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A scoping review of gendered barriers and facilitators of access and use of assistive technology

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ABSTRACT

Purpose: A disparity exists in the access and use of assistive technology (AT), with women exhibiting lower rates of access compared to men, despite a higher reported prevalence of disability. To address these gendered inequities in AT, a comprehensive understanding of the influence of sex and gender on AT utilisation, access pathways, and associated perceptions is crucial.

Methods: This scoping review aimed to synthesise existing evidence concerning how sex and gender affect access, use, and attitudes towards AT. A systematic search across seven databases yielded 120 relevant publications.

Results: The identified gendered barriers and facilitators influencing AT engagement are discussed through the lens of the World Health Organization's 5 "P" framework of AT, encompassing policy, provision, product, personnel, and people. Notably, the reviewed studies predominantly operationalised gender within a binary male/female framework. Across seventy-three distinct analyses examining AT use and related factors, a significant association with gender and/or sex was observed. While findings indicated a higher rate of assistive product usage among women, this group also reported a greater degree of unmet need.

Conclusions: Gender-specific facilitators of AT use identified in the literature include tailored clinical counselling approaches, aesthetically considerate product design aligning with diverse gender expressions, gender-adapted training methodologies, and the adoption of patient-centric care models.

Future research should consider the nuanced influence of sex and gender on user outcomes, and where data allow, these investigations should include other factors that interact with sex and gender to shape AT access, including age, ethnicity, socioeconomic status, educational attainment, and citizenship status.

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> IMPLICATIONS FOR REHABILITATION

- Enhanced collaboration between designers and users of AT is needed. Adaptive furniture and adaptive fashion are necessary to ensure users' needs surrounding compatibility of AT with clothing, footwear, as well as desired forms of gender expression.
- Caution is required to avoid the reproduction of stereotyping, double standards and replication of binary gender norms in the design, marketing, and provision of assistive products.
- Greater gender balance among providers, as well as adapted training to address stereotypes, including on disability and sexuality, can enhance user's comfort and satisfaction with experiences in product provision.
- Provision of clinical counselling can support users to navigate of psychosocial issues related to stigma, gender expression, and perceived shifts in gender-roles relative to assistive product use.
- Ensuring patient centric care systems, including reverence for informed and equal decision making, respect for user opinions and preferences, and attention to privacy and consent, including during physical examination are integral to enhancing the experiences of disabled women in rehabilitation.

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Lived Experience Commentary by Skie Hewett (SH),¹ M.Sc., M.Sci and Alicia Loh (AL),² LL.M., members of the Snowdon Trust's³ Disabled Leaders' Network.

In our experience, two main barriers to assistive technology (AT) use include cost and attitudes. We are even less likely to take the financial risk of purchasing AT when we are unsure whether attitudinal barriers will prevent us from using it. From a gendered perspective, society's pressures on us as women, including the expectation to be aesthetically pleasing, influence our resistance to AT. However, as we diverge further from societal norms as a power wheelchair user (AL) and a blind service dog/cane user (SH), which are very conspicuous indicators of disability, we find ourselves worrying less. Open AT use then becomes an act of rebellion, particularly when it can showcase a particular feature, e.g., the custom glittery body of a wheelchair, which further develops disabled identity.

Nevertheless, acceptance is nonlinear. We often contemplate the injustice of AT being socially accepted when wider society finds it useful versus when it is primarily used by disabled people. Age is an interesting factor—as a young disabled woman, AL feels able to be loud and proud about her use of AT, but worries about how this will change with age, as AT may be perceived as a signifier of age and desirability by society. In contrast, SH feels that her young age makes her feel self-conscious of AT due to wanting to “fit in” and seem independent and “able”. We have concerns around AT undermining our expression of identity. Therefore, improved personalisation and modernisation that promotes confidence and identity including gender expression is important.

Occupational therapists and councillors are crucial. I (AL) have been privileged with encouraging medical professionals and providers who present AT as enabling me to live more fully, and this has profoundly aided my perception and acceptance of AT. I (SH) worry that my disability being visible by using AT, exposes me to judgement, discrimination or even violence through appearing more vulnerable as a young blind woman. Other gender-based barriers to me accessing AT include male assessors suggesting that AT is unnecessary; implying that they are more knowledgeable about my needs than myself. I also worry about the provisions and availability of AT for pregnant people and parents as someone who hopes to one day become a mother.

We hope for further training for professionals, including on gendered differences in approaches to AT. In the processes of AT development and marketing, we hope for greater involvement of disabled users, with particular attention to collecting and implementing feedback across the gender spectrum and other minority groups, including minority cultural backgrounds.

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Introduction and literature review

The World Report on Disability found the global prevalence of any form of disability was 7% higher for women than men, at 19.2% and 12% respectively [1]. Whilst this may be in some part due to the survival paradox [2], where women, on average, live longer than men, yet have higher rates of illness and disability throughout their lives, this can be exacerbated by gender biases that arise from how biological sex is treated in society, impacting everything from occupational risks and healthcare-seeking behaviours to social and cultural norms surrounding health and vulnerability. Whilst biological sex is a key factor regarding device fit and some medical care, the social construct of the impact of sex and gender should not be overlooked.

In low- and middle-income countries, women are estimated to make up three-quarters of persons living with disabilities.¹ This is thought to relate to an interplay of biological and socio-demographic factors, including life expectancy, gender inequality and exposure to violence [3]. Despite higher prevalence of disability among women and girls, data shows that women are less likely to access assistive technology as compared to men [4,5], which is the application of organised knowledge and skills related to assistive products, including systems and services.² According to data collected across thirty-five countries, using the WHO rapid assistive technology assessment (rATA) questionnaire, female respondents reported higher prevalence of need for assistive products³ compared to male respondents in most countries surveyed. Conversely, male respondents reported higher levels of access to AT in most countries, with disparities increasing within countries with lower human development (HDI) index scores [4]. Improving access to AT across social determinants is recognised as a recommendation within WHO's Global Report on Assistive Technology (GrAT), as well as being integral to achievement of the Sustainable Development Goals (SDGs), and realisation of the Convention of the Rights of Persons with Disabilities (CRPD).

Socio-cultural gender norms contribute to unequal AT access for women and girls due to disparities in resources, education, and healthcare [4]. Sex and gender biases in health services are well documented, particularly pain management [3,6–8], may similarly affect AT provision, though current data in the sector are limited. Gender influences AT acceptance, potentially linked to family and community views and disability stigma [5,9]. The visibility of disability through AT use can affect AT uptake, influenced by individual and societal perceptions of risk [10].

The (re)production of gender norms in the design process of assistive products have been documented [11]. For example, adaptation of aesthetics based on user preferences, which may be both influenced by and reify norms associated with masculinity or femininity, has emerged as salient towards acceptance and use of assistive products. For example, recent studies have shown women reject

prostheses more often than men [12–14], highlighting gender as a significant factor. Resnik et al. suggest "appropriately gendered" aesthetics for prosthetics like the DEKA arm to improve acceptance among women [11]. However, understanding "appropriate gendering" for diverse gender expressions and identities, particularly regarding access to gender-affirming products, remains a gap. Others have also highlighted the crucial role of aesthetics in the adoption and abandonment of assistive devices, suggesting that gender significantly influences these preferences [10].

Lack of access and acceptance of AT contributes to a cycle of exclusion for women and girls, as well as those and others among gender minorities, with disabilities [15]. To bridge gendered inequalities regarding AT, it is first necessary to map evidence surrounding the role of sex and gender on AT. An objective of this review is therefore to explore how sex and gender, understood as a social construct [16], may shape access, acceptance, use, as well as other factors, of AT. In doing so, it seeks to identify the facilitators and barriers to the above among cisgender⁴ women and girls, and where data allow, gender minorities.

This work presents the gendered facilitators and barriers to AT Access, Use and Attitudes to support the identification of key research gaps. Documenting AT facilitators and barriers for women, girls, and gender minorities is vital for health equity and participation for all AT users. Understanding their experiences informs inclusive AT solutions and service delivery, ultimately fostering broader societal inclusion and well-being. This knowledge is crucial for equitable access and positive outcomes.

Objectives

1. Identify the barriers and facilitators of access to AT for women, girls and those of minority genders.
2. Identify the barriers and facilitators of the use of AT for women, girls and those of minority genders.
3. Explore the gendered factors influencing attitudes towards AT.

Positionality

We undertake this research as experts in the field of gender, disability and disability inclusion. We approach this research with the assumption that gender impacts and plays a pivotal role in the overall barriers and facilitators of access and use of AT. We have utilised a reflexive methodology of analysis of existing literature, which is outlined in detail in the Methods. Some members of the author team identify as disabled and users of AT and thus reflect on their own lived experiences in interpreting the results. In addition we have included a lived experience commentary as an additional tool to embed inclusion within scientific research, as spearheaded within mental health policy research.

Methods

The scoping review was conducted in accordance with the Johanna Briggs Institute methodology for scoping reviews [17]. A panel composed of experts by experience was engaged to provide a lived-experience commentary on findings [18]. This was done to validate the interpretation of findings, as well as increase the relevance of the recommendations of the review for the community concerned. A review protocol was devised and registered with Open Science Foundations (<https://doi.org/10.17605/OSF.IO/SVNDM>) prior to conducting searches, and a review on outcomes associated with AT based on this review has also been published [19].

Eligibility criteria

Study participants

To be eligible for inclusion in the review, study samples were required to include women, girls, and gender minority users,⁵ or potential users⁶ of AT. As stated within the WHO GREAT, "assistive technology is relevant for everyone in the world who experiences functional difficulties,⁷ either for short or long periods of time or permanently".

Studies reporting primary data from caregivers, or family members as “proxies” for AT users, were included. However, caution was taken in interpreting data on AT users, which did not arise directly from AT users themselves. Studies whose sample consisted solely of cisgender men or boys, or those within which data reported is not disaggregated by sex and/or gender, were excluded. Studies containing exclusively able-body/minded participants were excluded. The only exception to this was studies examining perceptions of social assistive robots, given the broad prospective user base.

Disability measures

No exclusions were made on the basis of how disability, chronic conditions or functioning⁸ was measured (i.e., self-report measures, clinical diagnosis, etc.). Both cisgender and transgender women and girls were eligible for inclusion. Also eligible were participants among gender and sex minorities,⁹ including, but not limited to: transgender men, non-binary/gender non-conforming persons, two-spirit, Hijra etc [10]. Studies which include cisgender men and boys among a broader sample were included, provided data reported was disaggregated by sex and/or gender, such that data could be extracted separately. Both gender and sex are understood according to the Sex and Gender Equity in Research Guidelines.¹⁰ [8].

Concept

Assistive technology is understood based on the WHO definition as “the application of organized knowledge and skills related to assistive products, including systems and services”. Assistive products are also understood based on the WHO definition as “any external product (including devices, equipment, instruments, or software), especially, produced or generally available, the primary purpose of which is to maintain or improve an individual’s functioning and independence, and thereby promote their well-being. Assistive products are also used to prevent impairments and secondary health conditions”¹¹

Non- functioning related use of information and communication technologies (ICTs) were excluded from consideration. For example, where smartphones were used as screen-readers, time-management devices for medication etc., or for other functioning related purposes, the study was included. General smartphone use or access, without explicit focus on assistive capacities, was excluded.

Any discrepancies regarding what constitutes AT were discussed among review authors and resolved based on International Standards Organisation (ISO) classification and terminology of assistive products (ISO 9999:2022) [20].

Context

No exclusions were made on the basis of setting through which studies were conducted (e.g., primary care, tertiary care, community-setting etc.). Peer reviewed papers from either high or low-income countries were included.

Types of sources

The following types of sources were excluded from consideration: opinion papers, book chapters or grey literature which did not report original empirical data, articles detailing instrument development, and conference abstracts. Non-English language studies, and those published prior to the year 2000 were excluded due to language limitations among the research team, while 2000 was selected as the relevant cut-off point based on previous systematic or scoping reviews of AT [21].

Information sources

Searches were performed within the following databases: Medline, Embase, CINAHL, PsycINFO, Web of Science (WoS), Cochrane Database (CENTRAL), and Institute of Electrical and Electronics Engineers (IEE).

Search strategy

The search strategy aimed to locate both published and pre-print studies. An initial limited search was undertaken within OVID to identify articles on the topic. Model articles for inclusion were identified, which supported shaping of both search terms and eligibility criteria. The text words contained in the

titles and abstracts of relevant articles, and the index terms used to describe the articles, as well as those used within previous systematic reviews on the topic of AT, were used to develop a full search strategy [21–24] (see [Appendix A](#)). The search strategy combined terms related to AT (concept one) with those related to gender (concept two) and use/acceptance/access to interventions (concept three). Searches were repeated in each individual database.

Selection of sources of evidence

Identified citations were collated in Rayyan¹², duplicates removed. Titles and abstracts were screened against inclusion criteria by the first author after an initial review. Full texts of potentially relevant sources were retrieved and assessed against inclusion criteria. Exclusion reasons are reported below. Disagreements were resolved by discussion [25].

Data charting process

Data were extracted from papers and input to an extraction tool developed by the reviewers. The form was piloted among 10% of included studies, and relevant adaptations, such as discussion of caregivers and/or family members, were made. Further adaptations, such as whether or not the relevant study was nationally representative, were made iteratively.

Data items

The following data was extracted from studies meeting inclusion criteria: author(s), year, study design, country or region, settings (e.g., community, primary-health etc.), follow-up time (if applicable), control-group (if applicable), sample size. Relating to participants, data on the following were extracted, subject to availability: inclusion/exclusion criteria, age, sex and/or gender, ethnicity, socio-economic status, type(s) of disabilities and type(s) of AT concerned, as well as how both were measured and defined. Data on the involvement of family/caregivers was also extracted. In relation to outcomes, narrative, and numerical outcomes, authors' interpretations, as well as how these were measured, and what instruments were used, were extracted.

Critical appraisal of individual sources of evidence

Quality assessment is not indicated for scoping reviews. Accordingly, no risk of bias assessment was performed. However, depending on scope of evidence identified, studies may be appraised based on accordance with the "Author's checklist for gender-sensitive reporting" included within the SAGER Guidelines [26].

Synthesis of results

Data analysis and presentation drew upon guidance within Pollok et al.'s "Recommendations for the extraction, analysis, and presentation of results in scoping reviews" [27]. A narrative synthesis accompanies the tabulated and/or charted results and describes how the results relate to the review's objective and question/s. Within the narrative synthesis, outcomes were sorted by individual, relational, communal, and organisational/institutional level findings.

Results

This section presents the findings from the scoping review. We begin with a description of the study characteristics, providing a broad overview of their methodology, design, and participant demographics. Following this, we present the study findings in a narrative synthesis, organised by the type of evidence they provided. The findings are first divided into two main categories: those that produced evidence on AT access and AT use, and those that examined attitudes towards AT.

Included studies

The search was conducted between November-December 2023. The database search returned a total of 8024 full-text records, of which 354 were duplicates. This left 7670 records for title and abstract screening

where 7341 records were excluded, leaving 329 records to be sought for full-text screening. Ten of such records could not be accessed, therefore that 319 records were read in full to assess eligibility. Following full-text screening, a total of 120 papers were identified as eligible for inclusion. Further details on the screening-phase, as well as reasons for exclusion upon examination of full-texts, are reported within the PRISMA-Flow Diagram below (Figure 1).¹³

Characteristics of sources of evidence

The majority of studies included ($n=101$) were quantitative in nature, of which 80 were observational while 21 were intervention studies. A qualitative or mixed-methods design was used in only 10% and 6% of studies, respectively. The most commonly used design of observational studies was cross-sectional ($n = 42$). High-income settings ($n=98$) were most represented among the studies included. Low-income settings were the least-represented ($n=2$). At least 14 studies were reported to be nationally representative (including Canada, China, Denmark, France, Ghana, Iceland, Korea, and the U.S.) The characteristics of studies included are presented in Table 1.

In terms of measurement of sex and gender within studies, a total of 21 specified how these terms operationalised. Among them, 16 studies mentioned capturing and reporting data on gender specifically, and four specifically on sex. The remaining papers which made specific comment on how sex or gender were operationalised did not state which was under consideration, instead making allusions to “male or female”.

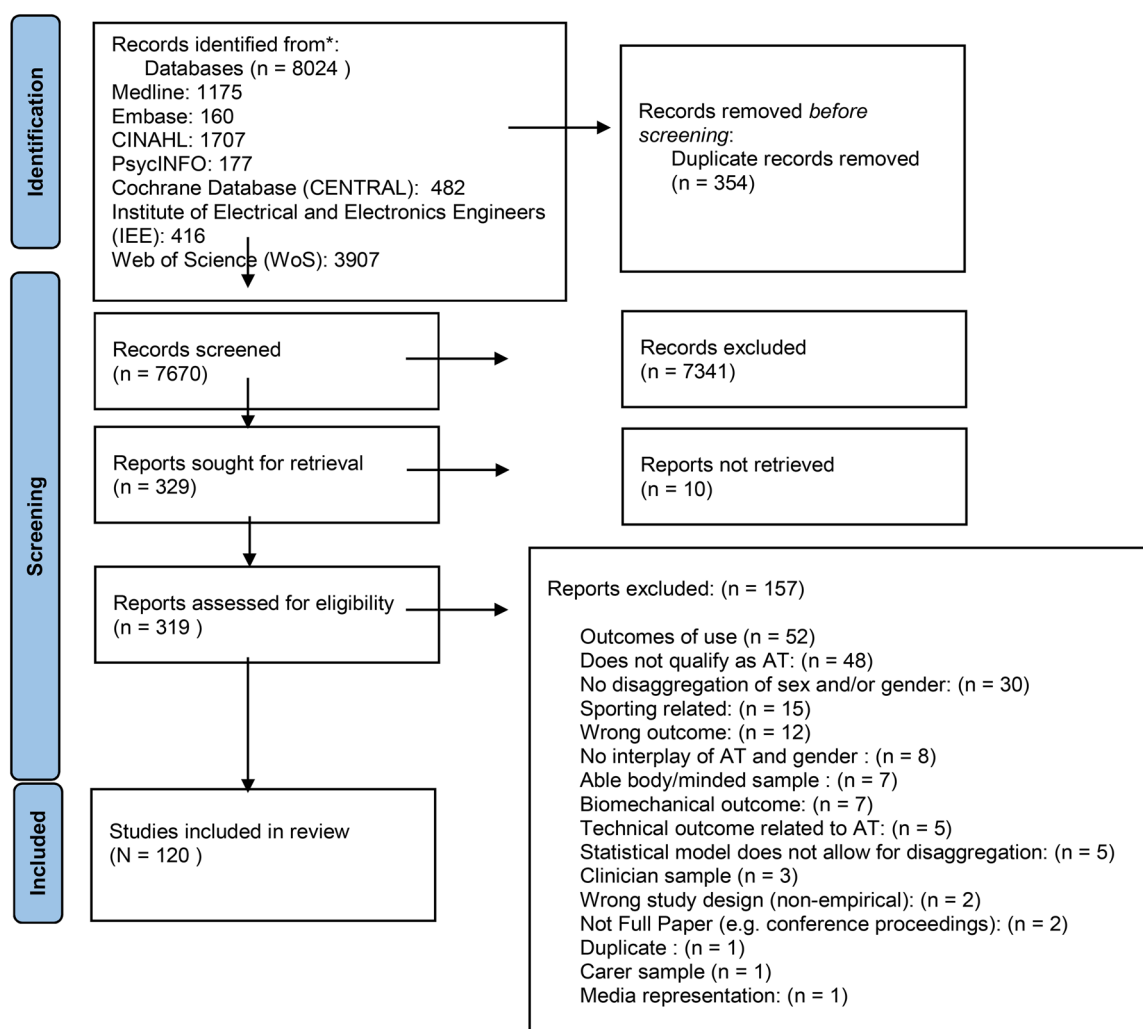


Figure 1. Identification of studies *via* databases.

Table 1. Overview of characteristics of included papers ($N=120$). Table showing characteristics of included papers, their design, region, sample size and year of publication. The number of papers and percentage of papers is reported.

Variable		n of papers reporting	% of papers reporting
Study Design [GENERAL]	Qualitative	12	10%
	Quantitative	101	84%
	Mixed-Methods	7	6%
Study Design [SPECIFIC]	Observational	80	66.6%
	Case study	1	0.8%
	Cross-sectional	42	35%
	Prospective	17	14%
	Retrospective	11	9%
	Other	9	7.5%
	Intervention	20	16.6%
Region	Americas	44	36.6%
	Africa	5	4%
	Europe	57	47.5%
	Eastern Mediterranean	3	2.5%
	South-East Asia	4	3.3%
Country/Region Income Level ¹⁴	Western Pacific	9	7.5%
	Low-Income Economies	2	1.6%
	Lower-Middle Income Economies	6	5%
	Upper-Middle Income Economies	14	11.6%
Sample Size	High Income	98	81.6%
	1–30	22	18.3%
	31–50	9	7.5%
	50–100	14	11.6%
	101–500	32	26.6%
	500–1000	10	8.3%
	1001–5000	14	11.6%
	5000–10,000	8	6.6%
	10,000–100,000	5	4.1%
	100,000 <	6	5%
	Year of Publication	2000–2005	5
2006–2010		13	10.8%
2011–2015		30	25%
2016–2020		41	34.1%
2021–2023		31	25.8%

Among the 16 papers reporting on gender, seven reported operationalising gender as a binary i.e., male/female. The rest did not further specify how the construct of gender was operationalised. Three studies mentioned that gender was based on the self-report of participants. Two papers reporting on sex specifically mentioned how this was operationalised, in this case, as a binary. The remaining two papers did not specify. Where ambiguity within reporting, results are henceforth discussed using the term “sex and/or gender”.

The majority of studies included participants with physical disabilities ($n=52$), followed by sensory ($n=44$), and cognitive ($n=13$). Ten studies encompassed multiple forms of disability. Characteristics of disabilities presented within studies, as well as use of definitions and measures, are presented in [Table B1](#), [Appendix B](#). Products related to mobility/dexterity were the category most frequently under examination within studies included in the review ($n=86$). While prosthetics ($n=27$) and wheelchairs ($n=24$) represented the first and second most common types of products for mobility related disability, hearing aids ($n=39$) were the most commonly studied type of assistive product in any category. A total of 64.5% of studies were concerned with products within WHO’s Priority Assistive Products List (APL). Products not represented within the APL included robotics ($n=14$), tactile mice, or tactile walking surfaces, electronic memory aids, incontinence alarms, signalling devices, and more. Categories of AT presented within studies, as well as use of definitions and measures, are presented in [Table C1](#), [Appendix C](#).

The following results section details studies examining AT access, AT use, and attitudes towards AT. Interchangeable terms for AT access, use, and attitudes (which we refer to as “facets”) were identified across the review studies. Review authors grouped these facets into these three main referential categories (access, use, and attitudes) to synthesise findings.

For AT access, facets included “adoption”, “affordability”, “prescription” and “receipt”. For AT use, facets included “adaptation”, “training and skills”, “compliance”, repair and maintenance” and “usability”. The fundamental distinction that informed this grouping is that **AT access** relates to factors influencing a person’s opportunity to acquire specific and relevant assistive technology, whereas **AT use** pertains

to the actual engagement with and successful integration of that technology into their daily life. Finally, facets describing attitudes towards AT include “abandonment”, “acceptance”, “preferences”, “care provision”, “design”, “refusal”, “satisfaction”, and “unmet needs”.

Synonyms used by original authors are listed within parentheses to increase transparency of reporting. An association with gender and/or sex was reported within 73 studies examining AT use, or surrounding facets (e.g., access, abandonment, adoption, etc.). Where results were significant are reported in the narrative synthesis. Quantitative findings are discussed in narrative synthesis, alongside qualitative findings concerning AT use (and surrounding facets such as access, abandonment, adoption, etc.).

Access to AT

Five papers specifically discussed access to AT [28–32], two of which examined differences in access based on gender [28,30]. While Christenson’s [28] cross-sectional study in the workplace among the Danish population found that women were less likely to have access to hearing aids (e.g., phone amplifiers or hearing loops) at their places of work than men. A baseline analysis of Puauschitz’s [30] stepped-wedge trial of home-based AT among Norwegian older adults with dementia found conversely, women were more likely than men to have access. The authors hypothesised that this may have been due to factors such as longer life expectancy as well as higher prevalence of dementia among women. It was also attributed to findings that living alone and having younger family members as caregivers were associated with greater access to AT, both of which were more frequent in women among the sample.

Difficulties in having their specific needs adequately understood by occupational therapists presented a challenge for women, as evidenced by Petterson [33], who reported instances of unsuccessful procurement of distinct assistive devices for indoor and outdoor use in workplace settings. Moreover, convoluted procedures associated with acquiring necessary home adaptations were identified by women as significant impediments to access. Tomson’s [31] observations among older Latvian women echoed these constraints, revealing that mobility devices were frequently ill-suited to their functional limitations, often due to their acquisition through informal channels such as relatives or other contacts. Furthermore, Orelanno-Collon [29] noted that a lack of available assistive technology service providers or manufacturers in lower-income communities within Puerto Rico was cited as a greater barrier to access for women compared to men.

Affordability and financial barriers to AT were discussed in six papers [29,34–38]. Jilla found significantly higher hearing aid affordability issues for women in the U.S [34]. Pal reported women paid more for mobile phones for low vision, attributed to men’s greater access to the used market *via* social networks [36]. Finance was a key barrier for older women in Puerto Rico [29] and for women manual wheelchair users in the U.K [38], who faced higher costs for more suitable lightweight devices due to design biases and inaccessible infrastructure. Conversely, Magnusson noted a non-significant trend of more men (54%) than women (42%) being unable to afford AT services [35]. Furthermore, the ability to acquire aesthetically desirable devices was perceived as a privilege of financial means, indicative of and reinforcing discrimination against disabled women [29].

The prescription of assistive products was discussed in four studies [29,39–41]. Two studies focused on prosthesis and assistive products for incontinence among older adults in Germany and U.S. veterans respectively [39,41]. In the former, men were found to be significantly more likely to receive prescriptions for incontinence alarms, or at least one other assistive product [39], while in the latter, veteran men were found to receive prosthetic prescriptions significantly faster than women veterans following amputation [41].

Two other studies explored barriers to the prescription of general assistive products among Puerto Rican women from low-income communities and pregnant wheelchair users in the U.S., respectively [29,40]. In the former, women encountered more barriers to prescription by physicians, who acted as gatekeepers, compared to men in the sample [29]. Even where prescriptions were provided, it was reported that slow and convoluted insurance processes prevented the prompt acquisition of products. Such created challenges for pregnant wheelchair users, whose devices could not accommodate shifts in their anatomical structures during gestation [40].

Four papers examined AT receipt by gender [42–45], with two focusing on prosthetics and reporting significant, yet contrasting, differences [42,43]. Highsmith found women more likely to receive cosmetic covers for lower-limb prosthetics (56% vs. 31%). Conversely, Miller reported longer wait times for women receiving lower-limb prostheses, potentially contributing to poorer functional outcomes [46]. Highsmith's finding aligned with the perceived importance of aesthetics. Toro found no gender difference in wheelchair receipt in Indonesia, contrasting Perotti's German study, which showed women waiting significantly longer for wheelchairs [44].

Use of AT

We found 46 studies which examined the use of AT. 13 studies which examined use suggested greater AT use among men, compared to 17 among women. 15 found no difference between use in men and women.

Women appeared more likely to use forearm crutches [47], sticks or walkers [48], wheelchairs and scooters [49], and mobility aids (ambulation aids and manual wheelchairs) [50], as well as wheeled mobility equipment in general [51]. Contrastingly, lezzoni found men to be more likely to use powered mobility devices, which may be reflective of gendered financial barriers [50]. However, no differences based on gender and either wheelchair use or general mobility aid use were found within the three other studies included in the review. Finally, women were found to be more likely to use both personal alarms and dentures.

Two studies examined differences in how users adapt to their products, based on gender [52,53]. Kaarali found no significant difference in adaptation to prosthesis between male and female users [52]. Houmoller, by contrast, noted a significant difference in adaptation to hearing aids by gender, with women with prior hearing aid use more likely to experience residual difficulties, hindering their ability to adapt to their devices [53]. Authors raised the importance of appropriate clinical counselling for women with prior experience of hearing aid use.

Of nine papers on AT adoption, six compared men and women [54–59], and three focused on women's adoption factors [11,60,61]. Chang's cross-sectional study in Taiwan found men more likely to adopt hearing aids than women [55], consistent with prior evidence, though reasons were not explored. Conversely, Simpson's U.S. longitudinal study showed women were more likely to adopt hearing aids at any point [58], with a non-significant shorter average adoption time (8.7 vs. 9.0 years for men).

Fitter found older women rated an exercise-assisting robot higher than men, suggesting greater adoption willingness, though the all-female team might have influenced this [56]. Conversely, Begde reported older U.K. men were more willing to adopt AT for physical activity and memory (55% vs. 43% for women), aligning with cited higher technophobia in women [54]. Dry found Canadian women with traumatic brain injury linked electronic memory aid adoption to social connection, highlighting marketing's role. Mistrust and unfamiliarity with technology hindered adoption, but positive peer evaluation increased willingness for memory aids [60] and hearing aids [61]. Both studies urged greater inclusion of (older) women in AT development and gender-based adoption research.

Resnik's quantitative trial evaluation showed no gender difference in DEKA arm adoption among veterans [57], yet qualitative insights from women participants highlighted the critical interplay of flexibility, functionality, and self-image accommodation [11]. These women emphasised the context-dependent role of their prosthetics, where cosmetic value could supersede physical function based on the environment. This prioritisation was less about self-stigma and more about managing unwanted attention directed at themselves or their prosthetics, particularly in easily demarcated public spaces. Participants carefully considered their visibility, influenced by both appearance and device-generated sounds. The DEKA arm's size and weight were negatively perceived by all three women, attributed to its perceived masculinised design that often clashed with feminine attire [11].

Authors advocated for "appropriately gendered" upper limb prosthetics to enhance adoption among women with limb difference [11]. Challenges with aesthetics and fit also hindered preferred footwear use [59]. Williams found women with rheumatoid arthritis experienced negative self-concept due to the conspicuousness of therapeutic footwear, impacting adoption willingness, unlike men.

Finally, secondary devices were mentioned as important towards adoption of AT among women within two studies [57,61]. This was seen to overcome discrepancies in the required function inside and outside the home. For example, this strategy was used to compensate for the lack of space to accommodate larger devices within the home.

13 studies on AT assembly, management, training, skills, and knowledge [29,33, 44,60, 62–70] revealed gendered differences. Convery found women nearly three times more likely to seek partner assistance with assembly [63]. Conversely, Johnson noted men were more likely to receive help with incontinence pad changes, potentially due to less familiarity with absorbent products [64]. Regarding hearing aids, Bennet reported significantly higher knowledge among men, possibly confounded by the older age of female participants [71]. However, Bennet and Vrysis found no significant gender association with hearing aid management/skills or mobile software aid skills, respectively.

Four studies explored wheelchair, scooter, and powerchair skills [65–68], three of which found significant gender associations [66–68]. Mortensen showed men scored higher on wheelchair skills, consistent with prior research [72]. Koontz noted men's greater armrest removal, highlighting transfer training needs for women veterans [66]. Perotti found that men were less satisfied with the explanations for wheelchair use during provision [44]. Petterson observed men favouring trial-and-error for powered mobility, while women preferred thorough training and reported more scooter challenges [33]. Authors stressed individualised training considering gender. Dry echoed this for women with brain injury using memory aids [60]. Ravenburg found gendered patterns in AT acquisition for sensory impairments, with shared concerns about information disparities [69]. More men perceived sufficient AT management skills [29].

Two papers examined AT compliance, one on all-female samples, the other on gender differences [73,74]. The latter found women showed greater compliance with thoracolumbar orthosis wear duration, despite low compliance overall. Issues with SpineCor brace compliance in adolescent girls were noted, with higher compliance in younger girls, suggesting peer influence [73]. Authors stressed educating on coping strategies and providing psychological support to address social impacts of use.

Regarding repair and maintenance, Bennet found no gender association with hearing aid upkeep [71], while Geilen reported women prioritised proximity of wheelchair repair services more than men [75]. Magnussun indicated women prosthetic and orthosis users had less access to repair workshops and reported more product repair needs [35], a finding supported by Smith's autoethnographic work on intersectional discrimination against disabled women of colour, highlighting gatekeeping and constrained access to AT upkeep services [76].

Five studies examined usability and suitability of AT by gender [29,40, 69,77,78]. Analysis among veteran women using manual wheelchairs revealed that almost one third reported usability issues in manoeuvrability, either of themselves or around specific items (i.e., groceries), which they linked to sex bias in the design process [77]. Sex biases in wheelchair design also came into play for pregnant users in the U.S. sampled by Iezzoni [40]. Namely, wheelchairs were not built to accommodate weight-gain or shifts in centre of gravity during gestation, leading to falls among users, as well as difficulties in transfers, stability, and manoeuvring. Authors called for increased interdisciplinary obstetrics care for pregnant persons with disabilities, including home visits by occupational therapists to mitigate environmental risks and identify solutions to compensate for shifts in performance of AT during pregnancy.

Ravenberg's qualitative analysis highlighted double standards and stereotyping in signalling devices for sensory impairments. Users felt forced to choose between functionality and gender expression, noting a default masculinised design. Women also raised safety concerns about signalling devices indicating their presence at home and described harassment related to device use, causing distress and privacy intrusions. Design or features were cited as a barrier by 64% of Puerto Rican women versus 25% of men [29].

Attitudes towards AT

We found many papers exploring attitudes towards assistive technology relating to gender. Here we discuss the acceptance of AT as well as the abandonment and refusal of AT. We also discuss satisfaction and preferences surrounding AT.

Four studies examined abandonment of AT [11,59, 79,80], finding women were more likely than men to abandon and/or reject prosthesis use [79]. Another found that women were over three times more likely than men to not use their prosthesis at four-years post hospital discharge [80]. Biddis' cross-sectional study revealed that women were more likely than men to reject an upper-limb prosthesis, although differences were noted based on the aetiology of limb absence. While no significant difference in rejection was found between men and women with congenital limb difference, women with acquired limb-absence were more likely to reject prosthesis than men with both trans radial and high-level amputation [79]. Two papers found that aesthetics were a salient factor in abandonment [11,59], with one finding women more likely than men to abandon therapeutic footwear for Rheumatoid Arthritis.

Fourteen papers examined acceptance of AT, nine of which compared acceptance based on gender and/or sex [56,78, 81–87]. Women with acquired limb-difference were less likely to accept prosthetics (38%), compared to women for whom limb-difference was present from birth (70%), while the opposite was true for men [79].

Significant differences in acceptance based on gender were apparent within five studies [64]. Those finding differences based on gender dealt with hearing aids [84], smart-home robotics [82], one social assistive robot [86], one robot oriented towards encouraging exercise among older person's [56], and an assistive product for breastfeeding [81].

Gender showed no overall association with user acceptance of social robots [85], low-vision aids [87], or gaming devices for low vision [78]. However, Gessl found significant sub-dimensional differences in social robot acceptance in Austria [83]. Women reported greater anxiety and lower perceived ease of use, but held more positive attitudes and saw robots as better for reminders [86]. Men more readily accepted autonomous robot decision-making.

Self-stigma emerged as a salient barrier to acceptance within three papers [29,61,88]. Dammeyer reported that girls were more likely than boys to attempt to hide their hearing aids, perhaps indicative of the greater relevance of socialisation among girls. Self-stigma also emerged as a barrier by Orelanno-Collon. Among women, self-stigma was related to perceived negative aesthetics of devices, which was emphasised to be in contention with norms surrounding beauty and ageing [29]. Canadian women also discussed the downstream effects that the use of hearing aids had upon self-image, citing in cases, aids could make it more difficult, rather than less, to adapt socially [61]. Finally, users of both genders sampled within Petterson's exploration of powered mobility device use in the Swedish context, believed that occupational therapists played a pivotal role in increasing acceptance of device use [33].

Four studies addressed AT preferences, one examining gender [85] and three service provision [59,77,89]. Gender did not influence preference between social robots and VR for cognitive training [85]. However, U.S. women wheelchair users preferred female service providers, citing a "boys club" atmosphere and feeling dismissed [77]. Similarly, women with major limb amputations favoured female prosthetists for comfort and safety during fittings [89].

Women reported a lack of patient-centric care and decision-making power within service provision, wherein their preferences were often discounted by male providers, in two distinct studies [59,89]. Unilateral decision-making on behalf of prosthetists and purveyors of therapeutic footwear impacted women's use and their participation in various realms [89]. Women in Williams' exploration of therapeutic footwear for rheumatoid arthritis further reported poor communication skills and a lack of knowledge/sensitivities concerning gendered experiences of the condition on behalf of male service providers. Male providers were also reported to discount female participants' knowledge of their own bodies, conditions, and needs [59].

Issues in prosthetic design were articulated by women with smaller-frames, who experienced devices as cumbersome and ill-fitting. Issues in fitting also emerged in relation to weight-gain, for which women felt prosthetists were often ill-equipped to navigate [89]. Overall, participants valued flexibility and independence in prosthesis use, including choices to use other devices where more suited to needs, underscoring the importance of patient-centric care, designed to maximise autonomy.

Three papers [29,60,90] discussed refusal of AT, namely hearing aids. Reasons for non-use included, noise quality, sound level, forgetting, device fit, device failure, battery issues, and disturbance of self-image, although no significant differences based on gender were found by Bulgurcu.

Satisfaction with AT and/or services was examined in 20 papers, two without gender comparisons [77,89]. Nine analyses noted gender-based satisfaction differences [91,92], with men reporting greater satisfaction in five [35,44, 91,93] and women in four [44,84, 91,92]. For sensory aids, five studies found no gender difference in hearing aid satisfaction [27,90, 94–96], while one reported greater satisfaction in women [84]. Women showed higher satisfaction with incontinence pads in one study [92], with no difference found in another [97]. Five studies found no gender differences in overall prosthesis satisfaction [14,57, 98–100], though Pezzin noted women rated prosthetists higher, and men rated fit, comfort, and appearance higher [91]. One study found greater prosthesis and orthosis satisfaction in men [35]. Regarding other mobility aids, men rated rollators and the wheelchair service delivery process higher [44,93], while women viewed wheelchair efficiency more favourably [44]. No gender difference in general AT satisfaction was found among Nigerian stroke survivors [101].

Two studies examined satisfaction in all-female samples [77,89]. Greenhalgh's mixed-methods study of women veterans using wheelchairs revealed that less than half were satisfied with their devices [77]. Dissatisfaction stemmed from sex-biased wheelchair design, with 58% believing female anatomy (hips/thighs) was inadequately considered and over 40% reporting ill-fitting chairs. A perception existed that wheelchairs were designed for male, but not female, anatomy. Authors recommended size, customisation, and manoeuvrability improvements, emphasising that better design is crucial for usability, independence, and health-related quality of life for disabled women. They advocated for greater inclusion of diverse disabled women in the wheelchair design process [77].

Two papers explored unmet AT needs [102,103]. Lindsay's Canadian study found women more likely to have unmet needs for mobility devices (walkers, electric wheelchairs, etc.) than men, with women aged 15–19 1.25 times more likely. Authors questioned if this was due to stigma for men or greater access barriers for women. Bonnard reported only one-third of women with moderate hearing loss had their hearing aid needs met [102].

Discussion

Our findings suggest that sex, and/or gender, are relevant social determinants (referred to by WHO as non-medical factors which influence health outcomes) in access to AT. This suggests that gender and sex should be considered in the design and implementation of interventions for AT. Indeed, while women were found to use AT more than men women also reported greater unmet need. Barriers and facilitators to AT use emerging with studies are discussed, next, in reference to the 5P's framework of AT access, namely: people, policy, products, provision, and personnel [4].

People

Facilitators for assistive technology (AT) use, particularly for women, include clinical counselling, goal setting, and expectation management, especially for non-novel users. Providing psychological support and education on coping strategies can mitigate the psychosocial impact of AT [104], which is crucial for groups susceptible to social pressures, such as adolescent girls [73]. Addressing gendered experiences of AT use, including perceived conflicts with gender norms and supporting users in navigating issues related to gender expression and shifting gender roles, is also a key facilitator.

Barriers to AT access and use exhibit distinct gendered patterns. Women face lower AT knowledge [103], disadvantaged access to mobile AT *via* social networks in resource-limited settings due to social isolation, and mistrust rooted in their own user competency [33]. Hegemonic masculinities can limit men's adoption of certain AT, with a preference for interpersonal support over device use potentially linked to masculine norms. Men's mistrust tends to focus on device failure. These barriers underscore the influence of social norms, knowledge gaps, and access disparities.

The implications of these gendered facilitators and barriers with regard to people necessitate a multi-faceted approach. Interventions should integrate psychological support and tailored training to address women's lower confidence and skill levels. Efforts to improve AT knowledge and access to social networks in resource-poor settings are crucial for women. Challenging hegemonic masculinities and

promoting help-seeking among men may facilitate AT adoption. Collaborative action involving technology manufacturers, governments, policymakers, and disability organisations, as highlighted by the GSMA report [105], is essential to dismantle these inequalities and ensure equitable access and use of AT for all genders.

Policy

Facilitators for AT access and use include transparent and user-friendly insurance claim processes, alongside alternative procurement means when claims are denied. Addressing macro-level socioeconomic concerns is crucial, ensuring AT provision aligns with basic needs like food security [37,106–109]. Policies should aim to overcome gendered gaps in financial access to and enjoyment of AT, including mobile AT, particularly for those in low-resource settings.

Barriers to AT access are significantly shaped by financial constraints and procedural complexities. Women face greater financial barriers due to higher costs for tailored products and disadvantages in resource access and household decision-making [29,36]. Their ability to procure AT is often contingent on household bargaining power, reinforcing dependency [29,31], and increasing vulnerability for those experiencing economic intimate partner violence. Consequently, women often rely on ill-fitting informal channels like hand-me-downs. Lack of transparent insurance processes further compounds difficulties in acquiring prescriptions and contributes to longer wait times for women, sometimes rendering devices obsolete upon arrival [29,40]. Macro-level socioeconomic disparities also limit access in lower-income communities [29].

These findings underscore the urgent need for policy interventions that address gendered financial inequalities in AT access and use. Insurance processes must be transparent and accessible, with alternative procurement pathways available. Recognising the influence of household power dynamics on women's AT acquisition is critical. Moreover, policies must consider the broader socioeconomic context to ensure AT provision is meaningful and contributes to overall well-being and rights, particularly addressing issues like food insecurity. Overcoming gendered gaps in financial access to and enjoyment of AT, especially in low-resource settings, should be a central policy aim.

Products

Considering the facilitators for AT adoption and use of products among women include offering flexibility, a range of functions, customisability, and compatibility with clothing and footwear [11,29, 31,59]. Aesthetics, discretion, and adaptability to different contexts are also important [11,29, 31,59]. For prosthetics, women with congenital limb absence show a greater tendency to accept them compared to those with acquired limb differences [79]. Clinical counselling, goal setting, expectation management, psychological support, and education on coping strategies are vital in promoting AT use, particularly for adolescent girls facing social pressures [73]. Addressing gendered experiences and supporting navigation of gender expression and role shifts are also crucial facilitators.

Barriers relating to encompass the cultural resonance of aesthetics, potentially leading to prioritisation of appearance over functionality and the reproduction of gender stereotypes in design [29,69, 110,111]. Sex-bias in product design, affecting fit and comfort of devices like wheelchairs and prosthetics, is a recurrent barrier [29,38, 40,77], potentially impacting outcomes [112]. A lack of consideration for the interaction of AT with comorbid disabilities also hinders use [29]. Furthermore, perceived threats to safety related to the visibility and "signalling" of assistive products pose a significant barrier, especially given the increased risk of harassment and violence faced by disabled women and girls [69,113–118].

The implications of these findings highlight the critical need for a paradigm shift in AT design and provision. Moving away from "i-methodology"—a design practice where designers unconsciously assume their own experiences represent all users, leading to designs based on their limited perspectives—towards inclusive and universal design principles [119] is essential to overcome inherent gender biases. The current reliance on i-methodology often results in products and services that inadvertently cater to the designers' demographic, overlooking the diverse needs and preferences of a wider user base [120].

This requires greater consideration of physiological differences and active involvement of users across the gender spectrum in the design process [121,122]. Designers must account for fluctuating physiological needs, such as those during pregnancy, and the interaction of AT with the built environment [40,123,124]. Collaboration between AT designers and adaptive fashion creators can better address users' aesthetic expression goals [125–127]. Addressing safety concerns related to product visibility for women and bolstering their decision-making power regarding gender expression and visibility are paramount. Ultimately, the focus should shift from placing the onus on end-users for "appropriate" use to creating AT that is inherently inclusive, functional, and responsive to the diverse needs and preferences of all genders.

Provision

Focusing on provision, there is a need to necessitate a focus on gender-adapted training processes [60], which can address reported tentativeness with powered mobility devices and foster greater user confidence [29,33]. Such training can also improve women's confidence in navigating the built environment [68]. Providing users with comprehensive information about AT, equivalent to that given to providers and accessible in its format, is crucial [69]. Furthermore, support from providers in acquiring and adapting secondary AT for diverse environments and functions can enhance adoption [31,33]. Ensuring proximity to fitting, repair, and maintenance services is integral to the functionality of AT systems, although this must be coupled with policies that enhance financial accessibility [35,128].

Several barriers within service provision were reported to impede women's access to and use of AT. These included a lack of privacy and consent during fitting processes, difficulties in having their needs understood, insufficient attention to power dynamics and potential distress during physical examinations, and the dismissal of patient preferences and embodied knowledge [59,77,89]. These issues are often exacerbated by male service providers exhibiting poor communication skills, which can negatively impact female users' self-stigma and self-esteem [59,77,89]. A lack of provider awareness regarding AT adaptation during pregnancy and post-natal care was a barrier [40,129]. Paradoxically, providers' overstepping of professional roles can reinforce gendered and ableist discrimination against disabled parents, particularly mothers [40]. Gatekeeping by physicians and within the repair and maintenance process further restricts access [76], disproportionately affecting marginalised groups like women of colour. The imposition of time quotas for powered mobility device use and convoluted processes for acquiring home adaptations also act as barriers [33]. Finally, a lack of accessible repair and maintenance services, particularly in terms of proximity, disproportionately affects women [128], potentially undermining the safety-enhancing benefits of AT in public spaces [130].

The identified facilitators and barriers underscore the critical need for a person-centered and gender-sensitive approach to AT service provision. Training programs for providers must prioritise communication skills, awareness of gender dynamics, and respect for patient autonomy and knowledge. Policies should actively combat gatekeeping and ensure equitable access to prescriptions and repair services, particularly for marginalised groups. Addressing the lack of provider knowledge regarding AT during pregnancy and parenthood is essential. Furthermore, service delivery models must be transparent, prioritise user consent and privacy, and avoid reinforcing discriminatory stereotypes. Enhancing the accessibility and proximity of repair and maintenance services, coupled with financial support, is crucial for sustaining AT use and maximising its benefits for women. Ultimately, a shift towards empowering users through knowledge, respectful service interactions, and accessible resources is necessary to overcome these gendered barriers and facilitate effective AT use.

Personnel

Further facilitating equitable AT access and use necessitates training healthcare personnel involved in AT provision to address gendered and ableist myths prevalent in the medical field [131,132]. The role of occupational therapists in fostering AT acceptance and pharmacists in facilitating access, given women's greater likelihood of encountering products in pharmacies [29,33], should be leveraged. Ensuring gender balance among providers is integral to enhancing comfort and satisfaction within service provision

[59,77,89]. Adherence to privacy and consent during examinations, alongside patient-centric care that emphasises informed and equal treatment in decision-making, continuity of care, respect for opinions and preferences, and active listening to users' concerns, is crucial [59,77,89]. For AT in collective care settings, broad and ongoing staff sensitisation and training are essential [37]. Finally, the supportive role of partners, caregivers, and family members in AT maintenance and use should be acknowledged [31,71,73] while safeguarding user autonomy and preventing surveillance [29,130].

Barriers within healthcare settings significantly impact women's access to and experience with AT. Qualitative findings align with broader evidence of gendered biases among healthcare personnel [59,77, 89,133–136], mirroring differential experiences in help-seeking for marginalised individuals at multiple intersections [8,137–140]. Specifically, biases have been documented in access to comprehensive sexual and reproductive health (SRH) services for disabled women [131,141–144], potentially stemming from attitudes of health personnel or service infrastructure [40,50], and reflecting sexual-ableism, which conflates disability with asexuality [145–147]. Consequently, the needs of disabled women and girls, as well as gender minorities requiring obstetrics and gynaecological services, are frequently overlooked [4,141]. The lack of provider awareness regarding specific assistive products or their adaptation during pregnancy and post-natal care also presents a barrier [40,129].

Addressing these barriers requires a systemic shift towards equitable and inclusive healthcare practices. Training for healthcare personnel must actively challenge gendered and ableist biases to ensure equitable care for all AT users. Healthcare infrastructure needs to be examined and adapted to ensure accessibility and sensitivity to the specific needs of women and gender minorities, particularly in areas like SRH and maternal care. Promoting gender balance among AT providers and emphasising patient-centric care principles, including privacy, consent, and shared decision-making, can enhance user comfort and satisfaction. Recognising and appropriately involving partners and caregivers in AT support, without compromising user autonomy, is also vital. Ultimately, dismantling these biases within healthcare settings is crucial for ensuring that all individuals, regardless of gender or disability, have equitable access to and benefit from assistive technology.

Diagrams portraying the gendered barriers and facilitators found within this study are shown below (see Figure 2).

Limitations

This scoping review offers robust evidence for navigating gender and assistive technology, a complex research field, by comprehensively mapping the existing literature to understand the breadth and nature of the available evidence. This work intends to identify significant knowledge gaps and analyse the

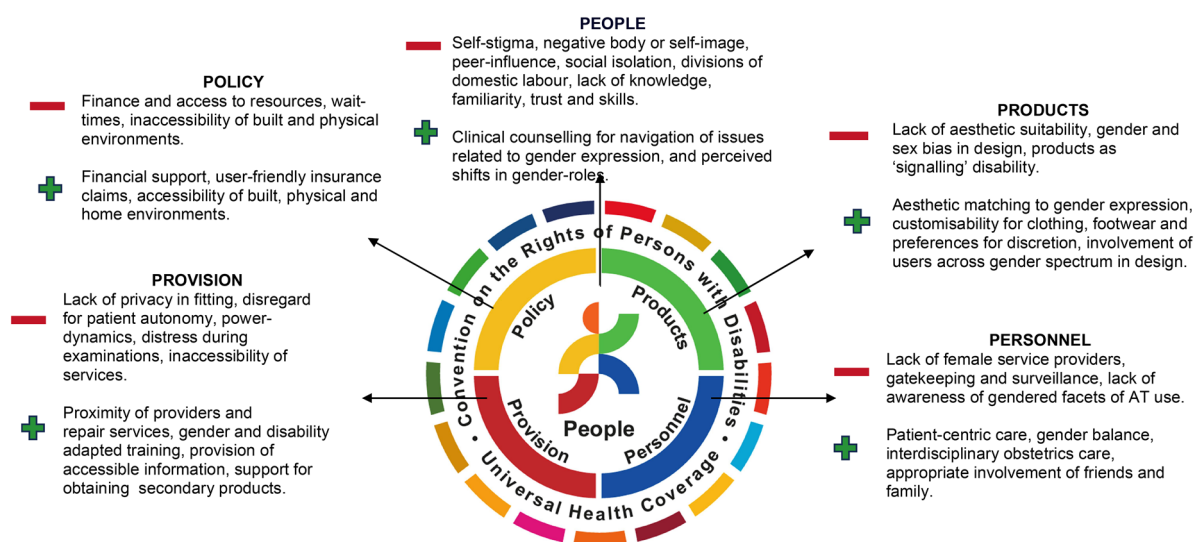


Figure 2. Gendered barriers and facilitators to AT use, according to the WHO 5 "P" model

research in this domain that has been undertaken to date. We hope this scoping review not only provides a foundational overview of the discipline but also serves as a crucial preliminary step for more focused research, ensuring that future research is both informed and strategically directed.

However, some relevant studies may have been missed due to a lack of access to two databases. The generalisability of our findings was limited based on the exclusion of participants by several sociodemographic and/or clinical factors within the included studies. As mentioned, no studies reported inclusion of gender beyond the binary of male/female. Thus, while possible that transgender, and gender non-binary persons were captured within data, the lack of comprehensive measurement and reporting limits generalisability across gender identity. Ten studies excluded participants living in institutional settings. Relating to AT, exclusion of institutional settings may have a profound impact upon the accuracy of estimations of use and/or unmet need, given the over-representation of both AT use and conditions conducive to need within. Persons with developmental disabilities were likely further precluded due to criteria limiting participation for those showing “difficulties understanding and expressing themselves in response to questionnaires” ($n=4$). This limits the extent to which findings can be generalised to women, and other users of AT, with multiple disabilities, including those with mental health conditions who were excluded within four studies. This review was also not able to combine findings from papers to indicate other confounding factors that may affect access, use and attitudes towards AT. This was due to the papers themselves not taking such factors as age, location, and income into account during the analysis. We suggest that further research should prioritise enabling comparability across research in this sector through transparency of research data and analysis methods.

Recommendations for research, policy and practice

Based on the findings of the scoping review the following recommendations are made.

Recommendations for research

- Ensure co-production with experts by experiences is embedded within research processes from inception to dissemination stages.
- Enable more disabled women, older women, and other women, and gender minorities using AT, to participate in design, development and testing of AT.
- Ensure eligibility criteria employed within primary research does not replicate health inequities, as well as research gaps, through narrowing participation of multiple marginalised populations.
- Ensure consistent measurement and reporting of sex and gender within primary research, including options for identification of non-binary gender identities, and where possible provide sex and gender-based analysis of findings.
- Synthesise evidence surrounding AT, sex and gender (alongside other social determinants) in terms of outcomes of use, as well as from the perspective of clinicians, other service providers, as well as those of caregivers, family members, and others.

Recommendations for policy

- Design of AT should embed concepts of inclusive/universal design, including through involvement of users across the gender spectrum.
- Work to eradicate gendered (and other) financial barriers both in access to AT, and in use of AT towards realisation of capacities, such as through provision of universal basic income.
- Ensure policy supports for adaptations in the home environment are available to AT users, including through involvement of multi-dimensional care teams, and can be rolled out in a timely manner.

Recommendations for practice

- Enhance collaboration between designers of AT and user, to ensure users' needs surrounding compatibility of AT with clothing, footwear, as well as desired forms of gender expression are met.

- Ensure gender-balance among providers and capacity to meet users' preferences surrounding provider' gender.
- Provide clinical counselling, where appropriate, including promotion of coping strategies, goal setting, and expectation management. This should support user navigation of psychosocial issues related to stigma, gender expression, and perceived shifts in gender-roles relative to AT.
- Implement gender and disability adapted training to address stereotypes among health care providers, including in relation to disability and sexuality.
- Ensure patient centric care systems, including reverence for informed and equal decision making, respect for user' opinions and preferences, and attention to privacy and consent, including during physical examinations.

Conclusion

This paper presents a scoping review of existing literature exploring gender and assistive technology. We explored the barriers and facilitators towards access, use and attitudes towards AT. We found that gendered barriers to AT use including self-stigma, peer-influence social isolation, lack of knowledge, familiarity, finance and access to resources, lack of aesthetic suitability, gender and sex bias in product design, lack of female service providers, and a lack of awareness of gendered facets surrounding AT use and adaptations among service providers. Whilst gendered facilitators to AT use included clinical counselling, financial support, accessibility of built and physical environments, support for home adaptations, capacity to tailor device aesthetics towards gender expression, gender adapted training processes, customisability of AT, and consideration of shifts in physiology (e.g., during pregnancy) and interaction with furniture within design.

Caution is required to avoid the reproduction of stereotyping, double standards and replication of binary gender norms in product design, marketing, and provision. Regarding service provision, ensuring a gender balance among providers, patient-centric care, including accommodations for user preferences for the gender of providers, and training of service providers on myths surrounding disability, arose as key facilitators of AT use. Recommendations are offered for further research, policy and practice.

Notes

1. Understood according to the CRPD as "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others".
2. Assistive technology is defined by WHO as a subset of health technology.
3. Assistive products are understood as "any external product (including devices, equipment, instruments or software), especially produced or generally available, the primary purpose of which is to maintain or improve an individual's functioning and independence, and thereby promote their well-being. Assistive products are also used to prevent impairments and secondary health conditions".
4. The American Psychological Association defines cis-gender as "an individual whose gender identity aligns with their sex assigned at birth", whereas transgender is defined as "an umbrella term used to describe the full range of people whose gender identity and/or gender role do not conform to what is typically associated with their sex assigned at birth".
5. Referring to "people who use assistive products for their enhanced functioning, optimizing functional ability including activities and participation, being productive, safe and independent, and living with dignity".
6. Referring to "those who might benefit from using an assistive product for the same purposes as users but do not yet have access".
7. Used within the GREAT "as an overarching term for impairments, activity limitations and participation restrictions".
8. As stated within the GREAT: "the International Classification of Functioning uses "functioning" when referring to all body functions, activities, and participation, and uses "disability" as an umbrella term for impairments, activity limitations and participation restrictions".
9. Gender minorities refers to people whose "gender identity that differs from that commonly associated with their sex assigned at birth".
10. The SAGER Guidelines refers to sex as "a set of biological attributes in humans and animals that are associated with physical and physiological features including chromosomes, gene expression, hormone function and

reproductive/sexual anatomy [1]. Sex is usually categorized as female or male, although there is variation in the biological attributes that constitute sex and how those attributes are expressed”, while gender speaks to “the socially constructed roles, behaviours and identities of female, male and gender-diverse people. [Gender] influences how people perceive themselves and each other, how they behave and interact and the distribution of power and resources in society. Gender is usually incorrectly conceptualized as a binary (female/male) factor. In reality, there is a spectrum of gender identities and expressions defining how individuals identify themselves and express their gender”.

11. Priority assistive products list. Geneva: World Health Organization; 2016 (<https://www.who.int/publications/i/item/priorityassistive-products-list>, accessed 20 April 2022).
12. Rayyan is a web-based software platform designed to help researchers streamline the process of screening and selecting studies for systematic reviews and other evidence syntheses. <https://www.rayyan.ai/>
13. From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71. Alt text: **Figure 1** PRISMA flow diagram detailing the systematic review process. 8024 records were identified, 354 duplicates removed, leaving 7670 for screening. 7341 were excluded after title/abstract review, 319 full texts were assessed, and 120 studies were finally included. Exclusion reasons at full text are also indicated.
14. * Based on World Bank Classification, as of July 2021.

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Appendix A

Example search, as executed in Medline, accessed through Ovid, November 2023:

1. self-help devices/ or communication aids for disabled/ or wheelchairs/ or motorised mobility scooter/ or sensory aids/ or hearing aids/ or auditory brain stem implants/ or cochlear implants/
2. "assistive technolog*".mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]
3. Wheelchairs/ or "assistive product*".mp.
4. "assistive equipment".mp.
5. "assistive device*".mp.
6. "self-help equipment".mp.
7. "self-help technolog*".mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]
8. "assistive robot*".mp.
9. orthoses.mp. or Orthotic Devices/
10. prosthesis.mp. or "Prostheses and Implants"/
11. "white cane*".mp.
12. orthopedic equipment/ or walkers/
13. "rollators*".mp.
14. "incontinence product*".mp. or Incontinence Pads/
15. "braille*".mp.
16. "deafblind communicator*".mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]
17. "braille display*".mp.
18. "screen reader*".mp.
19. "closed captioning display*".mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]
20. "self-care device*".mp.
21. "self-care technolog*".mp.
22. "self-care aid*".mp.
23. "self-care equipment".mp.
24. "self help aid*".mp.
25. "assistive aid*".mp.
26. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. gender.mp.
28. femininity/ or gender role/ or masculinity/
29. "gender norm*".mp.
30. "gender stereotype*".mp.
31. Female/ or wom*n.mp.
32. girl*.mp.
33. 27 or 28 or 29 or 30 or 31 or 32
34. disabled.mp. or Disabled Persons/
35. disabilit*.mp.
36. limit 35 to no language specified
37. "functional impairment*".mp.
38. "functional difficult*".mp.
39. "chronic condition*".mp.
40. "chronic illness*".mp.
41. handicap*.mp.
42. "hearing impairment*".mp. or *Hearing Disorders/
43. "visual impairment*".mp.
44. "older person*".mp.
45. "elderly".mp. or *Aged/
46. 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45
47. barrier*.mp.
48. facilitator*.mp.
49. "usage".mp.
50. enabler*.mp.
51. access*.mp.
52. acceptance.mp.
53. attitude*.mp.
54. perception*.mp.
55. preference*.mp.
56. *Treatment Outcome/ or outcome*.mp.
57. impact*.mp.
58. *Treatment Refusal/ or refusal.mp.

1.	self-help devices/ or communication aids for disabled/ or wheelchairs/ or motorised mobility scooter/ or sensory aids/ or hearing aids/ or auditory brain stem implants/ or cochlear implants/
59.	abandon*.mp.
60.	adoption*.mp.
61.	obstacle*.mp.
62.	47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61
63.	26 and 33 and 46 and 62
64.	limit 63 to (humans and yr="2000 - 2024")
65.	limit 64 to full text
66.	limit 64 to english language
67.	limit 66 to (female and full text and humans and yr="2000 -Current")
68.	limit 66 to full text

Appendix B

Table B1. Overview of characteristics of impairment represented within included papers ($N=120$). Table showing characteristics of impairments represented in papers, by Physical, Sensory, Cognitive and multiple. Papers are shown with the total number and as a percentage.

Variable	n of papers reporting	% of papers reporting
Forms of disability		
Physical	52	43.3%
Spinal Cord-Injury	7	5.8%
Amputation or Limb-difference	17	14.1%
Multiple Sclerosis	3	2.5%
Cerebral Palsy	6	5%
Surgery	1	0.8%
Spina Bifida	1	0.8%
Post-polio Syndrome	5	4.1%
Muscular Dystrophy	3	2.5%
Arthritis	3	2.5%
Involuntary Leakage	5	4.1%
ALS	1	0.8%
Osteoporosis	2	1.6%
Stroke	2	1.6%
Sensory	44	36.6%
Vision	7	5.8%
Hearing	36	30%
Vision and Hearing	1	0.8%
Cognitive	13	10.8%
Brain Injury	2	1.6%
Dementia	4	3.3%
General Ageing	7	5.8%
Multiple	10	8.3%
Papers providing definition of disability [general or specific]	33	27.5%

Appendix C

Table C1. Categories of AT presented within studies, as well as use of definitions and measures ($N=120$). Table shows the categories of AT presented within the studies. These are divided by physical, sensory, cognition and multiple. This is given as a total number of papers and as a percentage. The aides are also listed.

AT for	n of papers reporting	% of included papers reporting	Types of AT	n of papers reporting			
Physicality/ Mobility/ Dexterity	52	44.3%	Mobility Aids (unspecified)	2			
			Wheelchairs	13			
			Manual Wheelchairs	9			
			Powerchairs	9			
			Unspecified	4			
			Scooter	5			
			Therapeutic Footwear	1			
			Orthotics	8			
			Crutches	5			
			Prosthetics	15			
			Upper Limb	4			
			Lower Limb	4			
			Prosthetic Covers	1			
			Incontinence Products	7			
			Incontinence Pads	6			
			Incontinence Alarms	1			
			Incontinence Underwear	1			
			Rollators/Walkers	4			
			Walking Cane	3			
			Sensory/ Communication	44	36.6%	Hearing Aids	31
Vision Aids (unspecified)	1						
Sensory Aids (unspecified)	1						
Glasses	1						
Breastfeeding Assistive Technology	1						
Signalling Devices	1						
Mobile Devices	3						
Tinnitus Masker	1						
Video Game Device for Visual Impairments	1						
Virtual Assistant Connected Eye Wear	1						
Cognition	12	10%				Electronic Memory Aids	1
						Mobile-phone based Reminder Application	1
						Assistive Products for Ageing [general]	1
			Meal Preparation Instrument	1			
			Robotics	9			
			Social Assistive Robots	7			
			Smart Home Environments	2			
			Multiple	14	11.6%	Assistive Products [general]	9
						Papers providing definition of AT [general or specific]	21
Papers concerning AT on WHO's Priority Assistive Products List	102						
Papers discussing Branded/ Trademarked AT	12	10%	Aria (Aira Tech Corporation), COOK (Cooking Orthosis for cooking), Dorso Arexa (RollerWerk Medical Engineering), Dynamic SpineCor, Robot Era System, ICEROSS (Icelandic Roll-on Silicone Socket), JD Humaniod, EZ Robot, Breastfeeding in Action, Pepper (Softbank Robots Aldebaran), Baxter Research Robot (Rethink Robots), Gen3 DEKA Arm, MAHRU-I, NAO, TEDDY BEAR (Fujitsu), ACTROID-F, AIBO, RI-MAN, PARO.				