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Global availability of guidelines related to assistive technology: a systematic scoping review

This dissertation has been submitted to the University of Oxford in partial fulfilment of the requirement for the award of the degree of MSc in Global Healthcare Leadership

Summary

This thesis set out to explore the existing guidelines surrounding assistive technology to help people improve their functioning and live more independently. There are more than 900 types of tools and devices classified as assistive technology, such as wheelchairs, spectacles, hearing aids, prostheses, time management or voice-to-text apps. With the global need for assistive technology expected to rise significantly, potentially affecting 3.5 billion people by 2050, it is essential to understand the guidelines that govern the use of these technologies and identify any gaps that could be addressed to improve access.

This review looked at guidelines published between January 2008 and March 2024 related to specific types of assistive products and services or assistive technology in general, targeting users or their caregivers. However, it did not include guidelines that dealt with broader system-level interventions, such as how to finance, procure, or train the workforce in assistive technology.

The review used a structured approach to answer several key questions: What guidelines are available for assistive technology? Who are these guidelines benefit for? What types of products and services do they cover? In what contexts are these guidelines applied? How were these guidelines developed? The answers to these questions helped identify areas where further research and guideline development are needed.

The review uncovered 24 existing guidelines. These guidelines are mostly from high-income countries and tend to focus on well-known assistive products, such as those for mobility, hearing, vision, and self-care. However, there is a significant lack of

guidelines for products that assist with cognition and communication - areas that are just as crucial for improving the quality of life for many people.

Most of the guidelines were developed using evidence-based methods, meaning they rely on the best available research. Several of them also involved users of assistive technology in the development process, which helps ensure the guidelines are practical and relevant. However, the review highlighted challenges, such as inconsistencies in international standards, limited high-quality evidence to support the use of assistive technology, a lack of a specialised workforce, and complexity of integration to the current healthcare systems and policies to implement guidelines effectively.

In conclusion, this review provides an important snapshot of the current state of assistive technology guidelines. It highlights the need for more collaborations among different assistive technology standardization agencies, encourage innovation in research, and improve the development of guidelines to better meet the needs of the growing population that will require assistive technology in the future.

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Abstract

Objective: This thesis aims to conduct a comprehensive scoping review of existing guidelines related to assistive technology, with the intent of understanding the landscape to inform future research and guideline development.

Background: Given the rising global demand for assistive technology, predicted to encompass 3.5 billion people by 2050, understanding the availability of guidelines governing its use and identifying potential gaps is paramount.

Inclusion criteria: The review included guidelines, published between January 2008 and March 2024, related to specific types of assistive products and services or assistive technology in general for any users or their caregivers. However, guidelines targeting system level interventions such as financing models, procurement mechanisms, workforce capacity building were excluded from the review.

Methods: Following the JBI methodology, the scoping review inspected guidelines using the PCC (Population, Concept, Context) framework. The primary review question was the availability of guidelines related to assistive technology. Secondary questions explored the population addressed, the products and services covered, the applicable contexts, as well as the guideline development methodologies.

Results: The review identified 24 guidelines. These guidelines focus on improving health outcomes for diverse populations across different healthcare settings. Most guidelines originated from high-income countries and predominantly addressed commonly known assistive products for mobility, hearing, vision, and self-care. There was a notable gap in guidelines for assistive products for cognition and

communication. The identified guidelines primarily followed evidence-based methodologies and involved assistive technology users in their development.

Conclusions: This review provides a crucial overview of the existing landscape of assistive technology guidelines. It calls for further action to harmonise standards, leverage innovation in evidence generation and enhance guideline development to better serve the global population in need of assistive technology.

Introduction

Assistive technology is an umbrella term for assistive products and their related systems and services. Per definition by the World Health Organization (WHO), an assistive product is any external product (including devices, equipment, instruments, or software), especially produced or generally available, whose primary purpose is to maintain or improve an individual's functioning and independence, thereby promoting their well-being (WHO, 2016). Assistive products are also used to prevent impairments and secondary health conditions (WHO, 2016). Assistive products may be physical products such as wheelchairs, spectacles, hearing aids, prostheses, walking devices or continence pads; or digital, in the form of software and apps that support interpersonal communication, access to information, daily time management, rehabilitation, education, and training (ISO, 2022). They may also include adaptations to the physical environment, such as portable ramps or grab-rails (WHO, 2016; ISO, 2022).

Assistive technology is used by people of all ages, whether for brief periods, prolonged durations, or permanently. The International Organization for Standardization (ISO) defines the target population of assistive products as persons with disabilities (ISO, 2022). The WHO includes older people, people with disabilities, and those living with chronic conditions or functional difficulties as typical users and emphasised that any individual can be a user of assistive technology at some point in their lives (WHO, 2016; WHO and UNICEF, 2022).

Assistive technology can be utilised at home, within healthcare facilities, or in public spaces, and its provision necessitates various services to meet individual user needs

and optimise health outcomes (WHO and UNICEF, 2022). These services may vary according to the specific product, considering the user's health conditions, gender, physiological characteristics, daily living activities, cultural context, and more (WHO, 2023b).

International standards for assistive technology have existed for more than thirty years. The ISO published its first international standard, ISO 9999, on classification of assistive products (then technical aids for disabled persons) in 1992 (ISO, 1992). Since then, the ISO 9999 has expanded, and its 7th edition lists more than 900 assistive products (ISO, 2022), which is an exhaustive list of products addressing impairments in body structures or functions and across a wide range of health conditions. Though, ISO 9999 offers a reference of possible products to be considered in practices, there is an overwhelmingly huge number of products to choose from. In 2016, the WHO introduced the first Priority Assistive Products List (APL), which includes 50 products selected based on widespread need and impact on a person's life (WHO, 2016). The WHO APL aims to improve access to assistive technology by increasing supply and provision of these priority assistive products.

The 71st World Health Assembly resolution (WHA 71.8) calls for Member States to develop, implement and strengthen policies and programmes, based on national needs and context, including a national list of priority assistive products that are affordable and cost-effective and meet minimum quality and safety standards, to improve access to assistive technology within universal health and/or social services coverage (WHO, 2018). By 2023, at least nine countries (Bhutan, Ethiopia, India, Liberia, Malawi, Nepal, Nigeria, Sierra Leone, and Tajikistan) have developed their national priority assistive product list (WHO, 2024a). Some of these national APLs

were developed with government leadership, such as the Ministry of Health (MoH) in Liberia and Ethiopia, the MoH Department of Hospital Services in Nigeria, the Ministry of Health and Sanitation in Sierra Leone, the Division Leprosy Control of the Ministry of Health & Population in Nepal, and the Indian Council of Medical Research. One was developed by the WHO in Tajikistan in response to the National Programme on Rehabilitation of Persons with Disabilities 2017–2020 in the country (WHO EURO, 2019). Others were developed by national stakeholders, such as by a national referral hospital in Bhutan under the Article on free access to basic public health services in Bhutan's Constitution, and by a research consortia in Malawi based on the sub-national representative survey on access to assistive technology (Munthali *et al.*, 2024). Most of these national APLs' development drew on the WHO APL as a model list. However, limited information is published in these national APLs, as well as in the WHO APL, regarding the methodologies and evidence supporting the prioritization, how the list will be implemented, and how its outcomes will be monitored in the country.

According to the 2022 Global Report on Assistive Technology (WHO and UNICEF, 2022), around 2.5 billion people worldwide require at least one assistive product, a figure projected to rise to over 3.5 billion by 2050 due to a growing and aging population. However, the access to assistive technology (i.e., the proportion of people having the needed assistive products as a proportion of the population in need) varies significantly and as low as below 10% in some countries. The report further reveals that, despite the existence of legislation and policies, inadequacy in workforce well equipped with needed knowledge and skills to provide assistive products are a common system shortage in many countries (Figure 1~~Figure 1~~). Detailed analysis of 20 countries' data highlights the association between this system shortage and the low access in population (Borg, Winberg, *et al.*, 2023). The report outlines actions for

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national and global stakeholders, aligning with the WHA71.8, and emphasises the need for investment in data and evidence-based policies to facilitate access to assistive technology.

Guidelines play an instrumental role in translating evidence to policy and practices for the provision of assistive technology. In response to the global actions calling on strengthening policies and practices to improve access to assistive technology, and to address the paramount needs in the population, understanding the landscape of existing guidelines related to assistive technology is of importance. Given the vast spectrum of assistive technology, a scoping review on what guidelines are available and where the gaps are is a foundation for strengthening evidence-informed assistive technology policy and practices.

A preliminary search using a combination of 'scoping review' AND 'guideline' AND any of the following terms: 'assistive product*', 'assistive device*', 'assistive technolog*', 'wheelchair*', 'hearing aid*', 'prosthe*' in the title and abstract of articles in PubMed, the Cochrane Database of Systematic Reviews, and JBI Evidence Synthesis in July 2023 revealed no published or on-going work on the topic. Hence, this scoping review was conducted aiming to contribute to the normative work in assistive technology sector. The review aims to benefit the policymakers, practitioners, researchers, and users by providing an overview of available resources for assistive technology guidelines. For guideline developers, such as the WHO and many other interested parties, this review aims to inform crucial development and support future research.

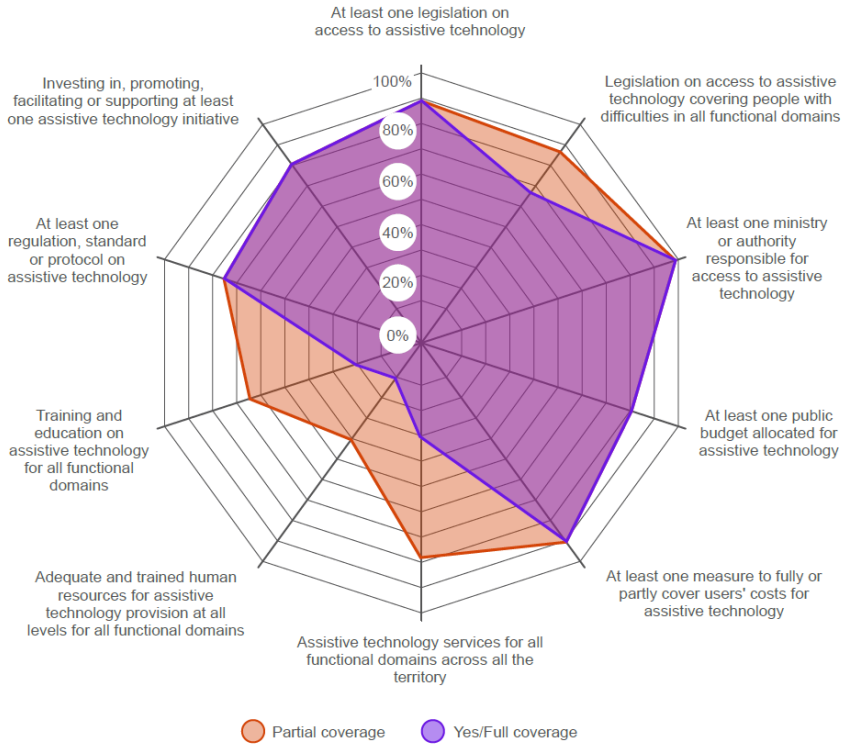


Figure 1. Proportions of countries reporting established elements of assistive technology system (WHO and UNICEF, 2022). Data aggregated from 70 WHO Member States reported Progress Indicators for access to assistive technology (WHO, 2021d).

Review questions

The aim of this scoping review was to identify the existing guidelines related to assistive technology. The primary review question was: What guidelines related to assistive technology have been published?

Additionally, the review aimed to provide a comprehensive understanding of the scope and characteristics of the identified guidelines. The following secondary review questions were addressed:

1. Which assistive products and related services are covered in the identified guidelines?
2. For which population groups (considering age, gender, geographic location, and health conditions or functional difficulties) are the identified guidelines intended?
3. In which contexts (such as home, community, primary care, or specialty care) are the identified guidelines applicable?
4. Were the identified guidelines developed following an established methodology?

Methods

This review followed the JBI methodology for scoping reviews (Aromataris and Munn, 2020). The review protocol was registered on 23 May 2024 in the Open Science Framework (Registration DOI: https://doi.org/10.17605/OSF.IO/FV7J8). The protocol was updated on 3 June 2024 [1], revising the title of the review to focus on the global availability of the guidelines. This update was justified to better reflect the scope of the review questions and the data extraction plan. The review was also guided by the PRISMA-ScR, which is an extension on reporting items for scoping reviews (Tricco *et al.*, 2018).

Eligibility criteria

The eligibility criteria for the review were guided by the PCC (population, concept, context) framework, which is used for formulation of review questions in a scoping review aiming at mapping and identifying the available evidence (Aromataris and Munn, 2020).

Population: The review incorporated guidelines pertaining to any demographic that utilises assistive technology or stands to gain from its use.

Concept: The focus was on assistive technology in general, specific assistive products, or related services for users or their caregivers. Guidelines including recommendations for these concepts were eligible for the scoping review. However, guidelines related to financing models, procurement mechanisms or workforce capacity building of assistive technology systems were excluded.

[1] Due to technical issues, the update was registered in OSF on 6 August 2024.

Context: Guidelines containing recommendations for the use of assistive products or related service provision at community or home care, primary care, or a specialty care (i.e., advanced, specialised care in specific medical fields) were considered.

This scoping review considered guidelines published by international organisations such as the WHO, national or international health or assistive technology associations, professional organisations, governmental bodies (e.g., ministries of health, education, social welfare, defence, etc), and consortia of health research or academia.

Search strategy

The aim of the search strategy was to locate published guidelines. An initial limited search of PubMed and TRIP medical database (TRIP, 2024) was executed using broad terms of “assistive technology” or “assistive products” or “assistive devices” and filter “guidelines” to identify records on the topic. The initial search yielded few relevant guidelines. Augmenting the search with terms presenting the functional domains: “cognition”, “communication”, “continence”, “hearing”, “mobility”, “self-care” and “vision” led to more relevant guidelines. Index terms from these relevant guidelines, such as “disability”, “ageing”, “chronic diseases”, “occupational therapy” as well as specific assistive product types identified as having a high prevalence of population need from the most recent surveys (Smith *et al.*, 2019; Danemayer *et al.*, 2021; WHO and UNICEF, 2022) were included in the search terms to capture relevant guidelines.

Guidelines either in English or available in English translation and published between January 2008 and March 2024 were screened. Considering the rapid advancements in assistive technology development, such as innovations brought by smartphones, wearables, and artificial intelligence in healthcare, guidelines from the past 15 years

should have captured the most relevant and up-to-date recommendations of interest for this review.

Source of review selection

The sources searched included health science publication outlets with a specific filter on clinical practice guidelines, including PubMed, CINAHL, TRIP, and WHO IRIS. In addition, Google Scholar was searched to complement the aforementioned outlets for any relevant guidelines. The final search strategy and terms were piloted and improved in collaboration with an experienced librarian from the University of Oxford. Additional guidelines found through the references of the relevant records were added for screening. Appendices I to V present the complete search terms for each included database.

The search was conducted in April and May 2024 following the defined terms, and citations were imported into Zotero 6.0.62 to generate BibTex files, which were subsequently imported to Rayyan (‘Rayyan’, 2021), an online systematic review support software, for systematic screening. Duplicates were identified by Rayyan using its automatic detection algorithm. The author examined each identified duplicate before removal. Keywords as used in the search terms, such as types of assistive products and functional domains, were highlighted in the title and abstracts by Rayyan to assist further screening. A document was identified as a guideline for this review when the term ‘*guideline’* was used to describe the work in the title or in the body of the text.

Data extraction and analysis

Specific assistive products and related services discussed in the documents were extracted. One or more of the functional domains these products addressed were labelled, including *cognition, communication, hearing, mobility, self-care* and *vision*. These six labels were chosen according to the categorization in the WHO's normative guidance on assistive technology (WHO, 2016; WHO and UNICEF, 2022). Two additional domains: *continence* and *environment-modification* were added to the labelling as they were used in other WHO normative work in rehabilitation (WHO, 2023a, 2023d). The context that the assistive technology-related recommendations addressed was labelled as *specialty*, *primary*, *home/community care*, *various* (or not specifically defined) or *others*. The methodology of the development was extracted and further analysed to determine if it followed evidence-based, consensus-based, or other approaches. The clarity of the recommendations was indicated by their presentation in the guideline. The data extraction instrument (see Appendix VI) included administrative information of the guideline (part 1) and information to answer the primary and secondary research questions (part 2 to part 5).

The data extraction performed by the author was verified using the GPT-4o (https://chatgpt.com/). The verification focused on whether the data extraction had identified all recommendations related to assistive technology. To conduct the verification, the definition of assistive products and the list of 50 priority assistive product (WHO, 2016) were uploaded to GPT-4o first. After that, the full text of the selected records was uploaded to GPT-4o to extract the relevant assistive product concept according to the definition and the product list. The author then compared the identified concepts between the extractions. Wherever discrepancies occurred, the

author made the (re)judgement and the final decision. The use of this tool for this purpose was approved by the MGHL examination office.

Results

The search returned 72 records from PubMed, 41 from CINAHL, 86 from TRIP, and 13 from WHO IRIS. Records returned in the first 11 pages (10 records per page) in the search of Google Scholar were scanned and 103 records were imported to Rayyan successfully [2]. This resulted in 315 records in total. After 24 duplicates were removed, 291 records were left for screening. Out of these records, 84 of the records' titles and abstracts were found relevant to the inclusion criteria, and their full documents were sought. Fourteen of these records could not be retrieved in full due to either the full text not being found (n=10) or not being available in English (n=4). Among the 70 full texts screened, 52 were excluded because these documents did not explicitly discuss any assistive product or related services or assistive technology in general (n=35), were background papers (n=1), or were not guidelines (n=16). One guidance statement (Avin *et al.*, 2015) was included because it was developed specifically based on existing guidelines. Another document (Kodera *et al.*, 2016) was included as it provided comprehensive information from its original guideline published by the Japan Audiological Society, whose full English translation could not be retrieved. Hence, 18 of the 70 full texts were included in the review. While screening the full texts, 16 new records were found relevant through citation searches. After screening the full texts of these additional documents, 6 were added to the review (excluding background papers: n=1, not explicitly discussing assistive technology: n=1, and non-guideline: n = 8). Finally, 24 relevant guidelines published in the past 15 years were identified. Figure 2~~Figure 2~~ presents the search results and the screening process through a PRISMA flow diagram for scoping review (Tricco *et al.*, 2018).

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[2] Unsuccessful importation was due to invalid file links.

Data extraction was verified by GPT-4o on 10 records (42% of the total reviewed records). These guidelines are oriented around health condition (such as falls, stroke, osteoporosis, urinary incontinence, etc) instead of assistive technology, and the conditions likely concerned multiple assistive product interventions. Among the verified records, discrepancies were found in two records. GPT-4o identified vaginal pessaries (NICE, 2019) and electrical stimulator (Winstein *et al.*, 2016), which were not identified by the author. These two products fit the definition of assistive products and the ISO 9999 classification. Hence, they were included in the data extraction. The full data extraction from the guidelines is presented in Appendix VII. Additionally, data were extracted from non-guideline documents. These documents, such as best practices, standards, handbooks, toolkits, or package of interventions and trainings, provided useful guidance related to assistive technology. Data, including relevant information about the population, the assistive technology functional domain, and the application context, were presented in Appendix VIII for the readers' additional reference but were not further analysed.

Figure 3~~Figure 3~~ illustrates the general demographic information of these guidelines, including the year of publication, the countries, and the types of developing organizations. Figure 4~~Figure 4~~ summarises the distributions of functional domains and care settings addressed by the identified guidelines related to assistive technology. Findings responding to the review questions on the availability of guidelines are summarised in the following subsections, with discussions deepening into the types of products and services covered, populations and typical health conditions addressed, applicable healthcare settings for interventions, as well as the methodologies used for the development of these guidelines.

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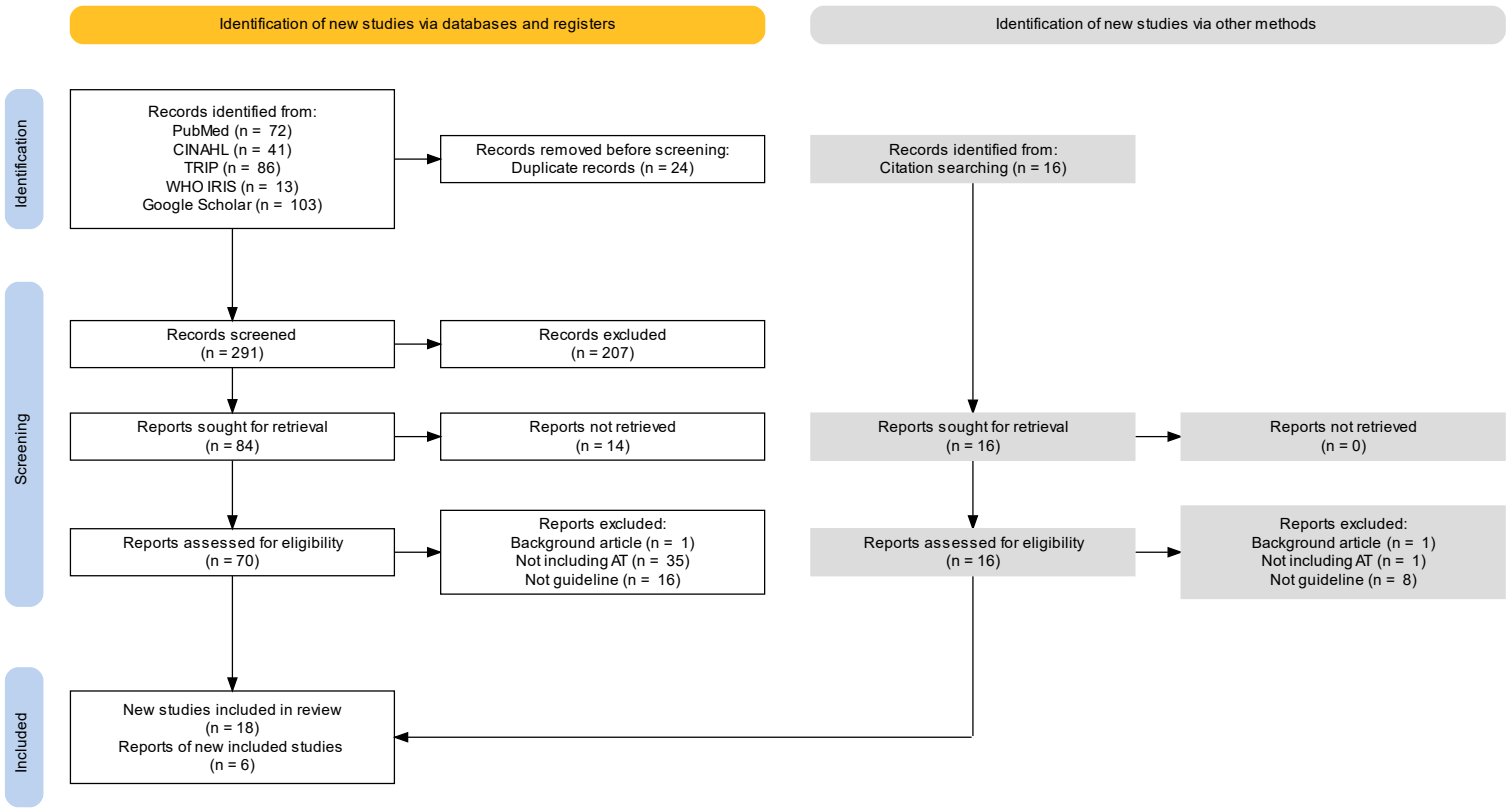


Figure 2. Flow diagram of search results and screening process for the scoping review. (Figure generated by Rayyan)

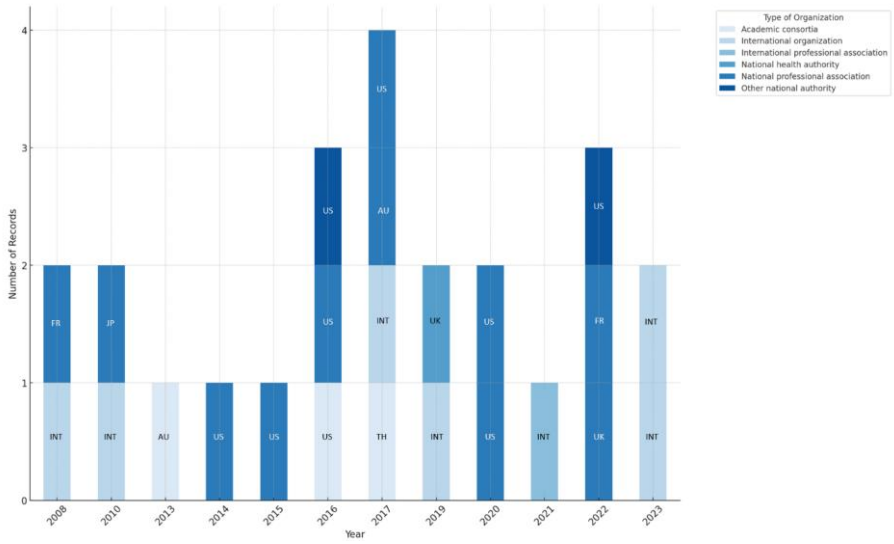


Figure 3. Identified guidelines by year, country, and type of developing organization. (Figure generated by GPT-4o)

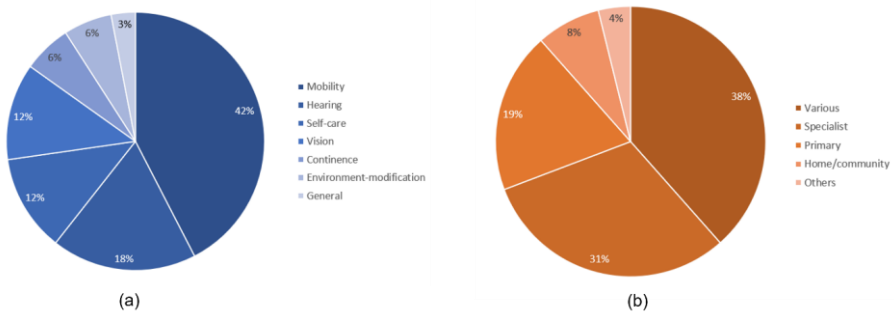


Figure 4. Percentages of assistive technology functional domains (a) and percentages of care settings/contexts (b) presented in the guidelines. (Figure generated by MS-Excel)

Availability of guidelines related to assistive technology

National health professional organizations based in high-income countries and upper-middle-income countries are found to be actively leading or involved in these guidelines' development. Of the 24 identified guidelines, more than half (n=17) were developed by national institutions. Among them, majority were published by national professional associations (n=11) consisting of practitioners, researchers, and policymakers, and representing a variety of clinical expertise in audiology, geriatrics, physical medicine and rehabilitation, cardiology, orthopaedics, occupational therapy, and general practice. One guideline was developed by a national health authority (NICE, 2019). Three guidelines' developments were led by national academic institutions (Lukersmith, Radbron and Hopman, 2013; Fisk *et al.*, 2016; Lersilp and Lersilp, 2017). Two guidelines were developed by other national authorities: department of veteran affairs and department of defence (Webster *et al.*, 2019; Crunkhorn *et al.*, 2023). One guideline was developed by an international medical professional association (Beniczky *et al.*, 2021). The WHO was the international organization identified as the leading developing agency, in collaboration with other international professional associations and development agencies for six of these guidelines.

Among the national institutions who developed these guidelines, nine of them are based in the USA, and others are from the UK (n=2), France (n=2), Australia (n=2), Japan (n=1) and Thailand (n=1). These guidelines mostly address national populations and settings, except for one that explicitly defines a global scope for its guidelines (Montero-Odasso *et al.*, 2022). Most identified guidelines developed by international organizations or international professional associations have a global

scope, except for two specifically addressing low- and middle-income or in low-resource settings (WHO, ISPO and USAID, 2008; WHO *et al.*, 2010).

All the guidelines aim to improve individuals' health outcomes with the recommended interventions of health products and clinical procedures, such as improved methods for screening, assessment, or selection of interventions and training. Health professionals such as practitioners or carers and other professionals who manage, develop, procure, or supply assistive technology are the primary target users of these guidelines. A few guidelines also anticipate system-level outcomes such as establishing or enhancing national health service provision systems and policies or improving design standards and regulation of assistive products. Some guidelines (n=8) include policymakers in governments or non-governmental organizations as primary or secondary audiences. Some guidelines (n=7) include people with the underlined health conditions or using assistive technology and their families, or organizations representing these people as target audiences of their guidelines.

Assistive products and related services covered

Assistive products to support functional difficulty in mobility appear in the recommendations of 14 guidelines, followed by those for hearing (n=6), self-care (n=4), vision (n=4), continence (n=2), and environment-modification (n=2). One guideline recommends assistive technology in general (Lersilp and Lersilp, 2017). None of the guidelines specifically discusses assistive products to support cognition or communication. Eight guidelines include recommendations of assistive products for more than one functional domain. Specific products for mobility, hearing and vision, such as wheelchairs, walking aids (such as canes, rollators), various forms of orthoses and prostheses, hearing aids, and spectacles appear repeatedly in the recommendations. Specific products for self-care are discussed in several guidelines,

such as hip protectors for hip fractures prevention (American Academy of Orthopaedic Surgeons, 2014; Avin *et al.*, 2015), and wearable devices for seizure detection (Beniczky *et al.*, 2021). Absorbent products, hand-held urinals, and toileting aids, and vaginal pessaries are recommended by one guideline in the package of managing incontinence in women (NICE, 2019). Another guideline discusses the usage of wetting alarms to assist parents in early childcare (Clark and Kingsley, 2020). Modification of the living environment in the identified guidelines include grab-bars and handrails (Montero-Odasso *et al.*, 2022) to improve accessibility, and room and bed sensors (Beniczky *et al.*, 2021) to assist caregivers for people living with functional difficulties.

Some of these guidelines include recommendations on services, in particular related to products for mobility, highlighting the practices for individualised needs assessment to select and adjust / fit the products for the users, and proper training to use and maintain the products to achieve the intended health benefits and outcomes. In addition, early screening for sensory functional difficulties is emphasised to enable timely and effective provision of appropriate assistive products such as screening for the need for hearing aids and low vision products. Interestingly, most guidelines (21 out of 24) emphasised consideration of patients' or users' preferences, values, and needs in the decision-making process for selection and delivery of interventions.

Guidelines focusing on assistive technology, such as those discussing wheelchairs and orthoses provision, provide detailed recommendations around proper product design and production, provision workflow, workforce qualification, user involvement, or policy frameworks (WHO, ISPO and USAID, 2008; Fisk *et al.*, 2016; WHO, 2023c). Less detailed discussions regarding assistive product provisions are common in guidelines where assistive technology is part of an intervention package, such as

those for self-care, incontinence and for environmental modification for improved accessibility or care.

These findings indicate that the representation of assistive products is limited and the guidance for assistive technology-specific service provision is scarce in the current guidelines. An important observation is that the guidelines generally highlight the people-centred approach in their recommendations to meet the goals and to design the intervention that matters for the patients and users. Initiatives in development of guidelines related to assistive technology in low- and middle-income countries, or guidelines targeting these countries, are lower compared to that in high-income countries in the current landscape.

Populations addressed

The identified guidelines primarily address people living with chronic health conditions or disabilities due to diseases or injuries that lead to short-term, long-term or permeant loss of part of their body functions or their body structures (in the case of amputations). Six guidelines specifically target adults living with certain health conditions or disabilities, including stroke (Winstein *et al.*, 2016), knee and hip osteoarthritis (RACGP, 2017), normal to mild cognitive impairment (WHO, 2019), hearing loss (Joly *et al.*, 2022), chronic primary low back pain (WHO, 2023d) and acquired upper limb amputations (Crunkhorn *et al.*, 2023). Recommendations for assistive products appear in these guidelines to support people regaining mobility and daily functions, and maintaining sensory functions, especially for those with hearing impairment. People with neurological conditions, such as stroke, seizures, and epilepsy that lead to different levels of physical functional impairments were recommended to use assistive technology to help manage simple daily activities.

To cope with capacity decline, such as fall-related injury preventions, older adults are a target population for interventions, for whom the recommendations highlight using simple assistive technology. Three guidelines discuss interventions to manage aged-related low vision (Kaldenberg and Smallfield, 2020), falls and intrinsic capacity decline (Avin *et al.*, 2015; WHO, 2017a). Cautions of using certain assistive products are highlighted as well in this target group. According to one guideline (RACGP, 2017), older people should not be prescribed bifocal or multifocal spectacles for outdoor use due to an increased risk of falls.

Two guidelines address the assistive technology applications for children, including infants on their early childhood development (Clark and Kingsley, 2020) and specifically for those living with development dysplasia of the hip (American Academy of Orthopaedic Surgeons, 2014).

Female adults are the target population of two guidelines addressing the osteoporosis post menopause (RACGP, 2017) and the urinary incontinence, where the guideline suggests following regular assessments to ensure optimal outcomes using a range of assistive products for incontinence and self-care (NICE, 2019).

Students with disabilities are the target population of one guideline which recommended assistive technology in general to navigate in school environment and access education resources (Lersilp and Lersilp, 2017).

These results suggest that assistive technology is relevant to and potentially beneficial to the management of a broad spectrum of health conditions in all age and gender groups. Guidelines oriented around health condition management are an important source for guidance on assistive technology interventions.

Applicable contexts

The identified guidelines address various healthcare contexts, including specialty care (n=8), primary care (n=7) and home/community care (n=5), where assistive products can be provided by specialists or general practitioners. Some guidelines (n=9) do not specify the health care settings to which the recommendations apply. The education (school) environment is included in two guidelines for implementing their recommendations with assistive technology (Fisk *et al.*, 2016; Lersilp and Lersilp, 2017).

Specialty care settings are discussed primarily for the types of assistive products with a wide range of variations and required individualised fitting, adjustment, and training for proper use, such as hearing aids, prostheses, some types of orthoses or wheelchairs. Assistive technology interventions for people with complex health conditions (such as serious injuries) are mostly discussed in a specialty care setting and including occupational therapists.

Primary care setting can be suitable for provision of simple assistive products to support mobilities, such as walking aids, or to manage incontinence or self-care, such as absorbent, and toilet aids. Primary care is also suggested for care provision with assistive technology when the users' health conditions are less complex. Some simple products could be provided through home and community care services, such as alarms for assisting carers or emergency responses, and for the environment modification like handrails, as well as simple mobility or vision products.

Above findings imply that the levels of complexity of assistive technology and severity of health conditions it intends to deal with are key factors influencing the applicability for a chosen health care setting to effectively deliver the interventions.

Development methods

The majority (n=18) of the identified guidelines followed evidence-based approaches in their development comprising comprehensive literature reviews, evidence synthesis, and appraisal in combination with stakeholder and/or expert consultations before consensus on the recommendations. However, the evidence to support recommendations for assistive products was generally weak in the reviewed guidelines. Three guidelines were developed following a consultative and consensus-based approach (WHO, ISPO and USAID, 2008; Fisk *et al.*, 2016; Montero-Odasso *et al.*, 2022). One guideline was developed based on principles and field validations (WHO *et al.*, 2010). Another followed a qualitative research approach using semi-structured interviews for the guideline development (Lersilp and Lersilp, 2017). The development process of one guideline could not be clearly identified (Kodera *et al.*, 2016). All guidelines but two present their recommendations in a clear and structured way that can be easily identified in the document and the strengths of the recommendations informed by the quality of the evidence are presented in most guidelines following the evidence-based approach.

For most guidelines, their developers followed an institutional guidance. For example, the WHO handbook for guideline development (WHO, 2014), is the guidance framework for guidelines developed by the organization (after the publication of the handbook) and the organization's Guideline Review Committee oversees all its guidelines' development. Several professional associations also developed their guidelines with the scientific guidance and under the oversight of their institutional scientific committees, such as the French National Agency for Health Accreditation and Evaluation (NAHAE), the American Heart Association (AHA) Stroke Council's Scientific Statement Oversight Committee and the AHA's Manuscript Oversight

Committee. Evidence evaluations mostly followed the well-established methodology GRADE (Guyatt *et al.*, 2008). One developer group (Avin *et al.*, 2015) used AGREE II framework (Brouwers *et al.*, 2016) to evaluate existing guidelines for their guidance statements development.

Though GRADE was followed by most evidence-based guideline development, one developer group pointed out that the lack of randomised controlled trials (RCTs) to evaluate and compare the effectiveness of various orthoses, posing a challenge for strong recommendations (Fisk *et al.*, 2016). The WHO Wheelchair Provision Guidelines discussed the limited high-quality research to support many of its recommendations to ensure appropriate procedures and services during provision (WHO, 2023c).

Though most identified guidelines target health professionals as primary users and these professionals were the major developer groups, six guidelines mention that the representatives of patients or potential users of assistive technology were involved, or their opinions were sought during the guideline development.

These findings suggest the wide adoption of evidence-based methodology in the identified guidelines' development and patients/carer receivers' involvement in the development is identified as a good practice. However, the availability and quality of evidence in the field of assistive technology could be limiting factors for producing reliable recommendations.

Discussions

This scoping review explored the current availability of guidelines related to assistive technology globally. These guidelines, developed by national and international organizations, address a variety of assistive technology to prevent and manage various health conditions in different healthcare settings and education environments. Most of the identified guidelines are oriented around health conditions, where assistive technology is one component among medicinal, surgical, nutritional, behavioural, and other interventions. Whereas guidelines primarily addressing assistive technology concentrate on a few commonly known products for mobility and sensory impairments. These findings suggest that assistive technology is likely under-explored for health interventions. Though majority of the guidelines developed following evidence-based methodologies, making reliable recommendations for assistive technology intervention is still hindered by inadequate evidence. The following discussions highlight the challenges of developing assistive technology guidelines, explore the opportunities, and suggest actions for stakeholders to advance assistive technology policy and practices. This section will also discuss the limitations and strengths of this review.

Challenges in assistive technology policy and practices for health interventions

The limited availability of assistive technology guidelines could be attributed to the challenges or barriers in each of the assistive technology system pillars, namely policy, products, provision, and personnel (WHO, 2020).

Ambiguity of international standards for assistive products

Despite the existence of international standards for many years and their alignment on the overall definition and scope, the classifications and terminologies for assistive products and product categories are inconsistent, notably between the ISO 9999 and the WHO APL, the two most prominently referenced standards in the field. Though ISO 9999 and WHO APL have different purposes, with the former aiming to standardise classifications and terminologies and the latter aiming to prioritise a subset of essential products to improve access, inconsistency creates ambiguity and makes communication of assistive technology concepts challenging among stakeholders (Elsaesser *et al.*, 2022). For example, ISO 9999 differentiate different types of *assistive products for alarming, indicating, reminding, and signalling*, including *clocks and time pieces, calendars and timetables, memory support products* (ISO, 2022). Whereas in WHO APL, a single product category: *time management products* covers a variety of products with features and functions. In another instance, four different categories of wheelchairs *(manual for active use, manual assistant-controlled, manual with postural support, and electrically powered)* were named in WHO APL versus only one single category of *lower limb prostheses*. However, the latter encompasses a vast variety of prostheses products that manage diverse and complex body structure and function needs, represented by more than 40 product categories in ISO 9999.

Ambiguity also arises from partial information in both product lists as neither list provides clear descriptions of the included products. For instance, *gesture to voice technology* is a priority product listed in WHO APL. The terminology refers to a technology that can be implemented in various applications requiring different hardware and software components, and their use cases vary. Without a clear

description, terminology is not helpful for understanding a concept, let alone applying relevant products in practice.

Lack of clarity and inconsistency in these standards also impose difficulty in information exchange between stakeholders in the assistive technology value chain (Elsaesser *et al.*, 2022). From manufacturing, procurement, and trade to systematic evidence generation of products' safety and efficacy profiles, adopting unified international terminologies and standards is critical.

Additionally, technology advancement, especially with the digital technology and artificial intelligence (AI) penetrating everyday life, is changing concepts of assistive products. For example, *personal digital assistant (PDA), video communication devices, portable travel aids* in WHO APL have faded out of the market and been replaced by general functions integrated into smartphones and tablets. Prioritizing these outdated products is meaningless for policy and practice. The diversity of users of assistive technology has been broadened thanks to the universal design. Products designed with features or technologies that originally help people with functional impairment specifically, are making everyone's life convenient nowadays. Example like text-to-voice and voice-to-text technology, and screen readers have become common functionalities in digital products on the market. The concept of assistive technology has become diverse beyond disability and will continue evolving (Smith *et al.*, 2024).

The observed trend of changing concept imposes further challenges to the relevance of the standards and requires developing future-proof terminology and classifications to guide applications of assistive products, especially beyond wheelchairs, orthoses, prostheses, walking aids, and hearing aids, the few product types discussed in the

identified guidelines. Developing meaningful guidelines that keep up with the fast-changing assistive technology landscape for effective provision in practice is challenging.

Lack of evidence-informed provision

Research has revealed that assistive products are often distributed without the appropriate steps of service provision, and beneficiaries have received assistive products that are inappropriate or unusable (WHO EURO, 2019). The challenge in evidence-informed provision is reflected in the limited and weak evidence to support most recommendations in the identified guidelines. The challenge of lack of high-quality study to generate evidence in assistive technology is a consistent observation (Smith, 2023), even in some of the most developed areas like wheelchairs (WHO, 2023c). This could be due to the methodological challenge to examine the complex interventions as assistive technology (Smith, 2023). For persons with complex health conditions, more than one health intervention is often needed. It is difficult to conduct RCTs, the gold standard for generating high-quality evidence, to evaluate the effects of the individual product in an interventions package including multiple health products, which is often the case for assistive technology applications.

The challenge is also due to lack of standard outcome measures for assistive technology, which impedes the evaluation, comparison and aggregation of data to draw confident conclusions regarding the effectiveness of interventions (Bell *et al.*, 2024). Furthermore, the lack of standard outcome measures also hinders improvement to the interventions.

Without guidelines on provision or synthesised evidence on the products' efficacy and safety, health professionals are left with challenges to make informed decision from

more than 900 ISO enlisted products or avoid prescribing assistive products. Though a shortlist of WHA APL is available, without evidence to support its prioritization, and the information ambiguity discussed earlier, provision of these priority products has remained a challenge. As a consequence, little field experience could be acquired to inform further studies and guideline development or improvement.

Inadequacy of professional workforce

The provision of assistive products to meet individual needs involves selection of the specific product model, fitting or adapting it to individual persons, and training for proper use and maintenance. This often requires a multidisciplinary team with expertise in a range of clinical and assistive technology interventions. Except for a few well-established professions, such as audiologists, opticians, orthotists, and prosthetists, there is no other assistive technology-oriented professions. The shortage of professional and competent assistive technology workforce, as revealed by recent data presented in Figure 1 (Global Health Observatory, 2022; WHO and UNICEF, 2022), weakens the driver for professional's career development, advancing the domain expertise, and advocating for policy and practices improvement in the field.

Furthermore, established professional groups might have a specific focus on a narrow scope of assistive products, but without sufficient knowledge of other relevant products for comprehensive interventions. For example, an audiologist has good knowledge of selecting and fitting hearing aids but may not be knowledgeable about alarm signallers to be embedded in the living environment or compatibility with remote microphone (or FM) system and hearing loop in public environment to support hearing aids users. A prosthetist could assess the need and fit the artificial limbs and need other professionals to provide a range of other self-care products adapted to the needs for

participation in activities. This could create siloed solutions leading to less optimal health outcome for persons with complex needs of assistive product interventions.

As the findings of this review indicate, professional groups are a driving force for guideline development. Lack of assistive technology professionals and less integrated knowledge in other health professions have left the assistive technology guidelines behind.

Complexity in leadership and governance for policy implementation

A recent article (Smith, 2024) argued that the integrated policy and provision of a range of ministries, agencies, and programs would better serve the people who need assistive technology for participation in their daily lives. It would also be more cost effective for governments providing the services as it would result in less duplication of efforts and a more coordinated approach. Assistive technology policy implementation, such as the model explained by Smith, requires coordinated programs across multiple ministries on budget and procurement planning and execution, joint technical and clinical workforce training and management, seamless service organization from referral to provision, and systematic monitoring and evaluation of the program outcomes. Such cross-ministerial coordination can be difficult to implement with the current infrastructures (updating IT systems for data sharing), finance structures (changing government budget distribution), human resources (additional administration personnel) and governance (complexity and bureaucracy of setting up the coordinating body and process).

Policy implementation can also be hindered by local context. In particular, constraints in local and global supply chains of assistive products can limit the selection to only products available on the local market or result in no access to the needed products,

as seen in other health products access challenges (Banda *et al.*, 2021). Insufficient public financing or lack of alternative financing models (such as private insurances) for assistive technology can also prevent the policy from its full implementation (Tay-Teo, Bell and Jowett, 2021).

While the discussion will not delve into power dynamics, their influence among stakeholders in the assistive technology sector should be acknowledged. Balancing the interests of national governments, global health donors, international development agencies, and the private sector is crucial for addressing other global health priorities with the available resources, as well as advancing the agenda to improve access to assistive technology.

The challenges in prosperity of assistive technology policy and practice implementation due to system complexity can demotivate its leadership and governance, which reversely hinder guideline development.

Opportunities for improving assistive technology guidelines and practices

There are opportunities to address some of the challenges in order to improve the availability and quality of assistive technology guidelines. This section discusses on-going and potential future initiatives to contribute to advancing assistive technology practices.

Harmonising norms and standards

A call has been made by assistive technology research community to standardise terminologies for assistive products as the first step to improving clarity and efficiency in generating and aggregating assistive product information in research and practices (Elsaesser *et al.*, 2022). The Global Assistive Technology Network made an effort to

map the products in the WHO APL to the ISO 9999 that support cross-referencing of terminologies in the product database (EASTIN, 2024). Other relevant and often referenced guidance for assistive product terminologies is the International Classification of Functioning, Disability and Health (ICF), which sets international norms on risk factors used by research and clinical practices in physical medicines, rehabilitation, disability studies. The ICF classifies assistive technology under environmental factors (WHO, 2001). The classification of assistive products in ISO 9999, WHO APL, and ICF should be aligned, for example, per functional difficulties of the user concerned for clinical practitioners' reference for relevant interventions for health conditions.

In 2021, the WHO published a set of 26 assistive product specifications (WHO, 2021a), including product descriptions, to provide practitioners, procurers, and users with practical information on the assistive products in WHO APL. Following that, the Training in Assistive Products further details the practices for selecting, fitting, and use of specific assistive products (WHO, 2023b). These initiatives bring useful practical information to assist practitioners and should be continued to keep the information updated while harmonization is taking place.

Harmonizing standards on assistive technology-related outcome measures is another effort to improve evidence generation and policy development. The Global Alliance of Assistive Technology Organisations launched an initiative in 2022, which surveyed 307 participants in 57 countries, on measuring assistive technology outcomes and impact (GAATO, 2022a). This initiative identified needed actions, including using user feedback more in outcome measures, adequate methods to measure cost effectiveness of assistive technology, expanding outcomes with non-clinical/non-health indicators, raising awareness, and training for outcome measures among

practitioners, and measuring system outcomes, for example, the effectiveness and efficiency of service delivery models (GAATO, 2022b; Borgnis *et al.*, 2023; Bell *et al.*, 2024). Measuring what matters for assistive technology users and review on relevant indicators were discussed in previous studies (Borg and Östergren, 2015; Layton *et al.*, 2023). It is an opportunity to harmonise the assistive technology outcome measures in the advancement in people-centred healthcare (Ford *et al.*, 2020). Such framework for outcome measures, besides Disability Adjusted Life Year (DALY) and Quality Adjusted Life Year (QALY), promotes the value of care receivers' feedback in the design and delivery, irrespective of the interventions. With a harmonised outcome measure framework, it is also possible to compare the outcomes of different types of interventions.

Harmonizing methods and instruments for assistive technology data collection would be an opportunity to draw on collective efforts for knowledge sharing and evidence generation. In 2019, the WHO launched a global initiative to measure access to assistive technology using two standardised instruments aimed at answering key questions on the population's needs for assistive technology (WHO, 2021c; Zhang *et al.*, 2021) and how prepared the health and social care systems in countries to meet the needs (WHO, 2021d). This initiative brought knowledge on the population needs for assistive technology in 35 countries, and systems' readiness to provide assistive technology in 70 countries between 2019 and 2021 (Global Health Observatory, 2022). The instruments continue evolving and improving since the launch of the initiative as more field experience becomes available (WHO, 2024c). It might be beneficial to harmonise among different data instruments. For example, disability and health surveys (WHO, 2017b; WGSS, 2024), quality-of-life surveys (WHO, 1997), and these assistive technology needs assessments could use the same set of questions

regarding a person's functional difficulty. The health system performance framework (Murray and Frenk, 2000; WHO *et al.*, 2022) might be linked to assistive technology system preparedness outcome assessments.

It is worth noting that harmonization of norms and standards does not mean choosing one or the other. It means a continuous process, following a consultative and collaborative approach, towards a common understanding and development of concepts, methods, and tools to enable synergised information on assistive technology. The harmonization of these international health and assistive technology terminologies and standards would potentially lead to greater integration of assistive technology provision into health interventions.

Identifying and filling evidence gaps

With improved harmonization and clarity of terminologies and outcome measures, the opportunity would increase to systematically generate useful evidence of assistive technology. In June 2024, the WHO launched a public call for systematic evidence reviews on the needs, benefits, and risks of about 300 candidate assistive products to support the update of the priority assistive product list (UNGM, 2024). At the same time, Clinton Health Access Initiative and the Global Partnership for Assistive Technology published the first market report compiling data on assistive product costs publicly available or provided by manufactures (CHAI and ATscale, 2024) and keep an open call to manufactures to contribute to the future reports. Though huge amount of work lies ahead, these initiatives will bring the best available evidence to the sector on a large scale. It would also highlight the methodological aspect of evidence generation for assistive technology and galvanize interests from researchers, practitioners, and providers in further discussions and improvements in this regard. To continue improving, it is essential to demonstrate how this evidence is applied in the

decision-making, in this case, how the prioritization of products or market-shaping policies are derived from the data and be clear and transparent on where the gaps are, in both evidence and methodologies for generating evidence, to guide future research.

Evidence generation should not only focus on safety and efficacy of assistive products, but also on delivery models. Studies on modelling the selection of assistive products (Scherer *et al.*, 2007; van Niekerk, Dada and Tönsing, 2019), and barriers and facilitators for delivering assistive technology interventions (GDI Hub, 2021; Borg, Gustafsson, *et al.*, 2023; Zander *et al.*, 2023) are critical to advance evidence-informed provision. Diversifying the implementation research to various target populations, such as in young children and older adults, and different socio-economic contexts, such as in resource-limited settings, would accelerate the translation of evidence into effective policy and practices.

It is important that evidence generation and update for assistive technology be a continuous and collaborative effort.

Advancing practice with living guidelines

Following the discussion on continuous evidence update, the living guidelines are a potential useful mechanism to ensure that the policy and practices advance based on up-to-date evidence. Living guidelines optimise the guideline development process to allow updating individual recommendations as soon as new relevant evidence becomes available (Akl *et al.*, 2017). The mechanism has been adopted by the WHO for updating the therapeutic guidelines for COVID-19 (WHO, 2021b), where the health condition was new, evidence was emerging fast, and time-critical guidance was needed to save lives. The WHO and national health authorities have been practicing living guidelines in other areas of work (Vogel *et al.*, 2019) before the COVID-19 global

pandemic. These examples demonstrate the opportunity for assistive technology practices to utilise the living guidelines' approach. For areas where there is little or no evidence, such as in assistive products for communication and cognition, expert opinions or consensus-based guidelines might be the baseline to start of the practical guidance for practitioners, and to cumulate evidence to update the guidelines. For fast evolving areas, such as artificial intelligence-enabled assistive products, timely systematic reviews including most recent research to update relevant recommendations are beneficial. Though there are no rules on how frequently such reviews and guidelines should be updated, the WHO recommended indicating a 'review-by' date for guideline users' discretion and for systematic reviewers' judgement for updates (WHO, 2014).

An analysis of original and updated NICE clinical guidelines and recommendations highlighted the pressing need to standardise the reporting and presentation of updated recommendations and the research gap about the optimal way to present updates to guideline users (Martínez García *et al.*, 2014). To take full advantage of living guidelines, stepping up the reporting of research results are critical for systematic reviews to capture the latest outcomes. Needed actions from research community have been emphasised in this regard with calls to stakeholders, especially scientific publishers, research ethics committees, and funding agencies, to reinforce the standards of the timely reporting both positive and negative research outcomes (Cuschieri, 2019; Butcher *et al.*, 2022). Should this request be followed, timely update of guidelines and translation to practices are feasible.

Initiatives on innovative research methodologies could be another cornerstone to advance clinical practices in assistive technology. Big data has offered new opportunities for health research to expand from traditional lab-bound and centralised

research environment to versatile contexts (for example, at the point of care delivery) and decentralised manner (for example, measuring outcome remotely using wearable devices). Opportunities are for researchers and practitioners to utilise innovations to boost research and evidence generation. Opportunities are for guideline developers to take advantage of data availability and analytical power growing at exponential speed to derive useful recommendations in the absence of RCTs.

Additionally, assistive technology guidelines and related policy translations should be developed as part of the evolution of related policy across a number of different sectors (MacLachlan *et al.*, 2018), such as education and social welfare. Adopting a system thinking for policy and practices, as well as the guideline development at its start, is key to delivering interventions to make positive impact on assistive technology users.

Raising awareness

With the first World Day for Assistive Technology announced on the 4 June 2024 (ATscale, 2024), raising awareness of assistive technology has gained new momentum. This campaign brings new opportunities for all relevant stakeholders, including assistive technology users, to draw attention to the importance of assistive technology and the urgent need to improve access to it, especially in many low- and middle-income countries (ATscale, 2024). The World Day for Assistive Technology became a reality based on years of work by many stakeholders in the sector, including gathering data to show the evidence of unmet need and inequity in access to assistive technology (WHO and UNICEF, 2022). Awareness-raising and advocacy for assistive technology will become powerful tools to mobilise more human and financial resources to research and policy development to address these challenges.

Actions for stakeholders

Effective translation of research outcomes to policy and practices is a joint effort of pushing evidence to practices and pulling research to address policy gaps. Assistive technology guidelines development is a key action in this intersection. Following actions are proposed to be considered by the WHO, researchers and practitioners, policymakers (such as ministries, regulators, research ethicists), and other stakeholders (such as global health and development donors, civil societies, and industry).

Researchers and practitioners are in the driving seat of developing new research methodology and innovating processes for generating high-quality evidence in assistive technology. For policymakers, actions to be considered include supporting evidence-informed guidelines and policy as a principle, taking a participatory, collaborative and outcome focused approach (Ebuenyi *et al.*, 2024), and engaging and valuing users' perspectives throughout policy development and implementation (MacLachlan *et al.*, 2018). Funders for research and development in assistive technology may consider enhancing resources for knowledge translation in their funding schemes, and enabling researchers' engagement with civil societies, industry, and policy makers to increase the chance of research outcomes being taken up by policy and practice. As a leading agency in global health norm and standard setting, the WHO is in a unique position to coordinate the multi-stakeholder efforts in harmonizing assistive technology standards, sharing up-to-date evidence and recommendations for practices globally. With its established Global Cooperation on Assistive Technology (WHO, 2024b), the organization is expected and supported by experts and stakeholders across the world to lead the collective efforts in setting the

assistive technology research and innovation agenda, and guiding the national policy development.

Limitations and strengths of the review

This scoping review has several limitations. Firstly, the review only included guidelines published in English or available in English translation, which may have excluded relevant guidelines published in other languages. Secondly, the search strategy was limited to a specific set of databases and search engines, potentially missing out on guidelines not indexed in these sources. These limitations likely under-reveal guidelines developed by local professional associations and governments. However, the assumptions are that some of the local guidelines' development, especially in less-resourced countries, might refer to or have high reliance on international guidelines or guidelines published by other well-resourced national organizations. Thirdly, the review focused on guidelines published in the past 15 years, which may have overlooked older, yet still relevant guidelines. Lastly, the review did not assess the quality of the guidelines in detail, which could have provided deeper insights into the rigor of the recommendations.

Despite abovementioned limitations, this scoping review has its strengths. It provides a comprehensive overview of the current landscape of assistive technology guidelines, highlighting the diversity of populations, and contexts addressed. The inclusion of a wide range of guideline sources, including international organizations, national institutions, professional associations, and academia ensures a broad perspective on the guidelines available. The review also identifies key gaps and challenges in the development and implementation of assistive technology guidelines, providing a foundation for future research and policy development. Furthermore, using GPT-4o for data extraction verification proved useful in enhancing human capacity in this study.

Although not all 24 guidelines were verified with the tool, 10 records were carefully selected for verification where the author had doubts about the original extraction. This approach likely yielded more reliable outcomes than random verification by a collaborator without assistive technology experience and allowed verification of more records than the originally planned 10% (2 or 3 records). Future review or research could expand on this review to examine specific recommendations on assistive technology and in broader contexts beyond the healthcare settings.

Conclusion

This scoping review provides a critical overview of the existing guidelines related to assistive technology. While a number of guidelines are available, they are predominantly focused on traditional assistive products like those for mobility and sensory impairments, and mostly originated from high-income countries. The notable lack of guidelines on products supporting cognitive and communication needs, and addressing low- and middle-income countries, reveals a significant gap in the global landscape of assistive technology guidelines, particularly in addressing the full spectrum of user needs and the rapidly evolving nature of assistive technology.

Key takeaways from the review findings emphasise on broadening and accelerating research and practices in the field of assistive technology to ensure that guidelines are supported by robust evidence and remain relevant and effective. Furthermore, harmonization in terminology and international standards is an urgent need for improving the clarity and application of assistive technology globally.

The discussions highlight the importance of continuous, coordinated, and collaborative efforts which value the perspectives of users and stakeholders in evidence generation and guideline development to advance assistive technology policy and practices. By addressing the identified gaps and leveraging the opportunities, stakeholders can improve the availability and the quality of assistive technology guidelines, ultimately enhancing the health and well-being of people in need of assistive technology globally.

Reflections

This systematic scoping review, built on the methodological foundations of module 4 and module 8, is a culmination of the insights and knowledge acquired throughout the two-year program. Notably, the theories of systems thinking and the "big picture" perspective from Module 3 profoundly influenced the analysis of challenges inherent in the complex assistive technology ecosystem. The exercises in Modules 6 and 7, which focused on crafting evidence-informed policy briefs, were instrumental in shaping the recommendations drawn from the review. The Discussions deliberately shift the narrative from identifying challenges to exploring the opportunities available to key stakeholders for advancing assistive technology policies and practices. The challenges in policy implementation, discussed in light of the learnings from Module 7, highlight the power dynamics often observed among national governance bodies. The author is cognizant of similar constraints faced by other stakeholders as in many other global health challenges.

As emphasised throughout the program, translating evidence into effective policy is a complex endeavor that demands a deep understanding of the implementation context, effective communication, and active engagement with relevant stakeholders. These skills, honed through real-world practice, are essential for success. The program has broadened my perspective on global health issues, deepened my understanding of health systems and policies, and allowed me to reflect on best practices for working with leaders of various styles. The development of this thesis enhanced my experience working on the frontlines of global health guideline development and capacity-building for country stakeholders in policy implementation. This journey has been instrumental in my growth as a leader committed to making a positive impact on my team and the broader global health community.

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Conflicts of interest

The author is a technical officer in an international organization responsible for the development and publication of some guidelines included in this review.

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Appendices

Appendix I: Search strategy with the full list of terms applied in PubMed

(technolog*[Text Word] OR assistive technolog*[Text Word] OR assistive product*[Text Word] OR assistive device*[Text Word] OR spectacle*[Text Word] OR eye glass*[Text Word] OR walking aid*[Text Word] OR walking device*[Text Word] OR walking stick*[Text Word] OR walking cane*[Text Word] OR mobility aid*[Text Word] OR mobility device*[Text Word] OR tripod*[Text Word] OR quadripod*[Text Word] OR crutch*[Text Word] OR shower chair*[Text Word] OR toilet chair*[Text Word] OR bath chair*[Text Word] OR wheelchair*[Text Word] wheel chair*[Text Word] OR hearing aid*[Text Word] OR hearing device*[Text Word] OR orthos*[Text Word] OR prosthe*[Text Word] OR continence aid*[Text Word] OR continence pad*[Text Word] OR incontinence aid*[Text Word] OR incontinence pad*[Text Word] OR "mobile health"[Text Word] OR "mobile app*"[Text Word] OR mhealth[Text Word] OR apps[Text Word] OR app[Text Word] OR digital technolog*[Text Word] OR digital product*[Text Word] OR digital device*[Text Word] OR wearables[Text Word] OR wearable technolog*[Text Word] OR wearable product*[Text Word] OR wearable device*[Text Word] OR smarthome*[Text Word] OR smart home*[Text Word] OR occupational therap*[Text Word] OR ((home*[Text Word] OR shower*[text Word] OR bath*[Text Word] OR toilet[Text Word])AND adapt*[Text Word]))

AND

(disabilit*[Text Word] OR disabled[Text Word] OR "old people"[Text Word] OR "older people"[Text Word] OR old person*[Text Word] OR older person*[Text Word] OR elderly[Text Word] OR "old age"[Text Word] OR aged[Text Word] OR aging[Text Word] OR ageing[Text Word] OR geriatric*[Text Word] OR veteran*[Text Word] OR chronic disease*[Text Word] OR chronic condition*[Text Word] OR long term condition[Text Word] OR "long-term care"[Text Word] OR vision impairment*[Text Word] OR "visually impaired"[Text Word] OR "low vision"[Text Word] OR blind*[Text Word] OR mobility[Title] OR mobility impairment*[Text Word] OR mobility difficult*[Text Word] OR hearing impairment*[Text Word] OR "hard of hearing"[Text Word] OR deaf[Text Word] OR hearing difficult*[Text Word] OR hearing disorder*[Text Word] OR communication[Text Word] OR speaking[Text Word] OR speech[Text Word] OR aphasia[Text Word] OR "cognitive decline"[Text Word] OR cognition impairment*[Text Word] OR incontinence[Text Word] OR continence[Text Word] OR selfcare[Text Word] OR self-care[Text Word])

Appendix II: Search strategy with the full list of terms applied in CINAHL

((TI technolog*) OR "assistive technolog*" OR "assistive product*" OR "assistive device*" OR spectacle* OR "eye glass*" OR "walking aid*" OR "walking device*" OR "walking stick*" OR "walking cane*" OR "mobility aid*" OR "mobility device*" OR tripod* OR quadripod* OR crutch* OR "shower chair*" OR "toilet chair*" OR "bath chair*" OR "wheelchair* wheel chair*" OR "hearing aid*" OR "hearing device*" OR orthos* OR prosthe* OR "continence aid*" OR "continence pad*" OR "incontinence aid*" OR "incontinence pad*" OR "mobile health" OR "mobile app*" OR mhealth OR apps OR app OR "digital technolog*" OR "digital product*" OR "digital device*" OR wearables OR "wearable technolog*" OR "wearable product*" OR "wearable device*" OR smarthome* OR "smart home*" OR "occupational therap*" OR ((home* OR shower* OR bath* OR toilet) "AND adapt*")) AND (disabilit* OR disabled OR "old people" OR "older people" OR "old person*" OR "older person*" OR elderly OR "old age" OR aged OR

aging OR ageing OR geriatric*" OR veteran* OR "chronic disease*" OR "chronic condition*" OR "long term condition" OR "long-term care" OR "vision impairment*" OR "visually impaired" OR "low vision" OR blind* OR (TI mobility) OR "mobility impairment*" OR "mobility difficult*" OR "hearing impairment*" OR "hard of hearing" OR deaf OR "hearing difficult*" OR "hearing disorder*" OR communication OR speaking OR speech OR aphasia OR "cognitive decline" OR "cognition impairment*" OR incontinence OR continence OR selfcare OR self-care)

Appendix III: Search strategy with the full list of terms applied in TRIP

((title:disabilit* OR title:disabled OR title:old OR title:older OR title:elderly OR title:aged OR title:geriatric* title:ageing OR title:aging OR title:veteran* OR title:chronic OR title:"long title:term" OR title:vision OR title:visually OR title:blind* OR title:mobility OR title:hearing OR title:deaf OR title:communication OR title:speaking OR title:speech OR title:aphasia OR title:cognitive OR title:cognition OR title:incontinence OR title:continence OR title:selfcare OR title:self-care) AND ("assistive technolog*" OR "assistive product*" OR "assistive device*" OR spectacle* OR "eye glass*" OR "walking aid*" OR "walking device*" OR "walking stick*" OR "walking cane*" OR "mobility aid*" OR "mobility device*" OR tripod* OR quadripod* OR crutch* OR "shower chair*" OR "toilet chair*" OR "bath chair*" OR "wheelchair* wheel chair*" OR "hearing aid*" OR "hearing device*" OR orthos* OR prosthe* OR "continence aid*" OR "continence pad*" OR "incontinence aid*" OR "incontinence pad*" OR "mobile health" OR "mobile app*" OR mhealth OR apps OR app OR "digital technolog*" OR "digital product*" OR "digital device*" OR wearables OR "wearable technolog*" OR "wearable product*" OR "wearable device*" OR smarthome* OR "smart home*" OR "occupational therap*"))

Appendix IV: Search strategy with the full list of terms applied in WHO IRIS

Subject equals ‘guideline’ AND contains (‘disability’ OR ‘rehabilitation’ OR ‘aging’ OR 'chronic’ OR ‘mobility’ OR ‘vision’ OR ‘hearing’ OR 'communication’ OR’ self-care’ OR ‘cognition’) AND Language equals ‘English’ AND Date issued equals [2008 TO 2024].

Appendix V: Search strategy with the full list of terms applied in Google Scholar

guideline AND assistive AND (technology OR technologies OR product OR products OR device OR devices)

Appendix VI: Data extraction instrument

ID	Index	Item	Description
Part 1: administrative information			
	1.1	Title	Full title of the guideline and the version, if the guideline has been updated.
	1.2	Organization	The organization leading the development of the guideline.
	1.3	Year	The latest update of the guideline.
Part 2: scope and purpose			
1	2.1	Population	Target population described by their demographic attributes (such as age, sex, country or region) and / or the health conditions.
2	2.2	Concept	Specific product types addressed and / or related services (such as referral, need assessment, product design/fitting/adaptation/maintenance, user training).
3	2.3	Context	The environment (such as home/community, primary or higher- level healthcare), where the recommendation is applicable.
4	2.4	Outcome	The health or other outcomes the recommendations intend to achieve (such as improved function, increased participation, etc).
Part 3: stakeholder involvement			
5	3.1	Target population preferences and view	Methods used to include assistive technology users' view in the guideline development.
6	3.2	Target guideline users	List of guideline users.
Part 4: rigor of development			
7	4.1	Methodology	Is the guideline developed following an established methodology?
Part 5: clarity of presentation			
8	5.1	Recommendations are identifiable	Are the recommendations easily identified in the guideline?

Appendix VII: Data extraction of guidelines related to assistive technology [3]

Title of guidelines (1.1)	Organization (1.2)	Type of organization	Country of organization	Year (1.3)	Population (2.1)	Specific product (2.2)	Specific service (2.2)	AT functional domain	Context (2.3)	Care level	Outcome (2.4)	Target Population Preferences and Views (3.1)	Target Guideline Users (3.2)	Development Approach (4.1)	Recommendation presented clearly (5.1)
Is there an evidence-based efficacy for the use of foot orthotics in knee and hip osteoarthritis? Elaboration of French clinical practice guidelines (Gélis *et al.*, 2008)	SOFMER (French Physical Medicine and Rehabilitation Society)	National professional association	France	2008	Adults with knee and hip osteoarthritis	Foot pronation orthotics, laterally wedge insoles, rearfoot wedge foot orthotics,	Not specific	Mobility	Clinical settings involving management of knee and hip osteoarthritis, focusing on non-pharmacological treatments	Specialty	Effectiveness and the place of FO in the management of knee and hip OA	No specific mention of considering patients' preference in the development or recommendations	Physicians in Physical Medicine and Rehabilitation, Rheumatologists, Orthopaedic Surgeons	Evidence-based, expert opinion	Yes.
Guidelines on the provision of manual wheelchairs in less-resourced settings (WHO, ISPO and USAID, 2008)	World Health Organization (WHO)	International organization	International	2008	People with disabilities in less-resourced settings, including children, adults, and the elderly	Wheelchair	Design and production, service delivery, policy and planning, user involvement in provision	Mobility	Less-resourced settings, including rural, semi-urban, and urban environments in developing countries	Various	Improved personal mobility, enhanced quality of life, and increased social and economic participation and country system development	Yes. The guidelines emphasise user involvement in design and selection processes to ensure the wheelchairs meet their needs	Government and nongovernmental policymakers, wheelchair service providers, designers, testers, donors, purchasers, adapters of wheelchairs, planners and managers of wheelchair production, developers of training programs, disabled people's organizations, users and their families	Stakeholder consultation, consensus-based	Yes.
Guidelines for the evaluation of hearing aid fitting (Kodera *et al.*, 2016)	Japan Audiological Society	National professional association	Japan	2010	Hearing-impaired individuals	Hearing aids	Evaluation of product efficacy and fitting	Hearing	Clinical practice settings, including general otolaryngology clinics, for fitting and evaluating hearing aids.	Specialty	Improved fitting and efficacy of hearing aids, ensuring they meet the needs of hearing-impaired individuals by improving speech understanding and tolerance to environmental noise.	Yes. The guideline recommended questionnaires assessing subjective hearing aid benefit in daily life scenarios for assessments of fitting outcomes.	Audiologists, otolaryngologists, hearing aid specialists, and other healthcare professionals involved in fitting and managing hearing aids.		Yes.
Community-Based Rehabilitation: CBR Guidelines (WHO *et al.*, 2010)	World Health Organization (WHO), UNESCO, ILO, International Disability Development Consortium (IDDC)	International organization	International	2010	People with disabilities, including children, adults, and elderly individuals	Spectacles, hearing aids, walking aids.	Not specific	Vision, Hearing, Mobility	Low and middle-income countries, community-level settings	Primary	Improved access to rehabilitation services, enhanced participation and inclusion of people with disabilities in society, and improved quality of life.	Yes. The guidelines emphasise involving disabled people and their families in the development and decision-making processes to ensure their needs and preferences are met.	Primary audience: CBR managers; Secondary audience: CBR personnel, primary health workers, social workers, community development workers, disabled people and their families, DPOs, government officials, development organizations, researchers, and academics.	Principle, field validation	Yes.
Development of clinical guidelines for the prescription of a seated wheelchair or mobility scooter for people with traumatic brain injury or spinal cord injury (Lukersmith, Radbron and Hopman, 2013)	Service Development & Review, Lifetime Care & Support Authority, Lukersmith & Associates, Brain Injury Rehabilitation Unit, Liverpool Hospital, Australia	Academic consortia	Australia	2013	Adults with spinal cord injury and/or traumatic brain injury	Seated wheelchairs, mobility scooters	Provision services from assessment to training users on maintenance of devices, and focusing on prescription of the right devices	Mobility	Not specifically mentioned. But likely require specialist capacity	Specialty	To reduce the potential for poor wheelchair prescription.	Yes. Recommendations emphasised people-cantered services where prescription of devices considering the user's anticipated activities in the possible environments.	Occupational therapists	Evidence-based	Yes.

[3] Records with * are verified by GPT-4o for data extraction.

Detection and Nonoperative Management of Paediatric Developmental Dysplasia of the Hip in Infants up to Six Months of Age (American Academy of Orthopaedic Surgeons, 2014) *	American Academy of Orthopaedic Surgeons (AAOS)	National professional association	USA	2014	Infants up to six months of age with paediatric developmental dysplasia of the hip (DDH)	Wheelchairs, bracing for DDH	Not specific	Mobility	Guidelines applicable in various healthcare settings, involving paediatricians, family physicians, radiologists, and orthopaedic surgeons	Various	Improved detection and management of hip instability and dysplasia in infants, early intervention to prevent progression	Yes. Involvement of patients' guardians in decision-making, mutual communication between guardians and healthcare providers	Healthcare professionals, including paediatricians, family physicians, radiologists, orthopaedic surgeons, and mid-level practitioners	Evidence-based, consensus-based	Yes.
Management of Falls in Community-Dwelling Older Adults: Clinical Guidance Statement From the Academy of Geriatric Physical Therapy of the American Physical Therapy Association (Avin *et al.*, 2015) *	Academy of Geriatric Physical Therapy of the American Physical Therapy Association	National professional association	USA	2015	Community-dwelling older adults	Mobility aids, hip protector	User training	Mobility, Self-care	Clinical settings, including physical therapy and multidisciplinary care teams	Various	Improved identification and management of fall risk, reduction in fall rates, better health outcomes	Yes. Inclusion of older people in guideline review. Recommendations emphasised including older people's values and preferences in decision-making, emphasis on tailored interventions	Physical therapists	Evidence-based	Yes.
Guidelines for Adult Stroke Rehabilitation and Recovery (Winstein *et al.*, 2016) *	American Heart Association/American Stroke Association	National professional association	USA	2016	Adults recovering from stroke	Ankle-foot orthosis (AFO), resting ankle splints, electrical stimulation, strapping and taping	Not specific	Mobility	Applicable in various healthcare settings including acute hospital care, inpatient rehabilitation facilities, skilled nursing facilities, home healthcare agencies, and outpatient settings.	Various	Improved stroke rehabilitation outcomes, enhanced recovery, reduced disability, better patient care, and effective organization and coordination among care providers.	Yes. The guideline emphasises patient and family education, patient-cantered care, and inclusion of patient preferences in rehabilitation planning.	Healthcare professionals including physicians, nurses, physical therapists, occupational therapists, speech-language pathologists, psychologists, social workers, and others involved in stroke rehabilitation. The guidelines considered questions interested by policy makers, such as organization and cost.	Evidence-based	Yes.
Suggested Guidelines for the Prescription of Orthotic Services, Device Delivery, Education, and Follow-up Care: A Multidisciplinary White Paper (Fisk *et al.*, 2016)	A task force of experts from universities and clinics in USA, with support from American Orthotic & Prosthetic Association.	Academic consortia	USA	2016	Patients needing orthoses, especially Medicare beneficiaries	Off-the-shelf and custom-fit orthoses	Prescription and delivery of orthotic services	Mobility	Multidisciplinary orthotic care involving orthopaedics, physical medicine physicians, therapists, and certified orthotists.	Specialty	Provide expert guidance for patient safety, minimise wasted expenditures, maximise clinical outcomes, and ensure efficient delivery of care for Medicare and other patients.	No specific mention. It discussed involvement of a multidisciplinary task force including experts in orthopaedics and orthotics to provide patient-centred care. But not specifically recommend if and how to take patients' preference, values in the care delivery.	Healthcare professionals including physicians, therapists, certified orthotists, and Medicare providers.	Consensus-based	Not in a structured format.
Clinical Practice Guideline (Update): Earwax (Cerumen Impaction) (Schwartz *et al.*, 2017)	American Academy of Otolaryngology - Head and Neck Surgery Foundation	National professional association	USA	2017	Individuals >6 months with cerumen impaction	Hearing aids	Detection and user training	Hearing	Any setting where cerumen impaction would be identified, monitored, or managed	Various	Better identify patients with cerumen impaction who may benefit from intervention and to promote evidence-based management to improve management, prevent symptoms, and ensure proper diagnosis	Yes. Recommendation emphasis on considering patient preference wherever evidence for action is doubtful and emphasis on patient education and counselling	All clinicians who are likely to diagnose and manage patients with cerumen impaction.	Evidence-based	Yes.
Osteoporosis prevention, diagnosis and management in postmenopausal women and men over 50 years of age (RACGP, 2017) *	The Royal Australian College of General Practitioners and Osteoporosis Australia	National professional association	Australia	2017	Postmenopausal women and men over 50 years of age	Hip protector, bifocal/multi-focal/single strength glasses	Not specific	Self-care, Vision	Community and healthcare settings in Australia	Primary, Home/community	Improved diagnosis, management, and prevention of osteoporosis-related fractures	Yes. The Working Group supports all recommendations and intends that they are used in conjunction with clinical judgement and patient preferences.	Healthcare professionals including general practitioners and specialists	Evidence-based, consensus-based	Yes.

Integrated care for older people: Guidelines on community-level interventions to manage declines in intrinsic capacity (WHO, 2017a) *	World Health Organization (WHO)	International organization	International	2017	Older people experiencing declines in intrinsic capacity	Hearing aids, spectacles, alarms, walking aids.	Screening, provision,	Hearing, Vision, Mobility	The interventions are designed to be implemented through models of care that prioritise primary care and community-based care. This includes a focus on home-based interventions, community engagement and a fully integrated referral system.	Primary, Home/community	Improved management of physical and mental capacities, prevention of care dependency, and support for caregivers	Yes. Consideration of values and preferences of older people, inclusion of stakeholders' views was recommended.	Healthcare providers, program managers, professionals developing training curricula, NGOs, and charities	Evidence-based	Yes.
A Guideline of using Assistive Technologies and Educational Services for Students with Disabilities in Higher Education (Lersilp and Lersilp, 2017)	Department of Special Education, Faculty of Education, Chiang Mai Rajabhat University, Thailand; Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Thailand	Academic consortia	Thailand	2017	Students with disabilities in higher education	Vision, hearing, mobility, cognition, communication products	Not specific	General	Higher education institutions in upper northern Thailand	Others	Accessibility to higher education for students with disabilities	Yes. Views from 12 service providers and 26 undergraduate students with disabilities collected via semi-structured interviews. The guideline also recommends considering values of the students.	Service providers, students with disabilities, educational institutions, governmental and non-governmental organizations	Semi-structured interview	
Clinical Practice Guidelines for the Rehabilitation of Lower Limb Amputation: An Update (Webster *et al.*, 2019)	US Departments of Defense and Veterans Affairs	Other national authority	USA	2019	Lower limb amputation patients of all ages	Prostheses, rigid or semirigid dressing, microprocessor knee units	Provision of prostheses	Mobility	Not specifically mentioned. Likely require specialist capacity	Specialty	Improved daily function and quality-of-life in patients with LLA	Yes. Patient values and preferences are considered for the guideline development. The guideline provides a framework for managing persons with LLA in the context of their individual needs and preferences.	Healthcare professional working with LLA patients	Evidence-based	Yes.
Risk Reduction of Cognitive Decline and Dementia: WHO Guidelines (WHO, 2019) *	World Health Organization (WHO)	International organization	International	2019	Adults with normal cognition or mild cognitive impairment (MCI)	Hearing aids	Screening	Hearing	Global, applicable to healthcare providers, policymakers, and the general population	Various	Delay or prevent cognitive decline and dementia, improve quality of life and functional level.	Yes. Promotes informed decision-making, considers individual needs and preferences, patient-cantered approach	The guidelines are primarily targeted at health care providers. Quality improvement teams at all levels of the system will benefit from the work. Guidelines and their derivative products have implications for policymakers, health care planners and programme managers at national and international level, as well as the general population.	Evidence-based	Yes.
Urinary Incontinence and Pelvic Organ Prolapse in Women: Management (NICE, 2019) *	National Institute for Health and Care Excellence (NICE)	National health authority	UK	2019	Women aged 18 and over with urinary incontinence, pelvic organ prolapse, or complications associated with surgery for these conditions.	Absorbent products, hand-held urinals, and toileting aids, vaginal pessaries.	Regular assessment and proper fitting	Self-care, continence	Applicable in various healthcare settings, including primary care and specialist services. It also addresses multidisciplinary team involvement and regional MDTs for complex cases.	Primary, Specialty	Improved management and treatment of urinary incontinence and pelvic organ prolapse, reduction in symptoms, better patient care, and management of complications related to mesh surgery.	Yes. Emphasises involving patients in decision-making processes, considering individual needs, preferences, and values, and promoting informed decisions about their care.	Healthcare professionals, service commissioners, and women with urinary incontinence, pelvic organ prolapse, or related surgical complications, including their families and carers.	Evidence-based	Yes.
Occupational Therapy Practice Guidelines for Early Childhood: Birth until 5 Years (Clark and Kingsley, 2020) *	American Occupational Therapy Association (AOTA)	National professional association	USA	2020	Children ages birth until 5 years	Wetting alarm	Not specific	Continence	Various early childhood settings, including home, community, hospital, and educational environments	Primary, Home/community, Others	Effectiveness of interventions to support the development of cognitive, social–emotional, motor, and self-care skills	Yes. People-cantered care with a focus on family involvement; interventions tailored to individual needs and preferences	Occupational therapists and occupational therapy assistants, as well as the people who manage, reimburse, or set policy regarding occupational therapy services. Can also be a reference for broad audience such as researchers and carers.	Evidence-based	Yes.

Occupational Therapy Practice Guidelines for Older Adults With Low Vision (Kaldenberg and Smallfield, 2020)	American Occupational Therapy Association (AOTA)	National professional association	USA	2020	Older adults with low vision	Magnifiers (CCTV, OrCam, low vision devices)	Not specific	Vision	Various healthcare settings, focusing on rehabilitation	Various	Improved service delivery, and quality of care, enhanced consumer satisfaction, and justified occupational therapy services to external stakeholders	Yes. Recommend using client-cantered problem-solving training to enhance ADL and IADL performance, reading, and leisure and social participation	Occupational therapists and occupational therapy assistants, as well as the people who manage, reimburse, and set policy regarding occupational therapy services. This guideline can also serve as a reference for health professional, regulators, and researchers.	Evidence-based, expert opinion	Yes.
Automated seizure detection using wearable devices: A clinical practice guideline of the International League Against Epilepsy and the International Federation of Clinical Neurophysiology (Beniczky *et al.*, 2021)	International League Against Epilepsy and the International Federation of Clinical Neurophysiology	International professional association	International	2021	Children and adults with epilepsy, who are not seizure-free and who have either (1) GTCS, including FBTCS or (2) focal impaired awareness seizures, without tonic-conic component.	Room/bed-placed sensor, wearable devices/alarms	Not specific	Self-care, environment-modification	Outpatients with epilepsy in ambulatory settings	Home/community	Sensitivity, false alarm rate, adverse events, usability of the interventions to decrease morbidity and mortality associated with seizures and for objective seizure identification and quantification.	Yes. The guideline emphasises costs, patients´ preferences and perspectives should be considered in the evaluation of impact of this technology.	Healthcare personnel working with patients with epilepsy	Evidence-based	Yes.
Guidelines of the French Society of Otorhinolaryngology-Head and Neck Surgery (SFORL) and the French Society of Audiology (SFA) for Speech-in-Noise Testing in Adults (Joly *et al.*, 2022)	French Society of Otorhinolaryngology-Head and Neck Surgery (SFORL) and the French Society of Audiology (SFA)	National professional association	France	2022	Adults with hearing loss, specifically those undergoing speech-in-noise testing	Hearing aids, bone-anchored bone-conduction devices.	Test for hearing gain/efficacy	Hearing	Various healthcare settings, including clinical and research settings	Specialty	Improved assessment and management of speech intelligibility in noise for adults with hearing loss.	No specific mention of considering users' preference in the development or recommendations.	ENT physicians, audiologists, audio prosthetists, and other healthcare professionals involved in hearing care	Evidence-based and expert opinion	Yes.
World guidelines for falls prevention and management for older adults: a global initiative (Montero-Odasso *et al.*, 2022) *	British Geriatrics Society	National professional association	UK	2022	Older adults aged 65 and over	Wearables, personal emergency alarms, handrail/grab bar	Not specific	Mobility, Environment-modification	Global initiative, applicable in community, care homes, and hospitals	Various	Reduction in falls, improved functional mobility, reduced fall-related injuries	Yes. Inclusion of older adults' perspectives, caregivers' views in the guideline development and emphasised the including older people's beliefs, attitudes and priorities in management of falls.	Healthcare professionals including physicians, nurses, physiotherapists, occupational therapists, pharmacists, and allied health professionals	Consensus-based	Yes.
Management of Upper Limb Amputation Rehabilitation (Crunkhorn *et al.*, 2023)	US Department of Veterans Affairs and US Department of Defence	Other national authority	USA	2022	Adults (≥18 years) with acquired upper limb amputation, including veterans as well as service members, military retirees, and beneficiaries.	Upper limb prostheses	Product design and fitting	Mobility	The updated guideline in 2022 includes an additional treatment algorithm that is designed specifically for primary care providers	Primary, Specialty	Improved quality of life in patients with ULA	Yes. Patient values and preferences are taken into account for the guideline development where it utilised gender-specific patient focus groups to identify priority clinical issues and gender-specific management considerations.	Healthcare providers engaged in the care of patients with ULA	Evidence-based	Yes.
Wheelchair provision guidelines (WHO, 2023c)	World Health Organization (WHO)	International organization	International	2023	Children, older persons, people with mobility disabilities, and those with chronic health conditions	Wheelchair	Individualised assessment, fitting and preparation, integrated services, systematic evaluation, and user training,	Mobility	Healthcare settings, including primary, secondary, and tertiary health facilities, and outreach to community settings	Various	Improved access to appropriate wheelchairs, ensuring mobility, inclusion, and participation at both individual service and system levels	Yes. Involvement of wheelchair users in guideline development and in decision-making processes, emphasis on user engagement and choice in the recommendation	Policymakers, healthcare providers, wheelchair service personnel, and representatives of wheelchair users	Evidence-based, consensus-based	Yes.

WHO guideline for non-surgical management of chronic primary low back pain in adults in primary and community care settings (WHO, 2023d) *	World Health Organization (WHO)	International organization	International	2023	Adults with chronic primary low back pain	Wheelchairs, mobility scooters, crutches, walking sticks/canes, and walking frames/walkers, lumbar braces/ belts and supports	Not specific	Mobility	Non-surgical interventions can be delivered in primary and community care settings	Primary, Home/community	Improved health and well-being outcomes related to CPLBP	Yes. The values and preferences of people with CPLBP and their families and health workers relating to the interventions and their outcomes as well as the acceptability and feasibility of the interventions were considered.	Health workers of all disciplines working in the primary and community care settings, and discipline neutral	Evidence-based	Yes.

Appendix VIII: Data on other normative guidance related to assistive technology

Title (1.1)	Organization (1.2)	Year (1.3)	Population (2.1)	AT functional domain (2.2)	Context (2.3)
INCOG Recommendations for Management of Cognition Following Traumatic Brain Injury, Part IV: Cognitive Communication	National Institute for Health and Care Excellence (NICE)	2014	Individuals with traumatic brain injury (TBI) and cognitive-communication disorders	Communication/speaking	Various healthcare settings, including rehabilitation facilities and community settings
Recommendations CODEPEH 2014 for the early detection of delayed hearing loss	Spanish Association of Paediatrics	2016	Children, specifically for early detection of hearing loss	Hearing	Primary care settings, early childhood care.
IWGDF guidance on the prevention of foot ulcers in at-risk patients with diabetes	International Working Group on the Diabetic Foot (IWGDF)	2016	Patients with diabetes at risk for foot ulcers	Mobility, Self-care	Various healthcare settings, including primary care and specialised diabetic foot clinics
Vision Screening in Children Aged 6 Months to 5 Years	US Preventive Services Task Force	2017	Children aged 6 months to 5 years	Vision	Primary care settings
Best Practices for Pressure Ulcer Prevention in the Burn Center	West Penn Hospital, part of Allegheny Health Network, Pittsburgh, Pennsylvania	2017	Patients requiring admission to a burn centre	Continence, Mobility	Burn centre settings, including both inpatient burn units and outpatient burn clinics, with a focus on critical care for burn patients.
Multidisciplinary recommendations for diagnosis and treatment of foot problems in people with rheumatoid arthritis	Amsterdam Rehabilitation Research Center	2018	People with rheumatoid arthritis experiencing foot problems	Mobility, Self-care	Healthcare settings in the Netherlands, involving multidisciplinary teams
Integrated care for older people (ICOPE): Guidance for person-centred assessment and pathways in primary care	World Health Organization (WHO)	2019	Older adults, specifically those aged 60 years or over, with a focus on those experiencing declines in intrinsic capacity	Hearing, Vision, Continence, Mobility, Cognition, Self-care, Communication/speaking, Environment-modification	Community and primary care settings, applicable in both low- and middle-income countries
Rehabilitation of the Laryngectomised Patient. Recommendations of the Spanish Society of Otolaryngology and Head and Neck Surgery	Spanish Society of Otolaryngology and Head and Neck Surgery	2019	Patients who have undergone total laryngectomy	Communication/speaking	Various healthcare settings including hospitals and rehabilitation centres
Acute care toolkit 3: Acute care for older people living with frailty	Royal College of Physicians	2020	Older people (aged 75+) with severe frailty	Hearing, Vision, Continence	Acute Medical Units (AMUs), emergency departments, and community settings
Early Diagnosis and Treatment of Unilateral or Asymmetrical Hearing Loss in Children: CODEPEH Recommendations	CODEPEH	2020	Children with unilateral or asymmetrical hearing loss	Hearing	Applicable in various healthcare settings, focusing on early diagnosis and treatment
Screening for Hearing Loss in Older Adults: US Preventive Services Task Force Recommendation Statement	US Preventive Services Task Force	2021	Asymptomatic adults 50 years or older with age-related hearing loss	Hearing	Healthcare settings, including primary care and audiology services
Screening for Impaired Visual Acuity in Older Adults	US Preventive Services Task Force	2022	Asymptomatic adults 65 years or older who present in primary care without known impaired visual acuity and are not seeking care for vision problems.	Vision	Primary care settings for asymptomatic older adults.
The audiologist's guide to hearing aids, personal sound amplification products, hearables, and over-the-counter devices	American academy of audiology	2022	All age with or without hearing loss depending on the devices. For PSAP and hearables, only for adults.	Hearing	Audiologist services, and the need for increased awareness of hearing loss and its comorbidities as part of annual primary care examinations
WHO-ITU global standard for accessibility of telehealth services	World Health Organization and International Telecommunication Union	2022	Persons with disabilities	Vision, Hearing, Communication	Telehealth services in general, particularly for persons with disabilities, in various healthcare settings.
WHO Disability-Inclusive Health Services Training Package	World Health Organization (WHO)	2022	People with disabilities in the Western Pacific region	Mobility, Communication/speaking, Self-care, Environment-modification	Health facilities, primary health care, local-level clinics, district hospitals
Package of Interventions for Rehabilitation, Module 3: Neurological Conditions	World Health Organization (WHO)	2023	Adults with neurological conditions such as stroke, Parkinson disease, traumatic brain injury, spinal cord injury, cerebral palsy, and dementia.	Mobility, Self-care, Environment-modification, Continence, Communication/speaking, Cognition	Applicable in various healthcare settings, including hospitals, rehabilitation centres, and community-based care.
Package of interventions for rehabilitation: Module 4 Cardiopulmonary conditions	World Health Organization (WHO)	2023	Adults with cardiopulmonary conditions, including ischaemic heart disease and chronic obstructive pulmonary disease (COPD)	Mobility, Self-care	Community and healthcare settings
Package of interventions for rehabilitation. Module 5. Neurodevelopmental disorders	World Health Organization (WHO)	2023	Children, adolescents, and adults with neurodevelopmental disorders, including autism spectrum disorders and intellectual development disorders	Cognition, Vision, Communication, Self-care, Mobility	Various healthcare settings, including community care, primary care, and specialized services
Package of interventions for rehabilitation. Module 6. Sensory conditions	World Health Organization (WHO)	2023	Children, adolescents, and adults with impairments in visual functions and hearing loss	Vision, Communication, Mobility	Various healthcare settings including community and home environments
Package of interventions for rehabilitation. Module 2. Musculoskeletal conditions	World Health Organization (WHO)	2023	Adults with musculoskeletal conditions	Mobility, Self-care, Environment-modification	Community-level, primary care, specialist services, multidisciplinary teams
Package of Interventions for Rehabilitation - Module 7: Malignant Neoplasm	World Health Organization (WHO)	2023	Children and adults with malignant neoplasms	Mobility, Self-care	Rehabilitation settings for individuals with cancer, including community and clinical environments.
Package of interventions for rehabilitation. Module 8. Mental health conditions	World Health Organization (WHO)	2023	Children, adolescents, and adults with schizophrenia	Communication/speaking	Rehabilitation for schizophrenia takes into consideration an individual's preferences and usually comprises a multifaceted approach that supports individuals to achieve their goals. Focus on social inclusion, community and social life.
Hearing aid service delivery approaches for low- and middle-income settings	World Health Organization (WHO)	2023	Adults with moderate to severe hearing loss; Children aged 5,Äì18 years with mild to moderately severe post-lingual hearing loss	Hearing, Communication/speaking	Low- and middle-income settings, community and primary health care facilities
EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis: 2023 update	European Alliance of Associations for Rheumatology (EULAR)	2023	People with hip or knee osteoarthritis	Mobility, Cognition, Continence, Self-care	Various healthcare settings, focusing on individual, community, and policy levels