

# Towards global standards in stroke rehabilitation and recovery: An international evaluation of practice alignment

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## Abstract

**Objective:** To evaluate how Centres of Clinical Excellence criteria align with routine clinical practice in international stroke rehabilitation centres and explore the factors influencing practices across diverse health systems.

**Design:** Mixed-methods study.

**Setting:** International stroke rehabilitation centres across diverse geographic and economic contexts.

**Participants:** Clinicians and service leaders representing 15 centres from 10 countries (two lower-middle-income, two upper-middle-income, and six high-income).

**Intervention:** Evaluation of how international stroke rehabilitation centres demonstrate performance that aligns with the multidimensional Centre of Clinical Excellence criteria, and exploration of the contextual factors influencing practices across diverse health systems.

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**Main measures:** Survey responses and semi-structured interview data examining patient-centred care, interprofessional practice, workforce development, research, mentorship and organisational structures supporting clinical excellence.

**Results:** Strong alignment was observed for patient-centred outcomes, interprofessional teamwork, and staff education, supported by established clinical pathways and outcome measurement processes. High-income and metropolitan centres more frequently reported protected time, funding, and formal workforce development structures. Centres in low- and middle-income and regional settings relied more on informal processes due to resource constraints. Across all contexts, leadership development, mentorship, advocacy, research engagement, and continuity of care were inconsistently implemented and documented.

**Conclusions:** Core domains of stroke rehabilitation are well established internationally; however, system-level supports that sustain evidence-based practice vary considerably. Embedding structured leadership, workforce development, research engagement, and advocacy mechanisms alongside routine care may strengthen sustainability, improve consistency of evidence-based practice, and reduce inequities in rehabilitation outcomes.

## Keywords

Stroke rehabilitation, clinical excellence, centres of clinical excellence, stroke recovery

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## Introduction

Stroke remains a leading cause of long-term disability worldwide, with significant personal, social and economic impacts.<sup>1</sup> Rehabilitation services play a critical role in improving functional outcomes, promoting independence, and enhancing quality of life for stroke survivor and their families.<sup>2</sup> In line with the WHO Rehabilitation 2030 initiative, strengthening access to high-quality rehabilitation is increasingly recognised as a global health priority.<sup>3</sup> Stroke rehabilitation centres are crucial in this stroke care pathway by delivering targeted interventions that address complex physical, cognitive, emotional and psychosocial needs of stroke survivors.<sup>4</sup>

Despite growing recognition of the importance of stroke rehabilitation, there is substantial global variability in the organisation, access, and quality of services.<sup>5</sup> Disparities are particularly evident between metropolitan and non-metropolitan centres, and in low- to middle-income countries (LMICs), where resource limitations and system-level challenges can limit the delivery of comprehensive care.<sup>6,7</sup> In response, stroke rehabilitation centres have increasingly sought to enhance service quality and

consistency.<sup>8</sup> To support this, the International Stroke Recovery and Rehabilitation Alliance (ISRRA) developed criteria and measurable indicators to support the development of Centres of Clinical Excellence in stroke rehabilitation, encompassing clinical and broader organisational domains.<sup>9</sup> These criteria were designed to be used by stroke rehabilitation centres that are aiming to demonstrate excellence in stroke rehabilitation services.

This study evaluated how international stroke rehabilitation centres interpret, accept, and demonstrate performance that aligns with the multidimensional Centre of Clinical Excellence criteria, and explored the contextual factors influencing practices across diverse health systems.

## Methods

Low-risk ethics approval was granted by the Southern Adelaide Clinical Human Research Ethics Committee via Flinders University (Project number: 5776), the Southern Adelaide Local Health Network (Office for Research number: 112.23), and local approval

**Table 1.** Criteria of centres of clinical excellence in stroke recovery and rehabilitation.<sup>9</sup>

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1. Delivery of outstanding rehabilitation to ensure optimal health, social and well-being outcomes.
  2. Strongly developed research culture and translation of research into best clinical practice.
  3. Inter-professional working and person-centred rehabilitation where staff, stroke survivors and carers work together toward a common goal.
  4. Knowledge exchange and mentorship with international colleagues and survivors of stroke.
  5. Shared strong ethical and value-based leadership
  6. Provision of continuous high-quality education to survivors of stroke, carers, staff, and the general public.
  7. Advocacy and promotion of equitable access of stroke rehabilitation services and funding for innovative research.
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from centres in Singapore, Malaysia, and Regional Australia. Formal ethics approval was not required from Sweden and China, as no local data were collected, although participating Swedish clinicians completed a formal declaration to ensure adherence to ethical principles. All participants provided informed consent prior to participation.

### *Study design and centre selection*

A mixed-methods design was used to evaluate the current practices at stroke rehabilitation centres, using the published Centre of Clinical Excellence criteria<sup>9</sup> outlined in Table 1.

Stroke rehabilitation centres were recruited through ISRRA's international networks. ISSRA expert members were asked to nominate stroke rehabilitation centres that would be interested in being contacted to participate in the survey or semi-structured interview. Twenty centres from low-, middle-, and high-income countries, including metropolitan and non-metropolitan areas, were nominated to participate in this research.

Centres were eligible to participate if they provided inpatient and/or community stroke rehabilitation services and were willing to engage in either an online survey or a series of semi-structured interviews. Stand-alone rehabilitation centres, as well

as centres that provided both acute care and rehabilitation, were eligible to participate. A key representative was nominated by each centre to facilitate communication between the research team and centre staff, coordinate local ethics approvals, and support data collection regarding the criteria and indicators. The key representative was selected on the premise that they had worked more than five years in the stroke rehabilitation service, were interested in participating in the study, and had the required resources (e.g. were able to participate in the support sessions for the duration of the study, had access to the internet, and had allocated project time within their role). There were no data collected on the respondents' demographics.

### *Data collection and analysis*

Data were collected at each centre via structured online surveys or semi-structured interviews, based on the centre's preference and availability. All centres provided data regarding staffing levels, rehabilitation services offered, and how healthcare was funded. Data collection tools were designed using the Consolidated Framework for Implementation Research (CFIR).<sup>10</sup> Informed consent was required before completing the survey or participating in interviews. In the results, each centre is only identified by country to preserve anonymity.

The survey was formatted and disseminated using the Qualtrics platform, capturing descriptive information about the centre's performance via a combination of closed (yes/no) and open-ended questions about whether and how the indicators were demonstrated. The survey took ~45 minutes to complete.

The survey was pilot-tested by five allied health professionals in Australia prior to dissemination, and feedback was used to refine the instrument. Key representatives from the participating centres were emailed a link to complete the survey and asked to complete one survey per centre, with input from their team. Some centres completed one survey per service (e.g. inpatient vs. outpatient).

Centres that consented to an in-depth exploration of the indicators participated in four semi-structured interviews, ranging from 30 to 60 minutes

**Table 2.** Location of participating centres.

| Country        | Metropolitan or regional  | World Bank Socioeconomic classification I |
|----------------|---------------------------|-------------------------------------------|
| Chile          | Metropolitan              | High-income                               |
| Denmark        | Regional                  | High-income                               |
| Ghana          | Metropolitan              | Lower-middle-income                       |
| India          | Metropolitan and regional | Lower-middle-income                       |
| United Kingdom | Metropolitan              | High-income                               |
| Australia      | Metropolitan and regional | High-income                               |
| China          | Metropolitan and regional | Upper-middle-income                       |
| Malaysia       | Metropolitan              | Upper-middle-income                       |
| Singapore      | Metropolitan              | High-income                               |
| Sweden         | Metropolitan              | High-income                               |

(Supplemental File 1). The questions explored the centre's practice, participants' perception of the indicators and reflections at the end of the trial period, which will be reported separately. These centres were also asked the same questions that were asked in the survey (i.e. how the indicators were demonstrated). All interviews were completed over Microsoft Teams by authors TK or EAL, and audio recorded. Interview data were transcribed by TK in Microsoft Word using the recording and field notes. The data from two sources (survey and semi-structured interview) about how the indicators were demonstrated were tabulated in Microsoft Word.

The structure of the interviews differed slightly between centres to accommodate local processes and preferences. For example, some centres only discussed the indicators at the interview, whereas others sent through the completed information prior to the scheduled interview and discussed what they had documented during the interview. Interview participants were staff members from the centre (e.g. rehabilitation clinicians, managers, and team leaders) who were invited by the key representative. Group interviews were conducted at most centres, although two centres opted for individuals to participate in the interviews (these participants collaborated with their teams and recorded responses before the interview). The same participants attended the (individual or group) interviews each time.

Dichotomous responses (yes/no) from all centres regarding whether data were collected on the indicators were tallied for each indicator. Open-ended survey

responses and data from interviews were analysed individually and coded inductively. Data from individual centres were compared to other centres for consistency and differences, patterns related to the healthcare funding model, the geographical location (metropolitan vs. regional centres (>100,000 people), high-income vs. low-to-middle-income centres) and the disciplines working at the rehabilitation unit.

## Results

Fifteen centres from 10 countries participated in this research. Nine centres participated in the interviews, and six centres participated in the survey. Table 2 summarises participating countries, the geographical location and the World Bank Socioeconomic classification.<sup>11</sup>

Stroke rehabilitation centres reported varied service models, with 13 centres (87%) providing inpatient rehabilitation, eight (53%) delivered telehealth (videoconferencing) as part of their services, and only three (20%) offered rehabilitation at home. Teams commonly included physiotherapists ( $n = 15$ , 100%), registered nurses ( $n = 15$ , 100%), occupational therapists ( $n = 14$ , 93%), speech pathologists ( $n = 13$ , 87%), and a medical professional ( $n = 14$ , 93%, most often rehabilitation consultant [ $n = 12$ , 80%], neurologist [ $n = 9$ , 60%] and/or general practitioner [ $n = 5$ , 33%]), see Table 3.

Participants deemed all seven Centre of Clinical Excellence criteria<sup>9</sup> to be valuable for assessing service delivery quality and identifying service gaps. Responses about each criterion and the underlying

**Table 3.** Summary of types of services and core team members of participating centres.

| Centre            | Type of services offered |                           |                            |            | Core team members         |             |                      |                 |                        |                    |           |                  |               |              |
|-------------------|--------------------------|---------------------------|----------------------------|------------|---------------------------|-------------|----------------------|-----------------|------------------------|--------------------|-----------|------------------|---------------|--------------|
|                   | Inpatient Rehabilitation | Outpatient Rehabilitation | Rehabilitation in the home | Telehealth | Rehabilitation Consultant | Neurologist | General Practitioner | Physiotherapist | Occupational Therapist | Speech Pathologist | Dietitian | Registered Nurse | Social Worker | Psychologist |
| Survey            | ✓                        | ✓                         |                            | ✓          | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Chile             | ✓                        |                           |                            |            | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  |           | ✓                | ✓             |              |
| Denmark           | ✓                        | ✓                         |                            |            | ✓                         | ✓           | ✓                    | ✓               | ✓                      | ✓                  |           | ✓                | ✓             | ✓            |
| Ghana             | ✓                        | ✓                         |                            |            | ✓                         | ✓           |                      | ✓               | ✓                      |                    |           | ✓                |               |              |
| India (M)         | ✓                        | ✓                         |                            | ✓          | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  |           | ✓                |               |              |
| India (R)         | ✓                        | ✓                         |                            | ✓          | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                |               | ✓            |
| United Kingdom    | ✓                        | ✓                         | ✓                          | ✓          | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  |           | ✓                |               | ✓            |
| Interview         |                          |                           |                            |            |                           |             |                      |                 |                        |                    |           |                  |               |              |
| Australia (M)     | ✓                        | ✓                         | ✓                          | ✓          | ✓                         |             |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Australia (R)     | ✓                        | ✓                         |                            | ✓          | ✓                         |             | ✓                    | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             |              |
| China (M)         | ✓                        | ✓                         |                            |            | ✓                         |             | ✓                    | ✓               | ✓                      | ✓                  |           | ✓                |               |              |
| China (R)         | ✓                        | ✓                         |                            |            | ✓                         | ✓           | ✓                    | ✓               | ✓                      | ✓                  |           | ✓                |               |              |
| Malaysia          |                          | ✓                         |                            | ✓          | ✓                         | ✓           | ✓                    | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Singapore (1)     | ✓                        | ✓                         |                            |            | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             |              |
| Singapore (2)     | ✓                        | ✓                         |                            |            | ✓                         | ✓           |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Singapore (3)     | ✓                        | ✓                         | ✓                          | ✓          | ✓                         |             |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Sweden            | ✓                        | ✓                         |                            |            | ✓                         |             |                      | ✓               | ✓                      | ✓                  | ✓         | ✓                | ✓             | ✓            |
| Total centre (15) | 13                       | 13                        | 3                          | 8          | 12                        | 9           | 5                    | 15              | 14                     | 13                 | 9         | 15               | 8             | 8            |

R: regional; M: metropolitan.

indicators are presented below, in order of criterion importance (identified in formative work<sup>9</sup>). One centre reported that engagement with the Centre of Clinical Excellence indicators prompted reflection on previously underdeveloped areas of practice and highlighted opportunities for integration into routine care.

### ***Criterion 1: Delivery of outstanding rehabilitation and optimal outcomes***

Centres reported that while some practices aligned with criterion indicators, these were not always documented, particularly in non-metropolitan and LMIC centres (e.g. regional China and Ghana). All centres reported routinely conducting comprehensive rehabilitation assessments at admission to guide rehabilitation service delivery, although these assessments were predominantly discipline-specific. Fourteen centres (93%) reported that rehabilitation interventions were initiated within 24 hours and tailored to patient goals. However, the intensity, duration, and integration of services varied, influenced by local resources, models of care, and cultural practices, including the use of Chinese traditional medicine. Self-management support was variable, with three centres (20%) reporting that self-management was integrated within structured programs to help patients manage mobility, fatigue, and cognitive challenges post-stroke. Eleven centres (73%) reported ongoing care and post-discharge support, typically through follow-up appointments, home visits, or telehealth sessions. Nevertheless, fragmentation in continuity of care remained a concern, particularly in lower-resourced settings and centres without formal transition pathways between hospital and community services.

Data regarding patient outcomes (e.g. 10-Meter Walk Test, Motor Assessment Scale and Berg Balance Scale) were collected at 13 centres (87%), while patient-reported outcome measures, such as quality-of-life questionnaires (e.g. EQ-5D), satisfaction surveys or goal attainment scales were less consistently applied. Carer supports were frequently overlooked, with only four centres (27%) reporting structured approaches for supporting carers, typically through informal training or discipline-specific assessments.

### ***Criterion 2: Research culture and translation of research to clinical practice***

A strong research culture involves active collaborations, local projects, and evidence-based practice, supported by organisational recognition, external partnerships, staff expertise, and skills in change management and ethical research.<sup>9</sup> In this study, considerable variation in research culture, capacity and activity was reported across centres.

Four centres (27%; Chile, metropolitan India, metropolitan Australia, and Sweden) demonstrated a comprehensive research culture and activity with structured processes to support research through the inclusion of research elements in job descriptions, infrastructure and resources for clinicians, pathways for research translation, access to support to lead funding applications and active collaboration with academic institutions and associated stakeholders.

Within this criterion, 13 centres (87%) reported partnerships with universities, typically through student placements, teaching activities, or joint academic appointments. Research leadership was evident across multiple disciplines in seven centres (47%), demonstrating interprofessional engagement in advancing evidence-based practice, while six centres (40%) reported national or international research collaborations. Only 10 centres (67%) reported having structured processes in place to support research activity, including infrastructure for data collection (e.g. national stroke registries), journal clubs, and quality improvement initiatives. Metropolitan centres and centres from HICs were more likely to report structured research processes and external collaborations. In contrast, the centres in LMICs and non-metropolitan centres described limited capacity due to resource constraints.

### ***Criterion 3: Interprofessional teamwork and patient-centred goal setting***

Clinical excellence in stroke care is achieved when stroke survivors and carers are equal partners in goal setting and decision-making, through coordinated inter-professional teamwork, and collaboration with external partners to deliver seamless, person-centred rehabilitation.<sup>9</sup> A common practice,

reported at all centres other than the Ghanaian centre, was the establishment of interprofessional rehabilitation goals. Goals were routinely reviewed by the team at 12 centres (80%), reflecting a structured approach to care planning. Shared decision-making and information sharing, most often through goal-setting meetings, were evident in 12 centres (80%), with patients and families actively involved in shaping rehabilitation journeys and integrating goals into broader care plans to guide interventions. Routine two-way communication with patients and families, through ward rounds, informal discussions, and family meetings, were reported by 13 centres (87%) to communicate openly and often about progress, barriers, and care needs. Many centres enhanced communication through virtual platforms ( $n = 11$ , 73%), which supported continuity of care and enabled communication with family members unable to attend the centre. Six centres (40%) demonstrated practices explicitly addressing culturally safe care, an essential component of equity and inclusivity in rehabilitation in some countries.

Gaps were apparent in the extent to which centres engaged with external agencies, thereby limiting fully integrated care. Only seven centres (47%) reported systematically identifying all relevant care stakeholders, such as community providers or primary care clinicians who would support the survivor on discharge from the centre.

#### ***Criterion 4: Knowledge exchange and mentorship***

High-quality stroke care is supported by knowledge exchange with policymakers, professional bodies, industry, and international partners, alongside mentorship between stroke survivors, clinicians, and clinical centres to share best practice and drive improvement.<sup>9</sup> Participating centres generally had systems supporting knowledge exchange, but formal mentorship opportunities were limited. All centres had collaborations with external organisations to share best practice, with 13 centres (87%) engaging in activities such as discipline-specific

interest groups, national stroke communities of practice, partnerships with universities or academic exchanges with clinicians from other stroke rehabilitation centres. Opportunities for staff to participate in knowledge exchange activities were available in most centres ( $n = 12$ , 80%), but protected time for these activities was only reported in only four centres (27%).

Mentorship was less common, reported at four (27%) sites. Mentorship was discipline-specific and provided for individuals, rather than being integrated across the rehabilitation service. Some high-income metropolitan centres offered mentoring opportunities linked to university partnerships or funded courses, although these were not always stroke-specific.

#### ***Criterion 5: Leadership***

Ethical, values-based leadership at both local and higher levels supports clinical excellence by fostering teamwork, workforce development, stakeholder engagement, and service adaptability to evolving clinical needs.<sup>9</sup> Most centres demonstrated ethical, values-based leadership through structured workforce development and training, although the depth and formality varied. Eight centres (53%) demonstrated comprehensive workforce and leadership development with structured recruitment, professional growth pathways, feedback mechanisms, and investment in leadership training. Annual appraisals, training plans, and stroke rehabilitation competency frameworks were commonly reported in Australia, Sweden, and Singapore, and formal leadership programs were available in Australia, metropolitan China, and Sweden, albeit with limited time and investment. All centres reported processes to recruit highly qualified staff. National and international leadership roles, such as involvement in the local stroke support organisation memberships, were more consistently reported in higher-resourced metropolitan centres.

#### ***Criterion 6: Education***

Education to promote clinical excellence should encompass clinical teams, stroke survivors, carers,

industry, and the public, with indicators measuring staff learning opportunities and the centre's delivery of education across professional, patient, and community settings.<sup>9</sup> Pathways for postgraduate qualifications were available in almost all centres ( $n = 13$ , 87%), with in-house training and discipline-specific education widely offered ( $n = 12$ , 80%). Many centres also supported off-site education through scholarships or funded opportunities ( $n = 12$ , 80%), although stroke-specific programs were less consistently specified. Across centres, staff education included monthly discipline-specific sessions, virtual workshops, and interprofessional learning, while clinical placements and university partnerships facilitated advanced qualifications. Conference presentations and in-services were commonly undertaken, enabling staff to disseminate knowledge and engage with peers across sites.

Education for stroke survivors and carers was consistently delivered in 11 centres (73%). In contrast, public education was infrequently provided, typically limited to events such as Stroke Week or World Stroke Day, highlighting a gap in broader community engagement.

### *Criterion 7: Advocacy and equitable access*

A Centre of Clinical Excellence should promote equitable acute care and early rehabilitation, and empower stroke survivors, carers, and stakeholders through ongoing communication, access initiatives, and advocacy to improve services and advance clinical breakthroughs.<sup>9</sup> Responses to this criterion varied. Most centres had processes for ongoing communication with key stakeholders, but monitoring and improvement mechanisms were inconsistent. Eight centres (53%) reported advocacy and activities to promote equitable access to stroke rehabilitation, such as referral pathways. Some centres actively monitored access and addressed gaps, while others relied on informal coordination. Equitable access mechanisms were more common in high-income centres, including priority referral systems, universal admission policies, and audits to ensure compliance with national or institutional guidelines. Advocacy was rarely formalised, though some centres reported engagement with professional

associations and media to raise awareness of stroke rehabilitation and drive service improvements.

## **Discussion**

This study offers a global perspective on the practical pathways and systemic conditions that underpin excellence in stroke rehabilitation. All centres (including those where English was not the national language) could understand and apply the Centre of Clinical Excellence criteria, and no additional training was provided to the centres. Practices aligned most consistently with criteria related to patient and service outcomes, interprofessional collaboration and staff education, reflecting the central role of these domains in routine rehabilitation care. In contrast, research activity, leadership, knowledge exchange, advocacy, and support for carer outcomes or mentorship were less consistently embedded. These findings are clinically relevant as they highlight how organisational structures and resources directly influence the consistency, coordination, and quality of rehabilitation delivered to people with stroke.

Stroke rehabilitation services are traditionally and understandably focused on service delivery, the most important feature of the Centre of Clinical Excellence from the initial prioritisation exercise.<sup>9</sup> However, this study highlights that the additional domains nominated in the Centre of Clinical Excellence definition work, such as leadership, workforce development, research engagement, and advocacy, are also recognised by clinical centres as important features that support and sustain high-quality clinical care and contribute to the advancement of stroke rehabilitation. While these elements may not be prioritised in day-to-day clinical operations, where understandably clinical care delivery is the primary focus, the findings suggest they are achievable and can be incrementally integrated when services adopt a deliberate, aspirational approach to quality improvement and system development.

Rehabilitation practices varied by country income level and metropolitan status. High-income and metropolitan centres more commonly reported protected time, funding, structured education pathways,

formal service monitoring, outreach, and organisational support for research, whereas LMIC and non-metropolitan centres relied on more informal collaboration and communication processes, constrained by limited workforce capacity and resources. Achieving high-quality stroke rehabilitation in LMIC and non-metropolitan settings is strongly influenced by workforce capacity, infrastructure and system-level support.<sup>7</sup>

Resource-constrained centres face persistent barriers to comprehensive rehabilitation, including limited time, staffing, funding, and formal systems to support education, monitoring, and advocacy, which restricts service development sustainability.<sup>12,13</sup> Evidence indicates that advancing care in these settings requires targeted investment in workforce development, protected time for education and research, strengthened interprofessional collaboration, and scalable systems for stakeholder engagement and service monitoring.<sup>14–16</sup> Even within high-income countries, non-metropolitan centres experience reduced access to specialised services, highlighting the need for equitable models that support professional development and research participation beyond metropolitan hubs.<sup>15,16</sup> The association between research activity in terms of reduced mortality, better clinical outcomes,<sup>16</sup> and improved staff morale and retention, offers tangible benefits for both patient care and workforce sustainability.<sup>17</sup>

The Centre of Clinical Excellence criteria are intentionally aspirational, and not all centres were expected to demonstrate achievement across all domains. Most centres aligned strongly with Criterion 1 (patient and service outcomes), reflecting the central clinical focus of stroke rehabilitation, while subsequent criteria highlighted additional organisational and system-level features that may support sustained excellence. Variation across these domains, therefore, identifies priorities for service development rather than deficits in care.

Participants in this research reported that data on leadership and advocacy were not well recorded within their centres. Although these criteria were widely recognised as important, it is consistent with the literature describing leadership and advocacy as central to service quality, sustainability,

and stakeholder engagement,<sup>18–20</sup> it was rarely formally documented. This lack of documentation appears to reflect not the absence of these activities, but rather that they are not captured within existing reporting systems. Centres that were able to demonstrate national leadership tended to record this information in policy documents, demonstrating that these data can be captured by centres providing stroke rehabilitation. Beyond audit requirements, documentation enhances transparency, supports evaluation and replication of effective practices, and is associated with more consistent care delivery, stronger implementation of evidence-based practice, and improved quality improvement processes.<sup>21</sup> From an implication to practice perspective, participants reported that there were insights gained from this research which potentially shifted their view from solely focusing on clinical aspects of rehabilitation, to incorporating other aspects of services, such as research and education, that promote excellence in their centres.

Several limitations should be acknowledged. There is a possibility of sampling bias because the sample included a limited number of international stroke rehabilitation centres, limiting generalisability. The centres were also nominated by those who were involved in the development of the criteria. Despite targeted recruitment efforts, centres from North America were not represented. Data were primarily self-reported and document-based, introducing potential reporting bias and variability in the interpretation of indicators. Comparisons across income level and geographic context may also be confounded by heterogeneity within these categories. Future research should be conducted across larger and more diverse stroke rehabilitation centres, using longitudinal and objective methods, with particular focus on under-represented domains such as mentorship, leadership, advocacy, and research culture. Further work could also be designed to better understand sustainable clinical practices and their impact on patient, carer, and service outcomes.

This study highlights that key components of high-quality stroke rehabilitation – patient-centred outcomes, interprofessional teamwork and staff education – are consistently embedded in routine

clinical practice across international centres. In contrast, systems to support research, mentorship, leadership and advocacy were less consistently implemented and documented, despite being recognised by clinicians as important contributors to care quality and service sustainability. These gaps were most evident in low- and middle-income and non-metropolitan settings, reflecting broader inequities in workforce capacity, infrastructure, and access to resources. Achievement of the Centre of Clinical Excellence in Stroke Rehabilitation requires extending beyond clinical standards apparent at most centres to include structured professional development, leadership, mentorship, and research support.

### Clinical messages

- International stroke rehabilitation centres consistently deliver strong clinical care.
- Organisational support for leadership, research, and workforce development is less consistently established in resource-constrained and non-metropolitan rehabilitation settings.
- Embedding leadership, mentorship, and research pathways may strengthen service sustainability and support consistent delivery of evidence-based rehabilitation.

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### Ethics and dissemination

All sources will be adequately referenced. The findings of our research will be disseminated through presentations at conferences and relevant forums.

### Authors contribution

TK conceived and led the study as part of her doctoral research, undertook data collection and analysis, and drafted the manuscript. EAL contributed to study conception and design, and critically revised the manuscript for important intellectual content. RCS and JMH contributed to study conception and methodological design, and critically reviewed the manuscript. ST, NAA, EG, JJ, and MAM contributed to study design refinement, supported interpretation of findings within their respective contexts, and critically revised the manuscript. All authors approved the final version.

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### Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Data availability statement

Data are available on reasonable request from the lead author.

### Supplemental material

Supplemental material for this article is available online.

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