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ORIGINAL ARTICLE

Awareness, Utilization and Barriers in Accessing Assistive Technology among Patients Attending Low Vision Rehabilitation Center

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ABSTRACT

Background: The UN estimates that more than one billion persons require one or more assistive devices to maintain their functioning.
Aim: To determine the knowledge, adoption and utilization of assistive devices among low vision patients.
methods: This cross-sectional study was conducted from September 2023 to December 2023 and consists of 130 subjects's visits to the low vision rehabilitation centre of Al Shifa Trust Eye Hospital. The questionnaire was filled out by asking the patients enlisted questions. The frequency and percentages were generated for the qualitative variables, whereas the mean and standard deviation were generated for the quantitative variables.
Results: The average age was 27.82 ± 8.65 (range 18- 50 years). By taking the mean value as a cut-off point, 58.5% of patients had poor awareness, whereas only 41.5% had good awareness of assistive technology. 75 patients Out of 130 were using some kind of assistive technology. Out of these 75, 63 patients got benefit from their prescribed devices, but 12 participants could not get any benefit. Lack of awareness and lack of training were the most frequently reported barriers in the study.
Conclusion: The awareness and utilisation of assistive devices among low-vision patients is relatively low. Different strategies should be introduced to increase awareness and utilisation and to overcome the major barriers.
Keywords: Low vision, Assistive technology, Artificial Intelligence

INTRODUCTION

The 10th revision of the WHO International Statistical Classification of Diseases, Injuries, and Causes of Death defines "low vision" as having visual acuity in the better eye less than 6/18 but equal to or better than 3/60, or a corresponding visual field loss to less than 20°, with the best possible correction, provided that the person is still able to use their vision for task planning and execution[1].

After heart disease and arthritis, vision loss has been rated third. The major causes of vision disability are uncorrected refractive error (43%), and cataract (33%). The most common eye diseases or abnormalities causing visual impairment include macular degeneration, retinitis pigmentosa, ocular trauma, glaucoma, and corneal opacity[2].

Globally, 1 billion individuals are affected by uncorrected refractive error (88.4 million), cataracts (94 million), glaucoma (7.7 million), corneal opacities (4.2 million), diabetic retinopathy (3.9 million), and trachoma (2 million), as well as near vision impairment caused by uncorrected presbyopia (826 million)[3].

The standardized prevalence of low vision in Pakistan is 1.7%, and the total blindness is 0.2%. In Pakistan, estimated 7,27,000 adults have low vision. The most common causes of low vision in Pakistan are uncorrected refractive error, cataracts, corneal opacity, and retinal abnormalities[4].

As of 2017, 1.09 million people in Pakistan had severe vision loss, and 6.79 million people had moderate vision loss. Presbyopia was also found to be the most common ocular condition contributing to near vision impairment that affected an estimated 12.64 million individuals[5].

Vision loss can lower quality of life in many ways, such as making it harder to read, limiting one's ability to engage in various activities and jobs, and limiting one's mobility in both the physical and practical (like operating a vehicle) aspects. Therefore, such people tend to socialize less[6].

In the group of 18-55 years of age, adults generally experience more hindrance in perusing the goals of life, such as supporting life or making a career. Visually impaired people are more likely to develop mental health problems and also face economic hardships such as the cost of treatment, extra facilities, special education, and services[7].

There is a wide range of devices to help people carry out their activities of daily life. Some devices that are optical or non-optical are very economical and suitable, while other devices that are electronic or digital are relatively costly and very complex to use; they require training before using them.

The World Health Organization defined it earlier in 2011 as “any equipment, product or tool – bought off the shelf, modified or customized – used to enhance the abilities of persons with disabilities.” This definition has been derived from the International Standard Organization (ISO) meaning”[8].

Thereafter, in 2016, the ICF-WHO re- defines and brings together the term ‘Health Technology’ into Assistive Technology (AT) and Assistive Products (AP)[9,10].

Visual appliances or vision therapy aids provides support to a low vision person through enlargements, contrasting, and increasing light densities – among other ways[11]. Assistive technology is used for low-vision patients whose quality of life cannot be improved by medication or surgery[12]. Patient satisfaction with the service provided and the number of individuals who use them have only rarely been evaluated[13].

The remaining visual abilities of a person with limited vision are improved by vision aids that improve eyesight through various means, such as magnification, contrast enhancement, and improved illumination. Low vision rehabilitation clinics frequently prescribe such visual aids[11].

There is a wide range of assistive technology available, starting from simple, low-cost things like large print books to high end, very expensive things like refreshable braille displays[14]. People with visual impairments also frequently use applications specifically designed for them for daily activities[15].

Mobility aids are designed to support various aspects of mobility, such as obstacle avoidance, way finding, and orientation. Long canes and other vision-substituted mobility aids are frequently utilized by those who are blind or severely visually impaired. Electronic visual aids powered by computers, the Internet, and artificial intelligence (AI) algorithms like voiceover, talkback, Seeing AI, Be my eyes, Tap Tap See, etc. are progressively altering the market environment for assistive devices[11].

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Object recognition and detection helps with a variety of visual tasks, such as mobility. For instance, an Orcam is a camera-based gadget that has the ability to recognize money, faces, text, and color, among other functionalities[16].

Mobile applications for visual support have grown in popularity over the past years as cell phones have become more necessary, occasionally taking the place of traditional assistive equipment. Patients and rehabilitation clinicians may need thorough information on the availability and capabilities of visual support apps, as there are hundreds already available on the market and more to come[17]. These assistive technologies are comparatively recent, and they typically use computer vision algorithms[16].

Numerous studies have demonstrated the importance of assistive technology that helps people with visual impairments to perform better in daily tasks, improve social interaction, live independently, and have higher self-esteem, determination, and quality of life[18].

With the help of assistive technology, elderly individuals can stay in their homes and postpone or avoid the need for long-term care[19]. Patients and doctors are becoming more interested in portable electronic low-vision aids, and these gadgets need to be further investigated[20].

More than a billion people worldwide depend on one or more assistive technologies to operate, and by 2030 that number is expected to rise. Merely 5–10% of individuals with reduced eyesight are thought to genuinely utilize these offerings. Importantly, poor eyesight is still a problem in many nations, especially developing nations and metropolitan areas[21,22].

The most common reasons include poor public awareness, unequal distribution of health and rehabilitation services among different areas, misconceptions of low vision services, missed communication by eye care professionals, a lack of awareness among practitioners and a low rate of referrals to low vision departments. The incidence of visual impairment is rising worldwide, with poorer nations bearing a greater fraction of the burden. Although the prevalence of visual impairment and low vision is increasing, the uptake of low vision services is relatively low in developing countries. Assistive technology, either conventional or AI, helps to improve the functional capabilities of visually impaired persons. AI is the latest technology that helps the patients in their functional abilities and eases them with the difficulties faced due to conventional devices. This study aimed to provide a preliminary analysis of the awareness, utilization and barriers in using conventional and artificial intelligence tools for visually impaired persons by constructing a validated questionnaire.

The objective of the study was to access the awareness, utilization and barriers in accessing the assistive technology and to compare the awareness and utilization of conventional and artificial intelligence tools.

METHODOLOGY

A hospital-based cross-sectional study was conducted on patients attending a low vision rehabilitation center. The study was conducted in the low vision clinic of Al Shifa Trust Eye Hospital Rawalpindi. All the participants fulfilling the inclusion criteria of low vision represented by WHO were included in this study.

Fully informed consent was taken from all the subjects, and confidentiality of the patients was ensured. Data was recorded on a structured questionnaire, which consists of 4 parts: demographics, awareness, utilisation, and barriers questions.

Demographics include age, gender, occupation, education, and residency of patients. The second part consists of 7 awareness questions with suitable options. The data from this part gives the frequency of awareness of conventional and artificial intelligence tools along with the suggested methods of improving low vision care by the patients. The third part consists of six questions about the utilisation of a prescribed low vision aid.

The patients were asked about the devices they are currently using, if any, and the activity for which they are using that aid. Also, they were asked about the preferred type of low-vision devices, either conventional or AI tools. The last part of this questionnaire deals with a question about barriers, and the patients were asked to tell the barriers commonly faced by them.

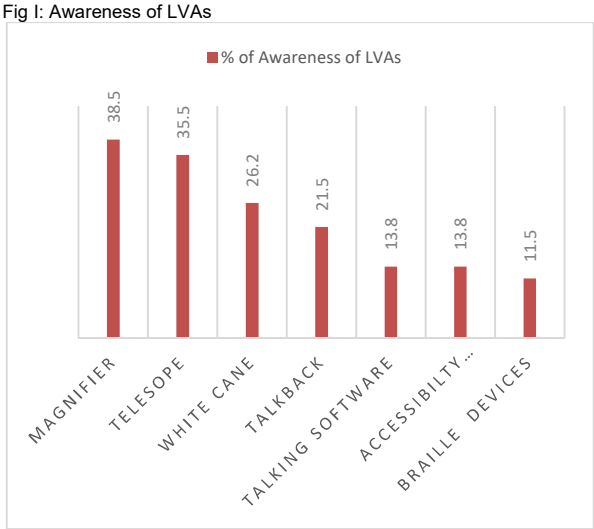
RESULTS

Descriptive Analysis: Overall, 130 low-vision patients were included in the study according to the inclusion criteria. The age range of the participants was 18-50 years with a mean of 27.82 years (SD ±8.647). Both genders were included, out of which 88[67.7%] were male participants while 42(32.3%) were females. Out of these participants, 121(93.1%) were educated, and 9(6.9%) had never attended the school. Also, 53(40.8%) were employed, 30(23.1%) were unemployed, 15(11.5%) were students, and 32(24.6%) were housewives. Out of total participants, 92 (70.8%) belong to urban areas and 38(29.2%) belong to rural areas, as shown in Table I.

Table 1: Demographic characteristics of patients

Characteristics		n	%
Age	18-25	64	49.2
	26-40	51	39.2
	>40	15	11.5
Gender	Male	88	67.7
	Female	42	32.3
Education	Educated	121	93.1
	Uneducated	9	6.9
Occupation	Employee	53	40.8
	Un employee	30	23.1
	Housewife	15	11.5
	Student	32	24.6
Residency	Urban	92	70.8
	Rural	38	29.2

Fig I: Awareness of LVAs



Out of total participants who had awareness of any kind of low vision aid, 60 participants were aware of the kind of task that LVAs can do effectively and efficiently, while 21 participants were not sure about it. The rest of 48 participants did not have any awareness about the tasks that LVAs can assist. 128(98.5%) of the total 130 participants consider the awareness of low vision tools to be important as they assist them in their daily life activities. Out of 130 participants 58 have received the prescribed low vision aid. 56 (43.1%) were using that aid while 2 (1.5%) participants were not using the prescribed aid. Following chart represents the frequency and percent of participants according to the usage of type of low vision aid. Seventy five participants out of 130 were using some kind of assistive technology. Out of these 75, 63

participants got benefit from their prescribed devices, but 12 participants could not get any benefit. The devices used by participants for different tasks are shown in the table V. 16.9% of the patients preferred conventional tools, while 12.3% preferred AI tools. 18.5% of the patients said that their preference depends on the type of task they are performing.

According to p values, lack of training is associated with education and residency, social stigma with education and high cost with gender and occupation.

Inferential analysis: A chi square test is a statistically test which is used for comparison between observed and expected results.

Table II: Awareness of low vision assistive devices among patients

Type of assistive technology	Are you aware		%age of awareness
	Yes	No	
Any Low vision aid?	81	49	**62.3**
Telescope	46	84	**35.4**
Magnifier	50	80	**38.5**
White cane	34	96	**26.2**
High power lenses	22	108	**16.9**
Braille devices	15	115	**11.5**
Any Artificial intelligence tool?	51	78	**39.2**
Closed circuit television (CCTV)	13	117	**10**
Talking software	18	112	**13.8**
Be my eyes	13	117	**10**
Jieshuo	10	120	**7.7**
Accessibility shortcuts	18	112	**13.8**
Talkback	28	102	**21.5**
Orcam	4	126	**3.1**
JAWS	12	118	**9.2**
Eloquence	9	121	**6.9**
Computer settings	4	126	**3.1**
Envision Artificial Intelligence (AI)	11	119	**8.5**
Cash reader	5	125	**3.8**

Table III: Ways of promoting awareness of low vision devices

Ways of promoting awareness of LVAs	n	%
Creating awareness among visually impaired	84	64.6
Creating public awareness	52	40
Through social media	24	18.5
Reducing cost	6	4.6
Provide training	14	10.8
Social events	18	13.8
Improving availability	5	3.8

Fig II: Utilization of different types of LVAs

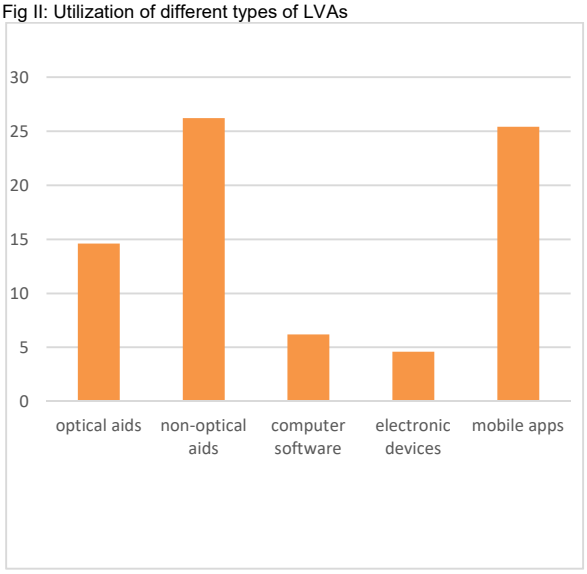


Fig III: Preferred type of LVAs

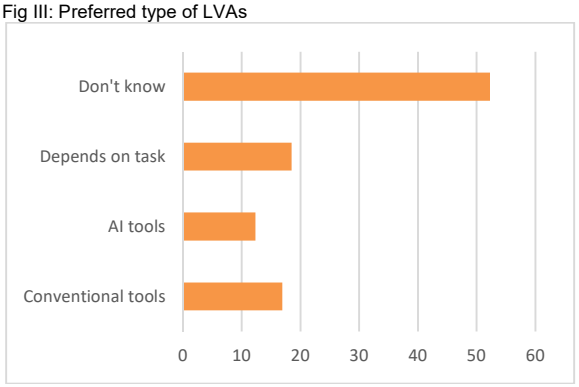


Table IV: Descriptive analysis of utilization of different low vision devices

Type of assistive technology	Do you use				
	Yes	No	No prescription	No need	% of yes
Telescope	6	54	54	16	**4.6**
Magnifier	12	48	54	15	**9.2**
White cane	30	29	54	16	**23.1**
High power lenses	4	56	54	16	**3.1**
Braille devices	11	49	54	16	**8.5**
CCTV	3	57	54	16	**2.3**
Talking software	12	48	54	16	**9.2**
Be my eyes	9	51	54	16	**6.9**
Jieshuo	10	50	54	16	**7.7**
Accessibility shortcut	13	48	53	16	**10**
Talkback	16	44	54	16	**12.3**
SARA	2	58	54	16	**1.5**
JAWS	8	52	54	16	**6.2**
Eloquence	9	51	54	16	**6.9**
Pebble	2	58	54	16	**1.5**
Envision AI	4	56	54	16	**3.1**
Cash reader	7	53	54	16	**5.4**

Table V: Barriers in using assistive technology

Barriers	Yes	no	%age
Lack of training	34	96	26.2
Lack of awareness	88	42	67.7
Non availability	27	103	20.8
Lack of motivation	24	106	18.5
Social stigma	17	113	13.1
High cost	27	103	20.8

Table VI: Association of awareness with Demographics of the patients

Characteristics	Categories	Good awareness	Poor awareness	Total	p value
age	18-25	23	41	64	0.443
	26-40	24	27	51	
	>40	7	8	15	
gender	Male	36	52	88	0.833
	Female	18	24	42	
education	Primary	30	27	57	0.106
	Secondary	10	26	36	
	Higher	10	18	28	
	Uneducated	4	5	9	
occupation	Employee	23	30	53	0.052
	Un employee	16	14	30	
	Housewife	8	7	15	
	Student	7	25	32	
residency	Urban	33	59	92	0.041
	Rural	21	17	38	

Table VII: Association of barriers with demographics of patients

Barriers	Age	p value	Education	Occupation	Residency
		Gender			
Lack of training	0.396	0.674	0.029	0.572	0.009
Lack of awareness	0.191	0.566	0.286	0.335	0.599
Non availability	0.099	0.208	0.418	0.404	0.598
Lack of motivation	0.537	0.716	0.637	0.319	0.324
Social stigma	0.510	0.784	0.024	0.144	0.555
High cost	0.462	0.048	0.329	0.040	0.671

DISCUSSION

People with visual impairments have a compromised quality of life. The use of assistive technology in people with visual disabilities can improve the quality of life and promote independent living. Generally, children and young adults with visual loss have a long way to live than older adults with visual loss. Therefore, augmenting their life from an early age with the use of assistive technology is of paramount importance.

The purpose of this study was to explore the awareness and utilization of low vision assistive devices and barriers in accessing these devices among patients ranging from 18 to 50 years attending a low vision rehabilitation center. The quality of life of blind and visually impaired persons can be enhanced by using assistive technology, which consists of conventional tools (optical and non-optical aids) and artificial intelligence tools (electronic devices, computer software, and mobile apps).

A total of 130 patients were included in this study; 88[67.7%] were male participants, while 42(32.3%) were females. Overall, 81(62.3%) patients were aware of conventional tools, and 51(39.2%) were aware of artificial intelligence tools, which shows that AI tools are not much popular among patients. Being a developing country, Pakistan is facing problems like a low literacy rate, a lack of skills, a high poverty level, and low technology use, because of which artificial intelligence tools are not much popular in our population.[4] In this study, out of all the devices, patients showed maximum awareness of a magnifier of 38.5%, a telescope of 35.4%, and a white cane of 26.2%, whereas in another study, good awareness was shown by 67+% of the participants of only two of forty-two assistive technologies—near optical magnifiers and walking long canes. [21-22] Based upon different variables, age group of 26-40, female gender, patients with primary level of education, employed patients, and the ones living in urban areas showed good awareness.

As the awareness of assistive technology is relatively low among patients, different strategies should be adopted to enhance awareness. According to the patients, low vision care services should be promoted in Pakistan by creating awareness among the visually impaired and the public through social media and social events[4-21].

Out of these devices, white cane 23.1%, talkback 12.3%, and magnifier 9.2% had maximum utilization with respect to others, whereas according to another study, long walking canes were used by only 15.3% of patients, and 25(35.2%) used near optical magnifiers. [23] These devices are mainly used for orientation and mobility and for studying purposes. In terms of utilization of these devices, the preference of the type of low vision tools depends on task.

The major barrier faced by the patients in using assistive technology is a lack of awareness. While non-availability to buy, lack of felt need, and financial constraints were barriers told by participants in another study[26]. In today's era of technology, there are many options that are easily available and free of charge, but due to a lack of awareness, patients could not benefit from these useful inventions. Hence, the awareness of the low vision devices is a determining factor for better provision of low vision services. Proper training, increasing availability, and reducing the cost of low vision assistive devices will help to improve the provision of low vision services. Knowledge of these barriers can help in creating content for awareness campaigns among patients, healthcare professionals, and general society.

CONCLUSION

The awareness and utilization of assistive devices among low-vision patients is relatively low. Different strategies should be introduced to increase awareness and utilization and to overcome the major barriers. There are some limitations in the study. A comprehensive list of low vision devices is used in this study, but all these devices are not required by every patient. The awareness and utilization of assistive devices among low-vision patients is relatively low. The sample size of the study was also less than 200, which has a significant impact on the result finding.

Different strategies should be introduced to increase awareness and utilization and to overcome the major barriers. Strategies to eliminate the barriers faced by patients in using low vision assistive devices will help to increase the utilization ratio. Further study may be recommended to identify the evidence-based best communication strategy for awareness activities on assistive technologies.

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1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.

3. Final approval of the version for publication.

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