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Exploring factors influencing the consistent adoption of a post-stroke upper extremity outcome measure using Normalisation Process Theory

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Abstract

Background Stroke rehabilitation guidelines recommend using outcome measures like the Fugl-Meyer Assessment for Upper Extremity (FMA-UE) to assess post-stroke upper extremity function. However, integrating such outcome measures into routine clinical practice remains challenging, highlighting the need to understand factors affecting their implementation in evolving healthcare models.

Objective Our study aimed to identify the barriers and facilitators to sustain the routine use of the FMA-UE among hospital-based occupational therapists (OTs) using a theory-driven approach.

Methods Employing a mixed-method sequential exploratory study design rooted in Normalisation Process Theory (NPT), we gathered quantitative data through a validated survey followed by qualitative insights analysed with directed content analysis from focus group discussions involving occupational therapists from four hospitals.

Results Survey findings ($n = 34$) revealed barriers primarily associated with NPT constructs of *collective action* and *coherence*. Facilitators were linked to the *cognitive participation* construct. Key barriers identified in focus groups included insufficient coaching, competing priorities, and perceived limited value of the FMA-UE. Facilitators included legitimation of therapists' role in outcome measurements and an open learning culture.

Conclusions Through a theory-based approach, we identified barriers and facilitators to sustain the routine of the FMA-UE. Our findings offer insights for designing implementation strategies to embed the FMA-UE into routine practice, supporting its sustained use in stroke rehabilitation.

Keywords Stroke, Outcome measure, Fugl-Meyer Assessment, Upper limb, Rehabilitation, Implementation science

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Background

Upper extremity impairments are a common and persistent consequence of stroke, affecting 77% of survivors with weakness and 63% with sensory deficits [1–4]. These limitations can significantly hinder a person's ability to carry out daily activities, often necessitating assistance or complete dependence on caregivers [5]. In addition to physical restrictions, these impairments can also lead to emotional challenges, such as depression and a reduced quality of life, while negatively impacting a survivor's sense of self [6–8]. As a result, restoring upper limb function is a crucial goal in stroke rehabilitation [9].

Evaluating upper extremity function is a crucial first step in the rehabilitation of the affected limb following a stroke. Stroke rehabilitation clinical practice guidelines worldwide recommend using outcome measures to evaluate upper extremity function after stroke [10, 11]. Outcome measures serve the dual purpose of establishing the status of upper extremity function and evaluating changes in upper extremity function over time [12, 13]. The Fugl-Meyer Assessment of Upper Extremity (FMA-UE) and the Action Research Arm Test are two post-stroke outcome measures that are not only widely used in clinical practice but are also recommended outcome measures for research when studying upper extremity sensorimotor recovery after stroke [14, 15]. However, despite these recommendations, integrating post-stroke upper limb outcome measures into routine clinical practice remains a significant and under-researched challenge.

Stroke rehabilitation professionals often endorse the use of and adherence to recommended outcome measures in stroke rehabilitation clinical practice guidelines. Yet, less than half consistently use outcome measures in their routine daily practice [16, 17]. This inconsistency is not unexpected, given the various challenges to implementing evidence-based practice changes [18]. Barriers to using outcome measures among rehabilitation professionals exist at individual, managerial, and organisational levels, as summarised in a systematic review by Duncan & Murray (2012) [19]. Their review identified four major themes that can act as facilitators or barriers: knowledge, education, and perceived value of outcome measures; support/priority for outcome measurement; practical considerations; and patient considerations [19]. Some barriers identified included the lack of knowledge about psychometric properties of outcome measures, low perceived value of outcome measures, and time constraints for assessment [19]. While insights from the review shed light on the reasons behind the limited integration of outcome measures in clinical practice, there is a pressing need to delve deeper into the barriers and facilitators to routine outcome measurements to address several knowledge gaps.

Knowledge gaps encompass several key areas. Firstly, there is a lack of understanding regarding the barriers and facilitators influencing the routine use of outcome measures in post-stroke rehabilitation, particularly beyond the early implementation stages. Our implementation experiences, marked by limited success in embedding the routine use of the FMA-UE in clinical practice, suggest that distinct barriers and facilitators exist beyond the early stages of outcome measurement implementation. Only one of the 15 studies included in Duncan & Murray's systematic review [19] investigated the barriers and facilitators following the implementation of a range of strategies aimed at increasing physiotherapists' use of outcome measures [20]. Examples of these strategies include conducting educational meetings and designating champions. Secondly, existing literature often lack a solid theoretical foundation when examining barriers and facilitators. Most studies included in Duncan & Murray's review [19] did not use a theory to examine the barriers and facilitators to the routine use of outcome measures. Using a theory that can explain behaviour change in healthcare professionals is important as it provides a theoretical base to: (1) understand the factors underlying current patterns of behaviours of rehabilitation professionals in the use of post-stroke upper extremity outcome measures, (2) identify appropriate targets for implementation strategies, and (3) explain and predict the mechanisms of change involved with implementation strategies [21, 22]. Lastly, there is a notable lack of published studies examining the systematic implementation of recommended post-stroke upper extremity outcome measures in clinical practice. Limited evidence exists concerning factors influencing the integration and embedding of outcome measures for evidence-informed, patient-centred upper extremity stroke rehabilitation care [23].

Addressing knowledge gaps in the integration and embedding of outcome measurement within stroke rehabilitation is crucial due to two key healthcare trends. Firstly, the increasing adoption of value-based care model in healthcare systems worldwide places a heightened emphasis on outcome measurement, an essential facet of value-based healthcare [24]. Secondly, the assessment and measurement of outcomes were central themes in the key recommendations for advancing post-acute stroke care systems and the proposed criteria for designating rehabilitation readiness for Comprehensive Stroke Centers [25]. Consequently, integrating and embedding outcome measures in routine clinical practice is necessary to align with evolving paradigms within healthcare systems and comprehensive stroke care.

Aim

Seeking to expand upon the findings from Duncan & Murray's systematic review and address identified

knowledge gaps, our study adopted an implementation science perspective and aimed to identify the barriers and facilitators to the routine use of a post-stroke upper extremity outcome measure among occupational therapists (OTs) in Singapore using a theory-driven approach.

Methods

Normalisation process theory

Normalisation Process Theory (NPT) is a sociological theory developed to address the challenges of implementing innovations and advances in healthcare settings [26]. We used this theory to guide our study, aiming to explore how the FMA-UE can be embedded in daily work processes so that that it becomes normalised and accepted as part of routine clinical practice beyond early stages of implementation [27]. The theory considers the normalisation of a set of practices as the product of four social mechanisms: *coherence*, *cognitive participation*, *collective action*, and *reflexive monitoring* [27]. Each mechanism is influenced by factors that promote or inhibit routine embedding of a set of practices and are also in a dynamic relationship and interact with the wider local practice context of group processes and conventions, organisational structures, and social norms [28]. The four social mechanisms (i.e. constructs) are each divided further into four components, i.e. 16 components in total [27]. Table 1 describes the NPT constructs and components in relation to the practice of using the FMA-UE.

Systematic reviews have highlighted NPT's reliability and flexibility in describing and understanding the implementation of complex interventions across diverse settings [29, 30]. This adaptability makes it particularly suited for examining the integration of outcome measures like the FMA-UE into routine practice. Although the FMA-UE is widely regarded as a gold standard measure of upper extremity motor function post-stroke, its implementation in routine clinical practice can still be considered a complex intervention. This complexity stems from factors such as the time and resources required for administration, the need for training to

Table 1 The constructs and components of the NPT in relation to the use of the FMA-UE

Construct	Component	Description
Coherence		Process of understanding the purpose and benefits of using the FMA-UE
	Differentiation	Actions OTs take to understand how using the FMA-UE differs from other outcome measures used in clinical practice
	Communal specification	Actions OTs do collectively (e.g. a group or a team) to understand the aims, objectives, and benefits of implementing and/or using the FMA-UE
	Individual specification	Actions individual OTs take to understand the efforts needed to implement and use the FMA-UE
	Internalisation	The work OTs do to understand the value, benefits, and importance of using the FMA-UE in their practice
Cognitive participation		The relational work to define and organise the efforts needed to build the routine practice of using the FMA-UE
	Initiation	Actions taken at the individual and/or group level to initiate and drive the use of the FMA-UE among OTs
	Enrolment	The work of engaging OTs to support the routine use of the FMA-UE
	Legitimation	The work that OTs do (at individual and/or group level) to justify their involvement in the routine practice of using the FMA-UE
	Activation	The continuing work to sustain the routine practice of using the FMA-UE
Collective action		The operational work needed to enact the routine practice of using the FMA-UE
	Interactional workability	The interactional work to operationalise the routine practice of using the FMA-UE
	Relational integration	The knowledge work to build OTs' confidence in administering the FMA-UE and to instil responsibility to use the FMA-UE in their routine clinical practice
	Skill set workability	The work of dividing and allocating tasks and resources according to one's competency in using the FMA-UE
	Contextual integration	The work of integrating the use of the FMA-UE into existing work processes and contexts. It includes allocation of resources or endorsing procedures to support the use of the FMA-UE
Reflexive monitoring		The work of appraising and evaluating the effectiveness of routinely using the FMA-UE
	Systemisation	The work of collecting and analysing data to determine the usefulness of the FMA-UE and the adherence to routine use of the FMA-UE among OTs
	Communal appraisal	Actions taken at a group level to evaluate the value (usefulness, worth) of the FMA-UE and adherence to routine use of the measure
	Individual appraisal	The work by individual OTs to evaluate the value (usefulness, worth) of using the FMA-UE on their clinical practice and patients
	Reconfiguration	Actions taken after evaluating and appraising the effectiveness of routinely using the FMA-UE

FMA-UE Fugl-Meyer Assessment of the Upper Extremity, *OTs* Occupational therapists

ensure accurate and reliable scoring, and the necessity of integrating it into existing workflows and priorities in resource-limited settings. NPT provides a robust framework to examine how these factors interact and influence the embedding of the FMA-UE into routine practice.

Study design

We employed a mixed-method sequential explanatory study design comprising two phases. In Phase 1, we used an online survey to collect quantitative data, followed by focus groups in Phase 2 to explain and elaborate on findings from the online survey.

Setting

We conducted our study at four public hospitals within the same hospital network in Singapore. Two are acute hospitals that provide hyperacute and acute stroke treatment, where OTs work in acute stroke units and inpatient wards to deliver early rehabilitation for stroke patients. The other two are community hospitals that provide short-term post-acute care and rehabilitation to facilitate recovery and transition back to daily lives and communities. OTs in community hospitals provide post-acute stroke rehabilitation services. The FMA-UE had been implemented at all four hospitals as a post-stroke upper extremity outcome measure, with the year of implementation ranging between 2013 and 2021. The assessment was operationalised as a routine outcome measure for patients with a newly diagnosed stroke referred for occupational therapy services on admission and discharge to the inpatient rehabilitation programs or units.

Phase 1 (Quantitative phase)

Online survey

The Normalisation Measure Development (NoMAD) survey is a 23-item survey instrument based on the NPT (Supplementary file 1) [31]. The survey was organised into three parts: Part A comprised of demographic questions; Part B included three general questions about FMA-UE use and responses were rated on an 11-point visual analogue scale; and Part C contained a set of detailed questions about the use of the FMA-UE to reflect the 16 components of the NPT. Responses for Part C were rated on a 5-point Likert scale.

Participants

All OTs at the four public hospitals were invited by the study team via email to participate. Inclusion criteria included OTs working with stroke patients or who had prior experience with stroke patients. OT trainees without a full practicing licence were excluded.

Data collection

The customised NoMAD survey was administered online via a platform developed by Government Technology Agency, Singapore. The survey link was sent in the invitation email, with a reminder sent a week before the survey closed. The survey was available for 6 weeks from October to December 2021.

Data analysis

We used descriptive statistics to summarise participant characteristics and survey responses. In Part C of the survey where each item corresponded to an NPT component, we examined the proportion of responses to determine whether the NPT component was a barrier or facilitator. An NPT component was classified as a barrier if fewer than 50% of participants rated *strongly agree* or *agree* on the corresponding survey item; otherwise, it was considered a facilitator. To address potential nuances in participant responses, we conducted a sensitivity analysis by excluding neutral (i.e. *neither agree nor disagree*) and *not relevant* responses. This analysis allowed us to examine the impact of neutral responses on the classification of barriers and facilitators. All data analysis was conducted using Statistical Package for Social Sciences (SPSS) version 6.

Phase 2 (Qualitative phase)

Participants

We recruited participants from Phase 1 survey respondents who agreed to be contacted for a follow-up focus group. Those who consented were invited to join the focus groups.

Data collection

Focus groups were held virtually and moderated by two of our authors [SXC, JY]. We prepared a semi-structured interview protocol and formulated guiding questions based on Phase 1 survey results and the NPT theoretical framework (Supplementary file 2). Questions were designed to prompt participants to explain the reasons behind the survey ratings to gain a more in-depth understanding of the barriers and facilitators to routine use of the FMA-UE. To facilitate an honest discussion between focus group participants and the moderator, we ensured that the moderator who led the discussion did not belong to the same hospital as the participants. All focus groups lasted about 1 h and were audio-recorded and supplemented with field notes.

Data analysis

Two of the three focus group audio recordings were transcribed verbatim; field notes replaced the transcript for the third due to technical errors. We applied directed content analysis with an initial coding framework based

Table 2 Survey participant characteristics (*N* = 34)

	n (%)
Site of Practice	
Sengkang General Hospital	4 (11.8)
Singapore General Hospital	10 (29.4)
Outram Community Hospital	14 (41.2)
Sengkang Community Hospital	6 (17.6)
Years worked at current hospital	
< 1 year	3 (8.8)
1–2 years	19 (55.9)
3–5 years	9 (26.5)
6–10 years	3 (8.8)
Main role in relation to the use of the FMA-UE	
Involved in administering the FMA-UE	33 (97.1)
Managerial role	1 (2.9)

FMA-UE Fugl-Meyer Assessment of the Upper Extremity

Table 3 Focus group participant characteristics (*N* = 8)

Participant		Practice setting
1.	Aw	Tertiary acute hospital, stroke unit and inpatient wards
2.	Anna	Tertiary acute hospital, stroke unit and inpatient wards
3.	Amber	Tertiary acute hospital, stroke unit and inpatient wards
4.	Emma	Tertiary acute hospital, stroke unit and inpatient wards
5.	Chloe	Community hospital, inpatient wards
6.	Emily	Community hospital, inpatient wards
7.	Diana	Acute hospital, inpatient wards
8.	Mel	Acute hospital, outpatient clinic

All names are pseudonyms

on the NPT. Three authors [SCX, JY, SA] independently reviewed transcripts, broadly coding them with the four NPT constructs, followed by detailed coding of NPT components. Data could be coded to more than one NPT construct, and data that did not fit within the NPT were assigned stand-alone codes. Authors met regularly to discuss and verify interpretations, resolving differences through consensus. Codes and themes were mapped and displayed using NVivo version 11.

Results

Consistent with our study design, analysed data from the survey and focus groups were merged and we report the study results as an integrated whole, structured according to the NPT.

Participant characteristics

Survey participants

We received responses from a total of 34 participants, which represented 47.2% of the OTs who fit our inclusion criteria. Participants' characteristics are summarised in Table 2. Most participants ($n = 19$, 55.9%) had 1–2 years of working experience at their current organisation. All but one participant was involved in administering the FMA-UE; this participant held a managerial role and oversaw the use of the FMA-UE by OTs in their hospital.

Focus group participants

Eight survey participants consented to follow-up focus groups, and we conducted a total of three focus groups. Two focus groups had only two participants due to scheduling conflicts.

Participant characteristics There were participants from all four hospitals (Table 3), and their working experience at the hospital ranged from 2 to 10 years.

Participants' practice setting The OT's practice settings were similar for both the community and one acute hospital, which all followed a generalist model of care. These OTs worked with patients with various medical conditions in their daily practice, including treating patients with stroke. In contrast, OTs practising at the acute tertiary acute hospital followed a specialist model of care and primarily worked with patients with neurological conditions (including stroke) daily.

Use of the FMA-UE

Table 4 presents survey responses regarding the use of the FMA-UE. Participants rated their familiarity with the FMA-UE at a mean rating of 6 ($SD = 2$) on an 11-point Likert scale, indicating moderate familiarity. When asked if using the FMA-UE felt normal in their work, the mean rating was 5 ($SD = 3$), reflecting a neutral perception.

Familiarity with the FMA-UE varied by practice setting. Participants in generalist care models encountered stroke patients only if they were admitted to their ward, leading to infrequent use of the FMA-UE and thus lower familiarity. In contrast, those in specialist settings frequently used the FMA-UE, enhancing their familiarity.

Table 4 Summary of responses to Part B of the survey (*N* = 34)

Survey Question	Mean	SD	(Min, Max)
When you use the FMA-UE, how familiar does it feel?*	5.68	2.31	(0, 10)
Do you feel the FMA-UE is currently a normal part of your work?†	5.09	2.88	(0, 10)
Do you feel the FMA-UE will become a normal part of your work?†	6.53	2.02	(2, 10)

FMA-UE Fugl-Meyer Assessment of the Upper Extremity, *Min* Minimum, *Max* Maximum

* Anchors of 11-point Likert Scale: 0 – Still feels very new, 10 – Feels completely familiar

† Anchors of 11-point Likert Scale: 0 – Not at all, 5 – Somewhat, 10 - Completely

Focus groups highlighted varied interpretations of 'normal part of work'. Some participants associated 'normal' with their frequency of using the FMA-UE; since they seldom administered it, it was not a normal part of their work. Others associated 'normal' with the work processes related to the FMA-UE, viewing its use as a standardised upper extremity outcome measure for stroke patients in their practice setting.

Barriers and facilitators to routine use of the FMA-UE framed by the NPT

Coherence

All four NPT components within the *Coherence* construct were interpreted as facilitators, with over 50% of survey participants agreeing with the relevant survey statements (Fig. 1), though agreement ranged from 52.9 to 67.6%. Sensitivity analysis showed no changes in the categorisation of barriers and facilitators (Supplementary file 3). OTs valued understanding the FMA-UE's purpose and benefits of using the FMA-UE beyond mandated processes, particularly its influence on patient care. As explained by Participant 6:

> *I guess the intention has to be clear whenever we roll out such assessments… if we want a good buy-in for therapists to use an assessment tool, the intention to why we bring in such a tool has to be very clear. How does this [the FMA-UE] actually affect the way we conduct rehab? Or how can we use the tool to motivate patients or to give a prognostication of how the upper limb [function] will return?*

A key theme from focus groups was the perceived value of the FMA-UE which acted as both a facilitator and a barrier. Participants from Focus Group 3 shared that the FMA-UE demonstrated objective improvements in the patients' affected upper extremities to both patients and the multi-disciplinary team. Improvements in FMA-UE scores motivated patients and helped OTs justify extending inpatient rehabilitation. Furthermore, OTs trained to use FMA-UE scores for intervention planning found it enhanced their clinical reasoning. They could match patients' upper extremity function to task difficulty and tailor functional task practice accordingly:

> *"I think things changed for me when I understood the use of the Fugl-Meyer for intervention planning… it was difficult to integrate it in the past, not because I didn't feel like I had enough training. I think it's more that I didn't understand the purpose of it; it was just part of a coordinated care pathway. But once I understood the importance of the Fugl-Meyer and you can directly implement it to treatment immediately, it was easier to integrate [into daily practice] for me." (Participant 4).*

> *"…understanding the view of the Fugl-Meyer and how it impacts intervention planning, I think it made a big difference… I learned it purely as a [assessment] tool and then many years later, I learned how it is used to help with intervention planning. And I think that was really helpful to change my entire mindset about the purpose or the use of this assessment." (Participant 1).*

Conversely, OTs who were not aware of how to interpret FMA-UE scores for intervention planning saw little value in the assessment, viewing it merely as only a mandated work process to evaluate patient outcomes:

> *"I think that with the scores that we get from the FMA-UE, it may not actually help guide a therapist in thinking of possible interventions for them… It doesn't come naturally to them because it's just a score to them. It's 'Oh I've been told I need to administer a tool, so I'm just going to administer it for the sake of doing it.'" (Participant 6).*

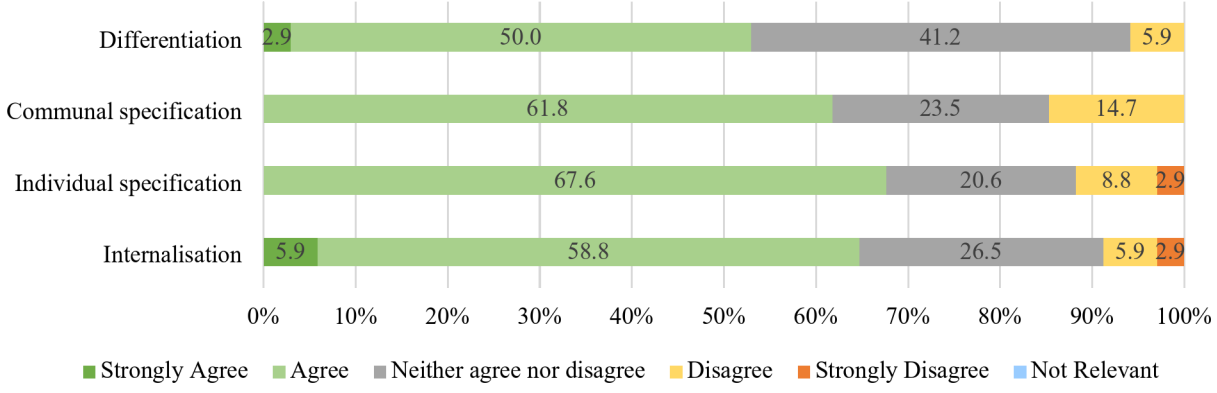

Fig. 1 Summary of responses of survey statements related to *Coherence* construct. For example, a response of "strongly agree" indicates that differentiation (seeing how the FMA-UE differs from usual ways of working) is perceived as highly important

A recurring theme from the focus groups was insufficient training, particularly on score interpretation, which emerged as a significant barrier to the routine use of the FMA-UE. This theme was further illustrated by the 41.2% neutral responses to the survey question, "I can see how the FMA-UE differs from usual ways of working." The neutral responses suggested a lack of clarity among participants regarding the assessment's distinct role and benefits. This uncertainty can be linked to insufficient training, which may have hindered OTs from recognising how the FMA-UE contrasts with their existing practices and other outcome measures.

Cognitive participation

Most survey participants agreed with the NPT components linked to *cognitive participation* construct, interpreting them as facilitators (Fig. 2). Specifically, 76.4% agreed with the statement, 'I believe that participating in the use of the FMA-UE is a legitimate part of my role,' and 79.4% agreed with, 'I'm open to working with colleagues in new ways to use the FMA-UE.'

Recognising the FMA-UE as integral to stroke rehabilitation was a key facilitator. Upper extremity rehabilitation is a primary focus of occupational therapy as upper extremity function impacts basic and instrumental activities of daily living. OTs work collaboratively with patients to facilitate and improve control and movements in the upper extremity after stroke to maximise their ability to perform daily tasks. Focus group participants highlighted the necessity of using standardised assessments like the FMA-UE to evaluate upper extremity function.

An open learning culture emerged as another facilitator. Participants described self-directed initiatives they took to familiarise themselves with the FMA-UE, beyond the training and educational resources provided in their departments. These initiatives included making time for extra practice and seeking coaching and clarifications from peers, supervisors or senior colleagues. These collaborative learning efforts reinforced the use of the FMA-UE in practice.

The presence of key champions promoting the FMA-UE was identified as both a facilitator and a barrier. Champions, individuals who actively advocated for and supported the FMA-UE, were crucial in driving its implementation and securing resources to support its operational use. Building a 'team culture' around the FMA-UE was considered essential to encourage its widespread adoption, as collective engagement fosters consistent use of the assessment. Survey results indicated 50.0% of participants agreed with the statement, "There are key people who drive the use of the FMA-UE forward and get others involved,". Sensitivity analysis indicated that excluding neutral responses did not change the classification of this survey item, reinforcing the presence of key champions as facilitators. However, focus group participants highlighted that the limited number of champions hindered broader uptake, as the responsibility of advocating for the FMA-UE was concentrated among too few individuals:

> *"It seems like there is only one senior therapist... trying to drive the use of the FMA-UE... But I think there are insufficient people to push this assessment forward and get others involved because of the proportion [of key champions to all other OTs]..." (Participant 5).*

This suggests that while champions are generally viewed as enablers, their effectiveness is compromised by the

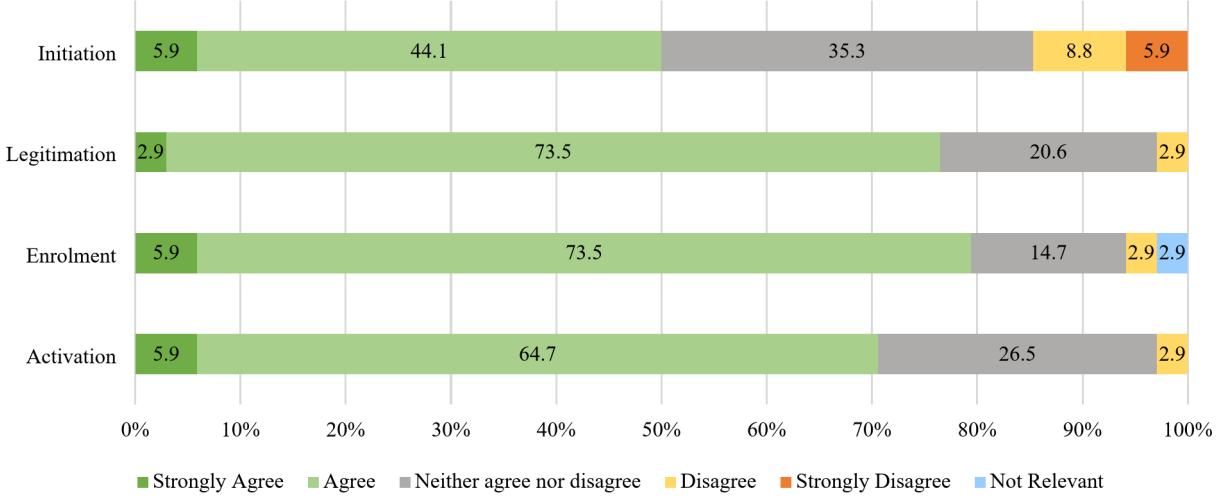

Fig. 2 Summary of responses of survey statements related to *cognitive participation* construct. For example, a response of "strongly agree" suggests that initiation (recognising key people who drive the use of the FMA-UE forward and get others involved) is seen as crucial

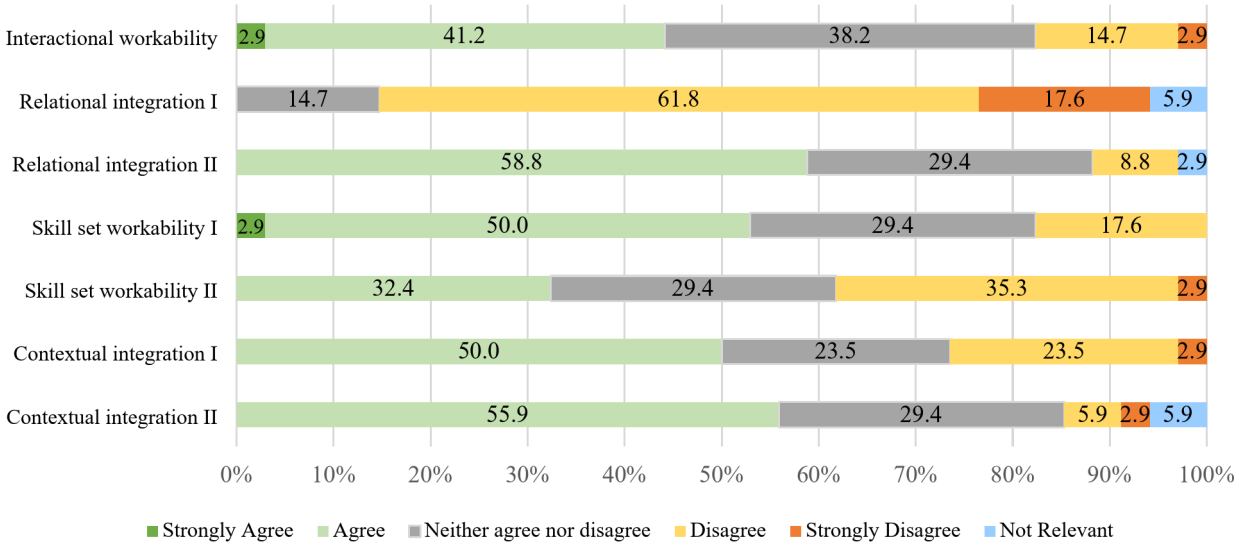

Fig. 3 Summary of responses of survey statements related to *collective action* construct. For example, a response of "strongly agree" reflects that interactional workability (easily integrating the FMA-UE into existing work) is regarded as very significant

limited number of advocates, indicating that their impact relies on a broader collective effort.

Collective action

Figure 3 shows survey responses to statements related to *collective action* construct. The NPT components *interactional workability* and *skill set workability* were identified as barriers, with only 44.1% agreeing with 'I can easily integrate the FMA-UE into my existing work', and 32.4% agreeing with 'Sufficient training is provided to enable staff to use the FMA-UE'. However, the sensitivity analysis (Supplementary file 3) revealed that when neutral responses were excluded, only the item related to interactional workability shifted to a facilitator. We speculate that participants who selected the neutral response had experienced these two items both as a barrier and a facilitator. Both *relational integration* and *contextual integration* emerged as facilitators, with 79.4% of participants disagreeing with the negatively worded statement, "Using the FMA-UE disrupts working relationships," and agreement with *contextual integration* ranged from 50 to 55.9%.

Focus groups revealed three key barriers affecting the integration of the FMA-UE into daily work: lack of equipment, unintuitive resources, and cumbersome multi-step work procedures. Although the necessary equipment (e.g. ball, pen, and cup) were generally available in therapy areas, it was inconvenient for OTs to gather these items. Additionally, FMA-UE administration guidelines lacked visual aids, making the instructions less intuitive and harder to follow. Finally, the multi-step process required to score, tabulate, and manually transfer FMA-UE results into electronic health records was time-consuming, making it challenging to fit into daily workflows.

Another recurrent theme was the perceived lack of training. While training on administering the FMA-UE was provided, focus group participants emphasised the gap in training on scoring and interpreting results (see Coherence). Coaching was viewed as critical for building confidence in administering the FMA-UE. However, this coaching was disrupted and even stopped during the COVID-19 pandemic due to safe distancing measures imposed within the hospitals. This resulted in newer staff missing out on this critical support, which contributed to the perception of inadequate training. Some participants also mentioned a lack of scoring calibration for the FMA-UE.

Finally, a facilitator highlighted by the first focus group was the FMA-UE's utility in delegating tasks to therapy assistants. By systematically using FMA-UE scores to prescribe upper extremity tasks, OTs could reduce practice variation and clearly communicate rehabilitation goals to therapy assistants.

Reflexive monitoring

Survey participants agreed with most statements related to the *reflexive monitoring* construct (Fig. 4). At least half of the participants agreed with the statements tied to *communal appraisal* (52.9%) and *individual appraisal* (58.8%), leading to the interpretation of these NPT components as facilitators. Although there was no mention of formal or informal group meetings to evaluate the utility of the FMA-UE during the focus group discussions, the act of participating in both the survey and focus groups inadvertently provided participants an opportunity for individual reflection. Positive appraisal at the individual level was evident in the focus groups, where participants shared insights into how the FMA-UE had been

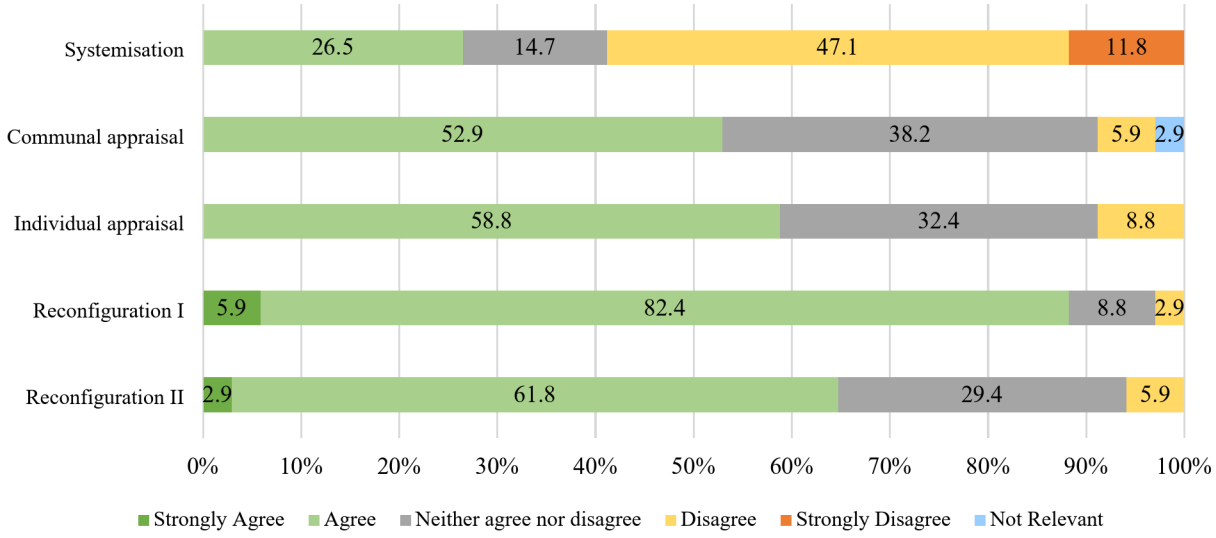

Fig. 4 Summary of responses of survey statements related to *reflexive monitoring* construct. For example, a response of "strongly agree" signifies that systemisation (awareness of the reports about the adherence rate of the use of the FMA-UE) is considered very important

beneficial in their clinical practice, as described in earlier themes (see Coherence and Collective Action).

Conversely, most participants disagreed (58.9%) or were neutral (14.7%) to the statement 'I am aware of the reports about the adherence rate of the use of the FMA-UE' (*Systemization*). Focus group participants clarified that no formal audits had been conducted on the consistency of FMA-UE use at their hospitals, and thus, no such reports on adherence rates were available. They speculated that having such reports could be useful to initiate discussions about the challenges and facilitators of using the FMA-UE in routine practice, potentially fostering a shared understanding and driving improvements in its implementation. Sensitivity analysis showed no changes in the categorisation of barriers and facilitators.

Discussion

In this age of healthcare transformation, integrating outcome measures seamlessly into routine clinical practice is crucial for effectively monitoring patient progress, planning interventions, and demonstrating the value and efficiency of healthcare services. In this context, our study set out to investigate the barriers and facilitators to the routine use of post-stroke upper extremity outcome measures, using the FMA-UE as an example, among OTs in Singapore. Results provided valuable insights into the facilitators and barriers to implementing outcome measures in rehabilitation settings. Factors consistent with existing evidence include: the presence of key champions, an open learning culture, lack of audit/appraisal, insufficient training, practical considerations, perceived value of outcome measurement, and legitimation [19, 32, 33]. While some of these factors align with existing evidence, our study uniquely examines them beyond the initial implementation stages. This approach offers a deeper understanding of their long-term impact and integration into routine practice, enriching our knowledge of the persistent factors that influence the routine use of outcome measures in clinical settings. These insights are crucial for developing strategies to enhance the integration of these measures into everyday practice and improve patient outcomes.

By adopting a theory-led approach, our study offers a comprehensive understanding of embedding post-stroke upper extremity outcome measures into routine practice. Our quantitative survey analysis highlighted facilitators across all four NPT constructs, aligning with the theoretical premise that all mechanisms are necessary for seamless integration. Insights from focus groups further nuanced our understanding of specific NPT components related to barriers and facilitators. Lastly, our sensitivity analysis affirmed most conclusions, though it revealed shifts in categorisation from barriers to facilitators (and vice versa) when excluding neutral responses. These shifts underscore the importance of clarifying factors like resource availability and workflow integration for sustained engagement with outcome measures.

Facilitators and barriers to sustained outcome measurement

Presence of key champions

Champions are individuals who are appointed or volunteered to promote and drive the adoption of implementation initiatives [34, 35]. They are committed to advocating for and leading implementation efforts, including addressing resistance at the organisational level, and leveraging their intrinsic motivation for change to inspire others through their influential positions [36].

Our study highlights the pivotal role of these advocates, or champions, in facilitating the use of the FMA-UE. This aligns with *cognitive participation* construct within the NPT, which encompasses collaborative efforts undertaken to define and organise the efforts needed to build the routine practice of using the FMA-UE.

Key champions in our study were OTs regarded by their peers for their expertise in stroke rehabilitation and proficiency in the FMA-UE. They served as both informal and formal leaders, possessing the authority to make necessary changes and adapt implementation strategies based on their understanding of the challenges associated with FMA-UE usage. Their clinical competence and strategic leadership allowed them to significantly influence the adoption of the FMA-UE in practice.

While the presence of key champions has not been widely identified as a facilitator for implementing outcome measures, existing evidence from a systematic review underscores the efficacy of clinical champions in increasing the use of innovations across healthcare settings [34]. Champions are also a widely utilised implementation strategy for overcoming barriers and enhancing implementation outcomes [34].

Open learning culture

A key facilitator identified in our study was the open learning culture. It was associated with the NPT component of *enrolment*, which involves the processes of engaging OTs to support the routine use of the FMA-UE. This culture, which promotes self-directed learning and sharing of experiences, was essential for encouraging the FMA-UE's routine use. OTs enhanced their proficiency not only through structured learning but also via informal, peer-based interactions. The willingness of peers, supervisors, and managers to support less experienced staff during FMA-UE administration significantly contributed to building confidence and expertise.

While continuous individual learning is vital, it may not suffice to drive performance improvement [37]. A collective learning experience is equally indispensable for empowering OTs to gain confidence and mastery in using outcome measures [38]. To foster such an experience, a scoping review highlights the necessity of cultivating a conducive climate or culture in organisational practices and structures [37]. This integration transforms learning into an interactive and interdependent process that will promote group learning and ultimately facilitate organisational improvement [39].

Lack of audit/appraisal

One barrier hindering the routine use of the FMA-UE was the absence of audit and appraisal processes. Audit and feedback, a strategy involving the compilation and dissemination of data regarding specific aspects of clinical practice to encourage practice improvement, are increasingly utilised in various clinical settings [40]. However, most hospitals in our study lacked formal audits to assess the effectiveness of FMA-UE implementation, leaving OTs unaware of the success or failure of their efforts to integrate the FMA-UE into routine practice, and without a means to monitor adherence to FMA-UE use. There was also an absence of formal group-level appraisals to assess the value (usefulness and worth) of the FMA-UE and adherence to its routine use. The lack of allocated time to discuss the challenges and successes of using the FMA-UE hindered the identification of any emerging obstacles and adaptations required to sustain the 'new' practice over time. Audit and appraisal processes are vital, as the theory of alignment posits that evaluation is a precursor to integrating outcome measurements into clinical practice [41]. Therapists must first assess an outcome measure's compatibility with their context before making adjustments to align implementation activities [41]. This proactive approach not only fosters the ongoing use of outcome measures but also helps normalise this new practice in routine care.

Insufficient training

Insufficient training emerged as a significant barrier in our study, which was an unexpected finding given that education and training for administering the FMA-UE were in place across all four hospitals. The training gaps identified by OTs were related to interpreting FMA-UE scores, which influenced their perceived value of the assessment. Specifically, OTs evaluated its value based on how FMA-UE scores could guide immediate clinical decision-making and patient care. This aligns with the NPT construct of *coherence*, underscoring the necessity for OTs to understand the purpose and benefits of using the FMA-UE.

Our findings suggest that training needs are dynamic and evolve at various stages of implementation. In the initial phases of implementation, the focus is on building competency, ensuring therapists can administer and score the outcome measure effectively. However, as implementation progresses towards sustaining the use of outcome measures, training needs would likely change. During the sustainment phase, it becomes essential to clarify the benefits of using the measure, including score interpretation, linking scores to clinical reasoning, and aiding in intervention planning.

Practical considerations

OTs brought to light practical challenges that hindered the integration of the FMA-UE into routine practice, primarily revolving around work processes. These challenges encompassed the absence of seamless integration with electronic medical records and multi-step work

processes. While practical obstacles have been previously reported, they typically focus on the outcome measure (e.g., the number of test items, complexity of instructions, and cost) and time constraints [19].

In parallel with training needs, our findings suggest the practical considerations necessary for supporting the use of outcome measures evolve over different implementation stages. In the initial stages of implementation where an outcome measure is first introduced, work processes are nascent and relatively unrefined in incorporating the measure into existing workflows. To sustain the use of the measure, it becomes imperative to periodically review and refine these workflows to enhance efficiency and integration. Additionally, work processes must remain adaptable to changes in the healthcare system, such as the adoption of electronic medical records or modifications to existing platforms.

Implications for practice

Based on our study findings, we propose the following for sustaining and integrating post-stroke upper extremity outcome measures into routine clinical practice:

1. *Identify key champions.* Recognise and engage influential individuals who are informal/formal leaders to drive change at various levels, facilitating the adoption of outcome measures and coordinating implementation efforts.
2. *Cultivate an open learning culture.* Foster a culture that supports self-directed and peer-based learning. Maintain in-person coaching for skill acquisition and ensure uninterrupted learning even during challenging situations like the safe-distancing measures during the COVID-19 pandemic.
3. *Conduct regular audits and appraisals.* Implement routine audits to assess adherence to outcome measurement and share findings with frontline staff. Encourage open discussions to address challenges and successes in routine measure use. Allocate time for periodic reviews of work processes and to identify new barriers and facilitators (if any).
4. *Simplify work processes.* Review existing work processes and aim to continuously simplify them. Ensure resources related to outcome measurement are user-friendly to reduce the cognitive load on therapists.
5. *Align the focus of training to the implementation stage.* After initial implementation stages, training should be focused on improving therapists' understanding of the rationale and advantages of utilising outcome measures to continuously enhance their perceived value of the measure. Customised training could include practical applications of measure scores in clinical reasoning and intervention planning. Training approaches should also be adaptable to dynamic healthcare circumstances, such as those arising during the COVID-19 pandemic.

Study limitations

Our study offers a comprehensive examination of the barriers and facilitators to outcome measurement beyond the initial implementation stages, focusing on various inpatient settings within hospitals. Future research should extend this examination to community settings (e.g. day rehabilitation centres) where clinical practices may differ and uncover new barriers and facilitators. To encourage survey participation and honest responses, we ensured a level of respondent anonymity; only OTs interested in follow-up focus group discussions identified themselves. Consequently, our focus group participants may have a vested interest and commitment to outcome measurement and a high perceived value of outcome measures. While maximal variation sampling could have provided broader insights, we prioritised participant anonymity to minimise social desirability bias and encourage honest responses. Our focus groups also included fewer than the recommended 4–8 participants, which may limit the diversity of opinions captured. To try to mitigate this issue, we took steps to ensure that therapists from all practice settings and with different levels of working experience were included in the focus groups to ensure that we could capture and compare the experience of the different groups across settings. Future studies should aim to include larger focus groups to enhance the robustness of the findings. Lastly, while adopting a theory-driven approach offers several key advantages, using a priori coding in our qualitative analysis may impose predefined categories onto the data, which could differ from insights that might have emerged organically.

Conclusions

While there exists compelling evidence for the use of upper extremity outcome measures in stroke rehabilitation, there is limited success in the translation of this evidence to practice. Embedding and integrating outcome measurement in routine clinical practice continues to be a challenge. Our study demonstrates the use of a theory-driven approach to identify the barriers and facilitators to routine administration of an upper extremity outcome measure among OTs in Singapore. In doing so, we were able to fully explore and understand how individual, system and environmental influences may affect the uptake, implementation, and full integration of the practice of using the measure beyond the initial implementation stages. Findings from our study provide an evidence base for developing and tailoring future implementation strategies, which may enhance adherence rates and embed the routine use of the FMA-UE in clinical practice.

Abbreviations

FMA-UE	Fugl–Meyer Assessment for Upper Extremity
NPT	Normalisation Process Theory
NoMAD	Normalisation Measure Development
OTs	Occupational therapists
SD	Standard deviation

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Authors' contributions

SXC reviewed the literature and conceptualised the study, was involved in data collection and analysis, drafted, and critically revised the manuscript. JY and SAMR contributed to data collection and analysis. CJL and JBT contributed to the data collection. EL and JT contributed to the study conception and data analysis. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethics approval was obtained from the SingHealth Centralised Institutional Review Board (CIRB Ref: 2021/2559). Prior to commencing the online survey, the webpage provided participants with brief study information and a statement detailing that the completion of the survey indicated their informed consent to participate in our study. Written informed consent was obtained for all focus group participants. This study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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