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A Cross-Sectional Survey Investigating Allied Health Professionals' Perspectives of Actuated Assistive Upper Limb Devices and Validation Methods

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Background

The ageing population is increasing, and the globe must prepare for old age dependency. Upper limb motor impairments, caused by conditions such as stroke, neuromuscular disease, ageing or injury, can significantly affect fine motor movement, therefore reducing independence and quality of life. Actuated assistive upper limb devices (such as powered orthoses and exoskeletons) can provide additional strength and prehension through motorised assistance. These active and powered assistive technologies can aid in activities of daily living, yet their clinical adoption remains limited [1][2]. Current guidelines and reports do not include these devices [3], and there is a lack of research on the perspectives of allied health professionals (AHPs) who prescribe these devices regarding their use and validation for users with muscle weakness.

Aim and Objectives

Aim: To investigate AHPs' perspectives on actuated assistive upper limb devices, focusing on barriers to prescription and clinical validation methods.

Objectives:

-Quantify design factors and use of outcome measures for actuated devices.

-Identify barriers to prescription and validation.

-Gather recommendations for future device design and assessment.

Method

A web-based, cross-sectional survey (26 items) was conducted between 2023 and 2024 using Qualtrics and validated using CHERRIES [4]. The survey was disseminated via professional associations (ASHT, BAHT, BAPO, and ISPO) and included both quantitative and qualitative items. Participants were AHPs with experience in prescribing or assessing all types of upper limb assistive devices. Data was analysed using descriptive statistics and thematic analysis using Braun and Clarke's method [5].

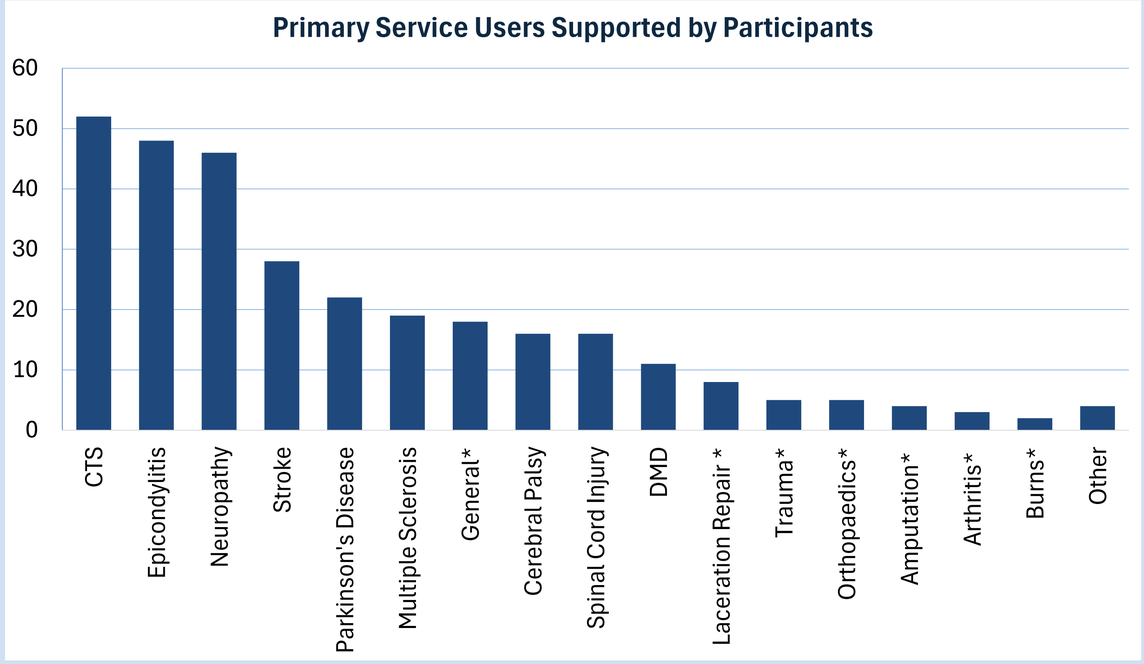

Figure 1. Primary service users supported by the respondents. * Abstracted qualitive responses
Abbreviations: Carpal Tunnel Syndrome (CTS), and Duchenne Muscular Dystrophy (DMD).

Results

Participants: 87 AHPs responded (69% completion rate, n=60), mainly from the USA (72%). Respondents' occupations included occupational therapists (44%), hand therapists (39%), and orthotists (10%). The primary service users supported by AHPs **(Figure 1)** varied, with CTS being most common.

Access: 66% reported insufficient access to actuated assistive devices; lack of awareness and experience were major barriers abstracted.

Validation Methods: 58% felt current outcome measures could be improved. Time constraints and a lack of standardised tools hindered validation of devices and tracking users' improvement **(Table 1).**

Design Factors: AHPs emphasised the importance of wearability, comfort, user satisfaction, safety, and ease of use in device design. These features are rarely quantified in research for comparison to other devices [2].

Barriers: Key barriers included limited device availability, lack of training, insufficient clinical guidelines, and challenges in justifying device prescription.

Qualitative Insights: Thematic analysis highlighted the need for user-centred design and the effects of cost, adaptation, and one-time visit on patient outcomes measured **(Table 2)**.

Key Conclusions

Future device design, validation, and clinical pathways must align with what users and prescribers need.

1. Limited Access Remains a Major Barrier
Over two-thirds of AHPs reported insufficient availability of actuated upper limb devices in their practice, hindering prescription and patient benefit.

2. Design Priorities Misalign with Clinical Preferences
While device developers emphasise power and portability, clinicians prioritise multifunctionality, ease of use, and patient comfort, indicating a gap in user-centred design.

3. Outcome Measures Are Useful But Need Updating
Though 72% of participants find outcome measures beneficial, 58% believe current tools are inadequate, citing time, equipment, and relevance to functional activities as limitations.

4. Call for ADL-Based Objective Validation
AHPs call for integrating real-world, activity-based assessments into validation protocols to reflect functional outcomes and user satisfaction.

Table 1. Main factors limiting AHPs from assessing outcomes for patients requiring hand and wrist assistive devices.
* Themes analysed from qualitative responses

Limiting factors	Mentions (n)	Respondents affected (%)
Time with patients	37	63
Lack of equipment	27	45
Lack of skills or training	21	35
None*	3	5
Cost*	2	3
Hygiene protocols*	1	2
Inappropriate use*	1	2

Table 2. Breakdown of themes from thematic analysis of AHPs' perspective on assistive devices for hands and wrists

Main theme	Sub-theme	Defining Statement (occupation, experience in years, country)
Device Design	Function	*"Multifunctional use, patients won't use it if it helps with only 1 [activity]"* (HT/OT, 33, USA)
	Comfort	*"In my experience, if an AD is not extremely comfortable and easy to use, they usually end up not being used."* (HT/OT, 6, USA)
	Durability	*"ability of the patient to obtain a replacement or extra items"* (HT/OT, 50, USA)
	Weight	*"if they do not have proximal strength to be able to lift and manipulate the device, what good is it?"* (HT/OT, 32, USA)
Awareness	Lack of experience	*"Very limited experience unfortunately - I could have used more information/experience to treat patients"* (HT/OT, 1, USA)
	Lack of knowledge	*"I am not familiar with the list of adaptive equipment in your international list."* (HT/OT, 43, USA)
Prescription	Unclear methods	*"Need for clearly defined way to assess if patient is appropriate for the assistive device"* (HT/OT, 40, USA)
User	Adaption	*"Patients are very quick to adapt their movements after an injury, and if they can use the opposite hand, they figure out how to quickly without the need of adapted equipment to assist."* (HT/OT, 6, USA)
Cost	Alternatives	*"many times just putting a wrist and hand in a more functional position through static custom splint fabrication can be a low-cost and effective way to address many ADL goals."* (HT/OT, 32, USA)

Conclusions

This study highlights critical gaps in the clinical accessibility and prescription of actuated assistive upper limb devices. Outcome measurement practices remain inconsistent between studies and clinical settings, limited by resources and practical constraints. There is a need to develop accessible, objective, and clinically relevant outcome tools focused on real-world functional activities.

Future directions:

Design and development of assistive technologies should be tailored to user requirements and accompanied by standardised and meaningful validation methods to support clinical adoption.

Increasing allied health professionals' awareness of existing actuated assistive devices could expand prescription options and improve patient outcomes.

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No conflict of interest to declare