Assistive technology usage, unmet needs and barriers to access: a sub-population-based study in India

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Summary

Background Assistive technology (AT) is essential to minimize functional limitations. The current study aimed to estimate the prevalence of needs, met and unmet needs for AT, and barriers to accessing AT among a subnational population in India.

Methods This cross-sectional study was conducted in eight districts, representing four zones of India, using the WHO Rapid Assistive Technology Assessment (rATA) tool. The tool was administered by trained staff using read aloud technique. Multi-stage cluster random sampling was used, as well as the probability proportional to size, to select smaller administrative units from the larger ones.

Findings In total, 8486 participants were surveyed out of 8964 individuals enumerated with a response rate of 94.6%. The sample prevalence of at least one difficulty was 31.8% (2700), with 6.3% (532) having severe or total difficulties. The sample prevalence for AT need was 27.8% (2357) with an estimated population prevalence of 24.5% (95% CI: 23.5–25.4). Similarly, the sample prevalence of unmet needs was 9.7% (823) with an estimated population unmet needs of 8.0% (95% CI: 7.43–8.60). The unmet needs among persons with severe or total difficulties was 52.3% (278/532), and was higher among females, rural residents, and older persons. Spectacles were the most used products, followed by canes/sticks, tripods, and quadripods. Nearly two-thirds of AT users purchased assistive products at their own expense, particularly from the private sector. The inability to afford AT (36.9%) was the most common barrier.

Interpretation The results show that the need for AT was substantial in the study population, the highest being for seeing difficulties. The unmet needs are higher in females, older population, rural residents, and persons having serious difficulties. While the majority of users have to make out-of-pocket payments to obtain AT, inability to afford and limited availability were the common barriers among those with unmet needs.

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Keywords: Assistive technology; Needs; Use; Unmet needs; Barriers; Sources; India

Introduction

Assistive Technology (AT) is an emerging field in the context of healthcare and well-being across the world. It is defined as the application of organized scientific knowledge and skills related to assistive products (APs), which includes systems and services to improve the functioning and independent living of a person with at least one or more functional difficulties or disabilities. With an initiative to improve access to AT globally, the Global Cooperation on Assistive Technology (GATE) team has recently released a priority list of AT (APL), aiming to guide its member states in preparing their

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Research in context

Evidence before this study

The WHO estimates that about 2.5 billion (one in three) people in the world need at least one or more assistive technology (AT). Yet, only one in ten persons can access the AT they need. With demographic and epidemiological transition compounded with increasing non-communicable diseases over time, the AT requirements will increase to 3.5 billion. Although the WHO reported that nearly 90% of people in need of AT live in low and middle-income countries (LMICs), limited data are available on the AT key indicators from India. Further, various institutions report different data on disability statistics due to non-uniformity in the definitions of disability used, leading to uncertainty about the magnitude of population need for AT.

Added value of this study

The current research, for the first time in India, reports on the prevalence of AT use, need, including met and unmet needs in the population of all age groups. In addition, the current study provides information on the barriers to accessing AT and their sources. The study also reports on the functional difficulties among the study population, including the level of difficulties they encounter in various domains. The findings will help to provide possible recommendations to improve AT services in the country.

Implications of all the available evidence

Evidence shows that AT provides effective support to persons with disabilities (PwDs), the elderly, and those with chronic health conditions in terms of independent living, everyday activities, occupational and educational performance, and social inclusion. Besides, the use of AT helps to reduce the rate of institutionalization, injury, and burden to caregivers or family members. The results of the present study would provide evidence for the planning and development of a national priority assistive products list in line with the World Health Organization list.

own APL list within respective country resources.[1] The list consists of fifty different types of assistive products that would benefit persons with various functional difficulties.

ATs are essential to persons with disabilities (PwDs), elderly, and those with chronic debilitating health conditions to improve not only independent living, and social participation but also healthcare access, and enhanced quality of life. A sizeable amount of evidence is available that AT provides significant life-changing support and benefits to those who are in need. For example, studies have shown that the use of AT among the elderly, including PwDs reduces their functional limitations in terms of physical, cognitive, self-care, and communication problems, and at the same time, helps to improve occupational performance and academic and non-academic skills.[2–5] Besides, the use of AT among the population in need decreases their frequent hospitalization along with the reduction in healthcare costs; causes less chance of injuries, and minimizes the burden to the caregivers or family members.[5]

Globally, as per recent World Health Organization (WHO) estimates, one in three persons needs at least one or more APs for their functional difficulties.[6] Although the need for AT increases with age, PwDs are the vulnerable population who require AT the most. With demographic shift coupled with epidemiological transition, the need for AT will rise to 3.5 billion by 2050. The WHO Global Report on AT (GReAT) has highlighted that access to AT is extremely varied across various countries with access as low as 3% of the total needs in low-middle-income countries (LMICs) to 90% in high-income countries.[6] Lack of access to AT can have serious health impacts on individuals who need them, their families, and the community as a whole. This can result in poor health outcomes due to secondary health conditions and poor access to healthcare services. Over the long run, it may lead to a higher burden on the healthcare delivery system, especially in LMICs. The World Economic Forum has reported that the cost of excluding PwDs reaches up to 7% of GDP (Gross Domestic Product) in some countries.[7] Therefore, investing in AT and rehabilitation services is critically important as it has a huge potential to improve the lives of millions of people globally.

In the recent past, after the 71st World Health Assembly resolution in 2018, the WHO has led many initiatives through its GATE Initiative for improving access to high quality and affordable AT for its member states.[8] At the same time, the UN Sustainable Development Goals (SDGs) have focused on the need for social inclusion with the pledge that "no one should be left behind", and that the governments should make efforts to reach the unreached first.[9] India, being a ratified member of the WHO and UN, is committed to aligning with the various global AT initiatives in order to improve access to safe, high-quality, and affordable AT for persons who need them.

In India, although the exact magnitude of need and unmet needs for AT is not known, the needs and demand for AT are considerably high, and will continue to rise over time due to demographic and epidemiological changes. For example, the census 2011 data revealed that approximately 2.2% of the total population suffer with some form of disability (around 30 million).[10] This estimation is much lower than what has been reported by the WHO, and the World Bank. The World Bank in 2007 estimated the prevalence of disabilities as three

times higher than the Census 2011 estimation.[11] Furthermore, the prevalence increases with age, in females, people living in rural areas, and underprivileged and vulnerable communities.[12] Since the need for AT is not restricted to PwDs per se, the volume of requirements will be much higher in the real sense. The problem is further compounded by limited studies on the sources and barriers to accessing AT among the Indian population. This indicates the need for conducting community based epidemiological studies related to all spheres of AT, in the country to generate evidence on the relevant indicators. Given the gap between demand and supply of AT, there is also a need for planning AT services in India within the limits of available resources. The current study aimed to assess the prevalence of AT usage, needs, including met and unmet needs in a subnational population of India. Additionally, the study also plans to investigate the sources and barriers to accessing AT among all age groups in the subnational population of India, using the WHO rapid assistive technology assessment (rATA) tool.

Methods

Study design and population

A cross-sectional study was conducted in four different zones of India from November to December 2021. The study participants were individuals of all age groups, irrespective of health conditions or functional limitations and regardless of the use of AT.

Sampling

The sample size of 8363 was estimated based on 1% prevalence of access to ATs in the general population, 25% relative precision, 80% power, 95% confidence interval, design effect 1.2, and a non-response rate of 10%.[13] Sampling involved two stages: firstly, one state from each zone, and further two districts from each state were selected, conveniently, leading to a total of eight districts for the study. Secondly, a multi-stage cluster random sampling along with probability proportional to size (PPS) was done to select a smaller local administrative unit in each district, such as a block or mandal or taluka. Further, the Census Enumeration Block (CEB), so called primary sampling units (PSUs), were listed in the selected local administrative unit to generate the sampling frame for cluster sampling. Each CEB has 150–250 households with a population of 750–1250. Using PPS, thirteen PSUs were selected in each district.

Finally, the compact segment technique was employed to select households in which the PSU was divided into segments of equal population size that had approximately twenty households each. A spot map was prepared after a discussion with local health workers. In the selected segment, the survey proceeded from one end to the other, until all twenty households were covered having around a hundred participants.

Study definitions

Assistive products

Any external product that can improve or maintain an individual's daily functioning and independence, and thereby promote health and well-being. This also includes products used to prevent impairment and secondary health conditions. An assistive product is not a device to treat or cure health problems or illnesses. For the purpose of the study, a list of predefined assistive products, as indicated in the WHO-rATA tool with illustrations called "AT Show Cards", was used to facilitate the identification of Assistive Products among participants.[14]

Assistive technology

Assistive products along with related service delivery systems, e.g., recommendation or prescription, training, supplies, etc., for people who need AT, so that the same can be used safely, effectively, and in the way it is supposed to be used. Conventionally, assistive products are meant to be used by individuals who have some form of functional difficulties or limitations in executing a particular task.

Disability

According to WHO-ICF (International Classification of Functioning), disability is an umbrella term which covers impairment, activity limitation, and participation restriction in any sphere of life. Moreover, not all persons with difficulties are disabled, but all disabled will have one or more difficulties. For AT services, the term difficulty is more appropriate.

Difficulties

Persons with difficulties are defined as those who are unable to perform or face challenges in doing a task that otherwise can be done easily by them. The authors intended to use this term consistently throughout the article rather than using disability.

Use of AT

It is the proportion of the clients who use any type of assistive products at the time of the survey, out of all those being surveyed.

Need for AT

It is the percentage of clients who are currently in need of at least one or more assistive devices for their functioning difficulties. The prevalence of need is the sum of the prevalence of met needs and unmet needs.

Met need for AT

This is the percentage of clients who need APs and already have the products they need, and do not require

new or additional products or services for a defined difficulty at the time of survey.

Unmet need for AT

It is the percentage of clients who need new or additional assistive products for a defined difficulty irrespective of whether they are already using assistive products. It indicates the number of participants reporting a need for a given predefined AT for their functioning, but not having it or having a damaged AT which needs to be replaced.

Barriers to accessing AT

These are the challenges faced by clients who have unmet needs of APs at the time of the survey.

Training of the survey team

One public health institute or medical college was selected from the selected district as the nodal institute. Training of trainers was conducted at the national level for two days, in which two persons (area supervisor and survey manager) were selected from the respective public health or community medicine department of the nodal institute. Training materials developed by the WHO GATE team were used and training proceeded as per recommended rATA master training program. Briefly, the training components included theoretical information about the rATA tool and deployment plan, followed by a hands-on session using the digital rATA tool on Android mobile phones. The participants practiced case vignettes depicting various real-life situations they might encounter in the field. They were taught how to use show-cards with respondents to understand the need for various APs. Three case vignettes were provided for practice and the feedback of the participants was also obtained. A pilot study was conducted in the field before the start of the survey, and minor changes were made in the deployment plan and semantics of the tool.

Data collection

Two districts, in each zone of the four divided zones of the country (North, East, West, South) were covered, giving a total of eight districts for the survey. The study tool was the WHO rATA digital tool which was installed in ArcGIS app. The English tool was translated into the local language and back translated into English to address any inconsistencies present in the translated tool. A color showcard of each included AP in the tool was developed to avoid any confusion. All children below 15 years of age were interviewed with proxy, whereas children between 15 and 18 years of age were interviewed on their own, provided that the parents or primary caregiver gave written consent or assent wherever applicable.[14] Enumeration and interviews were done by the enumerators with support from local volunteers, e.g., Accredited Social Health Activists (ASHA). A maximum limit of seven households per enumerator per day was fixed, to ensure data quality.

Data management and analysis

All the data collected was uploaded to the cloud and was checked and cleaned daily. Entered data was exported to STATA version 15 (StataCorp 2015, Stata Statistical Software: Release 15, College Station, TX: StataCorp LP) for analysis. Data were encrypted and password protected for confidentiality. Descriptive analysis was performed to summarize the results and data were presented as mean, percentages, and standard deviation. Multivariable regression was performed to explore predictors of AT usage such as sex, age, place of residents, and severity of difficulties and statistical significance was set at p-value < 0.05 level. Age-adjusted estimation was also calculated using standard population based on the census 2011 data. The odds ratio and 95% confidence limit for the estimated prevalence was calculated using STATA version 15. The investigators selected the standard district population and demographic variable sex for applying weights to the district prevalence. The cell-based weighting method was used in which the proportion of male and female respondents and the district census population as a proportion of the total population was used.[15] To reduce the impacts of data weighting, weights were applied to these two variables only. The prevalence of usage and need for assistive products in the subnational population was estimated by the weighted mean prevalence adjusted to the standard population sizes of each district.

Ethics clearance

The present study was reviewed and approved by the Institute Ethics Committee (Ref. no. IEC-632/03.09.2021).

Role of funding source

None.

Results

A total of 8486 participants were interviewed out of 8964 enumerations, with a response rate of 94.6%. Male respondents were 48.2% (4087, Table 1), and 48.9% (4151) of participants were urban residents. The maximum respondents was belonged to the age group 18–39 years (36.9%, 3130), followed by 40–59 years age group (25.3%, 2144). The prevalence of at least one difficulty among participants was 31.8% (2700, Table 1), which included 25.5% (2168) with some difficulties and 6.3% (532) with severe/total difficulties (Table 2). Seeing problem was the most frequently reported type of difficulty among the study sample (26.6%, 2256, Table 1) followed by mobility (11.9%, 1015) and hearing difficulty (3.4%, 287, Table 1). Given the severity of

Characteristics	n	Percentage
Mean age (SD)	34.5 (20.4)	
Age groups		
<17	2001	23.6
18–39	3130	36.9
40–59	2144	25.3
60–79	1082	12.8
≥80	129	1.5
Place		
Urban	4151	48.9
Rural	4335	51.1
Sex		
Male	4087	48.2
Female	4397	51.8
Functional difficulties		
Mobility	1015	11.9
Seeing	2256	26.6
Hearing	287	3.4
Communication	68	0.8
Cognitive	158	1.9
Self-care	125	1.5
Any difficulties	2700	31.8

Two participants did not disclose their sex.

Table 1: **Characteristics of the sample population for the survey (N = 8486).**

difficulties among participants, 25.5% (2168) have some difficulties of any type whereas 6.3% (532) have severe or total difficulty (Table 2). Furthermore, difficulty in seeing contributes the maximum for both some (23.3%, 1978) and severe/total difficulties (3.3%, 278, Table 2). This is followed by mobility problems accounting 9.2% (780) for some mobility difficulties and 2.8% (235) for serious difficulties (Table 2). The next functional difficulty was for hearing that included 2.7% (229) participants with some hearing difficulties and 0.7% (58) with severe hearing difficulties.

Needs, use, and unmet needs for AT

The estimated population prevalence of the need for AT was 24.5% (95% CI: 23.5–25.4, Fig. 1) among the study participants, whereas the sample prevalence was 27.8% (2357, Table 3). It ranged from 90.9% individuals with severe difficulties (484/532) to 83.7% individuals with some difficulties (1814/2168, Table 3). The estimated population prevalence of AT use was 19.9% (95% CI: 19.0–20.7, Fig. 1) and the sample prevalence was 22.2% (1888, Table 3), with 65.6% (349) AT users with severe difficulty and 1488 (68.6%) users with some difficulty. The most commonly used AT were those for seeing, i.e., spectacles (20.2%, 1712), followed by mobility products such as canes/sticks, tripods, quadripods (1.6%, 135), spinal orthoses (0.8%, 70), lower limb orthoses (0.5%, 45) and walkers (0.3%, 27), Fig. 2.

The results show that the estimated population prevalence of unmet needs was 8.0% (95% CI: 7.43–8.60, Fig. 1), although the sample prevalence was reported to be 9.7% (823, Table 3) of the study participants. The unmet need for AT was reported by 24.4% (530, Table 3) participants with some difficulty and 52.3% (278) participants with severe or total difficulties (Fig. 1).

Furthermore, both needs and unmet needs for AT were significantly higher among females compared to males (29.8% vs. 25.6%, $p < 0.0001$ and 11.6% vs. 7.7%, $p < 0.0001$, Table 3) Further, the use, need and unmet needs for AT increased significantly with age (Table 3). The unmet need is significantly higher among rural participants compared to urban (11.3% vs. 7.9%, $p < 0.0001$). The need for AT was reported by 69.1% (47) of participants with communication problems and 89.9% (2026) of participants with problems in seeing. In contrast, the unmet need for AT was reported by 26.9% (608) of participants with seeing difficulties and 63.8% (183) of participants with hearing difficulties (Table 3).

Sources of AT

Most AT users purchased their products by making out of pocket expenditures to the private sector (67.4%, 1273, Fig. 3A). One-quarter of them received funding from friends and family (23.5%, 444), whereas only 94 (4.9%) received assistive products from the public sectors. The study found that 40.5% (765) of AT users had to travel between 6 km and 25 km to obtain AT and related services, whereas 10.8% (203) had to travel more than 26 km to obtain AT (Fig. 3B).

Difficulties	Some difficulty n, (%)	Severe/total difficulty n, (%)	No difficulty n, (%)	Not disclosed n, (%)
Any difficulties	2168 (25.5)	532 (6.3)	5786 (68.2)	–
Mobility	780 (9.2)	235 (2.8)	7451 (87.8)	20 (0.2)
Seeing	1978 (23.3)	278 (3.3)	6209 (73.2)	20 (0.2)
Hearing	229 (2.7)	58 (0.7)	8178 (96.4)	21 (0.2)
Communication	40 (0.5)	28 (0.3)	7965 (93.9)	453 (5.3)
Cognitive	118 (1.4)	39 (0.5)	7875 (92.8)	453 (5.3)
Self-care	72 (0.8)	54 (0.6)	7905 (93.2)	455 (5.3)

Table 2: **Severity of functional difficulties among the sample population (N = 8486).**

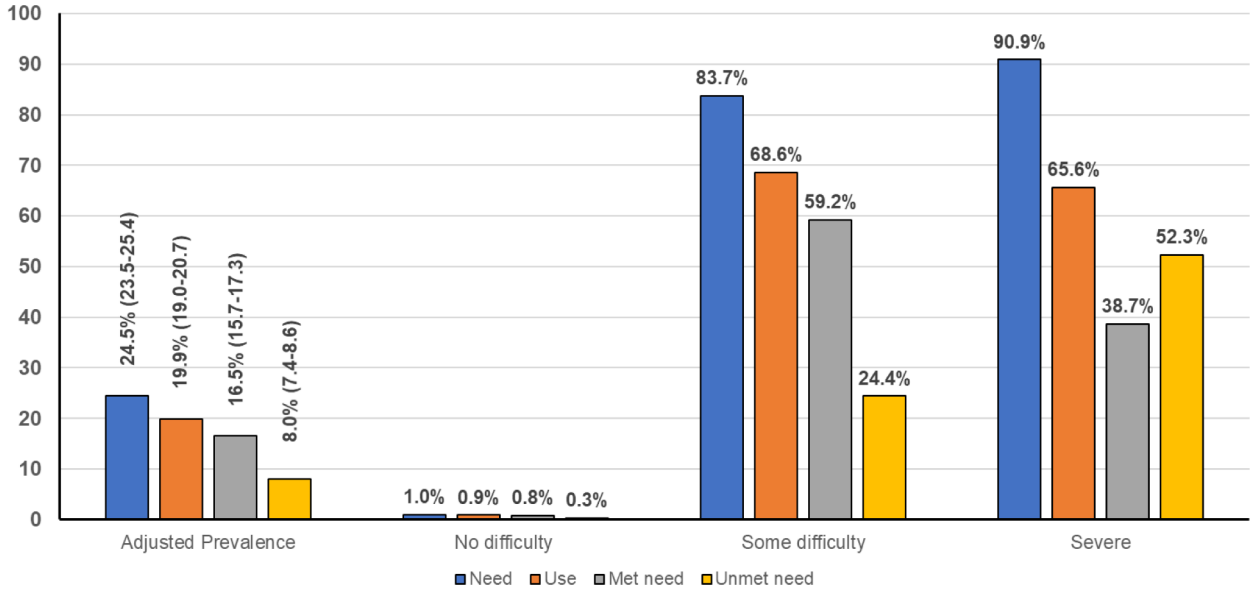

Fig. 1: Population prevalence of Assistive Technology use, need, met & unmet need, and sample responses by self-reported functional difficulties.

Characteristics	Indicators related to assistive technology			
	Use	Need	Met need	Unmet need
	n, (%)	n, (%)	n, (%)	n, (%)
Sex[a]				
Male	875 (21.4)	1047 (25.6)	733 (17.9)	314 (7.7)
Female	1012 (23.1)	1309 (29.8)	800 (18.2)	509 (11.6)
p-value	0.075	<0.0001	0.75	<0.0001
Age groups				
<17 years	97 (4.8)	128 (6.4)	91 (4.5)	37 (1.8)
18–39 years	278 (8.9)	362 (11.6)	244 (7.8)	118 (3.8)
40–59 years	836 (38.9)	1011 (47.2)	709 (33.1)	302 (14.1)
60–79 years	594 (54.9)	752 (69.5)	441 (40.8)	311 (28.7)
>80 years	83 (64.3)	104 (80.6)	49 (37.9)	55 (42.6)
p-value	<0.000	<0.0001	<0.0001	<0.0001
Places				
Urban	949 (22.9)	1135 (27.3)	804 (19.4)	331 (7.9)
Rural	939 (21.7)	1222 (27.9)	730 (16.8)	492 (11.3)
p-value	0.13	0.51	0.0015	<0.0001
Difficulties				
Mobility	566 (55.8)	788 (77.6)	356 (35.1)	432 (42.6)
Seeing	1726 (76.5)	2026 (89.8)	1418 (62.8)	608 (26.9)
Hearing	143 (49.8)	240 (83.6)	57 (19.9)	183 (63.8)
Communication	22 (32.4)	47 (69.1)	9 (13.2)	38 (55.9)
Cognitive	77 (48.7)	127 (80.4)	36 (22.8)	91 (57.6)
Self-care	76 (60.3)	111 (88.1)	34 (26.9)	77 (61.1)
Total (regardless of characteristics)	1888 (22.2)	2357 (27.8)	1534 (18.1)	823 (9.7)
Difficulties				
Some	1488 (68.6)	1814 (83.7)	1284 (59.2)	530 (24.4)
Severe/total	349 (65.6)	484 (90.9)	206 (38.7)	278 (52.3)
No	51 (0.9)	59 (1.0)	44 (0.8)	15 (0.3)

[a]Excluded one transgender.

Table 3: **Sample prevalence of assistive technology use, needs, met, and unmet needs by sample characteristics.**

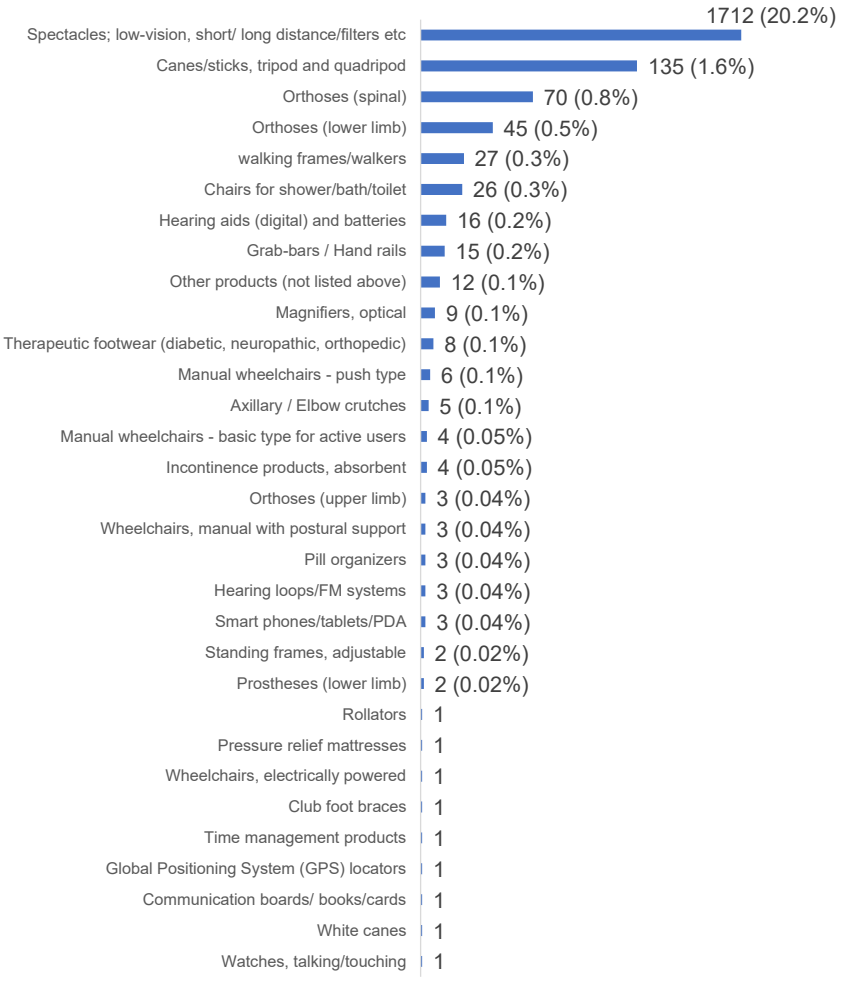

Fig. 2: Usage of assistive products in relative frequencies in the study sample.

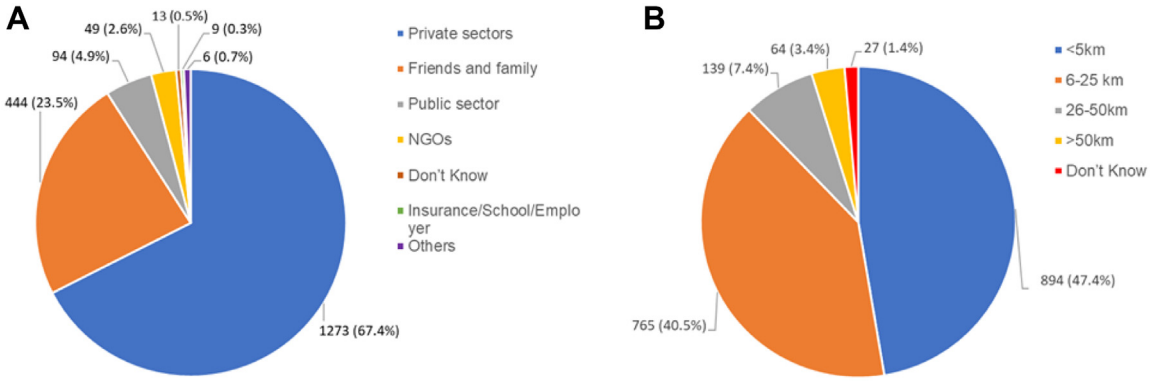

Fig. 3: Sources (A) and distance traveled (B) to obtain assistive products among the users of AT in the study sample (n = 1888).

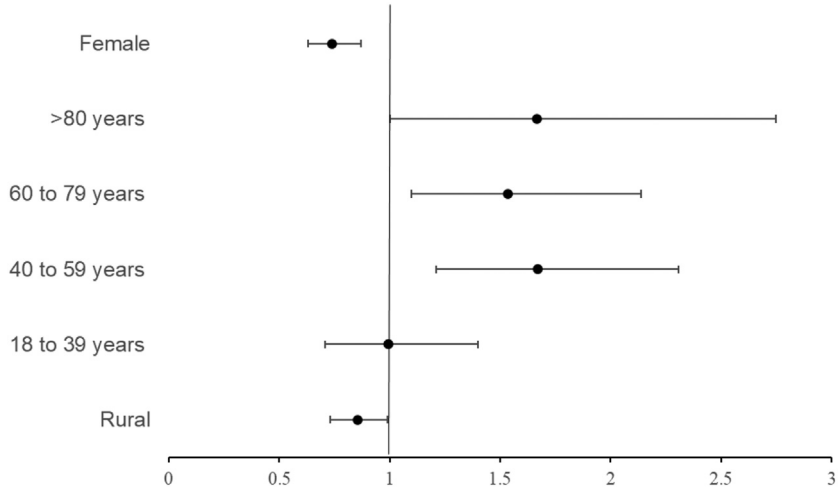

Fig. 4: Association of assistive technology usage with characteristics of the participants (sex, age, place, severity of difficulties) in the study sample using a linear logistic model. (Note: odds ratio for AT use among difficulties is not shown here due to a wide 95% CI, i.e., 143.9 to 264.3).

Factors associated with AT use

The multivariable logistics regression analysis showed lower usage of AT among females (OR: 0.73, 95% CI: 0.63–0.87), and rural residents (OR: 0.85, 95% CI: 0.73–0.99, Fig. 4) and higher usage among older participants (OR: 1.67, 1.53, 1.66 for age groups 40–59 years, 60–79 years, and ≥80 years, Fig. 4). Furthermore, individuals with difficulties are more likely to use AT than individuals without any difficulties (Fig. 4, footnote). When the same regression analysis was performed with the exclusion of difficulties, the odds ratios of age increased and varied from 1.9 (95% CI: 1.5–2.4) for those aged 18–39 years to 36.3 (95% CI: 24.0–55.0) for those aged more than 80 years (Supplementary Table S1).

Barriers to accessing AT

The inability to afford AT (36.9%, 414, Fig. 5) was the most common barrier reported by the study sample, followed by the limited time available to obtain AT (19.8%, 222) and the lack of support or companions to procure it (15.9%, 178). Other identified barriers were stigma associated with the use of AT (6.6%, 74), feeling uncomfortable while using the Assistive Products or unsuitable for use in participatory activities or public activities (5.6%, 63), lack of transportation to access Assistive products they needed (4.8%, 54), and non-availability of required AT (4.5%, 51, Fig. 5).

Discussion

The demographic transition is leading to a rapid rise in the elderly population, chronic debilitating health conditions, and persons living with various forms of disabilities across the world. The WHO estimates that over 1 billion people experience disability which is expected to increase to 2 billion by 2030.[16] India, where eighteen percent of the world population resides, is also observing a rapid growth of the elderly population with non-communicable diseases over the years.[17] These individuals, including other vulnerable groups will be needing AT and rehabilitation services to reduce their functional limitations and difficulties and to improve their independent living, health and well-being. The recent WHO and UNICEF GReAT report estimated that more than 2.5 billion people require one or more ATs which is further extrapolated to increase to 3.5 billion by 2050, and 90% of them are in LMICs.[6] Therefore, it is overarching that the health care system address issues related to essential assistive products and their relevant services in a timely manner.

To the best of our knowledge, the current study was the first to estimate the prevalence of AT use, needs, unmet needs, and challenges to accessing AT among a population of all age groups in India, using the WHO-rATA tool. This tool was developed by the WHO GATE initiative and validated for population-based surveys by member states.[18] To date, the tool has successfully been used in countries like Pakistan, Bangladesh, Indonesia and Sierra Leone. Although the tool is designed for self-reporting, the read-aloud technique was used in which the enumerator reads the questionnaires in the local language to the participants. This method of data collection enables the team to obtain information from individuals with motor or visual difficulties also.

The current study found that 2700 (31.8%) of the participants reported at least one or more difficulties, out of which 2168 (25.5%) had some and 532 (6.3%) had both severe and total difficulties. This extrapolates to nearly 381 million people in India having some form of functional difficulties. Among various types, seeing

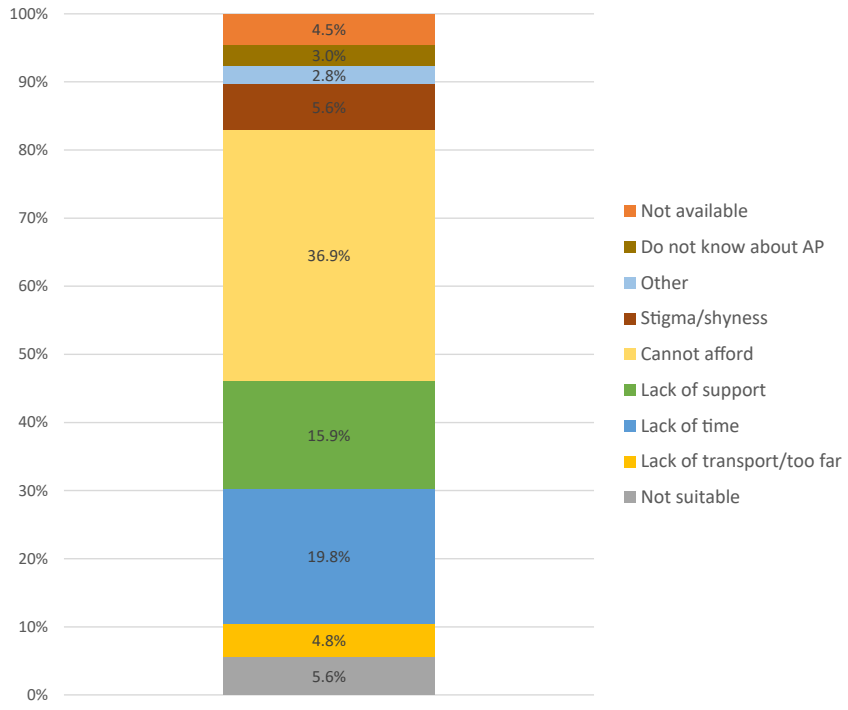

Fig. 5: Barriers to accessing assistive products among the AT users in the study sample (N = 1122).

difficulty (2256, 26.6%) was the most prevalent, which is higher than the prevalence reported by WHO GReAT (20.9%).[6] A rATA study in low-income setting in Sierra Leone and Indonesia reported that the prevalence of both severe and total difficulties ranged from 4.3% to 7.0%.[19]

The present study also estimated that the population prevalence of need for AT was 24.5% which extrapolates to nearly 294 million people in India requiring AT for their functioning. This observation indicates that not all people with difficulties express a need for assistive technology when compared with the total estimated difficulties. However, the AT need in the current study is within the range reported by WHO-GReAT (9.9%–68.9%).[6] Furthermore, the current study estimates that 75 million (6.3%) people in India have severe or total functional difficulties who would require APs on priority.

This study also estimated that the population prevalence of AT use was 19.9%, and persons with visual, locomotor and self-care difficulties reported higher usage. This figure is consistent with the GReAT (range: 2.9%–68%). Similar studies from Bangladesh and Pakistan demonstrated that AT usage is higher for mobility than for sensory and cognitive difficulties with a higher usage among males. The sex wise usage was reversed in India, but not statically significant.[20,21] Among developing nations, AT usage ranged from 7.2% in Pakistan to 11% in Bangladesh which is much lower than that of India (Table 4).

The study also identified that female, elderly, and rural residents had a significantly higher unmet need.

Country/Region	Year	Sample size	Unmet need	Met need	Total need	Usage
Western Guatemala[22]	2021	3050	17.1% (14.7–19.8)	3.2% (2.9–3.4)	20.3% (17.6–23.2)	7.4% (5.9–9.3)
Bangladesh[23]	2021	11,187	51.0%	1.0%	52.0%	11.0%
Sierra Leone[19]	2019	2076	-	-	40.1%	14.9%
Indonesia[19]	2019	2046	17.5%	-	73.0%	47.4%
Pakistan[21]	2021	62,723	13.1%	-	-	7.2%
GReAT report[24a]	2022	9 MIG countries	-	-	20.5% (13.4–30.6)	33.2% (15.7–65.3)
Current study	2022	8422	8.0% (7.4–8.6)	16.5%	24.5% (23.5–25.4)	19.9% (19.0–20.7)

[a]Medium-income countries only.

Table 4: Results of rapid assessment technology assessment studies in other countries and India.

The sample prevalence of unmet need for AT was 9.6% (823) with a higher prevalence among females, and the estimated population prevalence was 8.0% (95% CI: 7.43–8.60). This indicates that approximately 96 million people who require AT are not able to access them in India. The unmet need among persons with severe difficulties is estimated to be 52.3% which means that one out of two such individuals cannot access the AT that they need. The findings of the study are generally consistent with current estimates of unmet needs for AT.[3,25–28] The results also show that the key survey indicators, such as the prevalence of need for AT, usage, and unmet needs increase with age. The unmet need reported in the present study is much lower as compared to Pakistan (13.1%, Table 4).[23] Further, the Bangladesh rATA study conducted among Rohingya population living in refugee camps, in a humanitarian setting, reported that the prevalence of unmet need as 51%2[23] (Table 4).

Among the functional difficulties, participants with communication and cognitive difficulties had lower usage of AT, and those with hearing, self-care, and cognitive difficulties had the highest unmet needs. This study suggests that several factors account for unmet needs, including the inability to afford AT, limited availability, feeling uncomfortable while using AT, and associated stigma. The most important predictors of AT usage were male sex, older age, urban residence and having any difficulty in functioning.

The present study reported that the most used APs were spectacles, canes/sticks and orthoses. Several factors may account for spectacles being the highest used products, such as a higher prevalence of seeing difficulties, wider availability of spectacles from optical shops or numerous private eyecare facilities and the current government program for presbyopia correction implemented across the country. Furthermore, the reported predominant sources for APs are private or out-of-pocket payment (67.4%), non-governmental organizations (NGOs, 2.6%) and friends or family (23.5%). The results suggest that there is a need to strengthen government programs on the provision of AT with support from various national and international agencies. Besides this, public-private partnerships would be helpful to improve access to AT along with industry involvement. In India, specialized AT services are not usually available outside major metropolitan cities, except for a smaller subset of AT services—often mobility and vision services. To address these gaps, support from Non-Government Organizations and community-led services might be necessary.

The study had some limitations. First, during the survey, it was observed that a substantial number of participants were not aware of the existing assistive products. The tool used did not capture information on knowledge or awareness. Therefore, lack of awareness is one of the barriers to obtaining precise estimations of AT needs. Second, being a sub-national survey with a small sample size, the findings may not be generalizable to the country. Third, the study did not include clinical examination, so the prevalence of impairment may be under or overestimated from the actual figure. A self-reported instrument offers a relatively simple means to understand AT needs and provision, but has important limitations like social desirability bias, which may lead to over-reporting. Under-reporting might arise from a lack of knowledge about AT, or low expectations of its value. Fourth, the team could not rule out whether the devices provided were clinically appropriate and personalized fit which is important for adoption and consistent use. The study also did not investigate the cause of difficulties though it was important from medical management perspective. Fifth, the comparison of AT indicators among various surveys conducted in other countries may not be appropriate, although we used the same rATA tool for the survey, there might be variations in the methods of the analysis and definitions being used. Sixth, the estimation of 95% CI was directly based on the observed proportions of the subnational sample, it may not reflect the district level estimates of the AT parameters.

Open research practices in assistive technology

There are few surveys related to assistive technology, such as Rapid Assistive Technology Assessment being conducted in the WHO member states. As of today, data-sharing policies are not yet standard practice for AT research though there is significant global attention in the research environment and scholars recently. The database of many such surveys is not made publicly available to many researchers, academicians, and stakeholders. For example, many member states of the WHO have conducted studies to understand the various AT related indicators, but country-specific datasets are not freely available to wider audiences for their benefit. Some disciplines or publicly funded research in general are more open to sharing data, for instance, climate sciences data, where large open data repositories are present. Although the presence of financial barriers, institutional and technological issues, and confidentiality are some constraints in the research community, research data for AT should be open to increasing the visibility of the study. There is a need for widespread adoption of open research practices as far as AT studies are concerned and the creation of a standard repository-national or international. Evidence shows that open research practices (open data, open access, open practices, and open collaboration that follow the FAIR (Findable, Accessible, Interoperable, Reuse) principles not only lead to increasing in citations and visibility, potential collaborators, media attention, job and funding opportunities but also improves research quality, efficiency, and credibility of research outputs.[29–31] Furthermore, submitting research materials, including

databases, to a repository ensures the preservation and re-use of the data in the future both for self-access and for other researchers. Therefore, open research practices bring substantial benefits to researchers compared to traditional closed research practices. Open data policies also help the detection of misrepresentation and inaccuracies and facilitate reproducibility testing and meta-analyses. It is important to encourage authors to share research data related to assistive technologies given the current emerging digital platforms.

The science of assistive technology is one of the important disciplines and has received considerable attention in the healthcare environment worldwide in the recent past. It is well known that PwDs, the elderly and persons with chronic health conditions require AT to improve their functioning and daily living activities. The present novel study from India is a population based cross-sectional study conducted using online data collection tool from individuals of all ages regardless of their health status and AT usage. The findings indicate that the need for AT in the country is high among the study participants, the highest being for participants with seeing difficulties than other any other type of difficulties. The unmet needs are higher among females, the elderly and those residing in rural areas and suffering from serious difficulties. The majority of AT users spends their own money to obtain the required AT. Financial constraints, poor availability of AT, discomfort while using products and stigma associated ATs are few common barriers suggested by participants. There is a need for developing an appropriate strategy to address these various issues. The results also would be instrumental for planning and developing a country specific APL list and national AT policy.

Contributors

SSS, MS, KJ, and KA were responsible for the study planning and the study design, definition of intellectual content, and literature search. SSS, MS, JKP, CSD, and SSD were responsible for data acquisition from their respective area. SSS, SM, and KR were responsible for cleaning and statistical analysis. SSS and MS prepared the first draft of the manuscript. KJ and KA made suggestions to improve the draft. VP and TJS helped in administrative approval and data acquisition. All authors listed met authorship criteria, reviewed the manuscript before finalization, and had full access to the data. SSS is the principal investigator and guarantor.

Data sharing statement

The present study was outcome of the collaborative work of various public health institutions located in each selected zone of the country. The interview questionnaire used for data collection can be accessed from https://www.who.int/publications/i/item/WHO-MHP-HPS-ATM-2021.1. Data used in this paper (tables, figures, graphs, and related files) can be requested after communication with the corresponding author. Data sharing agreement will need to be signed between the funding agency or chief investigator and the requestor.

Declaration of interests

The research is non-commercial and the authors have not declared any specific grant for this research. The research is being conducted in the interest of public health and data collection was done by partner institutions located in each area. The authors declare no conflict of interest. The views and conclusions expressed in the work are results of a subnational survey India, and are solely those of authors, not necessarily represent the opinions or policy and decisions of any government or any other agencies.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lansea.2023.100213.

References

1 World Health Organization. *Priority assistive products list*. 2017.
2 World Health Organization. *Assistive technology, key facts*. Geneva. 2018.
3 Tebbutt E, Brodmann R, Borg J, MacLachlan M, Khasnabis C, Horvath R. Assistive products and the sustainable development goals (SDGs). *Glob Health*; 2016 [cited 2018 Jan 26];12(1):79. Available from: http://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-016-0220-6.
4 Kisanga SE, Kisanga DH. The role of assistive technology devices in fostering the participation and learning of students with visual impairment in higher education institutions in Tanzania. *Disabil Rehabil Assist Technol*. 2020 [cited 2022 Feb 17];17(7):791–800. Available from: http://www.ncbi.nlm.nih.gov/pubmed/32951491.
5 Ben Mortenson W, Demers L, Fuhrer MJ, et al. Effects of a caregiver-inclusive assistive technology intervention: a randomized controlled trial. *BMC Geriatr*. 2018;18(1):97.
6 World Health Organization. Global report on assistive technology (GReAT) launch [Internet] [cited 2022 Aug 2]. Available from: https://www.who.int/news-room/events/detail/2022/05/16/default-calendar/global-report-on-assistive-technology-launch; 2022.
7 World Economic Forum. Closing the disability inclusion gap: business leadership | World Economic Forum [Internet] [cited 2022 Oct 22]. Available from: https://www.weforum.org/impact/disability-inclusion/; 2022.
8 WHO. *Seventy-first World Health Assembly (WHA71.8) agenda item 12.5: improving access to assistive technology for everyone, everywhere* 2016:5–7.
9 The United Nation. United Nation sustainable development goal, leave no one behind [Internet] [cited 2021 Jul 6]. Available from: https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind; 2021.
10 Saikia N, Bora JK, Jasilionis D, Shkolnikov VM. Disability divides in India: evidence from the 2011 census. *PLoS One*. 2016 [cited 2022 Feb 17];11(8):e0159809. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0159809.
11 The World Bank. People with disability in India, from commitments to outcome [Internet] Chapter 4: Education. [cited 2019 Jun 6]. Available from: http://web.worldbank.org/archive/website01291/WEB/0__CO-43.HTM; 2019.
12 Ramadass S, Rai SK, Gupta SK, et al. Prevalence of disability and its association with sociodemographic factors and quality of life in India: a systematic review. *J Fam Med Prim Care*. 2018 [cited 2019 May 20];7(6):1177–1184. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30613494.
13 Karki J, Rushton S, Bhattarai S, De Witte L. Access to assistive technology for persons with disabilities: a critical review from Nepal, India and Bangladesh. Available from: https://www.tandfonline.com/action/journalInformation?journalCode=iidt20; 2021.
14 Zhang W, Eide AH, Pryor W, Khasnabis C, Borg J. Measuring self-reported access to assistive technology using the WHO rapid assistive technology assessment (rATA) questionnaire: protocol for a multi-country study. *Int J Environ Res Public Health*. 2021 [cited 2022 Apr 5];18(24):13336. Available from: https://www.mdpi.com/1660-4601/18/24/13336/htm.
15 Weighting survey data: methods and advantages - GeoPoll [Internet] [cited 2022 Nov 7]. Available from: https://www.geopoll.com/blog/weighting-survey-data-raking-cell-weighting/; 2022.

16 World Health Organization. *Summary world report on disability*. WHO; 2011:1–24.
17 India Population. Worldometer [Internet]. [cited 2022 Feb 17]. Available from: https://www.worldometers.info/world-population/india-population/; 2022.
18 World Health Organization (WHO). Rapid assistive technology assessment tool (rATA) [Internet] [cited 2022 Oct 22]. Available from: https://www.who.int/publications/i/item/WHO-MHP-HPS-ATM-2021.1; 2022.
19 Ossul-Vermehren I, Carew MT, Walker J. Assistive technology in urban low-income communities in Sierra Leone and Indonesia: rapid assistive technology assessment (rATA) survey results [Internet] [cited 2022 Oct 27]. Available from: https://at2030.org/assistive-technology-in-urban-low-income-communities-in-sierra-leone-and-indonesia/; 2022.
20 Pryor W, Nguyen L, Islam QN, Jalal FA, Marella M. Unmet needs and use of assistive products in two districts of Bangladesh: findings from a household survey. *Int J Environ Res Public Health*. 2018;15(12):2901.
21 World Health Organization. *Rapid assistive technology assessment (rATA): baseline survey in Pakistan*. WHO. 2021.
22 Boggs D, Kester A, Cordon A, Naber J, Rota G, Polack S. Measuring access to assistive technology using the WHO rapid assistive technology assessment (rATA) questionnaire in Guatemala: results from a population-based survey [cited 2023 Jan 27] *Disabil CBR Incl Dev*. 2022;33(1):108–130. Available from: http://dcidj.org//articles/10.47985/dcidj.573/.
23 *Bangladesh rapid assistive technology assessment (rATA), May 2021 - Bangladesh* [cited 2022 Oct 27]. ReliefWeb [Internet]; 2021. Available from: https://reliefweb.int/report/bangladesh/bangladesh-rapid-assistive-technology-assessment-rata-may-2021.
24 World Health Organization. *Global report on assistive technology (GReAT)*. 2022.
25 Samant D, Matter R, Harniss M. Realizing the potential of accessible ICTs in developing countries. *Disabil Rehabil Assist Technol*. 2013;8(1):11–20.
26 Rios A, Miguel Cruz A, Guarín MR, Caycedo Villarraga PS. What factors are associated with the provision of assistive technologies: the Bogotá D.C. case. *Disabil Rehabil Assist Technol*. 2014;9(5):432–444.
27 Okonji PE, Ogwezzy DC. Awareness and barriers to adoption of assistive technologies among visually impaired people in Nigeria. *Assist Technol*. 2019;31(4):209–219.
28 Mactaggart I, Kuper H, Murthy GVS, Sagar J, Oye J, Polack S. Assessing health and rehabilitation needs of people with disabilities in Cameroon and India. *Disabil Rehabil*. 2016 [cited 2018 Mar 20];38(18):1757–1764. Available from: http://www.tandfonline.com/doi/full/10.3109/09638288.2015.1107765.
29 Wiley. *Open research isn't just the future of research communications; it's the here and now* [cited 2023 Jan 24]. Wiley Author Services [Internet]; 2023. Available from: https://authorservices.wiley.com/open-research/index.html.
30 Peffers MJ, Webster LC. Open research—what is it, and how can equine veterinary journal's authors engage with open research initiatives? *Equine Vet J*. 2022;54(2):197–200.
31 Wilkinson MD, Dumontier M, Aalbersberg IJ, et al. The FAIR guiding principles for scientific data management and stewardship. *Sci Data*. 2016 [cited 2023 Jan 27];3(1):1–9. Available from: https://www.nature.com/articles/sdata201618.