabilitation are not compromised.

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Table 1. Search strategy for Medline (see Appendix for all search strategies)

| Concept | MeSH terms/"keywords" |
|---|---|
| Brain injuries | (exp Craniocerebral Trauma OR exp Stroke/ OR exp Brain Neoplasms/ OR exp Stroke Rehabilitation/ OR "stroke" OR "poststroke" OR "cerebrovascular accident*" OR "brain injur*" OR "craniocerebral trauma*" OR "cerebral trauma*" OR "brain neoplasm*" OR "brain cancer*" OR "brain tumor*" OR "brain tumour*" OR "cerebral cancer*" OR "cerebral neoplasm*" OR "cerebral tumor*" OR "cerebral tumour*") |
| | AND |
| Referral or admission | (exp Referral and Consultation/ OR exp Patient Selection/ OR exp Clinical Decision-Making/ OR "patient* eligibility" OR "eligible for rehabilitation" OR "rehabilitation candidacy" OR "rehabilitation candidate" OR "rehabilitation triage" OR "patient selection for rehabilitation" OR "selection for rehabilitation" OR "referral to rehabilitation" OR "selecting for rehabilitation" OR "selection criteria for rehabilitation" OR ((patient* or inpatient*) ADJ2 (selection* OR selecting OR appropriate* OR triage*)) OR (("discharge placement" OR "discharge destination" OR "discharge" OR "selection process" OR "selection" OR "assessment" OR "patient selection" OR "triage" OR "referral" OR "suitability for inpatient" OR "candidacy" OR "candidate" OR "potential" OR "acceptance" OR "admission" OR "decision to admit" OR "selection criteria" OR "admission criteria" OR eligible OR eligibility) ADJ1 (rehabilitation)) OR ("admission criteria" AND "rehabilitation")) |
| | AND |
| Rehabilitation | (exp Rehabilitation/ OR exp Rehabilitation Centers/ OR "rehabilitation") |

Table 2. Descriptive information for each article included (n=20)

| First author (year of publication) | Country[a] (state/region) | Research objective of interest to this scoping review | Research approach (data collection method) | Sample of professionals whose perception was reported [b] | Practice setting of participating professionals |
|---|---|---|---|---|---|
| ***Stroke population*** | | | | | |
| Burton et al. (2015)[23] | UK (England) | Investigate the meaning of rehabilitation potential and its influence on clinical practice of clinicians working across the stroke pathway | Qualitative (Focus groups) | OT (n=6)<br>SLP (n=4)<br>PT (n=1)<br>Rehab Assist (n=1)<br>*(Total n=12)* | Inpatient stroke unit and community rehab (inpatient and outpatient rehab) |
| Cormier et al. (2016)[29] | USA | Investigate physiatrist referral preferences for post-acute stroke rehabilitation | Quantitative (Questionnaire) | PHY (n=86) | Inpatient rehab (including skilled nursing facility)<br>Outpatient rehab<br>Acute care long term hospital |
| Grimaud et al. (2005)[40] | France (Rennes) | Identify factors contributing to the quality of patient transfer from acute care to rehabilitation as perceived by clinicians referring or admitting patient to post-acute rehabilitation | Qualitative (Interviews; Delphi survey) | PHY (n=unknown)<br>NUR (n=unknown)<br>PT (n=unknown)<br>OT (n=unknown)<br>SW (n=unknown)<br>*(Total n =39)* | Acute care<br>Inpatient rehab |

| | | | | | |
|---|---|---|---|---|---|
| Gulfo et al. (2018)[30] | USA | Examine occupational and physical therapists' referral or rehabilitation admission practices for patients after acute stroke | Quantitative (Questionnaire) | PT (n=41)<br>OT (n=33)<br>*(Total n=74)* | Acute care<br>Inpatient rehab (including skilled nursing facility)<br>Outpatient rehab |
| Hakkennes et al. (2013)[27] | Australia (Victoria) | Identify factors considered important when making referral decisions to inpatient rehabilitation after severe stroke | Quantitative (Questionnaire) | PHY (n=unknown)<br>Other (n=unknown)<br>*(Total n=14)* | Acute care |
| Hayward et al. (2014)[28] | Australia (Queensland) | Identify factors favoring or disfavoring admission to inpatient stroke rehabilitation | Quantitative (Questionnaire) | PHY (n=21) | Acute care<br>Inpatient rehab |
| Kennedy et al. (2012)[31] | Australia (Victoria) | Explore factors influencing patient selection for admission to inpatient rehabilitation after stroke | Quantitative (Questionnaire) | PHY (n=17) | Inpatient rehab |
| Longley et al. (2018)[24] | UK (north of England) | Identify factors influencing clinicians' referral or admission | Qualitative (Interviews) | OT (n=11)<br>PT (n=4)<br>NUR (n=3) | Acute care<br>Inpatient rehab<br>Community rehab |

| | | | | | |
|---|---|---|---|---|---|
| | | decisions about stroke rehabilitation for people with pre-existing dementia/cognitive impairment | | PHY (n=2)<br>PSY (n=2)<br>SLP (n=1)<br>*(Total n=23)* | |
| Longley et al. (2019)[26] | UK | Identify factors influencing clinical decision-making about patient access to stroke rehabilitation | Systematic review | *(Total n= 292)* [c] | Acute care<br>Inpatient rehab<br>Community rehab |
| Luker et al. (2014)[32] | Australia (Adelaide, South Australia) | Describe factors that influence allied health professionals'referral decisions regarding recommended post-acute care for stroke patients | Qualitative (Interviews) | PT (n=5)<br>SLP (n=3)<br>DIET (n=3)<br>OT (n=2)<br>SW (n=2)<br>*(Total n=15)* | Acute care |
| Lynch et al. (2016)[25] | Australia (South and New South Wales) | Explore how clinicians working in acute care stroke units determine which patients to refer to rehabilitation services | Qualitative (Team meeting observations; Focus groups) | Team meeting sample:<br>PHY (n=8)<br>NUR (n=6)<br>SLP (n=4)<br>OT (n=3)<br>PT (n=3)<br>SW (n=2)<br>DIET (n=2)<br>Other (n=2)<br>*(Total n=30)* | Acute care |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Focus group sample:<br>NUR (n=8)<br>OT (n=7)<br>PT (n=7)<br>SLP (n=5)<br>SW (n=3)<br>DIET (n=2)<br>*(Total n=32)* | |
| Magdon-Ismail et al. (2016)[35] | USA (New England, New York, New Jersey) | Examine factors perceived to influence discharge planners referral decisions regarding post-acute care | Quantitative (Questionnaire) | NUR (n=unknown)<br>SW (n=unknown)<br>Other (n=unknown)<br>*(Total n=77)* | Acute care |
| Meijer et al. (2003)[33] | Netherlands | Identify potentially relevant prognostic factors that could be of importance when deciding a discharge destination from a hospital stroke unit | Qualitative (Modified delphi procedure) | PT (n=unknown)<br>PHY (n=unknown)<br>NUR (n=unknown)<br>SW (n=unknown)<br>Other (n=unknown)<br>*(Total n=23)* | Unspecified (key disciplines of the transmural stroke service chain) |
| Putman et al. (2007)[10] | Europe (UK Belgium Germany Switzerland) | Explore factors involved in admission decisions to European stroke inpatient rehabilitation units | Quantitative and Qualitative (Questionnaire and Interviews) | PHY (n=unknown) | Inpatient rehab |

***TBI population***

| | | | | | |
|---|---|---|---|---|---|
| Cnossen et al. (2017)[11] | Europe (20 countries) | Describe variations in referral processes for post-acute inpatient or outpatient care | Quantitative (Questionnaire) | PHY (n=unknown)<br>NUR (n=unknown)<br>*(Total = n=70)* | Acute care |
| Foster et al. (2004)[39] | Australia | Examine factors influencing referral to rehabilitation following TBI | Qualitative (Team meeting observations; Interviews) | PHY (n=5)<br>NUR (n=2)<br>Allied health professionals (n=9)<br>Rehabilitation practitioners (n=2)<br>*(Total n=18)* | Acute care<br>Inpatient rehab on site in acute hospital |
| Jourdan et al. (2019)[37] | Finland (Varsinais-Suomi) and France (Ile-de-France) | Investigate practitioners' opinion of decision-making on care transitions for TBI patients (including referral and admission decisions) | Qualitative (Interviews) | PHY (n=10) | Acute<br>Post-acute including inpatient rehab |
| Ivy & Nicholson (1999)[38] | USA | Examine how frequently prognostic and socio-economic variables are used when selecting TBI patients for admission to | Quantitative (Questionnaire) | PHY (n=unknown)<br>NUR (n=unknown)<br>Therapy providers (n=unknown)<br>*(Total n=19)* | Inpatient rehab |

| | | | | | |
|---|---|---|---|---|---|
| | | inpatient rehabilitation centers | | | |
| Swaine et al. (2018)[36] | Canada (Quebec, Ontario) | Examine the perception of health care providers regarding referral and admission criteria to brain injury inpatient rehabilitation | Quantitative (Questionnaire) | NUR (n=81)<br>PT (n=48)<br>OT (n=37)<br>SW (n=37)<br>SLP (n=22)<br>PHY (n=16)<br>NEUROPSY (n=20)<br>PSY (n=5)<br>Other (n=79)<br>*(Total n=345)* | Acute care<br>Inpatient rehab |
| ***Acquired brain injuries (Stroke and TBI)*** | | | | | |
| Lam Wai Shun et al. (2017)[34] | Canada (Québec) | Examine occupational therapists' perception of factors influencing their perception of acquired brain injury patients' rehabilitation potential for inpatient rehabilitation | Qualitative (Focus group) | OT (n=12) | Acute care<br>Inpatient rehab |

[a] Abbreviations : UK, United Kingdom; USA, United States of America

[b] Abbreviations: PHY: physicians; NUR: nurses; OT: occupational therapists; PT: physical therapists; SLP: speech language pathologists; Rehab assist: rehabilitation assistants; SW: social workers; PSY: psychologists; DIET: dietician; NEUROPSY: neuropsychologist

[c] Number of professionals participating in each study included in this review can be found in Longley et al.'s article [26].

Table 3. Patient-related factors perceived to influence referral or admission to post-acute rehabilitation and frequency counts

| ICF framework terminology | Terminology used by study authors | Number of studies reporting this factor | |
|---|---|---|---|
| | | Stroke (n=14[a]) | TBI (n=6[a]) |
| **PRE-STROKE or PRE-TBI patient characteristics (63%, n=12)** | | | |
| **Overall body functions or structures (53%, n=10)** | *Past-medical history, health prior to injury, history of substance abuse, comorbidities* | 21% (n=3) | 50% (n=3) [b] |
| | *Pre-stroke function* | 50% (n=7) | 0 |
| **Specific body functions (58%, n=11)** | | | |
| Mental functions | *Pre-morbid cognition, dementia, depression* | 50% (n=7) | 0 |
| Musculoskeletal and movement-related functions | *Pre-morbid physical functions* | 21% (n=3) | 0 |
| **Activity and participation (21%, n=4)** | | | |
| Overall activity and participation | *Pre-morbid functional independence, disability* | 21% (n=3) | 17% (n=1) |
| Communication | *Pre-morbid communication* | 7% (n=1) | 0 |
| Mobility | *Pre-morbid mobility* | 7% (n=1) | 0 |
| **Environment (26%, n=5)** | | | |
| Home environment | *Pre-morbid living situation, residence* | 36% (n=5) | 17% (n=1) |
| **Personal factors (5%, n=1)** | | | |
| Lifestyle prior to injury | *Lifestyle prior to injury* | 7% (n=1) | 0 |

**POST-STROKE or POST-TBI patient characteristics (100%, n=19)**

| | | | | |
|---|---|---|---|---|
| **Overall body functions or structures (63%, n=12)** | | | | |
| | | *Medical status, medical stability* | 36% (n=5) | 67% (n=4) |
| | | *Deficits, functional disabilities* | 21% (n=3) | 0 |
| **Specific body functions (84% n=16)** | | | | |
| Mental functions | Overall mental functions | *Cognition, cognitive functions* | 71% (n=10) | 67% (n=4) |
| | Energy and drive | *Motivation, participation, patient goal* | 71% (n=10) | 33% (n=2) |
| | Psychic stability | *Depression, behavioural problem, aggressive* | 42% (n=6) | 33% (n=2) |
| | Consciousness | *Consciousness, alertness* | 14% (n=2) | 17% (n=1) |
| | Insight | *Insight, acceptance of prognosis, self-awarness* | 29% (n=4) | 17% (n=1) |
| | Attention | *Attention* | 14% (n=2) | 17% (n=1) |
| | Visuospatial function | *Neglect* | 21% (n=3) | 17% (n=1) |
| | Sequencing complex movements | *Apraxia* | 21% (n=3) | 17% (n=1) |
| | Orientation | *Disorientation time and place* | 14% (n=2) | 0 |
| | Memory | *Amnesia* | 17%(n=1) | 33% (n=2) |
| | Higher-level cognitive functions | *Executive functions* | 7% (n=1) | 17% (n=1) |
| Sensory functions | Proprioceptive | *Position and movement sense* | 7% (n=1) | 0 |
| Speech functions | | *Speech* | 7% (n=1) | 0 |
| Neuromuscular and movement-related functions | Overall neuromuscular and movement-related functions | *Motor impairment, physical abilities* | 14% (n=2) | 33% (n=2) |
| | Muscle power | *Paresis* | 14% (n=2) | 17% (n=1) |
| | Balance (sitting balance) | *Sitting balance* | 14% (n=2) | 0 |
| Genitourinary functions | Urinary continence | *Urine continence* | 14% (n=2) | 0 |

| | | | | |
|---|---|---|---|---|
| Cardiovascular and respiratory functions | Physical endurance | *Fatigability, tolerance, stamina* | 29% (n=4) | 17% (n=1) |
| Digestive functions | Swallowing | *Swallowing* | 7% (n=1) | 17% (n=1) |
| Other | | *Observed progress, improvement during hospitalisation, demonstration of functional improvement, carry-over* | 42% (n=6) | 33% (n=2) |
| **Body structures (63%, n=12)** | | | | |
| | Nervous system - Brain | *Severity of injury, type of stroke* | 57% (n=8) | 33% (n=2) |
| | Respiratory system | *Tracheostomy status* | 0 | 33% (n=2) |
| **Activity and participation (73%, n=14)** | | | | |
| | Communication | *Communication, able to follow commands* | 36% (n=5) | 0 |
| | Mobility | *Mobility* | 36% (n=5) | 0 |
| | Self-care | *Ability to perform activities of daily living* | 29% (n=4) | 17% (n=1) |
| | Learning | *Minimal new learning, capacity to learn* | 0 | 33% (n=2) |
| | Handling stress | *Capacity to cope* | 0 | 17% (n=1) |
| **Environmental factors (79%, n=15)** | | | | |
| | Support and relationship | *Home social support, capacity of family to care* | 79% (n=11) | 67% (n=4) |
| | Family member attitudes | *Family expectations, assertiveness, advocacy* | 50% (n=7) | 17% (n=1) |
| **Personal factors (68%, n=13)** | | | | |
| | Age | *Age* | 57% (n=8) | 100% (n=6) |
| | Spoken language | *English as a second language can delay care* | 7% (n=1) | 17% (n=1) |
| | Cultural background | *Cultural appropriateness* | 0 | 17% (n=1) |

[a] Lam Wai Shun et al.'s (2017) study was included in the total number of articles for both stroke and TBI articles.
[b] Grey shades indicate factors reported in at least half of the studies.

Table 4. Organizational factors perceived to influence referral or admission to post-acute rehabilitation and frequency counts

| ICF framework terminology | Sub-themes emerging from data | Terminology used by study authors | Number of studies reporting this factor | |
|---|---|---|---|---|
| | | | Stroke (n=14[a]) | TBI (n=6[a]) |
| Health care services | **Acute care** | | | |
| | Multidisciplinary process of decision-making | *Multidisciplinary approach, allied health input* | 50% (n=7) [b] | 33% (n=2) |
| | Organization of professional services | *Absence of bed managers, hierarchy of decision makers, referrals within acute care* | 36% (n=5) | 17% (n=1) |
| | Pressure for bed turnover | *Pressures for timely transfer, limited time for assessment, short length of stay* | 29% (n=4) | 50% (n=3) |
| | Discharge or referral process to post-acute rehabilitation | *Discharge process, referral system* | 21% (n=3) | 17% (n=1) |
| | Expertise in stroke care | *Presence of stroke unit* | 21% (n=3) | 0 |
| | **Post-acute rehabilitation** | | | |
| | Availability of post-acute rehab services | *Resource deficiencies across the continuum, bed availability, availability of early supported discharge, availability of professional care* | 50% (n=7) | 67% (n=4) |
| | Geographical proximity of the post-acute rehab to the home | *Location of post-acute facility, patient's residence within the facility's catchment area* | 57% (n=8) | 17% (n=1) |

| | | | | |
|---|---|---|---|---|
| | Competence of the post-acute rehab team | *Specialized neurorehabilitation, capacity to manage the person with stroke* | 21% (n=3) | 33% (n=2) |
| | Network between acute care and rehab | *Affiliation, relationship with referring physician, availability of medical consultant from rehab* | 36% (n=5) | 17% (n=1) |
| | Admission criteria | *Admission criteria, policies* | 14% (n=2) | 17% (n=1) |
| | Constraints of the post-acute rehab service | *Inpatient census on rehab unit, prioritization of services, personnel-patient ratio* | 14% (n=2) | 17% (n=1) |
| | Quality of care | *Quality of care* | 21% (n=3) | 17% (n=1) |
| Health care system | Insurance | *Funding source, insurance* | 21% (n=3) | 17% (n=1) |
| | Efficiency in service delivery | *Efficiency (issues of cost, best use of resources)* | 0 | 17% (n=1) |

[a] Lam Wai Shun et al.'s (2017) study was included in the total number of articles for both stroke and TBI articles.

[b] Grey shades indicate factors reported in at least half of the studies.

Table 5. Clinician characteristics perceived to influence referral or admission to post-acute rehabilitation and frequency counts

| ICF framework terminology | Sub-themes emerging from data | Terminology used by study authors | Number of studies reporting this factor | |
|---|---|---|---|---|
| | | | Stroke (n=14[a]) | TBI (n=6[a]) |
| Health professionals | Professional field of practice | *Professional field of practice, professional discipline* | 21% (n=3) | 17% (n=1) |
| | Experiential knowledge | *Clinical experience* | 21% (n=3) | 17% (n=1) |
| | Knowledge of scientific evidence | *Research studies, clinical practice guidelines, evidence-based recommendations* | 14% (n=2) | 17% (n=1) |
| | Knowledge of services in the continuum | *Knowledge of resources, knowledge of constraints and possibilities of post-acute rehabilitation* | 14% (n=2) | 33% (n=2) |
| | Ethical sensitivity | *Ethical consideration, ethical sense* | 21% (n=3) | 17% (n=1) |

[a] Lam Wai Shun et al.'s (2017) study was included in the total number of articles for both stroke and TBI articles.

Table 6. Factors related to clinicians' prediction of outcomes and frequency counts

| Sub-themes emerging from data | Example of terminology used by study authors | Number of studies reporting this factor | |
|---|---|---|---|
| | | Stroke (n=14[a]) | TBI (n=6[a]) |
| Predicting discharge destination after rehabilitation | *Anticipated discharge destination, likelihood of ultimate return to the community* | 50% (n=7)[b] | 17% (n=1) |
| Predicting recovery | *Prognosis for functional improvement, recovery potential, anticipated recovery* | 57% (n=8) | 50% (n=3) |
| Predicting what can be achieved in rehabilitation | *Presence of achievable rehabilitation goals, rehabilitation potential* | 36% (n=5) | 33% (n=2) |
| Predicting likelihood of being accepted in rehabilitation | *Judging which patients meet rehabilitation admission criteria, likelihood of being accepted by the rehabilitation* | 14% (n=2) | 17% (n=1) |
| Predicting length of stay in rehabilitation | *Anticipated length of stay in rehabilitation* | 7% (n=1) | 0 |

[a] Lam Wai Shun et al.'s (2017) study was included in the total number of articles for both stroke and TBI articles.

[b] Grey shades indicate factors reported in at least half of the studies.

Table 7. Factors perceived as most influential for the referral or admission of stroke patients to post-acute rehabilitation.

| ICF framework terminology | *Terminology used by study authors* | Cormier, 2016 | Gulfo, 2018 | | Magdon-Ismail, 2016 |
|---|---|---|---|---|---|
| | | PHY[a] Post-acute rehab USA | OT[a] Post-acute rehab USA | PT[a] Post-acute rehab USA | NUR, SW[a] Acute care hospitals USA |
| **PRE-STROKE patient characteristics** | | | | | |
| Overall activity | *Pre-stroke functional status* | 2[b] | 3 | 3 | 6 |
| **POST-STROKE patient characteristics** | | | | | |
| Overall body function | *Medical comorbidities/ complexity* | 6 | 11 | 10 | 12 |
| Overall mental function | *Cognitive/communicative impairments* | 9 | 7 | 8 | 9 |
| Mental function -Energy and drive | *Motivation* | 11 | 9 | 6 | 11 |
| Body structure - Nervous system | *Stroke severity* | 4 | 6 | 2 | 3 |
| Activity - Mobility | *Mobility, current mobility* | 8 | 4 | 4 | 7 |
| Activity - Self-care | *Ability to perform ADLs* | 7 | 5 | 7 | 8 |
| Environmental factors - family support | *Home social support* | 10 | 2 | 5 | |
| Personal factors | *Age* | 12 | 13 | 13 | 14 |
| | *Immigration Status* | | | | 13 |
| **Health care services** | | | | | |
| Quality of post-acute rehabilitation | *Quality of post-acute facility* | 3 | 8 | 11 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| Relationship between acute care and rehabilitation facilities | *Affiliation of facility with my hospital or system* | 13 | 15 | 15 | 15 |
| Geographical location of post-acute rehabilitation facility | *Location of post-acute facility* | 15 | 14 | 14 | 10 |
| **Health care system** | | | | | |
| Social security | *Insurance, Funding source* | 14 | 12 | 12 | 1 |
| **Prediction of patient outcome**[c] | | | | | |
| Predicting recovery | *Prognosis for functional outcome* | 1 | 1 | 1 | 4 |
| Predicting discharge destination after rehabilitation | *Likelihood of ultimate return to the community* | 5 | 10 | 9 | 5 |

[a] PHY: physiatrists, OT: occupational therapists, PT: physical therapists; NUR: nurses; SW: social workers.
[b] Grey shades represent the top 5 most influential factors as rated by clinicians.
[c] This terminology is not part of the ICF framework but related to data that emerged from this scoping review

Table 8. Top five factors favoring and disfavoring admission to inpatient stroke rehabilitation.

| Terminology used in this article | *Terminology used by authors* | Favoring admission | | Disfavoring admission | |
|---|---|---|---|---|---|
| | | Hakkennes, 2013 | Hayward, 2014 | Hakkennes, 2013 | Hayward, 2014 |
| **PRE-STROKE patient characteristics** | | | | | |
| Overall mental function | *Premorbid cognition* | 1 | 1 | | 3 |
| Home environment | *Pre-morbid living situation, place of residence* | 5 | | 4 | 1 |
| Overall activity and participation | *Premorbid functional disability* | | | | 2 |
| Mobility | *Premorbid mobility* | 2 | | | |
| Communication | *Premorbid communication* | 3 | | | |
| | | | | | |
| **POST-STROKEpatient characteristics** | | | | | |
| Overall mental function | *Current cognition* | | | 2 | |
| Insight | *Insight, acceptance of functional prognosis and the goal of rehabilitation post stroke* | | 2 | 4 | |
| Energy and drive | *Motivation* | 4 | | | |
| Psychic stability | *Severe behavioural problems* | | | | 3 |
| Physical endurance | *Able to tolerate intensive therapy during acute hospitalization* | | 2 | | |
| Overall activity and participation | *Severe functional disabilities in general* | | | | 4 |
| Mobility | *Current mobility* | | | 1 | |
| Other activity and participation (progress) | *Functional improvements during acute hospitalization* | | 1 | | |
| Other activity and participation (participating in therapy) | *Able to participate in therapy* | | 1 | | |
| Support and relationship | *Social support* | | | 2 | |

Figure 1. Flow chart of the article selection process

# Appendix – Search strategies

***Ovid Medline All***

1. exp Craniocerebral Trauma/
2. exp Stroke/
3. exp Brain Neoplasms/
4. exp Stroke Rehabilitation/
5. (stroke or poststroke or cerebrovascular accident* or brain injur* or craniocerebral trauma* or cerebral trauma* or brain neoplasm* or brain cancer* or brain tumor* or brain tumour* or cerebral cancer* or cerebral neoplasm* or cerebral tumor* or cerebral tumour*).ab,kf,ti.
6. 1 or 2 or 3 or 4 or 5
7. exp Rehabilitation/
8. exp Rehabilitation Centers/
9. rehabilitation.ab,kf,ti.
10. 7 or 8 or 9
11. exp "Referral and Consultation"/
12. exp Patient Selection/
13. exp Clinical Decision-Making/
14. ((patient* or inpatient*) adj2 (selection* or selecting or appropriate* or triage*)).ab,kf,ti.
15. ((discharge placement or discharge destination or discharge or selection process or selection or assessment or patient selection or triage or referral or suitability for inpatient or candidacy or candidate or potential or acceptance or admission or decision to admit or selection criteria or admission criteria) adj1 rehabilitation).ab,kf,ti.
16. 11 or 12 or 13 or 14 or 15
17. 6 and 10 and 16
18. (patient* eligibility or eligible for rehabilitation or rehabilitation candidacy or rehabilitation candidate or rehabilitation triage or patient selection for rehabilitation or selection for rehabilitation or referral to rehabilitation or selecting for rehabilitation or selection criteria for rehabilitation).ab,kf,ti.
19. (Eligible adj1 rehabilitation).ab,kf,ti.
20. (Eligibility adj1 rehabilitation).ab,kf,ti.
21. (admission criteria and rehabilitation).ab,kf,ti.
22. 18 or 19 or 20 or 21
23. 16 or 22
24. 6 and 10 and 23

***Ebsco CINAHL***

S1 (MH "Head Injuries+")
S2 (MH "Stroke+") OR (MH "Stroke Patients")
S3 (MH "Brain Neoplasms+")
S4 TI ( stroke or poststroke or "cerebrovascular accident*" or "brain injur*" or "craniocerebral trauma*" or "cerebral trauma*" or "brain neoplasm*" or "brain cancer*" or "brain tumor*" or "brain tumour*" or "cerebral cancer*" or "cerebral neoplasm*" or "cerebral tumor*" or "cerebral tumour*" ) OR AB ( stroke or poststroke or "cerebrovascular accident*" or "brain injur*" or "craniocerebral trauma*" or "cerebral trauma*" or "brain neoplasm*" or "brain cancer*" or "brain tumor*" or "brain tumour*" or "cerebral cancer*" or "cerebral neoplasm*" or "cerebral tumor*" or "cerebral tumour*" ) OR SU ( stroke or poststroke or "cerebrovascular accident*" or "brain injur*" or "craniocerebral trauma*" or "cerebral trauma*" or "brain neoplasm*" or "brain cancer*" or "brain tumor*" or "brain tumour*" or "cerebral cancer*" or "cerebral neoplasm*" or "cerebral tumor*" or "cerebral tumour*" )
S5 S1 OR S2 OR S3 OR S4
S6 (MH "Rehabilitation+")
S7 (MH "Rehabilitation Centers+")
S8 (MH "Physical Medicine")
S9 TI rehabilitation OR AB rehabilitation OR SU rehabilitation
S10 S6 OR S7 OR S8 OR S9
S11 (MH "Referral and Consultation+")
S12 (MH "Patient Selection")
S13 (MH "Patient Admission")
S14 (MH "Decision Making+")
S15 TI ( (patient* or inpatient*) N2 (selection* or selecting or appropriate* or triage*) ) OR AB ( (patient* or inpatient*) N2 (selection* or selecting or appropriate* or triage*) ) OR SU ( (patient* or inpatient*) N2 (selection* or selecting or appropriate* or triage*) )
S16 TI ( ("discharge placement" or "discharge destination" or discharge or "selection process" or selection or assessment or "patient selection" or triage or referral or "suitability for inpatient" or candidacy or candidate or potential or acceptance or admission or "decision to admit" or "selection criteria" or "admission criteria") N1 (rehabilitation) ) OR AB ( ("discharge placement" or "discharge destination" or discharge or "selection process" or selection or assessment or "patient selection" or triage or referral or "suitability for inpatient" or candidacy or candidate or potential or acceptance or admission or "decision to admit" or "selection criteria" or "admission criteria") N1 (rehabilitation) ) OR SU ( ("discharge placement" or "discharge destination" or discharge or "selection process" or selection or assessment or "patient selection" or triage or referral or "suitability for inpatient" or candidacy or candidate or potential or acceptance or admission or "decision to admit" or "selection criteria" or "admission criteria") N1 (rehabilitation) )
S17 S11 OR S12 OR S13 OR S14 OR S15 OR S16
S18 S5 AND S10 AND S17

S19 TI ( "patient* eligibility" or "eligible for rehabilitation" or "rehabilitation candidacy" or "rehabilitation candidate" or "rehabilitation triage" or "patient selection for rehabilitation" or "selection for rehabilitation" or "referral to rehabilitation" or "selecting for rehabilitation" or "selection criteria for rehabilitation" ) OR AB ( "patient* eligibility" or "eligible for rehabilitation" or "rehabilitation candidacy" or "rehabilitation candidate" or "rehabilitation triage" or "patient selection for rehabilitation" or "selection for rehabilitation" or "referral to rehabilitation" or "selecting for rehabilitation" or "selection criteria for rehabilitation" ) OR SU ( "patient* eligibility" or "eligible for rehabilitation" or "rehabilitation candidacy" or "rehabilitation candidate" or "rehabilitation triage" or "patient selection for rehabilitation" or "selection for rehabilitation" or "referral to rehabilitation" or "selecting for rehabilitation" or "selection criteria for rehabilitation" )

S20 TI Eligible N1 rehabilitation OR AB Eligible N1 rehabilitation OR SU Eligible N1 rehabilitation

S21 TI Eligibility N1 rehabilitation OR AB Eligibility N1 rehabilitation OR SU Eligibility N1 rehabilitation

S22 TI ( "admission criteria" AND rehabilitation ) OR AB ( "admission criteria" AND rehabilitation ) OR SU ( "admission criteria" AND rehabilitation )

S23 S19 OR S20 OR S21 OR S22

S24 S17 OR S23

S25 S5 AND S10 AND S24

***Ovid Embase***

1. exp head injury/
2. exp cerebrovascular accident/
3. exp brain tumor/
4. exp stroke rehabilitation/
5. (stroke or poststroke or cerebrovascular accident* or brain injur* or craniocerebral trauma* or cerebral trauma* or brain neoplasm* or brain cancer* or brain tumor* or brain tumour* or cerebral cancer* or cerebral neoplasm* or cerebral tumor* or cerebral tumour*).ab,kw,ti.
6. 1 or 2 or 3 or 4 or 5
7. exp rehabilitation/
8. exp rehabilitation center/
9. rehabilitation.ab,kw,ti.
10. 7 or 8 or 9
11. exp patient referral/
12. exp patient selection/
13. exp clinical decision making/
14. ((patient* or inpatient*) adj2 (selection* or selecting or appropriate* or triage*)).ab,kw,ti.
15. ((discharge placement or discharge destination or discharge or selection process or selection or assessment or patient selection or triage or referral or suitability for inpatient or candidacy or candidate or potential or acceptance or admission or decision to admit or selection criteria or admission criteria) adj1 rehabilitation).ab,kw,ti.
16. 11 or 12 or 13 or 14 or 15
17. 6 and 10 and 16
18. (patient* eligibility or eligible for rehabilitation).ab,kw,ti.
19. rehabilitation candidacy.ab,kw,ti.
20. rehabilitation candidate.ab,kw,ti.
21. rehabilitation triage.ab,kw,ti.
22. patient selection for rehabilitation.ab,kw,ti.
23. selection for rehabilitation.ab,kw,ti.
24. referral to rehabilitation.ab,kw,ti.
25. selecting for rehabilitation.ab,kw,ti.
26. selection criteria for rehabilitation.ab,kw,ti.
27. (Eligible adj1 rehabilitation).ab,kw,ti.
28. (Eligibility adj1 rehabilitation).ab,kw,ti.
29. (admission criteria and rehabilitation).ab,kw,ti.
30. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29
31. 16 or 30
32. 6 and 10 and 31

***Cochrane***

1. (stroke or poststroke or cerebrovascular accident* or brain injur* or craniocerebral trauma* or cerebral trauma* or brain neoplasm* or brain cancer* or brain tumor* or brain tumour* or cerebral cancer* or cerebral neoplasm* or cerebral tumor* or cerebral tumour*).af.
2. rehabilitation.af.
3. ((patient* or inpatient*) adj2 (selection* or selecting or appropriate* or triage*)).af.
4. ((discharge placement or discharge destination or discharge or selection process or selection or assessment or patient selection or triage or referral or suitability for inpatient or candidacy or candidate or potential or acceptance or admission or decision to admit or selection criteria or admission criteria) adj1 rehabilitation).af.
5. (patient* eligibility or eligible for rehabilitation).af.
6. rehabilitation candidacy.af.
7. rehabilitation candidate.af.
8. rehabilitation triage.af.
9. patient selection for rehabilitation.af.
10. selection for rehabilitation.af.
11. referral to rehabilitation.af.
12. selecting for rehabilitation.af.
13. selection criteria for rehabilitation.af.
14. (Eligible adj1 rehabilitation).af.
15. (Eligibility adj1 rehabilitation).af.
16. (admission criteria and rehabilitation).af.
17. 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18. 1 and 2 and 17