Physiotherapy assessment in people with neurological conditions—Evidence for the most frequently included domains: A mixed-methods systematic review

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Abstract
Rationale: There is a lack of consensus in the literature related to what is assessed clinically by physical therapists in people with neurological disorders.
Aims: This mixed-methods systematic review aimed to identify domains that physiotherapists routinely assess in people with neurological conditions in clinical settings and explored factors influencing assessment domains including country, clinical setting, therapist experience and neurological condition.
Method: Five databases were searched from 1946 to 31st January 2023. Studies with any design reporting on domains assessed by a physiotherapist, in people with neurological conditions in any clinical setting, were included. Independent reviewers assessed eligibility and risk of bias using relevant McMaster critical appraisal tools. Data were extracted and synthesised following the Joanna Briggs Institute approach for mixed systematic reviews.
Results: A total of 23 (16 quantitative, 7 qualitative) studies involving 3134 participants were included. The studies were rated as high (n = 14) or medium (n = 9) quality. The domains of function (n = 14); postural alignment and symmetry (n = 11); gait (n = 11); balance (n = 9), and muscle strength (n = 8) were most frequently included in assessments. Five key themes were identified from the qualitative studies: the clinical reasoning process, clinical use of standardised measures, utilisation of the senses, clinician experience and information gathering. There was minimal data on how country, clinical setting, therapist experience and neurological condition influence inclusion of assessed domains.
Conclusion: Five domains were most frequently included in assessment: function; postural alignment and symmetry; gait; muscle strength; and balance. This limited number of domains is in stark contrast to the full neurological physiotherapy assessment recommended by expert textbooks. Further research is needed to understand the reasons why this might be so.
1 | INTRODUCTION

Approximately one billion people are affected by a neurological condition worldwide. Physiotherapy commonly plays an important role in the overall care and management of people with neurological conditions, and this assessment is a cornerstone of clinical practice. The World Health Organisation (WHO) has described assessment as a process that includes examination, history taking, screening and the use of specific tests and measures through analysis and synthesis within a process of clinical reasoning. More specifically within the physiotherapy context, World Physiotherapy (WPT) highlights the clinical reasoning element of the assessment, by defining a physiotherapy assessment as an approach using clinical reasoning, incorporating current evidence and the patient and care giver’s perspectives, and ensures that the physiotherapist develops and evaluates an appropriate plan of care for each patient.

In preparation for clinical practice, physiotherapy students are taught many assessment domains such as pain; posture; range of movement; strength/weakness; sensation; balance; and co-ordination. Some of these domains, such as communication and mood, can also be assessed by other health professionals. Physiotherapy students often identify complexity in the assessment process and difficulties in developing an optimal treatment plan for people with neurological conditions. The theoretical basis for assessment in expert textbooks recommends the inclusion of approximately 28 domains. The detailed assessment students are taught at university for people with neurological conditions is often not reflected in expectations while on placement, suggesting that other factors may influence assessment such as experience or healthcare setting. In addition to health care settings, geographical settings may also need to be considered. A large study investigating the scope of musculoskeletal practice tendencies between countries worldwide has demonstrated a large variability, discussing this in the context of educational requirements and models as well as differences in healthcare systems.

Current clinical practice in the assessment of people with a neurological condition is based on a diversity of resources, including textbooks, recommendations by professional associations, government bodies and disability frameworks such as the International Classification of Functioning, Disability and Health (ICF) framework, or condition-specific guidelines such as stroke. However, to date, there is a lack of formal consensus on the domains that physiotherapists should include in their assessment.

Different strategies have been described for clinical reasoning from novices to experienced physiotherapists, suggesting differences in assessment practices. Evidence has demonstrated differences in clinical reasoning processes between expert and novice clinicians in musculoskeletal and cardiorespiratory physiotherapy practice, including information gathering and synthesis, communication, and assessment time have been. Little information is available on the factors that influence assessment practices in neurological physiotherapy training and practice. Moreover, the focus has been mainly on the assessment of a single domain, such as gait, and the use of standardised measurement tools in relation to specific conditions.

In summary, there is limited evidence in the literature related to the domains to be included in the physiotherapy assessment of a person with a neurological condition in varying clinical contexts. Although there is some evidence suggesting that certain factors, such as therapist experience, clinical and geographical setting, and clinical condition may play a role, little is known about factors influencing neurological physiotherapy assessment practice.

This mixed-methods systematic review aimed to determine (1) what domains physiotherapists routinely assess in clinical practice in people with neurological conditions, and (2) whether the factors of clinical and geographical setting, therapist experience and neurological condition play a role in the choice of these assessment domains.

2 | METHOD

A mixed-methods systematic review aimed to determine the scientific and grey literature was conducted. The Joanna Briggs Institute (JBI) Convergent Integrated Approach to mixed-methods systematic reviews was used. The results were reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

2.1 | Search strategy

Searches were conducted in MEDLINE, PubMed, CINAHL, Scopus, Web of Science, and the Cochrane Library. The searches were limited to English publications published from 1946 to January 2023. Additionally, relevant grey literature was searched, such as websites of physiotherapy associations and councils, and targeted hand searching of reference lists supplemented the search strategy. The full search strategy for scientific and grey literature searches is presented in Appendix 1.

2.2 | Eligibility and screening

For the purpose of this review, the term ‘physiotherapy assessment’ describes any process that includes history-taking, screening and evaluation of the results of the examination through analysis and synthesis within a process of clinical reasoning.

Studies of any research design reporting on domains of physiotherapy assessment in clinical practice with people with neurological conditions.
neurological conditions were included. Studies were included for any setting; if participants were physiotherapists who assessed adults with neurological conditions; and the study provided data about assessment domains. Studies were excluded if they were systematic or scoping reviews, textbooks, or commentaries; reviewed the reliability and validity of a standardised measurement tool; directed therapists to use a specific standardised measure; or focused on a theoretical discussion of best practice guidelines with no data on neurological physiotherapy assessment in clinical practice. Studies describing the assessment related to headache, dementia, and vestibular dysfunction were excluded, as their assessment domains were different from those of other neurological assessments.20-22

The title and abstract, as well as full-text articles, were screened independently by two authors (JG, SV). Disagreements regarding eligibility for study inclusion were discussed and resolved and involved two further members of the research team (MB, BL), which were deemed necessary.

2.3 | Methodological quality

The methodological quality of the included studies was assessed using qualitative or quantitative McMaster University critical appraisal tools23,24. The research team identified four McMaster criteria that were deemed critical based on answering the questions for this review (see Appendices 2-3 for full details). These four criteria are critical: a detailed description of the intervention, a detailed description of the sample, appropriate analysis methods, and appropriate conclusions.

2.4 | Data extraction and analysis

Data were extracted by one researcher (JG) and checked for accuracy by the research team (MB, BL, SL) using a purposefully developed pro forma, based on the JBI Mixed Methods Data Extraction Form following a Convergent Integrated Approach.25 Data related to study characteristics, participant characteristics, and assessment, were extracted from all quantitative and qualitative studies. The study characteristics included author, year, country, study design, study aim, clinical setting, study population and sample size. Data related to participant characteristics included age, sex, level of education, years of qualification, and neurological physiotherapy experience. Finally, collated information related to the assessment domains assessed, neurological condition assessed, assessment timing, and frequency of assessment. Classification of domains was decided on using a consensus approach, which was guided by the literature and discussed between the researchers until an agreement was reached. As part of this discussion, in the context of gait patterns, it was decided that individual impairments, such as strength and, somatosensation, were considered separately from gait-related parameters, such as distance and speed described as gait. Quantitative data were presented descriptively, tabulated, and synthesised using a narrative synthesis approach. In parallel, further to the data extracted as described above, any additional qualitative data pertaining to assessment were also extracted and managed using NVivo 12 software.26 An inductive thematic analysis approach was used to analyse and synthesise this data.27 Codes were developed based on the identified content in these qualitative studies, then refined and grouped into sub-themes and themes. This was reviewed, and discussed with the research team (MV, BL, SL) until a consensus was reached. The qualitative and quantitative data were then integrated to verify domains routinely assessed by physiotherapists in clinical settings in people with neurological conditions and to explore factors influencing the assessment.

3 | RESULTS

Figure 1 shows the PRISMA flow diagram. Following the removal of duplicates, 1742 studies were independently screened for eligibility. One hundred and seventy-seven full texts were assessed as potentially eligible. Most studies were excluded from assessment data that were theoretical in nature (n = 31) or described non-physiotherapy assessment (n = 30). In total, 23 studies were judged eligible for inclusion in this review (16 quantitative studies and 7 qualitative studies). The review findings are presented separately for the quantitative and qualitative studies.

4 | QUANTITATIVE STUDIES

4.1 | Study characteristics

The characteristics of the 16 quantitative studies included are presented in Table 1. Studies have been conducted in the United Kingdom,18,28-30 Canada,31-33 Canada and India,34 Australia,35 and the United States of America.36 One study included participants worldwide.37 Thirteen studies used a cross-sectional design using surveys,18,28,30,32,35,37,42 two used a case study design,29,36 and one used a retrospective chart audit.31 With regard to study aims, seven studies explored the influences of assessment on treatment choice and decision-making,18,29,30,33,36 and six studies explored the use of standardised measures.14,29,31,32,39,43 Three studies aimed to develop an expert consensus related to beliefs underpinning physiotherapy assessment practice.18,28,42

The number of physiotherapists included in the studies ranged from 144 to 1022.18 Two studies reported the age of participants, with 89% of participants aged between 30 and 59,33 and mean age 32.65 (SD 9.19).31 Sex, reported in four studies only, was mainly female.33,34,37,39 Years of clinical experience were reported in nine studies,18,28,29,38 ranging from 7 to 16 years.43 The clinical work settings were mixed in eleven studies.38 One study included mostly rehabilitation settings,35 and three studies were conducted in a single setting, that is inpatients,31 outpatients29 and stroke units.18

Clinical populations included stroke (n = 9),14,18,28-30,36-38,43 neurological conditions in general (n = 4),31,32,34,45 Parkinson’s disease (n = 1),14,33 and acquired brain injuries (n = 2).33
4.2 Study quality

Appendix 2 provides the quality assessment results. Seven studies were judged medium quality, and nine studies were judged high quality. The main limitations are related to the lack of analysis and limited description of the methods.

4.3 Assessment domains

The assessment domains identified in the quantitative studies are summarised in Table 2. Most frequently described domains included function (n = 9), strength (n = 8), balance (n = 7), range of movement (n = 6), postural alignment and symmetry (n = 6), gait (n = 6), and somatosensation (n = 6).

Domains that were reported only once included spasticity, tremor, psychological and higher brain function, mood, deep tendon reflexes, pain, and quantified motor practice.

4.4 Factors influencing selection of assessment domains

There are not enough data to support the influence of country, clinical setting, therapist experience or neurological condition on the included assessment domains.
### TABLE 1  Study characteristics and quality of included quantitative studies (n = 16).

<table>
<thead>
<tr>
<th>Author/year/country/study number</th>
<th>Aims/scope</th>
<th>Design and methodology</th>
<th>Clinical population and setting</th>
<th>Therapist population demographics</th>
<th>Key assessment domains (list)</th>
<th>Timing of assessment</th>
<th>Key findings</th>
<th>Quality rating</th>
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</thead>
<tbody>
<tr>
<td>1. Bailey et al., 1998 United Kingdom</td>
<td>To enhance research into assessment and treatment of hemineglect, and to increase knowledge about current practice in stroke</td>
<td>Survey</td>
<td>Stroke Outpatients: 18% Private practice: 2% Elderly care and general medical wards: 32% Specialist units: 25% Community: 23%</td>
<td>Physiotherapists n = 167 Years since qualifications: at least 6 years, 84% &gt;17 years</td>
<td>BIT, copy picture or draw figure, simultaneous extinction tests</td>
<td>No data</td>
<td>15% of physiotherapy respondents reported testing for neglect. 98% identified neglect as part of routine assessment, 40% by observation and 60% by observation and specific tests</td>
<td>Medium</td>
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<tr>
<td>2. Blanchette et al., 2017 Canada</td>
<td>Increase knowledge about current trends in spasticity management and treatment</td>
<td>Survey</td>
<td>General neurological Outpatients: 15.7% General wards: 10.3% Acute wards: 17.2% Extended care: 2.5% Rehabilitation: 53.4% Community: 10.3% Home care: 11.3%</td>
<td>Physiotherapists n = 204 Gender: Female n = 88 Male n = 16 Level of education: Diploma n = 6 Bachelor degree n = 146 Masters degree n = 49 PhD n = 3 Neurological experience: &lt;1 year n = 5 (2.5%) 1–3 years n = 26 (12.7%) 4–10 years n = 52 (25.5%) &gt;10 years n = 121 (59.3%)</td>
<td>clonus, Motor Assessment Scale, deep tendon reflexes functional scales, Original Ashworth Scale, Modified Ashworth Scale, rapid passive movements</td>
<td>83.3% of Occupational therapists and Physiotherapists believed spasticity should be assessed on admission to rehabilitation, with reassessment at an interim time, discharge, and follow up</td>
<td>83% performed spasticity assessment on admission with lower reassessment percentage</td>
<td>High</td>
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<td>3. Carr et al., 1994 Australia</td>
<td>Investigate factors what influences treatment choice, theoretical basis for treatment choices</td>
<td>Survey</td>
<td>Stroke Rehabilitation: 89% Acute wards: 77% Nursing homes: 36% Other: 28%</td>
<td>Physiotherapists n = 208 Level of education: Additional education post-qualifying: 71% Neurological experience: 8 ± 6.0 years</td>
<td>Abnormal postural reactions, Action Research Arm Test, Functional Independence Measure, quantified motor performance, motor control, Motor Assessment Scale, tone</td>
<td>No data</td>
<td>Respondents had difficulty explaining the underlying theoretical basis for their treatment choices</td>
<td>High</td>
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<td>4. Cavanaugh &amp; Schenkm- an, 1996 United States of America</td>
<td>Describe the decision-making process of a physiotherapist working with a stroke patient</td>
<td>Case report</td>
<td>Stroke Inpatient rehabilitation: 100%</td>
<td>Physiotherapists n = 1 No other data</td>
<td>Activity tolerance, bed mobility, behaviour, Berg Balance Scale, cognition, falls risk, Fugel Meyer, sensorimotor evaluation, divided attention, extinction, gait, goal identification, item</td>
<td>Admission and discharge</td>
<td>The case illustrated how a physiotherapist uses models and frameworks to organise information and the value of analysing assessment findings that explore</td>
<td>High</td>
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<td>5. Checketts et al., 2020 Worldwide</td>
<td>To determine which neglect tests are used, by which stroke clinicians, in which countries, and whether choice is by professional autonomy or institutional policy Survey Stroke Inpatients: 74.5% Outpatient: 23.6% Community: 16.3% Physiotherapists n = 55 Years since qualifications: 3 months to 34 years Assessment of neglect No data</td>
<td>cancellation, line bisection, Mini Mental State Exam, mood, multitasking, pain, postural control, range of movement, rolling, reaching, sitting balance, standing, transfers, Timed Up and Go Test, timed sitting and standing, trunk weakness, visual attention, 6-min walk test</td>
<td>functional limitations, assisting in setting goals and prioritise treatment</td>
<td>High</td>
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<td>6. Demers et al., 2018 Canada and India</td>
<td>Identify and compare the use of standardised outcome measures and factors that influence this Survey General neurological Outpatients: 32% General hospital: 20% Acute ward: 20% Extended care: 6% Rehabilitation: 52% Community: 11% Home care: 20% Other: 8% Physiotherapists n = 317 Gender: Female n = 259 Male n = 58 Level of education: Bachelor n = 183 Masters degree n = 123 PhD n = 11 Neurological experience: &lt;3 years n = 93 4–10 years n = 80 &gt;10 years n = 144 No data No data</td>
<td>10.8% of Canadians reported never using standardised outcome measures, compared with 3.3% of Indians</td>
<td>High</td>
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<td>7. Gervais et al.,2014 Canada</td>
<td>Identify physiotherapy assessment tools in the assessment of balance in inpatient population</td>
<td>Retrospective chart review</td>
<td>Stroke and other (complex musculoskeletal, amputee, deconditioning after acute illness, cardiac surgery) Inpatients 100%</td>
<td>No data</td>
<td>Activity tolerance, active range of movement, balance, orientation in space, individual sensory input, static stability control of dynamics, anticipatory movement strategies, reactive movement strategies, cognitive processing, Berg Balance Scale, Chedoke-McMaster Stroke Assessment Scale, co-ordination, gait, distance walked, internal perturbations, external perturbations, pain and temperature, postural alignment, proprioception, passive range of movement, light touch, stairs, strength, swelling, transfers, Timed Up and Go Test, vision, 2-min walk test, 6-min walk test</td>
<td>No data</td>
<td>There is variation in the assessment of balance</td>
<td>High</td>
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<tr>
<td>8. Lennon, Baxter &amp; Ashburn, 2001 United Kingdom</td>
<td>Provide expert consensus related to theoretical beliefs underpinning current Bobath practice</td>
<td>Survey Stroke Stroke units: 10%–15% More than one setting: 15%–17%</td>
<td>Physiotherapists n = 8 Years since qualifications: 7–13 years Neurological experience: 5–15 years (mean = 9.4 years)</td>
<td>Bartel Index, outcome measures, self-devised outcome measures</td>
<td>No data</td>
<td>Bobath therapists believed normal tone was essential and use normal movement patterns to perform functional tasks If tasks affected tone adversely some tasks were delayed There was use of walking aids and orthotics</td>
<td>Medium</td>
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<td>9. Lennon, 2001</td>
<td>To describe the use of outcome measures to document</td>
<td>Case description Stroke Outpatients: 100%</td>
<td>Physiotherapists n = 2 Years since qualifications: &gt;10 years</td>
<td>Communication ability, correct alignment, and block atypical movements,</td>
<td>No data</td>
<td>Suggests recovery of more normal movement patterns</td>
<td>Medium</td>
<td>(Continues)</td>
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<td>United Kingdom</td>
<td>recovery of movement within the gait cycle and walking ability an describe treatment process used by the physiotherapists to educate gait</td>
<td>Neurological experience: &gt;6 years</td>
<td>collaborative functional goals, current functional level, gait, pre-morbid functional level, goals, hearing, information gathering re: history, light touch, medical history, mental status, muscle tone, neglect, outcome measures, passive or active assisted movement, postural tone, problem list, proprioception in the limbs, social, history, vision</td>
<td>and functional ability and gives insight into bobath therapists practice</td>
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<td>10. Lennon, 2003</td>
<td>Provide expert consensus of the theoretical beliefs underlying physiotherapy practice in stroke rehabilitation</td>
<td>Survey Stroke</td>
<td>Inpatient: 14% Mixed setting: 17%</td>
<td>Physiotherapists n = 1022 Years since qualifications: &gt;10 years – 58%</td>
<td>Alignment of key points and the interaction between base of support with gravity in different postural sets, balance, Barthel Index, function, Functional Independence Measure, muscle strength, range of movement, Rivermead Motor Assessment, selective movement, sensation, self-devised tools, tone</td>
<td>31% would review at 6 weeks, 2% reviewed at 6 months</td>
<td>Four theoretical themes were in use in practice: the promotion of normal movement, the control of tone, the promotion of function, and recovery of movement with optimisation of compensation</td>
<td>Medium</td>
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<td>11. Lyon et al., 2022</td>
<td>Explore current practices in use of balance outcome measures and the role of outcome measures in clinical decision making</td>
<td>Survey Acquired brain injury</td>
<td>Inpatient: 29.5% Outpatient: 51.5% Home: 5.1% Mixed: 3.5% Other: 2.4%</td>
<td>Physiotherapists n = 373 Age: 23–67 (mean = 32.65, SD = 9.19)</td>
<td>18 outcome measures most frequently used: Berg Balance Scale, Dynamic Gait Index, Timed Up and Go</td>
<td>No data</td>
<td>93% used outcome measures in people with acquired brain injury comfort, equipment availability, and psychometric properties were the most frequent reasons for choosing the outcome measure</td>
<td>High</td>
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<td>12. Proud et al., 2013 Australia</td>
<td>Survey</td>
<td>Parkinson's disease Inpatient: 46% Outpatient: 51% Residential: 11% Community: 7%</td>
<td>Physiotherapists and Occupational therapists Physiotherapists n = 122 Years since qualifications: 10 years - 58% Level of education: no data, neurological experience: no data</td>
<td>Active movement, bradykinesia, Coin Rotation Task, Canadian Occupational Performance measure, Disability Rating Scale, dyskinesia, Goal Attainment Scale, Motor Assessment Scale, muscle length, nine-hole peg test, passive range of movement, Parkinson's Disease questionnaire, Purdue Pegboard Test, sensation, strength, timed functional activities, tone and rigidity, tremor, Unified Parkinson's Disease Rating Scale, JHF</td>
<td>No data</td>
<td>54% of respondents regularly assessed the upper limb There was widespread use of non-standardised methods to assess Parkinson's Disease-specific impairments Standardised measures were more frequently used to evaluate activity limitations</td>
<td>Medium</td>
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<td>13. Sackley &amp; Lincoln, 1996 United Kingdom</td>
<td>Survey</td>
<td>Stroke Large variety in work settings. Most frequent community and hospital: 39.5%</td>
<td>Physiotherapists n = 91 Gender: Female n = 68 Male n = 23</td>
<td>Chartered Society of Physiotherapy published tools and local ones, Chekdeke- McMaster Stroke Assessment Scale, Lindmark, Motor assessment Scale, Motor Club Assessment, Motricity Index, Rivermead Motor Assessment, Rivermead Motricity Index, Sheffield Motor Assessment, Teler Standardised Assessment, timed, balance scores, walking distance</td>
<td>No data</td>
<td>Physiotherapists found it difficult to describe a theoretical basis for their treatment Limited use of standardised assessments</td>
<td>High</td>
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<td>14. Wilson et al., 2018 Canada</td>
<td>Describe the current practice patterns of Canadian physiotherapists regarding the assessment and treatment of gait dysfunction</td>
<td>Survey</td>
<td>Moderate to severe acquired brain injury (not including stroke)</td>
<td>Physiotherapists $n = 59$</td>
<td>Dynamic balance, functional independence of gait, gait efficiency, gait endurance, gait kinematics, gait speed, goal setting</td>
<td>Admission and discharge</td>
<td>Domains of assessment most frequently included “often or very often” at initial and discharge-visual observation (≥88.2% for adults with mild-moderate and severe ABI) and the Berg Balance Scale (≥76.3% for adults with mild-moderate ABI) Higher level gait training exercises were used more often for adults with mild-moderate than severe ABI</td>
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<td>Inpatient: 52%</td>
<td>Age: 30–59 years (89.8%) Gender: Female $n = 36$ Male $n = 23$</td>
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<td>Outpatients: 67%</td>
<td>Years since qualifications: 0.5–5 years $n = 9$ (15%) 6–10 years $n = 15$ (25%) 11–15 years $n = 7$ (12%) 16–20 years $n = 6$ (10%) 21–25 years $n = 11$ (19%) 26–30 years $n = 7$ (12%) 31–35 years $n = 4$ (7.5%)</td>
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<td>Community: 14%</td>
<td>Level of education: Diploma $n = 1$ (2%), Bachelor degree $n = 27$ (46%) Masters degree $n = 29$ (49%) PhD $n = 2$ (3%)</td>
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<td>Residential: 5%</td>
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<td>Other: 3%</td>
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<td>15. Winward et al., 1999 United Kingdom</td>
<td>Identify perceived clinical relevance of somatosensory testing for health professionals (doctors, occupational therapists, and physiotherapists)</td>
<td>Survey</td>
<td>Stroke No data on setting</td>
<td>Physiotherapists $n = 95$</td>
<td>Light touch, pain, proprioception, pin prick, pressure, stereognosis, temperature, vibration, two-point discrimination, extinction</td>
<td>93% assess somatosensation on admission, 7% assess weekly, 12% assess monthly, 24% assess pre-discharge</td>
<td>82 physiotherapists (84%) indicated that they routinely performed somatosensory assessment The two most commonly included domains were proprioception and light touch</td>
<td>Medium</td>
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<td>Gender: Female 85% Male 15%</td>
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<td>Years since qualifications: 7–16 years</td>
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<tr>
<td>Author/year/country/study number</td>
<td>Aims/scope</td>
<td>Design and methodology</td>
<td>Clinical population and setting</td>
<td>Therapist population demographics</td>
<td>Key assessment domains (list)</td>
<td>Timing of assessment</td>
<td>Key findings</td>
<td>Quality rating</td>
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<tr>
<td>Yoward et al., 2008, United Kingdom</td>
<td>To explore the current use of outcome measures of balance, walking, and gait in physiotherapy clinical practice</td>
<td>Survey</td>
<td>General neurological, stroke, multiple sclerosis, brain injury, Parkinson's disease, spinal cord injury, central nervous system tumours</td>
<td>Physiotherapists $n = 269$ Years since qualifications: 2–38 years (mean = 12.6 years)</td>
<td>Balance, Elderly Mobility Scale, range of movement, co-ordination, sensory system, postural alignment, Berg Balance Scale, Timed Up and Go, Functional Reach, Motor Assessment Scale, muscle strength, POAM, postural sway, Rivermead Mobility Index, Rivermead Mobility Index incorporating, modified Rivermead Mobility Index, sitting balance, timed standing, (incorporating timed unsupported standing/TUSS), Tinetti/modified Tinetti, 6-min (or other time) walk test, tone Turn tests combined (180-and 360°), walking, 10-metre (or other distance) walk test</td>
<td>No data</td>
<td>91% of respondents (245/269) reported using standardised measure The most commonly used outcome measures were: 10-metre (or other distance) walk test; the Berg Balance Scale; the Get Up and Go/Timed Up and Go Test; and the Functional Reach Test</td>
<td>Medium</td>
</tr>
</tbody>
</table>
QUALITATIVE STUDIES

5.1 Study characteristics

Seven qualitative studies were included in this review, and their characteristics are summarised in detail in Table 3. Studies were conducted in Canada, Australia, Japan, the United States, and Saudi Arabia. All six studies used interviews to collect data. One study additionally used an observational approach to gather information on physiotherapy assessment and treatment, another study also used focus groups. Most studies investigated clinical reasoning as part of a physiotherapy assessment of people with neurological conditions (n = 6).

The number of physiotherapists included in the studies ranged from 10 to 33. Age and sex were described in only three studies, with participants being predominantly female and age ranging from 20 to 50 years and over. Five studies reported years of clinical experience, noting a mean of 8 years, a mean of 11.4 years, a range from 2 to 10 years, a range from 1 to 21 years, and a range from 1 to greater than 15 years. The clinical work setting of the participants was described in six studies and included inpatient rehabilitation, outpatients, and mixed settings. Clinical populations included those with stroke, Multiple Sclerosis, and mixed neurological conditions.

5.2 Study quality

Appendix 3 presents the results of the quality assessment. Studies were mostly rated as high quality (n = 5) and two study were considered medium quality. Limitations related to theoretical connections and procedural rigour.

5.3 Assessment domains

The assessment domains identified from the qualitative studies are presented in Table 4. The domains described in at least three of the
<table>
<thead>
<tr>
<th>Author/country/ study number</th>
<th>Study aims</th>
<th>Design &amp; methodology</th>
<th>Clinical population and setting</th>
<th>Therapist population demographics</th>
<th>Key assessment domains</th>
<th>Timing of assessment</th>
<th>Key findings</th>
<th>Quality rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alatawi et al., 2022 Saudi Arabia</td>
<td>To integrate the PARIHS framework as a way of categorising evidence, context, and facilitation elements for effective implementation of evidence based PHS rehabilitation from a vast dataset of rigorous stroke sources of evidence</td>
<td>Interviews and consensus approach</td>
<td>Stroke Rehabilitation centre</td>
<td>Physiotherapists n = 21, age and gender no data, Years since qualification: 1–5 years 9.5%, 6–10 years 42.9%, 11–15 years 33.3%, &gt;15 years 14.3%, Level of education: Dip 9.5%, Bsc 66.7%, Msc 19%, PhD 4.8%</td>
<td>Range of movement, pain, sensation, function</td>
<td>No data</td>
<td>Total of 74 recommendations, 63 reached the consensus level for PHS practice, secondary prevention of PHS (n = 10), assessment (n = 14), PHS care management (n = 19), and service delivery (n = 20)</td>
<td>Medium</td>
</tr>
<tr>
<td>2. McGlynn and Cott, 2007 Canada</td>
<td>Explore clinical decision-making process and sources of information or evidence that are used in daily practice</td>
<td>Semi-structured interviews</td>
<td>Stroke Inpatients: 66.6% Outpatients: 16.6% Community: 1.6%</td>
<td>Physiotherapists n = 12 Gender: Female n = 11 Male n = 1 Years since qualifications: mean 13.5 years Level of education, neurological experience n = 1–21 years (mean 9 years)</td>
<td>Gait, goal setting outcome measures muscle tone, movement restriction subjective, information Timed up and Go Test 2-min walk test, 6-min walk test</td>
<td>No data</td>
<td>Preference for informal information sources to guide decision making sight, touch, discussions with clients, clinical experience, and consultation with peers Formal information including outcome measures for professional development, evidence review, ongoing education and to support decisions</td>
<td>High</td>
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<tr>
<td>3. Normann et al., 2014 Norway</td>
<td>Identify what aspects community physiotherapists perceived as significant when guided by a</td>
<td>Semi-structured interviews</td>
<td>Multiple sclerosis Inpatients: 100%</td>
<td>Physiotherapists n = 10 Age: no data Gender: no data Years since qualifications, level of education: no data Neurological experience: 2 to &gt;10 years</td>
<td>Alignment, balance, gait</td>
<td>No data</td>
<td>Community physiotherapists identified movement analysis of a familiar patient as significant for professional development</td>
<td>High</td>
</tr>
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</table>

(Continues)
### TABLE 3 (Continued)

<table>
<thead>
<tr>
<th>Author/country/study number</th>
<th>Study aims</th>
<th>Design &amp; methodology</th>
<th>Clinical population and setting</th>
<th>Therapist population demographics</th>
<th>Key assessment domains</th>
<th>Timing of assessment</th>
<th>Key findings</th>
<th>Quality rating</th>
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<tbody>
<tr>
<td><strong>4. Pattison et al., 2015 Canada</strong></td>
<td>Describe the methods used to evaluate walking and the reasons for choosing these methods</td>
<td>Semi-structured interviews</td>
<td>Stroke Inpatients: 67.8%</td>
<td>Physiotherapists, sample size $n = 28$ Age: 5-29 years ($n = 5$) 20-29 years, 30-39 years ($n = 9$) 40-49 years ($n = 10$), 50+ ($n = 4$) Gender: Female $n = 25$ Male $n = 3$, Years since qualifications: $&gt;10$ years $n = 18$, 5-9 years $n = 8$, 6-9 years $n = 3$, level of education: Bachelor $n = 20$, &lt;aster $n = 7$, certificate $n = 1$ Neurological experience: no data</td>
<td>Information from peers, modified standardised measures, standardised measures, Timed up and Go Test, Chedoke-McMaster Stroke Assessment, 2-min walk test</td>
<td>Physiotherapists used observation of movement and standardised assessment tools Factors that influenced choice of tools were characteristics of tool, the therapists’ familiarity with using the tool, the workplace, and patients.</td>
<td>High</td>
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<tr>
<td><strong>5. Plummer et al., 2006 Australia</strong></td>
<td>Identify how physiotherapists assess, record and measure Unilateral neglect (ULN) and the clinical reasoning processes used</td>
<td>Focus groups and one on one phone interviews</td>
<td>Stroke No data</td>
<td>Physiotherapists $n = 33$ Age: no data Gender: no data Years since qualifications: no data Level of education: no data, neurological experience: no data</td>
<td>Function, attention - sustained and in complex environments, grooming, hand positioning, hygiene, maintenance of midline, pen and paper tests, posture, response of the patient to the therapist, response of the patient to verbal cueing</td>
<td>No data</td>
<td>Physiotherapists use observation of functional tasks to assess for unilateral neglect and do not differentiate between the different types of ULN ULN is rarely measured Physiotherapists use hypothesis testing and pattern recognition to clinical reason in the assessment of ULN</td>
<td>High</td>
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<tr>
<td><strong>6. Seale &amp; Utsey, 2020 USA</strong></td>
<td>Investigate the current trends in PTs clinical reasoning in assessing and managing gait in</td>
<td>Semi-structured interviews and focus groups</td>
<td>Stroke Inpatients: 100%</td>
<td>Physiotherapist $n = 22$, Age: mean age 46 years Gender: Female $n = 19$ Male $n = 3$</td>
<td>Gait, tone, standardised measures</td>
<td>No data</td>
<td>Novice and experienced clinicians take systematic approach to the examination of a person with a hemiplegia, they agree</td>
<td>High</td>
</tr>
<tr>
<td>Author/country/ study number</td>
<td>Study aims</td>
<td>Design &amp; methodology</td>
<td>Clinical population and setting</td>
<td>Therapist population demographics</td>
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<td>Quality rating</td>
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<td>7. Takahashi et al., 2014, Japan</td>
<td>Determine the physiotherapy focus when deciding on level of independence of a patient with walking aids and the reasoning process</td>
<td>Semi structured interviews</td>
<td>Stroke inpatients: 100%</td>
<td>Physiotherapists n = 15, age: mean 32.5 ± 4.5 year; Gender: Female n = 5, Male n = 10; Years since qualifications: mean 8.0 ± 3.2 years; Level of education: no data; Neurological experience: no data</td>
<td>Brunstruum stage, cognitive ability, mental stability, daytime drowsiness, direction changes, falls, functional analysis, gait, understanding and responding to the environment, light-headedness, pain, stability, shortness of breath, standing, stepping, walking aids, walking to a target</td>
<td>Walking independence was decided by observation of behaviour during walking or treatment.</td>
<td>Walking independence was decided by observation of behaviour during walking or treatment.</td>
<td>Medium</td>
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seven studies included: postural alignment and symmetry,\textsuperscript{44,46–49} gait,\textsuperscript{44,46,47,50} and function.\textsuperscript{36,37,48,49} The domains of muscle tone, non-specific and self-devised outcome measures,\textsuperscript{46} diagnostic specific outcome measures,\textsuperscript{44} activity tolerance\textsuperscript{48}, subjective/social history and ‘falls and safety’,\textsuperscript{49} were reported only once.

5.4 | Key themes were identified in relation to physiotherapy assessment of people with neurological conditions

Thematic analysis of the qualitative studies identified five key themes related to physiotherapy assessment of people with neurological conditions. These included the clinical reasoning process, clinical use of standardised measures, utilisation of the senses, clinician experience and information gathering. A thematic schema (see Figure 2) was developed based on the approach outlined by Farrance et al.\textsuperscript{45} and shows how the themes and associated concepts interact.

5.5 | Clinical reasoning process

The clinical reasoning process was considered in all seven qualitative studies,\textsuperscript{44,46–51} including the concepts of hypothesis formation, trigger for pattern recognition, experience guiding prognostication, and understanding movement behaviour. The study findings showed that experienced physiotherapists often used a ‘form of pattern recognition’ to assess certain deficits such as neglect, rather than a specific assessment tool.\textsuperscript{48} They also used an in-depth understanding of movement behaviours to assist prognostication. These concepts, under the overarching theme of the clinical reasoning process, were noted as important foundations for the assessment and planning of treatment.

5.6 | Clinical use of standardised measures

The clinical use of standardised measures was mentioned in five studies.\textsuperscript{44,46,47,50} Concepts of familiarity, confidence, suitability for individual patients/clients, and time to completion are believed to influence their use.

“The decision to administer a measure with each patient is influenced first and foremost by patient factors, then caseload, time and priority, and documentation by others.”\textsuperscript{46}

5.7 | Information gathering

Four studies referred to information gathering as part of both subjective and objective assessment. It was evident from these studies that this process did not happen at one point in time, but was a continuous process throughout the management of the patient/client and was used to continually generate and test hypotheses.

“Although some of the participants described a systematic method for collecting clinical data from the patient, it was clear that the physiotherapists interpreted the assessment findings continuously.
generating and testing hypotheses and modifying the assessment accordingly".46

5.8 | Utilisation of senses in assessment

Clinicians use their senses to guide their assessment and adjust and tailor their responses and interactions with patients/clients. Utilisation of the senses was evident in four of the seven studies.46,47 Physiotherapists described the use of more than one sense at a time such as observation and ‘hands on’ when assessing people with neurological conditions and expressed the importance of knowing when and when not to use touch during assessment.

"Participants with 5 years or more of neurological physiotherapy work experience mentioned their clinical experience as an important source of information guiding their practice ...".46

The authors reported that previous experience guided thinking when making judgements regarding anticipated outcomes.46

5.9 | Clinician experience

In four out of seven studies46–48,50 physiotherapists talked about clinical experience within the context of prognostication and the use of standardised measures. Physiotherapists believed that clinical experience guided prognostication, and those with 5 or more years’ of clinical experience valued this and used it to guide how they predicted recovery in their patients/clients and, how they made decisions that guided their practice.46

5.10 | Integration of quantitative and qualitative data in context of the research aim

The key findings across all 23 studies were integrated, noting that the frequently assessed domains in neurological assessment included gait, balance, muscle strength, postural alignment and symmetry, and function (see Figure 3). The findings suggest that the type of information gathered contributes to the clinical reasoning process and clinician experience and utilisation of the senses may play a role

FIGURE 2  Thematic schema, influences on the assessment process.
in the choice and interpretation of assessment. However, the role of factors thought to influence the selection of assessment domains, including country, clinical experience, healthcare setting, and type of neurological condition remains unclear. Novice clinicians use standardised measures to assist with prognostication. All but one of the studies focusing on stroke referred to the domains of muscle strength and range of movement, inferring that this was essential when assessing people with this condition.

6 | DISCUSSION

The primary aim of this systematic review was to systematically identify the domains that physiotherapists assess in individuals with neurological conditions in a clinical setting. This review identified the five most frequently included assessment domains in the physiotherapy assessment of people with neurological conditions in the clinical setting: function, postural alignment and symmetry, gait, balance, and muscle strength. Minimal data were provided on factors thought to influence the inclusion of assessment domains such as country, clinical experience, healthcare setting, and type of neurological condition. Clinical experience has been found to influence the use of standardised measures.

Expert textbooks are used as a reference for physiotherapy practice and to inform physiotherapy students about assessment. They recommend a varied set of domains, including cognition, mental state, motivation, coping, memory, vision awareness, awareness of self-movement, quality of life, attention, orientation, appropriate interaction communication, understanding blood pressure, and activities of daily living. This review identified only a limited number of domains commonly assessed in clinical practice, in contrast to the multiple domains recommended in expert theoretical textbooks. A potential explanation for this may be that some of these domains are viewed as remits of other health professionals or may be specific to
each patient presentation; therefore the number of domains may vary depending on the individual case. Further work is needed to identify how appropriate it would be to include these five domains in clinical practice.

The assessment of people with neurological conditions is the basis of clinical reasoning. The clinical reasoning process is the sum of thinking and decision-making processes associated with clinical practice. It has been defined as “a process in which the therapist, interacting with significant others (e.g., family and other health-care team members), structures meaning, goals and health management strategies based on clinical data, client choices, and professional judgement and knowledge.” The International ProfessionalBody for Physiotherapy WPT recommends that treatment should be based on a comprehensive assessment involving a clinical reasoning process of (1) information gathering (subjective, objective); (2) interpretation (hypothesis formation from a problem list linked to collaborative goal setting); (3) treatment planning, and (4) evaluation/review (use of standardised measures; goal achievement). A total of 19 of the 23 included studies referred to clinical reasoning processes but not all studies reported on the four key components described by the WPT. Only four studies discussed all four components. Most studies included information gathering, and only eight studies discussed this interpretation. References to treatment planning were noted in more than half of the included studies. Evaluation and review were described by 12 studies. Evaluation and review were mainly discussed in relation to the use of standardised outcome measures. The use of standardised measures has been recommended for monitoring changes in the patient's health status in guidelines.

The methods of assessment were described by 12 studies. The use of touch, including terms such as ‘hands on and hands off’, was described in two studies, suggesting the use of touch as a method of assessment. Observation was described in all qualitative studies and seven quantitative studies. Observation skills was needed for movement analysis which is the ‘systematic study of movement produced during human action using skilled observational assessment’. Movement analysis, as an assessment method, is a core component of physiotherapy clinical practice with 12 studies in our review including some of the above domains related to more common aspects of movement analysis.

These skills are used in neurological assessment to assess walking, sit to stand, bed mobility, reaching and grasping, posture, and balance. With the increased use of web-based therapy as a method for delivering care to people in their homes with neurological conditions, physiotherapists assessing and treating patients with these conditions, such as stroke, may need to the enhance observation-based analysis necessary for tele- therapeutic interactions. The strength of this review is that it is the first systematic review, to our knowledge, to identify the domains that are frequently included in physiotherapy assessment of people with neurological conditions in the clinical setting, taking an inclusive approach including all study designs.
7 | CONCLUSION

Only limited guidance has emerged from this review regarding frequently assessed domains that are included in the assessment of people with neurological conditions in clinical practice. The appropriateness of these five most frequently assessed domains, and the need to include more domains, requires exploration in future work. This review demonstrates that the physiotherapy profession has yet to reach a consensus on the frequently assessed components that underpin neurological assessment. With literature supporting the use of the ICF framework to guide assessment and management in the clinical setting, physiotherapists should look at a more structured approach to assessment in their clinical practice. Further research is needed to explore the assessment of people with neurological conditions in clinical practice.

AUTHOR CONTRIBUTIONS
Jill Garner: conceptualisation, methodology, formal analysis, data curation, software, writing—original draft preparation, visualisation, project admin. Maayken van den Berg: conceptualisation, software, software, validation, formal analysis, data curation, writing—original draft preparation (draft review), supervision, project admin. Belinda Lange: conceptualisation, software, validation visualisation, Investigation, writing—original draft preparation (draft review), supervision. Sally Vu: data curation. Sheila Lennon: conceptualisation, software, validation, formal analysis, resources, writing—original draft preparation (draft review), writing review, visualisation, supervision.

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CONFLICT OF INTEREST STATEMENT
The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT
Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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APPENDIX 1: SEARCH STRATEGY

Databases: Ovid MEDLINE, CINAHL, Scopus, web of science and Cochrane Library, Pubmed

Database(s): Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to January 2023

Search Strategy:

# Searches

1 neurological examination/

2 (neurol* adj3 (Assess* or measur* or test* or examin* or evaluat*)).ti,ab,kf.

3 or/1–2

exp Nervous System Diseases/

5 exp brain injuries/

6 ((nervous system or somatosens* or sensor*) adj2 (condition* or disease*)).ti,ab,kf.

7 (stroke or poststroke or multiple sclerosis or parkinson* or guillain barre or polio* or dystonia or brain cancer* or brain neoplasm* or brain tumo* or Glioblastoma or Amyotrophic Lateral Sclerosis or Motor neurone disease or ALS or MND or Spinal cord injur* or brain inj*).ti,ab,kf.

8 or/4–7

9 "Outcome Assessment (Health Care)"/or "Outcome and Process Assessment (Health Care)"/or Treatment outcome/or Disability evaluation/

10 (Assess* or measur* or test* or examin* or evaluat* or domain*).ti,ab,kf.

11 or/9–10

12 and/8.11

13 or/3,12

14 exp Physiotherapy Modalities/

15 Physical Therapists/

16 Physiotherapy Specialty/

17 (physiotherap* or physical therap*).ti,ab,kf.

18 or/14–17

APPENDIX 2: QUALITY ASSESSMENT OF QUANTITATIVE STUDIES

Studies which met the four McMaster criteria deemed critical by the research team were based on answering the research questions for this systematic review. They were detailed description of the intervention, detailed description of the sample, appropriate analysis methods, appropriate conclusion. If the study met all four criteria and scored 80% or more on the McMaster critical appraisal tool for quantitative studies, these were judged as high quality. Studies which met three of the critical criteria and/or obtained an overall score of between 50% and 79% were judged medium quality. Studies which met two or less of the critical criteria and/or obtained an overall score of ≤49% were judged low quality. These studies were marked with green triangle for yes, red triangle for no.
APPENDIX 3: QUALITY ASSESSMENT OF QUALITATIVE STUDIES

Studies which met the four McMaster criteria deemed critical by the research team were based on answering the research questions for this systematic review. They were procedural rigour, analytical rigour, auditability and theoretical connections. If the study met all four criteria and scored 80% or more on the McMaster critical appraisal tool for qualitative studies, these were judged as high quality. Studies which met three of the critical criteria and/or obtained an overall score of between 50% and 79% were judged medium quality. Studies which met two or less of the critical criteria and/or obtained an overall score of ≤ 49% were judged low quality. These studies were marked with green triangle for yes, red triangle for no.