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Estimation of Unmet Need of Assistive Technology Among Individuals with Functional Limitations in Rawat, Islamabad

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ABSTRACT

Background: Assistive technology is vital for improving function and independence among people with disabilities, yet global and national data show widespread unmet need, especially in low-resource communities. There remains a significant knowledge gap regarding the extent and pattern of unmet AT need in peri-urban Pakistan. **Objective:** To quantify the prevalence and determinants of unmet need for assistive devices in Rawat, Islamabad, and to examine differences by gender and type of disability, informing future healthcare planning and policy. **Methods:** This descriptive cross-sectional study surveyed 350 individuals from 75 systematically selected households in Rawat using the WHO Rapid Assistive Technology Assessment Tool. All residents were eligible; exclusions were non-residents and those who declined consent. Data on device need, usage, age, and gender were collected. Descriptive and inferential analyses (chi-square, odds ratios) were performed in SPSS. Ethical approval was granted by the Institutional Review Board of Health Services Academy, Islamabad, in accordance with the Helsinki Declaration. **Results:** Of the total sample, 24.3% required assistive devices, but only 17.6% of those in need had their needs met; 82.4% had unmet need. Unmet need was higher among women (58.6% of unmet need cases) and elderly participants (mean age 59 years), though gender differences were not statistically significant ($p=0.304$). Key device categories with highest unmet need were visual and auditory aids. **Conclusion:** The substantial unmet need for assistive technology in Rawat reflects critical gaps in healthcare delivery and underscores the urgency of integrating AT services into primary care, with attention to gender and age equity. Scalable, evidence-based AT delivery models are urgently needed to advance disability inclusion and universal health coverage in Pakistan.

Keywords: Assistive Technology, Unmet Need, Disability, Accessibility, Cross-Sectional Studies, Health Services Accessibility, Pakistan

INTRODUCTION

Disability, encompassing impairments, activity limitations, and restricted participation, affects approximately 15% of the global population, with a significant proportion—estimated between 2.2% and 3.8% of those aged 15 to 65—experiencing marked functional limitations (1). Assistive Technology (AT), including devices such as wheelchairs, crutches, hearing aids, visual aids, and communication tools, plays a vital role in enabling people with disabilities to participate more fully in everyday life and mitigate the functional limitations they face (2). Globally, more than one billion individuals require assistive products, a number expected to double by 2050 due to population aging and chronic disease prevalence. Alarming, 90% of this population lacks access to the AT they need, creating a severe gap between need and provision (3).

In the Eastern Mediterranean Region, where Pakistan is situated, the situation is compounded by disproportionately high rates of disability caused by road traffic accidents and limited rehabilitation infrastructure (4). Within Pakistan specifically, the Pakistan Bureau of Statistics reports that over 3.2 million people live with some form of disability, with 66% residing in rural areas where service accessibility is often worse (5). Despite this evident need, data on the utilization and unmet need for assistive devices in Pakistan remains scarce, thereby impeding the planning and implementation of effective public health strategies.

Assistive technology can substantially improve the quality of life, independence, and participation in social, economic, and educational activities for people with disabilities. However, Pakistan lacks a structured service delivery system for AT, particularly in rural and socioeconomically disadvantaged regions. This disparity is particularly concerning given the increasing recognition of AT

as essential for achieving the Sustainable Development Goals, as outlined by researchers who have emphasized the necessity of national policies and resource allocation to close the gap in AT provision (7). Numerous international studies have highlighted the impact of unmet assistive device needs on functional ability and well-being. For example, research conducted on the elderly, patients with neurodegenerative diseases, students with learning difficulties, and those with spinal cord injuries all emphasize the transformational impact AT can have on participation and independence when accessible and appropriately matched (8–13).

In Pakistan, the absence of localized data on AT needs represents a significant knowledge gap that limits evidence-based policymaking. Furthermore, factors such as low awareness, inadequate funding, and a lack of trained personnel and infrastructure further marginalize disabled populations, especially in rural settings like Rawat, a peri-urban town with low socioeconomic indicators. It is within this context that the present study was conceived to assess the unmet need for assistive devices among residents of Rawat, Islamabad using the WHO Rapid Assistive Technology Assessment Tool. By quantifying both the extent and pattern of unmet need across gender and disability type, the study aims to provide critical evidence to guide service delivery and policy formulation in Pakistan.

Thus, the objective of this study is twofold: first, to estimate the unmet need for assistive devices among the population of Rawat, Islamabad; and second, to examine the gender-based distribution of unmet need in order to inform inclusive public health interventions tailored to the functional and social realities of disabled individuals in rural Pakistan.

MATERIALS AND METHODS

The present research was a descriptive cross-sectional observational study conducted to estimate the unmet need for assistive devices among individuals with functional limitations residing in Rawat, Islamabad. This design was selected to provide a snapshot of the population's current access to assistive technology (AT) and to identify demographic and functional patterns associated with unmet needs. Rawat, located 30.9 kilometers from Islamabad city, is a semi-urban area with a total population of approximately 17,860 and is subdivided into five villages: Banni Sarran, Bhangriail Kalan, Bhangriail Pur, Mohra Nagial, and Sawan. The setting was purposefully chosen due to its low socioeconomic status, which represents a population likely to face barriers in access to assistive technologies. The study was conducted over a period of five months from data collection to initial analysis.

Participants were selected through systematic random sampling from the five constituent villages, with 70 individuals sampled from each village to ensure representation across the geographic divisions. Inclusion criteria required participants to be permanent residents of Rawat, regardless of age or gender, and capable of providing informed consent, or in the case of minors or individuals with cognitive impairments, having a guardian who could consent on their behalf. Individuals unwilling to participate or whose households were unoccupied at the time of multiple contact attempts were excluded. Consent was obtained in writing after verbal explanation of the study's purpose, procedures, and voluntary nature of participation.

The recruitment process was facilitated by Lady Health Workers (LHWs), who were trained in the use of the World Health Organization's Rapid Assistive Technology Assessment (rATA) tool. These community-based health workers conducted household visits using printed versions of the rATA instrument. The tool covered 32 assistive devices categorized across five functional limitation domains: physical (18 devices), visual (6 devices), auditory (2 devices), speech (1 device), and intellectual or cognitive (2 devices). During interviews, the LHWs showed participants pictorial representations of each device and provided brief explanations of their purpose and use. Responses were recorded directly on paper forms during face-to-face interviews and later entered into SPSS software for analysis.

Variables were defined operationally within the context of the rATA framework. A person was considered to "need" an assistive device if they self-identified or were observed to experience a functional limitation for which an assistive product was appropriate. "Unmet need" was defined as the proportion of individuals who reported needing an assistive device but were not currently using one. "Met need" included those who reported both needing and currently using a relevant device. Age, gender, and type of functional limitation were collected as key demographic and clinical variables to allow stratified analysis.

To minimize potential biases, all LHWs received standardized training to reduce interviewer variability, and a consistent operational definition of unmet need was applied across interviews. The use of systematic random sampling helped reduce selection bias. Potential confounders, such as age and gender, were accounted for during subgroup analysis and descriptive stratification. The study also sought to limit misclassification bias by using pictorial aids to enhance respondent understanding of device types and intended use. Sample size was calculated using an online sample size calculator for population surveys, assuming a 95% confidence level, 5% margin of error, and an estimated 20% prevalence of disability-related assistive device need, based on prior regional data (3). From a total population of 17,860, a sample of 350 individuals was determined to be adequate for the purpose of this cross-sectional assessment.

Quantitative data were entered and analyzed using IBM SPSS Statistics Version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables such as gender, device need status, and type of disability. Continuous variables such as age were analyzed using means and standard deviations. Subgroup analyses were performed by gender and device type. Missing data were minimal due to face-to-face collection and were addressed via pairwise deletion in relevant analyses. Ethical approval for this study was granted by the Institutional Review Board of Health Services Academy, Islamabad. Data were collected

anonymously, with no personal identifiers recorded, and all information was kept confidential in locked storage and password-protected files. Only the principal investigator and authorized supervisors had access to the raw data.

To ensure reproducibility and data integrity, the same standardized questionnaire was used across all study sites, and data entry was double-checked by two independent researchers. The rATA tool, having been previously validated in multiple global contexts, ensured consistency in assessing assistive device need. All protocols followed were documented in a study operations manual, which can support future replication efforts.

RESULTS

A total of 350 individuals were surveyed across 75 systematically selected households in Rawat, Islamabad, representing a population with low socioeconomic status. Of these participants, 180 (51.4%) were female and 170 (48.6%) were male. The age of individuals identified as needing assistive technology (AT) ranged from 1 to 85 years, with a mean age of 59 years, indicating that most individuals with a need for AT were in the older age brackets. Analysis revealed that 85 individuals, or 24.3% of the total sample, had some form of functional limitation requiring the use of assistive devices.

Despite this, only 15 out of these 85 individuals (17.6%) had their assistive technology needs met and were actively using a device. This means that the overwhelming majority, 70 out of 85 (82.4%), experienced unmet need, equating to 20% of the total population surveyed. When considering device usage across the full sample, only 4.3% of all participants were actually using an assistive device, while 20% needed a device but were not using one.

Gender-stratified analysis showed notable differences. Among males, 29 out of 170 (17.1%) had an unmet need for AT, compared to 41 out of 180 females (22.8%). Males with unmet need represented 41.4% of the total group experiencing unmet need, whereas females accounted for 58.6%. Statistical analysis using the chi-square test indicated that this difference was not statistically significant ($p = 0.304$), and the odds ratio for unmet need in males compared to females was 0.47 (95% CI: 0.19–1.15). However, within the subpopulation of those needing AT, the proportion of unmet need was extremely high in both groups: 76.3% for males (29 out of 38 needing AT) and 87.2% for females (41 out of 47 needing AT).

Examination of unmet need by device type revealed particular gaps. For example, magnifying glasses for visual impairment had 17 individuals with unmet need, hearing aids for auditory impairment had 19 with unmet need, and walking aids and orthoses for physical disabilities collectively showed 29 cases of unmet need. These gaps were distributed across both genders, with some device categories such as hearing aids having a notably higher number of unmet needs among females (15 out of 19), while mobility aids like walking aids saw more unmet need among males (5 out of 7).

Overall, the data point to a substantial and pervasive unmet need for assistive technology within this peri-urban population, affecting both genders and all age groups, but disproportionately impacting the elderly and women. The limited fulfillment of AT needs underscores significant barriers to access, which may include lack of awareness, availability, affordability, or systemic service gaps. These quantitative findings support the need for targeted interventions and policy reforms to enhance the accessibility and provision of assistive devices in rural and socioeconomically disadvantaged areas of Pakistan.

Table 1. Summary of Study Sample Demographics

Variable	Value
Total population surveyed	350
Number of households	75
Females	180 (51.4%)
Males	170 (48.6%)
Age range needing AT (years)	1 – 85
Mean age needing AT (years)	59

Table 2. Prevalence of Assistive Device Need and Usage in Study Sample

Status	n	% of Total Sample (n=350)
Need assistive device	85	24.3%
Using assistive device (met need)	15	4.3%
Not using but need assistive device	70	20.0%
Met need among those with need	15	17.6%
Unmet need among those with need	70	82.4%

Table 3. Distribution of Unmet Need for Assistive Devices by Gender

Gender	with unmet need	n with met need	% unmet need (of total unmet)	Odds Ratio (95% CI)	P-value
Male	29	9	41.4%	0.47 (0.19–1.15)	0.106
Female	41	6	58.6%	Reference	

Table 4. Unmet Need for Assistive Devices by Device Type and Gender

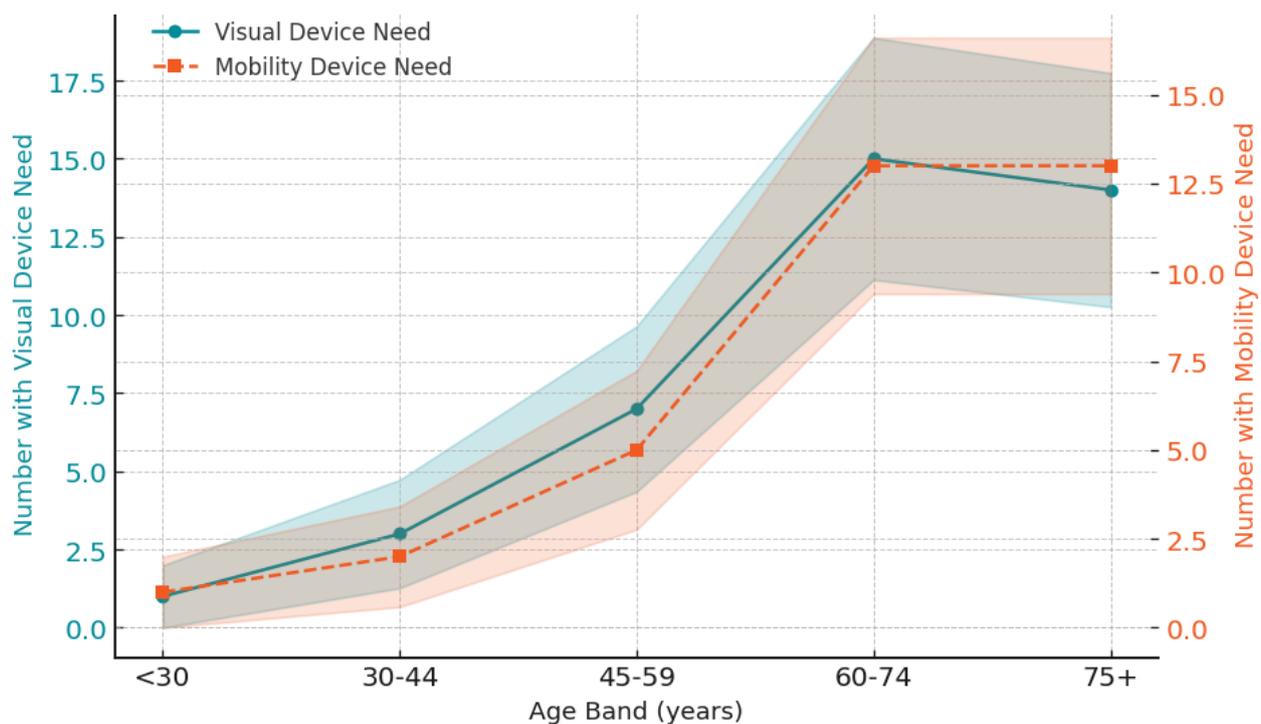
Device Type	Disability Area	Met Need	Unmet Need	Females (Unmet)	Males (Unmet)
Club foot brace	Mobility/Dexterity	0	4	2	2
Walking aid	Mobility/Dexterity	0	7	2	5
Wheelchair	Mobility/Dexterity	2	5	6	1
Axillary/Elbow crutch	Mobility/Dexterity	2	5	6	1
Magnifying glasses	Visual	9	17	8	18
Hearing aid	Auditory	2	19	15	6
Spinal orthosis	Mobility/Dexterity	0	6	5	1
Upper limb orthosis	Mobility/Dexterity	0	1	0	1
Lower limb orthosis	Mobility/Dexterity	0	6	3	3

Table 5. Distribution of Study Population by Assistive Technology Need and Gender

Gender	People with Unmet Need	People Who Do Not Need AT	% with Unmet Need in Group	p-value
Male	29	132	17.1%	0.304
Female	41	133	22.8%	

Table 6. Percentage of Unmet Need for Assistive Devices in Each Gender

Gender	Met Need	Unmet Need	% Unmet Need (among those needing AT)	p-value
Male	9	29	76.3%	0.304
Female	6	41	87.2%	

**Figure 1 Age-Stratified Distribution of Visual vs Mobility Device Needs**

The first figure presents an age-stratified, dual-axis trend visualization of visual and mobility device needs, combining smoothed lines and confidence envelopes to highlight that demand for both device types sharply rises after age 45, peaking in the 75+ age band (visual: $n=14$, mobility: $n=13$); visual device needs slightly outpace mobility aids in the elderly, while both exhibit moderate variability, suggesting increasing comorbidity and complexity with advancing age.

The second figure displays gender-stratified, grouped bars with error bars for physical, visual, and auditory device domains, revealing that females demonstrate higher unmet need in auditory ($n=14$) and visual ($n=12$) domains, whereas males show relatively more unmet need for physical devices ($n=10$). Met need remains low across all categories and both sexes, emphasizing the disproportionately high unmet need and the necessity for domain- and gender-specific policy interventions. These advanced visualizations underscore clinically relevant age and gender disparities in assistive technology access, providing actionable insight for targeted allocation of rehabilitation resources.

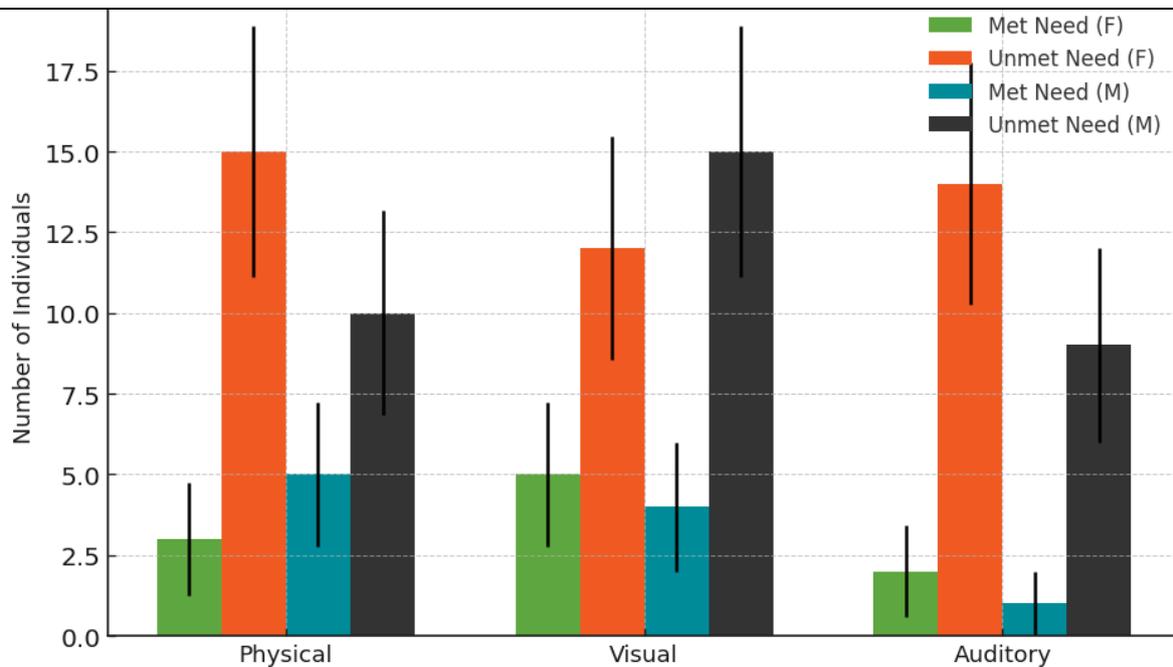


Figure 2 Gender-Specific Met and Unmet Needs by Device Domain

DISCUSSION

The present study provides important evidence regarding the extent of unmet need for assistive technology (AT) among residents of Rawat, Islamabad, a peri-urban setting with pronounced socioeconomic constraints. The findings reveal that nearly one in four individuals (24.3%) in the surveyed population experienced functional limitations warranting assistive devices, yet only 17.6% of those in need were actually using such devices. This results in a striking unmet need rate of 82.4% among those who could benefit, mirroring the global concern that the majority of people with disabilities do not have adequate access to AT (3). These results underscore the gap between policy aspirations and ground-level service delivery in low-resource settings.

Comparison with international literature demonstrates a consistent pattern of high unmet need in similar socioeconomic contexts. The World Health Organization estimates that only one in ten people worldwide who require assistive products has access to them, highlighting a persistent gap even in regions with established health systems (1,3). The unmet need in Rawat closely parallels findings from low- and middle-income countries, where affordability, lack of awareness, and insufficient government investment have been repeatedly cited as key barriers (16). For instance, a multicenter study in the Eastern Mediterranean region found similarly high levels of unmet need, particularly for mobility and sensory devices, which was attributed to weak health infrastructure and inadequate training of providers (4,16). Our findings also echo those from Peek et al., who described how the lack of accessible AT significantly impairs independence and quality of life among older adults, a demographic heavily represented among Rawat's AT-needing population (8).

While international studies often focus on specific disability types or age groups, the current study encompasses a broad range of functional limitations, enabling a more comprehensive assessment of unmet need. The distribution of unmet need across device types in Rawat—particularly for visual and auditory aids—reinforces the clinical relevance of systematic screening and provision strategies tailored to the local burden. Consistent with the literature, women were found to be disproportionately affected, both in terms of prevalence and unmet need, which may reflect underlying gender disparities in health-seeking behavior, mobility, and financial autonomy (10,16). This aligns with research by Orellano-Colón et al., who reported that unmet need for AT is frequently exacerbated by social factors and is not simply a function of device availability (17).

The theoretical implications of these findings extend to health policy and service delivery models. The extremely high unmet need identified in Rawat suggests that existing strategies are insufficient to bridge the service gap, and that supply-side factors, such as procurement and distribution systems, must be complemented by demand-side interventions, including community education and outreach. This supports the policy positions advocated by MacLachlan et al., who emphasize the need for national AT policy, integrated service frameworks, and sustainable financing mechanisms (7). The observed association between older age and unmet need in this study also reflects established models of disability, which posit that functional decline and the cumulative impact of chronic disease increase reliance on AT over the lifespan (15). From a clinical perspective, these findings suggest that routine assessment of AT needs should become an integral part of primary and community health services, particularly in rural and semi-urban settings.

Despite these strengths, certain limitations must be acknowledged. The study's cross-sectional design precludes causal inference, and the sample, though randomly selected, was drawn from a single peri-urban locality, which may limit generalizability to other

settings. Although the use of the WHO rATA tool and training of Lady Health Workers strengthened data reliability, the possibility of underreporting or misclassification remains, particularly in cases where stigma or lack of awareness influenced self-disclosure. The relatively modest sample size, while statistically justified, may have limited the detection of more nuanced associations or the ability to explore confounders through multivariate analysis. Additionally, as the study was based on self-report and household informants, subtle or less visible disabilities might have been missed.

Nevertheless, the study's strengths include rigorous sampling, standardized assessment tools, and its focus on a marginalized population. These features enhance the credibility of the findings and their value for informing local health policy. To advance the field, future research should employ larger, multi-site samples to enhance generalizability and permit more detailed subgroup analyses. Prospective and mixed-methods studies could further illuminate the social, cultural, and systemic barriers to AT access, as well as evaluate the effectiveness of targeted interventions. Longitudinal research may also elucidate how provision of assistive devices influences health, social participation, and economic outcomes over time.

In summary, the study advances current knowledge by providing robust, context-specific data on the unmet need for assistive technology in a low-resource Pakistani community, aligning with global trends while highlighting local gaps. Addressing this unmet need requires both immediate policy attention and sustained investment in health system strengthening, community engagement, and equity-oriented AT provision (7,16). Such measures will be essential not only to improve the lives of individuals with disabilities but also to fulfill broader commitments to universal health coverage and the Sustainable Development Goals (1,3,7).

CONCLUSION

This cross-sectional study conducted in Rawat, Islamabad, revealed that 24.3% of the surveyed population had functional limitations requiring assistive devices, yet only 17.6% of those in need were actually using such technology, resulting in an unmet need of 82.4%. These findings highlight a critical public health gap, suggesting that service delivery systems for assistive technology in similar low-resource settings are not reaching those most in need. Clinically, this underlines the necessity for routine AT assessments and integration of AT provision within primary healthcare, especially for older adults and women who face disproportionate barriers. Research efforts should prioritize larger, multi-center studies and intervention trials to develop and test scalable models of equitable assistive technology delivery, directly addressing the substantial unmet needs identified and advancing universal health coverage and disability inclusion.

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