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Theories, models and frameworks to understand barriers to the provision of mobility-assistive technologies: a scoping review

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ABSTRACT

Objectives There is strong evidence that mobility-assistive technologies improve occupational performance, social participation, educational and employment access and overall quality of life in people with disabilities. However, people with disabilities still face barriers in accessing mobility products and related services. This review aims to summarise and synthesise: (1) theories, models and frameworks that have been used to understand mobility-assistive technology access, (2) determinants of access and (3) gaps in knowledge.

Design A scoping review using the five-step framework by Arksey and O'Malley.

Data sources We searched the MEDLINE, EMBASE, Cumulative Index to Nursing and Allied Health Literature and SCOPUS databases for publications published between 2000 and 2024. We searched for articles published up to 20 March 2024.

Eligibility criteria We included English-published literature in peer-reviewed journals that reported (a) barriers to the provision of mobility-assistive technologies, (b) including at least one theory, model or framework and (c) between 2000 and 2024.

Data extraction and synthesis We extracted the study characteristics, theories, models, framework usage, research recommendations, key findings on mobility-assistive technology barriers and theoretical propositions. We conduct a theoretical synthesis guided by Turner's approach.

Results We included 18 articles that used 8 theories, models and frameworks, synthesised into 9 propositions. The synthesised theory emphasises that mobility is essential for human flourishing, and that certain health conditions may impose restrictions on mobility. This impact can be alleviated by two direct determinants: (1) the provision of suitable services and (2) their comprehensive provision. Policies and costs influence these services indirectly. Environmental and personal factors also affect the use of these services. Ineffectively addressing these determinants can limit access to mobility-assistive technologies and subsequent disabilities.

Conclusion Our synthetic model describes the logic of providing evidence-based mobility-assistive technologies, and we identify the determinants of access that can act as targets for future work to improve the provision of mobility-assistive technologies.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ We used a comprehensive search strategy developed with the assistance of an information specialist to identify relevant publications.
⇒ We mapped reported barriers to a widely used conceptual framework—the Consolidated Framework for Implementation Research—for consistent terminology.
⇒ We conducted a theoretical synthesis to generate new insights.
⇒ We excluded non-English studies, potentially limiting the applicability of our findings.
⇒ We exclude grey literature, which further narrows the scope of the review.

INTRODUCTION

Neurological conditions, musculoskeletal disorders and ageing are associated with considerable human burdens, including decreased quality of life (QoL),[1 2] activity limitations,[3] participation restrictions,[4 5] increased dependence and caregiver burden.[6] Mobility-assistive technologies (MATs) are vital for addressing the challenges posed by these conditions, as they can help improve QoL, promote independence, enhance occupational performance, increase participation and alleviate the burden on individuals, families and societies.[7] MATs encompass assistive products for mobility and related systems and services.[7] These assistive products include devices, software or instruments specifically designed or widely available to enhance the functioning of an individual.[8] They support or substitute the ability to move, thereby facilitating movement from one location to another.[8] Examples include wheelchairs, walking frames, rollators and prosthetic and orthotic products.[8]

Wheeled mobility products, prosthetics and orthotics are cost-effective for improving the QoL and independence of people with disabilities.[9 10] Despite being endorsed by the

United Nations (UN)[11] and WHO,[7] which are essential for creating equitable opportunities for people with disabilities, access to these MATs remains limited.[7 12] There is a considerable unmet need for MATs worldwide, with only a small percentage of those who require them having access.[7 12] Access to assistive technology (AT) is defined as the equitable and sustainable provision of assistive products and support services that adhere to six key principles: accessibility, affordability, availability, adaptability, acceptability and quality.[7] These principles ensure that assistive products and services are reachable, cost-effective, adaptable to individual needs, culturally appropriate, widely available and of high quality.[7]

The reasons for the unmet need for MATs are poorly understood but include the absence of national policies, high costs and insufficiently trained personnel.[7] Several pre-existing theories, models and frameworks (TMFs) have been used to understand the determinants of access and uptake, each with different conceptual coverage and terminology, which could help plan corrective actions. A framework is a structure for organising concepts that enable the description of phenomena.[13 14] For instance, the conceptual framework by Levesque *et al* defines five dimensions of healthcare accessibility: approachability, acceptability, availability, affordability and appropriateness.[15] This framework builds on the foundational work of Penchansky and Thomas, which originally identified the key dimensions of access to healthcare services as availability, accessibility, accommodation, affordability and acceptability. These dimensions define access by assessing how well healthcare systems are prepared to meet patients' needs.[16] The International Classification of Functioning, Disability and Health framework (ICF) is a framework developed by WHO that classifies the health and disability components of functioning and contextual factors.[17] These include multi-aspect concepts related to body functions, structures, activities, participation and environmental factors.[17]

A model is a simplified representation of reality that holds for a specific case or population[13 18 19]; models may describe the relationship between their components but tend to be descriptive rather than explanatory.[13] For example, the Human Activity Assistive Technology (HAAT) model describes the interaction between human activity, AT and the physical, social and cultural contexts in which it is used.[20] The integrated multi-intervention paradigm for the assessment and application of concurrent treatments (IMPACT^2) model describes the variables related to AT interventions.[21] The Matching Person and Technology (MPT) is a model that describes the interaction between environmental, personal and technological factors in the success of AT uptake.[22] The Systemic Development Model (SDM), developed by the World Engagement Institute, describes four interconnected pillars of sustainability—health, culture, economics and politics—to enhance the understanding of capacities at the personal, organisational and institutional levels.[23]

A theory is an interconnected set of abstract statements that explain, predict or prescribe phenomena, going beyond specific contexts to consider broader meanings and implications.[13 14 18 24] For instance, Gibson's theory proposes that the environment contains actionable (and therefore explanatory) properties, 'affordances', that are directly perceived.[25] When a research area is characterised by theoretical incoherence, researchers must choose between rigid empiricism, selecting theories based on their virtues, developing their own theory and theoretical synthesis.[26] Theoretical synthesis can amalgamate propositions from different theories into a propositional network, enabling researchers to extend the coverage, content validity and document points of convergence.[26] Scoping reviews are ideal for uncovering key concepts and informing future research designs.[27] This paper presents a scoping review that summarises and synthesises the TMFs used to understand MAT access, identifies the determinants of access and highlights the gaps in current knowledge.

METHOD

We report a five-stage scoping review based on the approach outlined by Arksey and O'Malley,[28] in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (online supplemental appendix 1).[29] This study did not meet the eligibility requirements for registration using PROSPERO. The research questions were as follows: What theories, models and frameworks have been used to understand the barriers to the provision of MATs for people with mobility issues? What are the determinants of access to MATs for people with mobility issues? What are the current knowledge gaps in access to MATs for people with mobility issues?

Eligibility criteria

The Behaviour of Interest, Health Context, Exclusion, Models or Theories framework[30] was employed to formulate the search concepts (table 1) and eligibility criteria (table 2).

Table 1 Application of the BeHEMoTH framework to define search concepts

BeHEMoTH	Concept
Be—Behaviour of interest	Barriers to access or provision
H—Health context	People with mobility issues AND MATs
E—Exclusions	Not Applied
MoTh—Models or Theories	Models or Theories or Frameworks

MATs, mobility-assistive technologies.

Table 2 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria	Rationale
Publications reporting on the barriers to the provision of MATs	Publication concentrates on aspects other than barriers to access, and there is no report on barriers	This review focuses on understanding barriers to the provision of MATs
Publications including at least a theory, model or framework	Publications that did not employ a theory, model or framework	To ensure that the articles concentrate on theory, model or framework to understand the barriers
Publications in peer-reviewed journals	Other publications such as conference abstracts and theses	To ensure that studies had undergone rigorous evaluation
Publications published in the English language	Publications in other languages	Costs and time commitment associated with article translation
Publications between 2000 and 2024	Publication published before 2000	To ensure using the most relevant publications from the previous 24 years

MATs, mobility-assistive technologies.

Information sources and searches

Literature searches were performed by (AA) on MEDLINE (Ovid), EMBASE (Ovid), Cumulative Index to Nursing and Allied Health Literature (EBSCO) and SCOPUS databases for studies published between 1 January 2000 and 20 March 2024. To identify the appropriate publications relevant to the research issue, a priori search strategy was established in collaboration with the authors (AA and DH) and an information specialist (Louise Falzon). The search terms combined the concepts of 'barriers to provision, mobility issues, AND "MATs", and a theory/model/framework'. Free-text terms, subject heading, use of the Boolean operators "AND" and "OR" and truncation were all used to ensure a successful search. The final search strategy was tested on MEDLINE via Ovid, and then translated into other databases. The full search strategy and results are presented in online supplemental appendix 2. We reviewed the reference lists of the included articles to identify additional relevant articles[28] but restricted the eligibility to peer-reviewed studies, excluding grey literature.

Study selection

The Rayyan platform (https://www.rayaan.ai) was used for study selection. Initial title and abstract screening were conducted by (AA), where the primary aim was to assess studies for potential relevance based on predefined inclusion and exclusion criteria. Given the subjective nature of this assessment, any uncertainties regarding study eligibility encountered by AA were systematically discussed with the other reviewers (DH, SR and BF). Full-text screening involved consistent discussions among (AA, DH, SR and BF), and the full texts of eligible articles were subsequently retrieved for a more detailed assessment.

Data charting process

To facilitate consistent data presentation and synthesis, we charted general and study-specific information from the studies in Microsoft Excel spreadsheets. Data items included country of origin, study population, aims, sample size, study design, data collection tool, TMF used, a brief description of its purpose, research recommendations and key findings related to barriers to the provision of MATs. We extracted theoretical propositions from the TMFs, as discussed in the articles included in our review. In instances in which these articles did not provide a comprehensive explanation of TMFs, such as Gibson's affordances theory, the IMPACT^2 model and the HAAT model, we referred to the foundational sources. The sources cited within the included articles are original materials in which TMFs were first introduced or explained thoroughly. This ensured that our understanding and coverage of TMFs was comprehensive, especially when the application of these TMFs in the reviewed articles lacked depth. Although these foundational sources were not directly included in our review as they did not meet our inclusion criteria, they were consulted for additional insights. We mapped the reported barriers to one of the updated constructs of the Consolidated Framework for Implementation Research (CFIR), a synthetic framework of constructs used in 19 implementation theories,[31 32] using a codebook (https://cfirguide.org/). The CFIR provides a set of standardised constructs to guide researchers, creating a common language for explicitly and consistently describing aspects that may affect the provision.[33]

Synthesis of results

Tabular summaries and narrative syntheses were completed for the included articles and their TMFs.[34] We conducted a theoretical synthesis to generate new insights that were unavailable for any TMF.[35] The synthesis was guided by Turner's[36] approach. In step 1, the TMFs are summarised, and their shared themes are identified. In step 2, the aspects of the TMF that pertain to core concepts by extracting the phrases used, their definitions and their explicit and implicit relationships are identified. In step 3, the TMFs are broken into simple propositions that can be compared and tabulated. In

step 4, the theories are compared and determined how they converge or diverge by combining similar elements. In step 5, the convergent elements from the TMF are combined into a single conceptual model that focuses on the relationships between concepts. For example, during this stage, we examined how concepts from these TMFs—such as cost, services and activity (mobility)—interacted and influenced each other within the synthesised theory to gain theoretical insight. We incorporated statements from the studies included in this review to strengthen the synthesis and support the resulting conceptual model (step 6).

Gaps analysis

To identify knowledge gaps and areas for future research, we reviewed papers and tabulated explicit recommendations, which is a core function of scoping reviews.[27]

Patients and public involvement

No patients or public were involved in the study.

RESULTS

Characteristics of the studies

The literature search yielded 306 citations after the removal of duplicates. A total of 246 citations were excluded after initial screening, and 60 potentially eligible articles were retrieved for full-text review. Of these, 45 were excluded because barriers were not reported (n=10), TMFs were not reported (n=27) and the citations were conference abstracts (n=7) or theses (n=1). Fifteen studies identified from the databases met all the eligibility criteria. After reviewing the reference lists and conducting manual searches, 25 additional studies were identified and examined for eligibility, and 3 studies were determined to be eligible (figure 1).[37]

The final synthesis included 18 articles (online supplemental appendix 3).[16 22 23 38–52] Eight studies addressed the challenges associated with the provision and use of MATs.[16 22 23 38 39 42 44 47 49 50] Four studies examined environmental barriers to participation.[40 45 48 51 52] Two studies explored the experiences of patients and caregivers and their rehabilitation needs.[43 46] One study drew attention to inconsistencies in AT provision schemes.[41] There were (n=5) secondary studies and (n=13) primary research studies conducted between 2012 and 2023 in South Africa,[49] Mongolia,[48] Canada, India,[46] Australia,[38 41] Malaysia,[44] New Zealand,[40] Uganda,[47] Brazil,[43] the USA,[42] Iran,[16] Sweden,[22 45] Tanzania,[51] Canada and the USA.[39] The primary studies contained between 1 and 318 participants.

Eight TMFs, representing various perspectives, were identified. Two were biopsychosocial in orientation: the ICF[17] and HAAT,[20] which focused on AT. Two other models that focus on AT are IMPACT[221] and MPT.[22] Four other identified TMFs were applied to AT access: framework by Penchansky and Thomas,[16] theoretical framework

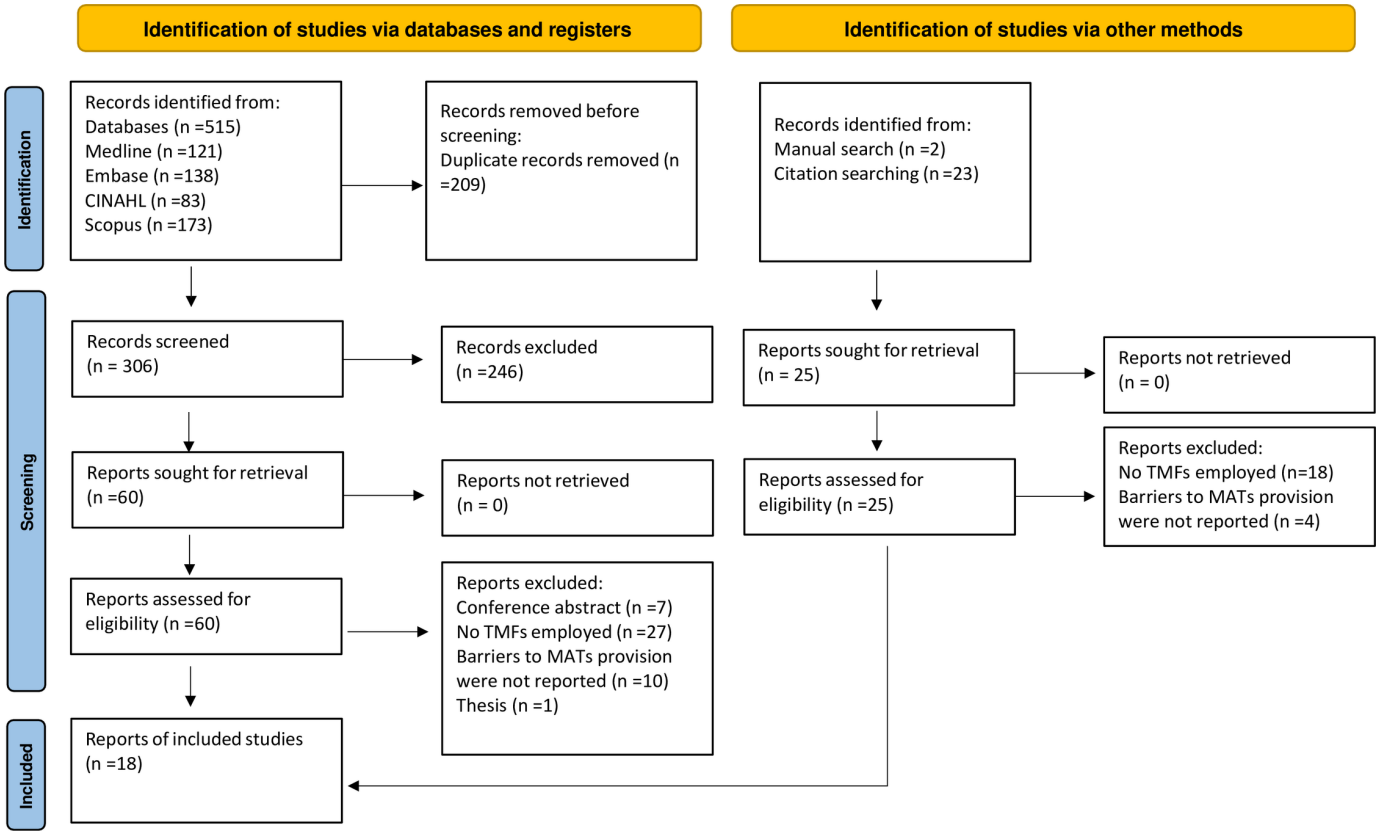

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram. CINAHL, Cumulative Index to Nursing and Allied Health Literature; MATs, mobility-assistive technologies; TMFs, theories, models and frameworks.

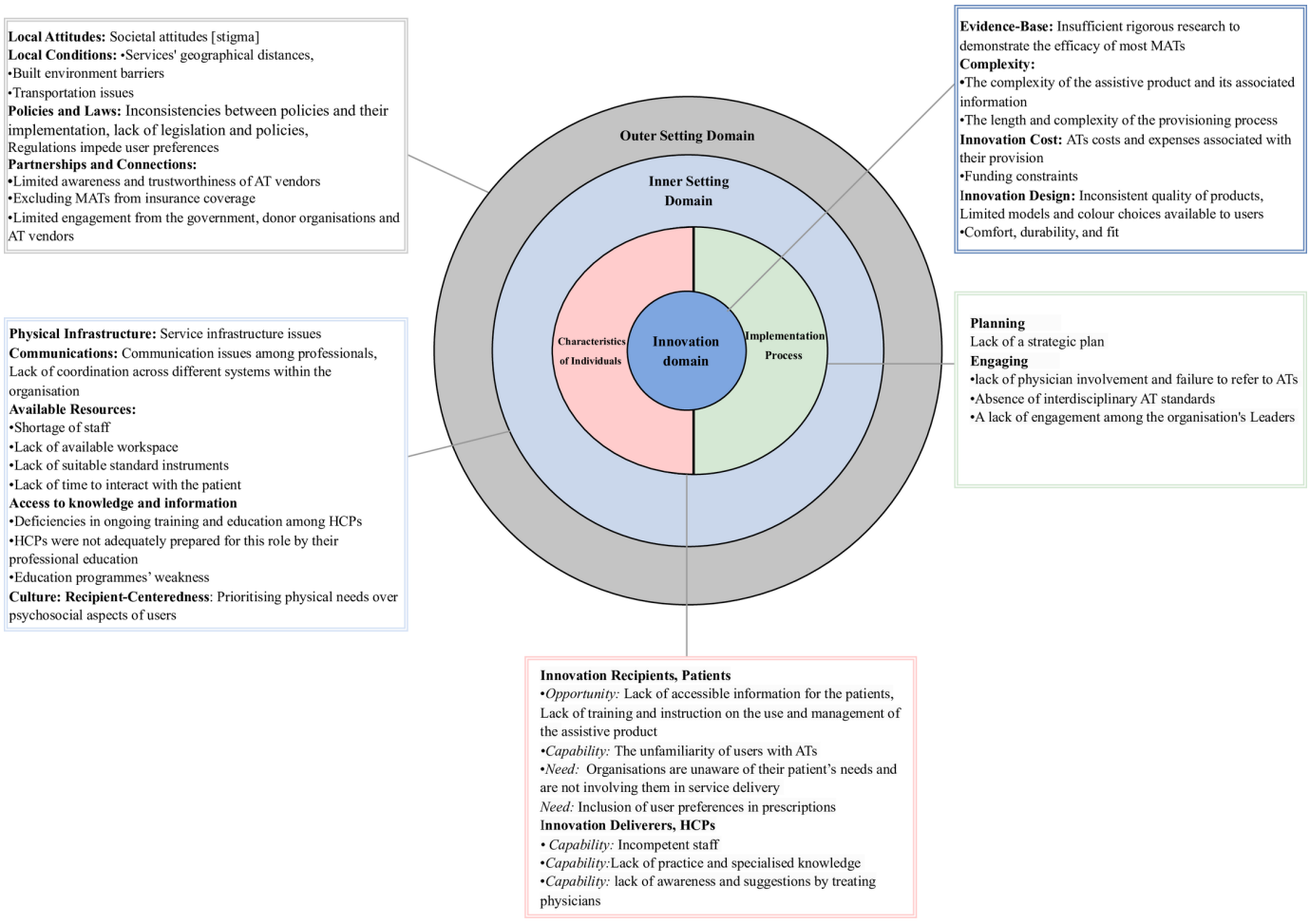

Figure 2 Barriers to the provision of mobility-assistive technologies (MATs) synthesised using the Consolidated Framework for Implementation Research. AT, assistive technology; HCP, healthcare professional.

by Levesque *et al*,[15] Gibson's affordances theory[25] and the SDM.[53] The most frequently used TMF was ICF (n=12). All included studies applied one TMF, except for one,[41] which used two in combination: ICF and IMPACT^2. There are three distinct applications of TMFs, as shown in online supplemental figure 1. The majority were used as a basis for analysis and interpretation (n=13) or as a guide for designing the surveys and interviews (n=2). In addition, TMFs were used as a comprehensive framework to provide a context for reviewing the relevant literature (n=3).

Barriers to MATs provision synthesised using CFIR

The key barriers in the innovation domain are cost concerns,[16 23 38–42 44 46 48 49] intervention complexity,[23 39 45 47] inadequate evidence of effectiveness,[41 42] product-related factors such as comfort, durability and fit[52] and limited models and colour choices available[22] (figure 2). The outer-setting domain highlights societal attitudes towards AT,[22 47 48 50 52] geographic distance,[16 41 43 49] a lack of supportive legislation[16 23 39 45 47 48 50 51] and environmental barriers.[22 52] Within the inner-setting domain, resource constraints,[23 42 43 47 49] restricted knowledge and information access hinder provision.[23 38 39 42 47 50] The characteristics of the individuals' domains revealed knowledge about the intervention[23 47 48 50] and low self-efficacy among healthcare professionals[16 42 49] as barriers to its adoption. In addition, within the characteristics of individual domains, barriers include limited information access,[16 38–40 43 45 49] such as a lack of access to training and instructions on the use and management of mobility products.[16] Furthermore, there is a lack of awareness among users,[49 50] and insufficient inclusion of user preferences in prescriptions.[22] In the process domain, barriers include insufficient stakeholder engagement,[39 42 50] absence of interdisciplinary standards[42] and limited strategic planning.[39]

Theories, models and frameworks synthesis

The propositions derived from the TMF are described in online supplemental appendix 4, and the resulting synthetic model is presented in figure 3.

Proposition 1: mobility is essential for human flourishing

The ICF framework highlights activity as a key component of health, with disabilities resulting from restricted activities, such as mobility issues.[17] This affects participation in everyday activities, such as work, socialisation

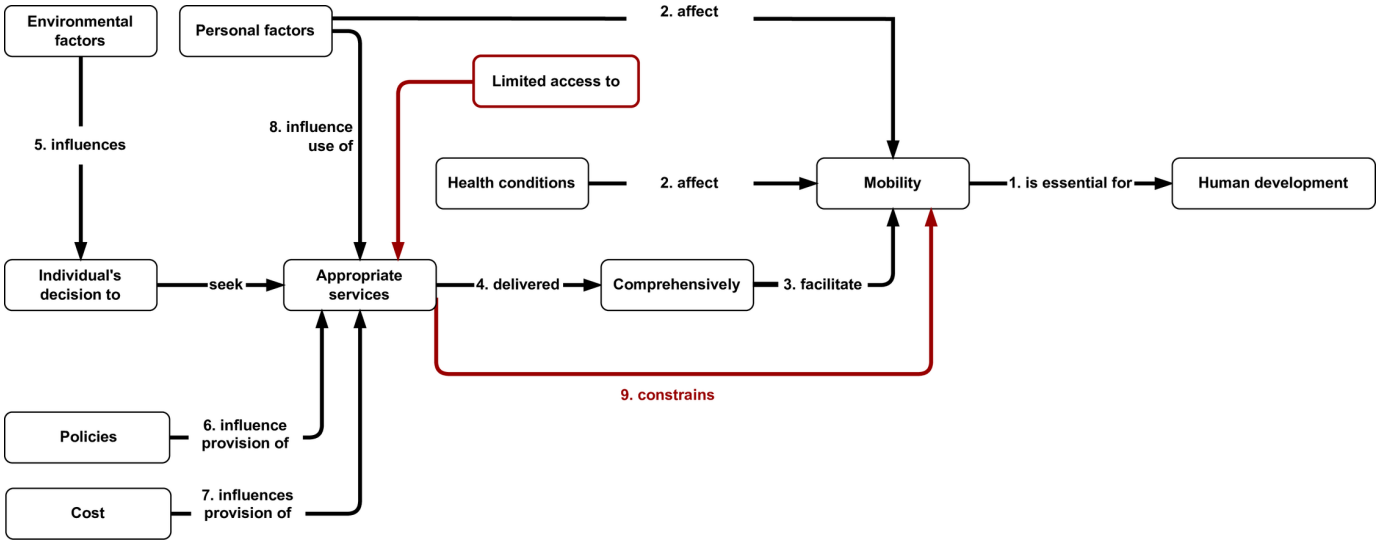

Figure 3 Synthetic model.

and healthcare access.[17] The HAAT model explains a similar concept, describing the 'activity' as the action of performing a task that represents the functional outcome of human performance.[20] Building on these insights, 'mobility' is viewed as an individual's ability to perform tasks that enable meaningful participation. The HAAT model and IMPACT^2 emphasise the importance of participation in everyday activities, such as working and socialising, for overall health,[20 21] describing it as 'necessary to human existence'.[20] According to the HAAT model, humans are defined based on their intrinsic physical, cognitive and emotional abilities.[20] Accordingly, mobility is viewed more as a necessary means of meaningful participation than an end to the development of physical, cognitive and psychosocial skills throughout life.[38 46]

Proposition 2: health conditions and personal factors influence mobility

An individual's mobility is influenced by health and personal factors, which, in turn, affect their participation in social, work and leisure activities. For example, the ICF framework clearly describes how health issues and personal factors can affect activities and participation[17] and describes health conditions as umbrella terms for diseases, disorders, injuries or trauma.[17] Similarly, the HAAT model highlights the impact of a person's physical and cognitive abilities and personal elements, such as emotional and psychological factors, on their ability to perform activities.[46] Accordingly, 'personal factors' that encompass elements, such as psychological attributes, age and coping style influence an individual's ability to perform activities.[17] For example, Dwyer and Mulligan[40] highlighted how emotional changes caused by spinal cord injury could impede participation in rehabilitation services and other areas of reintegration, such as employment and leisure activities.

Proposition 3: appropriate services influence mobility

The ICF and HAAT models explicitly describe the relationships between the activities and their environments. Both emphasise the importance of activities for participating in and developing in life, and some interventions can improve a person's ability to engage in the desired activities.[17 20] For instance, in the ICF framework, AT services are considered to be an environmental factor, which is appropriate for helping individuals achieve their intended activities and participate in various situations.[17] Similarly, the MPT model was developed considering the ICF framework and focusing on the relationship between individuals and AT.[54] This suggests that AT is an essential means of bridging the gap between an individual's capabilities and the demands of tasks in their environment, thereby significantly enhancing their engagement in the desired activities.[22] The framework by Levesque *et al*, building on the foundational work of Penchansky and Thomas, identifies that 'the appropriateness of a service' is determined by its alignment with the needs of the client, whereas the HAAT and MPT models emphasise that with AT, an individual's capabilities are increased.[15 16 20 22] Consequently, to meet individual needs and maximise capabilities, we define the appropriateness of services based on the extent to which they are tailored. This demonstrates that MATs are vital for people with disabilities and for older people who require them, thus enhancing their independence and participation in daily life.[38 46]

Proposition 4: service delivery must be comprehensive to influence human mobility

Institutional factors significantly influence individual activities, as explained by the HAAT model[20] and ICF frameworks.[17] The framework by Levesque *et al* emphasises the importance of how services are provided to meet client needs,[15] whereas Penchansky and Thomas highlight the necessity of adequate

resources, including staff, to ensure that these needs are effectively met.[16] Similarly, the IMPACT^2 model is concerned with providing services and ensuring that outcomes are met, including QoL, participation and satisfaction with the services provided.[21] The MPT model demonstrates that user satisfaction with service provision can be achieved by considering key features of products such as usability, quality, weight, stability and safety.[22] Accordingly, the concept of 'comprehensive services' refers to providing clients with high-quality products and the necessary support services to meet their needs and achieve satisfaction. Providing comprehensive services encompassing assessment, training and maintenance is crucial for enhancing personal mobility.[23 39] Effective delivery of AT services requires well-trained personnel.[23] These are critical components of service delivery systems that help individuals enhance their mobility.

Proposition 5: environmental factors influence individuals' decision to seek appropriate healthcare services

Assistive products for mobility and participation are influenced by environmental factors such as social, cultural and physical environments, which affect individuals' health and well-being. The ICF framework views disability as a health experience arising from context and not solely within an individual.[17] It emphasises how society can create barriers such as inaccessible services or neglected facilitators, such as the lack of AT.[17] Furthermore, an individual's level of functioning is determined by their relationships with family, people and healthcare providers, all of which can influence their decision to seek healthcare.[17] A similar concept of how society affects activities is highlighted by the HAAT model, which places particular emphasis on an individual's cultural context.[20] The MPT model also emphasises the role of sociocultural factors, acknowledging how a user's social setting and cultural attitudes towards disability can influence their perception of and adoption of mobility products. This includes consideration of product-related social implications and stigmas.[22] For example, parents of children with disabilities oppose wheelchairs because of social stigma,[46] and some older people perceive mobility products negatively because of stigmatising symbolism.[50] This demonstrates the significant influence of sociocultural factors, such as support and relationships from family, health professionals and community on MAT accessibility and acceptance. Furthermore, the MPT model emphasises the importance of the physical environment, which includes both the built environment within the user's home and the external surroundings, in affecting use and acceptance.[22] For example, if a wheelchair does not fit the physical and psychosocial environment in which it is used, it is more likely to limit function rather than enhance it.[22] Therefore, the success of MAT is measured by its technical features and by its ability to fit into the user's psychosocial context.[22]

Proposition 6: policies influence the provision of services

The SDM framework highlights how organisational service delivery policies influence appropriate service provision,[53] whereas the ICF explains how policies affect participation and activities.[17] As part of the ICF, the term 'policy' is commonly used within the environmental factor domain as an external factor that can impact an individual's health and function.[17] This set of guidelines, rules and regulations governs the range of services provided to individuals, including policies and standards that define the eligibility criteria for services.[45] For instance, prostheses are not considered to be life-saving medical devices or crucial components of the healthcare system.[43] However, they are life-changing for users and can quickly restore most functions.[43] The framework by Levesque *et al* argues that the availability of health services should ensure those in need can access either the physical facilities or healthcare personnel.[15] However, barriers to access emerge when healthcare is unavailable in certain geographic areas or when individuals' insurance does not cover the necessary treatments.[15 16] Penchansky and Thomas further emphasised the need for a well-organised supply of resources, including the integration of telephone or remote service consultations.[16] The lack of such accommodations can prevent individuals from obtaining the required healthcare, potentially leading to adverse health outcomes. Disparities between government and institutional policies can result in confusion among AT providers and decrease service utilisation.[23 47]

Proposition 7: cost influences the provision of appropriate services

The SDM framework[53] highlights the significant influence of economic factors on service delivery and reinforces the idea that costs can significantly influence access to healthcare services. The term 'cost' refers to the expenses incurred by individuals and healthcare systems to provide services.[15 21] This comprises the direct prices of services such as consultation fees, product costs and related expenses.[15] For instance, the IMPACT^2 model underlines the role of cost implications in selecting intervention approaches and demonstrating the cost effects at each stage of AT provision.[21] Both Penchansky and Thomas[16] and Levesque *et al*[15] emphasised the critical role of an individual's financial capacity, including income and willingness to pay, in accessing healthcare. Therefore, costs can significantly influence access to AT.

Proposition 8: personal factors influence healthcare utilisation

Healthcare utilisation is influenced by various 'personal factors' that represent an individual's internal aspects, such as psychological characteristics.[17] This concept is explained using the framework by Levesque *et al*. It highlights factors such as an individual's need for care, awareness of these needs and desire for treatment.[15] Gibson's affordance theory suggests that an individual's perception

of their environment is based on its potential to fulfil their needs, thereby shaping their decisions.[25] Therefore, the individual is responsible for unravelling the utility presented by affordance. For instance, the client in the study by Mairami *et al*[44] converted a household chair into a wheelchair. This demonstrates how the client's perception of their environment shaped their recovery when an existing structure was found to have assistive potential. The ICF model explains the significance of environmental factors, such as the visibility of services, in determining an individual's level of functioning,[17] which is related to Gibson's affordance theory, in which environmental cues trigger actions.[25] Consequently, the lack of service limits the activities that can be conducted. Personal factors not classified within the ICF are acknowledged to have a significant impact on healthcare access.[17] The MPT model highlights that the choice of assistive products is deeply personal and shaped by individual aspirations, anticipated satisfaction of needs and perceived personal value of these products.[22] These elements play a crucial role in influencing the uptake of MATs, as they are associated with the context of users' lives.[22]

Proposition 9: limited access to healthcare services creates disability

The ICF acknowledges the influence of environmental factors on disability development and emphasises the limitations it imposes on individuals' abilities to access healthcare services and engage in social activities.[17] As defined by the ICF, disabilities include impairments, limitations in activity levels and restrictions on participation.[17] Consequently, restricted AT accessibility impairs body function, hinders participation and contributes to disabilities. The SDM framework explains the significance of economic factors, particularly the 'lack of economic means', which limit access to services such as MAT.[53] Restricted access can trigger continuous cycles of disabilities and poverty.[23] Persistent mobility constraints, whether due to inadequate MAT service support or diminished participation in daily life, have been identified as significant factors leading to disability.[47 48]

Gaps analysis

This review highlights key research areas in AT services that warrant further investigation (online supplemental appendix 5). Investigations should focus on AT access in remote regions,[38 46 49] examine gender disparities in service accessibility,[16] explore stakeholder perspectives on rehabilitation services and barriers to AT access[47 49 51] and address challenges related to funding, policy and legislation.[22 23 40 42 44 48 51] Data collection and methodological enhancements are required, including standardised instruments for assessing functioning and disability,[43 45] comparisons of user experiences with and without AT[39 41] and comprehensive evaluation tools combining objective and subjective measures.[39 41] Emphasis should also be placed on understanding the in-country perspectives, inclusive solutions and the impact of contextual factors on AT access.[23] This involves evaluating how new products impact workplace settings and determining which types of AT are essential.[22] Future studies should examine product compatibility, enhance user skills and improve accessibility to the built environment.[52] Addressing these research gaps could contribute to the development of more effective, inclusive and accessible AT services for individuals with disabilities.

DISCUSSION

This scoping review offers a summary of the barriers to MAT provision and synthesis theories to guide future work based on 18 articles. The synthesised theory emphasises that mobility is essential for human flourishing (proposition 1) and that certain health conditions may impose restrictions on mobility (proposition 2). This impact can be ameliorated by two direct determinants: the provision of suitable services (proposition 3) and their comprehensive provision (proposition 4). Policies (proposition 6) and costs (proposition 7) indirectly influence these services. Furthermore, an individual's decision to access these services is determined by their environment (proposition 5) and personal factors (proposition 8). If these direct and indirect determinants are not effectively addressed, it could result in limited access to MATs and subsequent disability (proposition 9). This synthesised theory integrates empirical and ethical dimensions and provides evidence-based approaches to solving problems.[18]

To the best of our knowledge, this is the first report on the synthesis of TMFs and the barriers to MAT provision. Although literature review by de Jesus Alves and Matsukura[55] outlined the various theoretical models used in the AT literature, they did not attempt theoretical synthesis. TMFs organise concepts and thoughts to provide insights into different elements of practice and research.[13] Lakatos proposes that scientific enquiry should appraise a series of theories rather than a single theory, noting that 'the members of such series of theories are usually connected by a remarkable continuity which welds them into research programmes'.[56] Lakatos advocated for a 'pluralistic model' of scientific theories, in which several theories, which are organised deductively to varying degrees, are brought together in a unified approach.[56] Unlike Lakatos, we view this study as an enhancement of problem-solving effectiveness.[57] By combining propositions from different theories, we increased the coverage of the resulting syntheses of individual theories. It should predict the range of barriers encountered in MAT access and provision.

The theory covers a socially significant issue given that it addresses the current research priorities identified by expert panels organised by government agencies and clinical specialty organisations.[7 58–60] It addresses the phenomenon of interest to rehabilitation scholars by filling the gaps in the existing TMFs. Although the MPT model does not explicitly discuss barriers to AT access, it

provides valuable insights into the interactions between the personal, technological, and environmental factors that influence successful AT adoption.[22] The MPT model, developed based on the ICF framework,[54] highlights the importance of aligning assistive products with user needs, preferences and contexts to optimise functionality and satisfaction. Future research should further explore how the MPT model can inform strategies to address barriers to access and provision of MAT.

An adequate specification was achieved by providing a clear and concise overview of the theoretical synthesis. In addition, we establish linkage adequacy by defining the concepts and their relationships.[61] The theory is testable because it contains observable concepts and propositions that can be operationalised and corroborated in empirical research. A limitation of the scoping review was the exclusion of non-English language studies, which could limit the applicability of the findings; research from other languages could have offered additional valuable insights.[62] Another limitation is that the review's focus on studies from 2000 to 2024 potentially omitted earlier relevant research on barriers and TMF. However, a broader historical scope may have reduced the relevance of the findings to contemporary decision-making in the provision of AT. The exclusion of grey literature, including government reports and policy documents, further narrowed the scope of the review. This exclusion may have resulted in the omission of relevant non-peer-reviewed TMFs. In addition, the processes of data extraction, coding using CFIR and synthesis inherently involve subjectivity. Our search strategies and the databases selected may not have captured all relevant literature pertaining to other important TMFs that have been used to understand barriers to MAT access, such as the Student, Environment, Tasks, and Tools (SETT)[63] and the Wisconsin Assistive Technology Initiative (WATI).[64] Despite using SETT and WATI as search terms, these terms yielded no results in the databases we explored. This could indicate a lack in the literature where these frameworks are applied or reported in relation to barriers to MAT access, which requires further investigation. Search terms such as 'service delivery', 'service*', 'deliver*' and additional or alternative terms for older people, such as 'older person*' or 'older adult*', may have identified additional studies.

Our review highlights several key knowledge gaps regarding MAT access and provision. These include the need for research on AT access in remote regions, stakeholder perspectives on barriers and enablers, funding and policy challenges and the impact of contextual factors.[23 38 40 42 44 46 47 49 51] Methodological improvements such as the adoption of standardised instruments and the incorporation of user satisfaction measures are also needed to advance the field.[39 41 43 45] Importantly, the widely used ICF framework does not include personal factors that play a crucial role in MAT access.[17] Future research should address these gaps to provide a more comprehensive understanding of the determinants of access to MAT. Figure 2 and online supplemental figure 1 provide overviews of the identified barriers and the TMFs used in the included studies, respectively. Although no single model can fully capture the complexity of MAT access, researchers and practitioners should consider the strengths and limitations of each TMF and select the most appropriate one(s) based on specific research questions and contexts.

The insights from this review and the resulting integrated model have the potential to influence clinical practice and policymaking in line with the ethical imperatives outlined by WHO and the UN.[7 11] These organisations have emphasised the necessity of AT to meet individual needs and enable equitable opportunities for people with disabilities. The synthesised theory aligns with the principles of access to AT as advocated by WHO and UNICEF, highlighting the necessity for assistive products and services to be reachable, affordable, adaptable to individual needs and environments, culturally appropriate and of high quality. By addressing the direct and indirect determinants of access, as identified in the theory, including service provision, policies, costs, personal preferences and physical, social and cultural factors, we can align better with these global principles.[7] These factors are important and have also been linked to the abandonment or discontinuance of using mobility products.[65–67] For example, difficult interactions between users and their products, as well as difficulties with the environment in which users live, could contribute to product discontinuance.[65] Therefore, this review proposes a theoretical basis for reforming the existing system to align it with international standards, thus addressing the pressing and unmet needs more equitably and personally to ensure successful access to and use of AT. To achieve this, future research must examine these determinants, understand the barriers to MAT provision and plan and evaluate strategies to enhance its provision. Having a set of determinants organised around the CFIR[32] allows the creation of local implementation strategies to suit different policy jurisdictions.

There is a consensus-based[68 69] and evidence-based approach[70] to overcome the barriers to effective AT provision found in this review. The barriers identified by the CFIR can be linked to Expert Recommendations for Implementing Change strategies.[71] These strategies guide the selection of implementation methods to mitigate barriers and include (1) activating local clinical leaders or champions, (2) providing educational materials, (3) organising meetings and (4) implementing outreach or ongoing training. The implementation of these strategies can assist decision-makers in making informed choices regarding the selection of strategies for MAT provision.

CONCLUSION

The synthesised theory emphasises that mobility is a crucial aspect of human life and certain health conditions may restrict mobility. Providing comprehensive and

appropriate services can reduce this impact; however, cost and policy decisions regarding these services affect their provision. Accessibility to these services is also affected by environmental and personal factors. This knowledge can be used to develop strategies to enhance provision.

Rights retention statement

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