REVIEW ARTICLE

Challenges and Barriers in Assistive Technology and the Scale for Their Assessment: A Global and Indian Perspective

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ABSTRACT

Assistive Technology (AT) plays a critical role in enabling independence, participation, and rehabilitation for persons with disabilities. However, current access rates remain critically low, with only 5-10% of individuals in low- and middle-income countries (LMICs) receiving the assistive products they need. This paper examines the multidimensional challenges and barriers hindering access of AT globally and in India, including policy gaps, economic constraints, service delivery limitations, and social stigma. Furthermore, it reviews existing assessment scales and frameworks such as WHO-GReAT, QUEST, PIADS, and the ATLAS framework that can systematically evaluate these barriers. The findings underscore the urgent need for comprehensive AT policies, standardized assessment tools, and inclusive implementation strategies to realize assistive technology as a fundamental right rather than a privilege and charity.

KEYWORDS

Assistive Technology; Barriers in Assistive Technology; Health Equity; Assessment in Assistive Technology

INTRODUCTION

Assistive Technology (AT) is defined by the World Health Organization as "any device, equipment, instrument, technology or software to enable people with functional impairments to perform tasks that would otherwise be difficult or impossible" (1). AT encompasses a extensive range of products from simple devices like walking sticks and spectacles to classy technologies such as powered wheelchairs, hearing aids, and communication devices. The WHO Priority Assistive Products List identifies 50 essential assistive products that should be universally accessible (2). The implication of AT extends beyond functional enhancement; it is intrinsically linked to human rights frameworks including the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), which recognizes access to AT as essential for realizing the rights to health, education, employment, and independent living (3).

Assistive technology (AT) plays a vital role in fostering independence, rehabilitation, and social inclusion, aligning closely with the Sustainable Development Goals especially SDG 3 (Good Health and Well-being) and SDG 10 (Reduced Inequalities) (4). AT should be viewed not only as a public health concern but also as a fundamental human right, necessitating robust policy frameworks and efficient service delivery systems (5). However, despite growing global awareness, a substantial access gap remains. The WHO Global Report on Assistive Technology (2022) reveals that over one billion people require assistive products, yet only a small proportion have access estimated at just 5–10% in low- and middle-income countries (LMICs) (1). This disparity, often referred to as the "AT gap," is especially severe in resource-limited settings (6). In India, this disparity is particularly acute, where millions of persons with disabilities face barriers ranging from affordability to awareness and availability.

Measuring and understanding these barriers is dominant for developing evidence-based interventions and policies. Systematic assessment not only identifies gaps but also guides resource allocation, service planning, and policy formulation (7). This is emphasizing the importance of measuring AT outcomes in rehabilitation to ensure effective service delivery (8). This paper addressees two primary objectives: first, to broadly identify and categorize the challenges and barriers in AT access and utilization; and second, to discuss existing assessment scales and frameworks including WHO-GReAT, the ATLAS framework (1), QUEST (Quebec User Evaluation of Satisfaction with Assistive Technology) (9), PIADS (Psychosocial Impact of Assistive Devices Scale) (10), MPT (Matching Person and Technology) (11), and others that can measure these barriers systematically.

By examining both global and Indian contexts, we are trying to explain about the complexity of AT barriers and the tools available to address them.

Types of Challenges and Barriers in Assistive Technology

1 Policy and governance challenges: Policy and governance challenges remain major barriers to equitable access to assistive technology (AT) in many countries. The lack of comprehensive national AT policies often leads to fragmented service delivery, inconsistent quality standards, and insufficient resource allocation (12). The WHO policy framework underscores the importance of integrated strategies that combine legislation, financing, and service delivery to strengthen AT systems (13).

In India, although the Rights of Persons with Disabilities Act (2016) recognizes the importance of assistive devices, the mechanisms for implementation are still weak, and a dedicated national AT policy is still not existing. Procurement processes are frequently inefficient, resulting in distribution delays and inadequate maintenance of assistive products. Effective AT policy should integrate sustainable financing, efficient supply chain management, skilled workforce development, and active user participation components that are often missing in current governance structures (14). To address these challenges, an international framework for AT provision has been proposed to guide the development of coherent national policies (15).

2 Economic Barriers: Economic constraints are among the most significant barriers to accessing assistive technology (AT) worldwide. The high cost of assistive products, combined with limited insurance coverage and insufficient government subsidies, places a heavy financial burden on users (16). Research indicates that these cost-related barriers disproportionately impact vulnerable populations, particularly in low- and middle-income countries (LMICs), where healthcare spending is largely out-of-pocket (17). In such contexts, even basic assistive devices are often unaffordable, forcing individuals and families to choose between essential healthcare needs and AT (18). Global evidence underscores the deep economic inequities in AT access, with affordability remaining a key determinant of

inclusion (19). In India, although programs such as the Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP) scheme aim to improve affordability, their reach is limited, and many beneficiaries continue to face system challenges through government systems and hierarchy in obtaining subsidies.

3 Service Delivery Barriers: Service delivery challenges in assistive technology (AT) include a shortage of trained professionals, insufficient assessment services, and weak supply chain infrastructure. The limited availability of qualified personnel capable of conducting comprehensive assessments, prescribing suitable devices, and providing user training is a major constraint, especially in rural regions. Workforce shortages affect not only the initial provision of AT but also essential follow-up services, such as maintenance and repair (20,21). Studies emphasize that in low- and middle-income countries (LMICs), AT delivery systems face additional barriers, highlighting the need for context-specific and sustainable service models (22). Moreover, frequent supply chain disruptions, limited local production, and heavy reliance on imports lead to product shortages, long waiting times, and restricted user choice. Evaluating AT service outcomes is therefore essential to identify inefficiencies and strengthen overall service delivery systems (23).

4 Awareness and Social Barriers: Social and cultural factors play a critical role in determining the acceptance and continued use of assistive technology (AT). Stigma surrounding disability and the visible use of assistive devices often leads individuals to avoid or abandon prescribed technologies. Negative perceptions are particularly strong when devices are highly noticeable or conflict with cultural and aesthetic norms (24). Limited awareness among potential users and healthcare providers about the range and benefits of AT further exacerbates these challenges (21). Additionally, caregiver burden contributes to non-use, as family members may lack adequate knowledge about device operation, maintenance, and the importance of consistent use. Addressing these social and cultural dimensions is therefore essential to ensure meaningful and sustained AT utilization.

5 Design and Usability Barriers: Lack of customization and limited user-centered design remain major challenges in the development and delivery of assistive technology (AT). Many devices are created for generic populations, overlooking the diverse needs, preferences, and environmental contexts of individual users. Research shows that device abandonment is strongly linked to poor performance, evolving user needs, and minimal involvement of users in the selection process (25). Best practices in AT emphasize the importance of user-centered design, ensuring that technologies are tailored to individual goals and real-life contexts (26). In India and other low- and middle-income countries (LMICs), products designed for high-income settings often fail to adapt to local environments, cultural norms, and functional demands, resulting in reduced satisfaction and higher rates of device abandonment.

6 Technology and Infrastructure Barriers: Limited research and development (R&D) in assistive technology (AT), especially within low- and middle-income countries (LMICs), significantly hinders innovation and the availability of context-appropriate solutions. The absence of interoperability between assistive products and other technologies, such as information and communication systems, restricts functionality and integration into users' daily lives. Additionally, infrastructural barriers including inaccessible built environments, unreliable electricity, and limited internet connectivity further reduce the usability of advanced AT. Inadequate technological infrastructure thus prevents users from fully realizing the potential benefits of assistive technologies (27). Studies focusing on low-income settings also highlight how these infrastructural and systemic limitations remain major obstacles to equitable AT access and sustainability (28).

7 Training and Maintenance Barriers: Insufficient training for users, caregivers, and service providers poses a major challenge to the effective use of assistive technology (AT). Many recipients receive devices with little or no guidance on proper operation,

maintenance, or troubleshooting, often resulting in misuse or eventual abandonment. The lack of structured after-sales support and maintenance systems further compounds the problem, as even minor repairs can leave devices unusable for long periods. Studies on AT provision, particularly in wheelchair services, highlight the critical need for adequate training and ongoing technical support (29). In resource-limited settings, shortages of spare parts, technical expertise, and dedicated service centres create additional barriers especially for complex devices that require regular calibration and maintenance to remain functional.

8 Accessibility and Geographic Barriers: Geographic disparities in access to assistive technology (AT) remain a major concern, with rural and remote areas facing limited availability of products and services. Concentration of AT facilities in urban centres, poor transportation infrastructure, and lack of outreach programs make access particularly challenging for rural populations (18). Studies from Africa reveal similar barriers, mirroring those seen in rural India, where distance and inadequate service networks further restrict access (30). Broader accessibility challenges such as non-inclusive public spaces, inaccessible transportation systems, and environments that do not follow universal design principles further diminish the effectiveness of assistive products. Comprehensive assessments of environmental barriers demonstrate that physical, attitudinal, and policy-related factors collectively influence how effectively individuals can benefit from AT (31).

Scales and Frameworks for Assessing AT Barriers

1 WHO Global Report on Assistive Technology (GReAT) and ATLAS Framework: The WHO Global Report on Assistive Technology (2022) introduces the Assistive Technology Assessment (ATLAS) framework, a comprehensive tool for evaluating and strengthening national AT systems (1). The framework assesses five core components policy, products, provision, personnel, and place (the 5Ps) to provide a holistic understanding of system performance. Through this structured approach, ATLAS helps countries identify gaps in governance, availability, service delivery, workforce capacity, and environmental context. By offering standardized metrics, it facilitates evidence-based policymaking, equitable resource allocation, and international comparison of AT system maturity. The framework builds upon the foundational WHO policy principles that guide its implementation (13).

2 Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST): QUEST is a widely used outcome measure assessing user satisfaction with assistive technology devices and related services (9). Demers et al. developed QUEST 2.0 as a reliable and valid instrument for measuring user satisfaction. The instrument evaluates satisfaction across two domains: device characteristics (including dimensions, weight, safety, durability, simplicity of use, comfort, and effectiveness) and service delivery factors (including service delivery process, repairs and servicing, professional services, and follow-up services). QUEST provides valuable insights into user perspectives on both product quality and service provision, making it essential for identifying areas requiring improvement in AT programs. Auger and Demers (16) demonstrate QUEST's utility in measuring AT outcomes in community settings.

3 Psychosocial Impact of Assistive Devices Scale (PIADS): The Psychosocial Impact of Assistive Devices Scale (PIADS), developed by Day and colleagues (32), evaluates how assistive technology (AT) influences users' lives across three key dimensions: competence (functional independence and performance), adaptability (social engagement and openness to new experiences), and self-esteem (confidence and emotional well-being). Research demonstrates that PIADS effectively captures subjective outcomes that go beyond physical functionality, acknowledging the broader psychological and social benefits of AT use (10). This scale is particularly valuable for assessing user experiences and identifying

technologies that improve quality of life in a holistic manner.

4 Matching Person and Technology (MPT) Model: The Matching Person and Technology (MPT) model offers a comprehensive framework for aligning individuals with the most suitable assistive technologies by integrating three key dimensions person characteristics, technology features, and environmental factors (11). This model incorporates several assessment tools designed to evaluate user needs, preferences, and predispositions alongside contextual and technological variables. A central component of the framework is the Assistive Technology Device Predisposition Assessment (ATD-PA), which aids in selecting devices that best fit user abilities and lifestyles (33). By promoting individualized device matching, the MPT model reduces the likelihood of abandonment and enhances long-term satisfaction and effectiveness of AT use.

5 Assistive Technology Assessment (ATA) Model: The Assistive Technology Assessment (ATA) model, developed by Federici and colleagues (34), offers a comprehensive framework for evaluating assistive technology (AT) needs, guiding device selection, and measuring outcomes. The model integrates multiple dimensions user characteristics, environmental context, device features, and psychosocial outcomes to ensure a holistic approach to AT assessment and provision. By emphasizing the interaction between the user and their environment, the ATA model supports more personalized, effective, and sustainable AT interventions.

6 Psychometric Evaluation Frameworks: Psychometric evaluation frameworks for assistive technology (AT) outcome measures emphasize the use of validated and reliable instruments to ensure accuracy and consistency in assessing outcomes (35). These frameworks guide the appropriate selection and application of tools that capture meaningful impacts of AT use. Furthermore, the measurement of participation outcomes is crucial, as it extends beyond assessing device functionality to encompass real-world engagement, social inclusion, and overall quality of life (36).

7 AT Outcome Measurement Tools: A comprehensive review of outcome measures in assistive technology (AT) research categorizes assessment tools based on their focus device, user, or system level and their measurement domains, including function, activity, participation, satisfaction, and quality of life (7). This structured approach assists practitioners and researchers in selecting context-appropriate and purpose-specific tools to evaluate the effectiveness and impact of AT interventions.

8 Craig Hospital Inventory of Environmental Factors (CHIEF): Building on earlier work assessing environmental influences on disability, the Craig Hospital Inventory of Environmental Factors (CHIEF) measures barriers encountered by people with disabilities across five key dimensions: physical/structural, attitudinal/support, services/assistance, policy, and work/school (31). This tool highlights that the effectiveness of assistive technology (AT) is strongly influenced by environmental conditions. By systematically identifying these barriers, CHIEF enables a comprehensive understanding of AT access challenges and guides the implementation of environmental modifications to enhance AT benefits.

DISCUSSION

Comparative Analysis: Global, LMIC, and Indian Contexts: Barriers to assistive technology (AT) access vary across contexts, yet several recurring themes are evident. In high-income countries, challenges often revolve around limited insurance coverage, regulatory delays in keeping pace with technological innovation, and the need to ensure user-centered design. In contrast, low- and middle-income countries (LMICs) face more fundamental barriers, such as shortages of assistive products, lack of trained professionals, and lack of comprehensive policy frameworks (18,28). Global inequities in AT access remain stark, with significant disparities between high-income countries and LMICs (19). Evidence from Africa reflects many of the same challenges seen in South Asia, including India, where growing manufacturing capacity and increasing policy recognition of

disability rights are offset by persistent implementation gaps, regional inequalities, and economic constraints (30). Resource-limited environments therefore require context-specific and locally adaptable solutions, rather than the direct adoption of high-income country models (18,22).

Underutilization of Assessment Scales: Despite the existence of several well-established assessment tools for evaluating assistive technology (AT) outcomes (7,9,10,11,34,35), their use in low and middle-income countries (LMICs) remains limited. Barriers to large-scale implementation include a shortage of trained assessors, limited time and resources in clinical settings, lack of culturally adapted versions, and low awareness among service providers. Moreover, many of these tools were originally developed and validated in high-income countries, raising concerns about their suitability in different cultural and economic contexts. The appropriate selection of outcome measures based on local context is therefore essential (7). To promote equitable and evidence-based AT services, there is an urgent need for validation studies, cultural adaptation, and capacity building to support broader adoption of standardized assessment instruments. Systematic measurement of AT outcomes can ultimately strengthen rehabilitation services and policy development (8).

Research Gaps: Several critical research gaps in assistive technology (AT) demand focused attention. First, longitudinal studies on AT outcomes, device abandonment, and long-term impacts in low and middle-income countries (LMICs) are limited, despite evidence of high abandonment rates (25). Second, comprehensive cost-effectiveness analyses of different AT provision models are needed to guide policy and resource allocation (17). Third, research on culturally appropriate AT design and the integration of indigenous knowledge in product development remains underexplored. Fourth, there is insufficient evidence on how intersecting factors such as gender, caste, and rural location affect AT access and utilization (30). Fifth, implementation science research is urgently needed to understand how evidence-based AT policies can be effectively translated into large-scale practice (14). Finally, although several frameworks for AT provision have been proposed (15), empirical studies evaluating their effectiveness across diverse contexts are still lacking.

Emerging Trends and Opportunities: Several promising trends are emerging that could help overcome barriers to assistive technology (AT) access. The growing focus on universal design and accessible mainstream technologies has the potential to lower costs and reduce stigma associated with AT use (5). Advances in 3D printing and local manufacturing enable affordable, context specific production tailored to local needs. Digital health platforms and telemedicine are expanding service reach, improving access to assessments and follow-up in remote areas. Innovative financing models, such as social entrepreneurship initiatives, micro-insurance, and rental schemes, are helping to mitigate economic constraints (17).

At the policy level, increased global attention illustrated by the WHO Global Cooperation on Assistive Technology (GATE) initiative has created significant momentum for international collaboration and policy advancement (13). The GREAT Summit further elevated AT policy as a global priority (14), while the recognition of assistive products as essential for achieving the Sustainable Development Goals (SDGs) continues to drive investment and strengthen AT systems worldwide (4).

CONCLUSION

Assistive Technology represents a fundamental right rather than a luxury, essential for enabling persons with disabilities to achieve independence, participate in society, and realize their full potential (3,5). However, this paper has demonstrated that barriers to AT access are multidimensional, spanning policy, economic, service delivery, social, design, technological, training, and accessibility domains. These barriers interact and compound each other, creating particularly acute challenges in LMICs including India,

where the majority of persons with disabilities reside (18,19,28,30).

The existence of robust assessment scales and frameworks—including WHO-GReAT (1), ATLAS (1), QUEST (9), PIADS (10), MPT (11), ATA (34), and others (7,35)—provides valuable tools for systematically identifying and measuring these barriers. However, their underutilization highlights the gap between available knowledge and implementation (8). Addressing AT access challenges requires comprehensive, multi-sectoral approaches informed by systematic assessment, combining policy reform (12,13,14), financing innovation (16,17), service delivery strengthening (15,22,23), workforce development (20), local manufacturing (19), user-centered design (21,26), and social inclusion efforts (24).

For India specifically, the path forward demands the development of a comprehensive national AT policy aligned with WHO frameworks (1,13), integration of AT into universal health coverage (5), investment in local manufacturing through Make-in-India initiatives, training of a skilled AT workforce (20), and adaptation and implementation of standardized assessment tools (35). The WHO Priority Assistive Products List (2) should guide essential product availability. Importantly, persons with disabilities must be central to all these efforts—not as passive recipients but as active partners in designing, implementing, and evaluating AT systems (21).

The urgency of addressing AT barriers cannot be overstated. With the global population aging and non-communicable diseases rising, the number of people requiring assistive products will grow substantially (1). Failure to act decisively will widen existing inequalities and undermine progress toward sustainable development goals (4). Conversely, comprehensive AT systems represent an investment with substantial returns enabling workforce participation, reducing healthcare costs, and most importantly, affirming the dignity and rights of all people regardless of ability. The tools, frameworks, and knowledge exist (7,26); what remains is the political will and sustained commitment to translate evidence into action (14), ensuring that assistive technology becomes a universally accessible reality rather than a distant aspiration.

RECOMMENDATION

Addressing assistive technology barriers requires comprehensive, multi sectoral interventions grounded in evidence-based frameworks. Countries must develop integrated national AT policies incorporating the WHO 5Ps framework (policy, products, provision, personnel, place) with dedicated institutional structures, clear implementation timelines, and adequate budget allocations (1,13,14,15). AT must be mandated within universal health coverage and essential health benefits packages, recognizing assistive products as medical necessities rather than optional aids, with the WHO Priority Assistive Products List serving as a foundation for essential product availability (2,5). Innovative financing models combining government subsidies, insurance coverage, public-private partnerships, AT banks, and rental schemes are essential to reduce catastrophic out-of-pocket expenditure and improve affordability (16,17). Investment in workforce development through specialized AT curricula, continuing professional development, and task-shifting strategies will address critical personnel shortages, while strengthening supply chain infrastructure including procurement systems, quality assurance, distribution networks, and maintenance services extending to rural areas is paramount (12,15,20,22,23).

User centered approaches must be foundational, ensuring meaningful participation of persons with disabilities throughout AT development, selection, and evaluation processes (21,26). Standardized assessment protocols using validated instruments such as QUEST (9), PIADS (10), MPT (11), and ATA (34) should be implemented systematically to ensure appropriate device-user matching and measure both functional and psychosocial outcomes (32,35,36). For India specifically, developing and validating culturally appropriate, linguistically diverse AT assessment scales while implementing the ATLAS framework for national system

evaluation is critical (1,35). Promoting local manufacturing through Make-in-India initiatives, supporting social enterprises, and investing in context-appropriate R&D will reduce import dependence, lower costs, and improve product suitability (18,19,26). Comprehensive awareness campaigns targeting healthcare providers, educators, employers, and the public, combined with implementing universal design principles in built environments and addressing infrastructure gaps, will maximize AT effectiveness (5,24,28,31). Ultimately, persons with functional impairments must transition from passive recipients to active partners in designing, implementing, and evaluating AT systems, affirming their dignity and rights while ensuring that assistive technology becomes a universally accessible reality (3,21).

Authors Contribution

Suman Badhal and Arvind Vashist conceptualized the study and provided the core idea and overall guidance for the manuscript. Tushar and Kajal Hans were primarily responsible for drafting the manuscript, data interpretation, and carrying out all necessary revisions and amendments. All authors contributed equally to this work and approved the final version of the manuscript.

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Conflict of Interest

There are no conflicts of interest.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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