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Medication Adherence Challenges in Visually Impaired Patients: Insights and Solutions from the National Capital Region of India

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Abstract

A major challenge in medication use for visually impaired (VI) individuals is the similarity in the texture and shape of medicine containers and packaging. The absence of distinct tactile features can result in confusion, thereby elevating the risk of medication errors, such as administering the wrong drug or incorrect dosages. Data from Delhi NCR may serve as a foundation for enhancing pharmaceutical services for this patient group and propose innovative solutions to overlooked issue.

A cross-sectional study, using an interviewer administered questionnaire on 313 VI adults was carried out in Delhi NCR.

Among 313 participants, 96% faced challenges with identification of medicines. 91% faced challenges with dose recognition and measurement. 79% required assistance of person with normal vision for ensuring expiry date. Majority of participants wanted to get medication information in an audio format (83%), braille labelling on medicines (100%). The concept of incorporating audio QR codes on prescriptions and medication packaging was favored by 69.97% of the participants.

Self-adopted coping strategies were inadequate to overcome these and may cause serious health outcomes. Emerging technologies can be implied to improve medication adherence in VI patients.

Key words: Blind, visually impaired, coping strategies, disability, accessibility, medication-adherence, Delhi NCR.

Introduction:

India is home to one of the largest populations of visually impaired (VI) individuals in the world, with an estimated 4.95 million blind and 70 million vision-impaired persons (Mannava et al., 2022). Despite this significant demographic, the healthcare challenges faced by VI patients, particularly regarding medication management, remain under explored.

One of the significant challenges faced by visually impaired individuals in medication management is the similarity in texture and shape of medicine containers and packages (Figure 1).

Figure 1: Medicine containers with similar shapes and tactile features

Many pharmaceutical products are packaged in standard-sized bottles, blister packs, or boxes that feel identical, making it extremely difficult for those with vision impairments to differentiate between them. This lack of distinct tactile features can lead to confusion, increasing the risk of medication errors such as taking the wrong drug or incorrect dosages. The uniformity in packaging design often forces visually impaired individuals to rely heavily on memory or external assistance, which can be unreliable and diminish their sense of independence. In critical situations, where timely and correct medication administration is essential, these challenges can have severe health implications. The absence of accessible, tactile cues on medication packaging underscores the urgent need for innovative solutions that cater to the specific needs of visually impaired patients, ensuring safer and more effective medication use.

Royal National Institute for the Blind (United Kingdom) has developed a audio labelling device (*PenFriend*) may be beneficial for visually impaired individuals in managing medication. It allows users to record and playback custom audio labels for medicine containers, ensuring accurate identification and dosage instructions. This tool enhances medication safety, reduces the risk of errors, and promotes independence, addressing critical challenges faced by visually impaired patients in medication adherence. Saranya et al., 2016 reported that a pre-recorded audio file can be tagged with a quick response code (QR code). On scanning, it fetches the same audio file.

Crews and Campbell (2004) suggested that vision significantly impacts medication management, with individuals who have visual impairments facing greater challenges in handling medications compared to those with normal eyesight (Nikolaus et al., 1996). The process of safely identifying, measuring, and administering medications is inherently complex for VI individuals, yet the healthcare system and pharmaceutical services have been slow to address their specific needs. In India, where the population of VI individuals is substantial, these challenges are compounded by inadequate pharmaceutical services tailored to meet their specific needs.

Despite the importance of this issue, research on medication usage among VI individuals in India remains limited. Existing studies (including those conducted outside India) have small sample sizes, typically involving fewer than 100 participants, and focus predominantly on broad disability-related challenges rather than the specific difficulties faced in medication management. Furthermore, there is a significant gap in the literature regarding the experiences of VI individuals residing in urban areas like Delhi NCR. A study conducted in Sri Lanka (Weeraratne et al., 2012) reported that 28.57% (n=62) couldn't complete the due course of treatment, 39.68% missed a dose/doses. Another study that was conducted in Saudi Arabia (Almukainzi et al., 2020) reported that most common challenges encountered by blind patients (n=95) were linked to drug identification (75%), dose recognition (82%), and identification of expiration date (92%). In year 2022, for easy verification of authenticity of medicines, Indian ministry of health and family welfare issued a gazette notification {G.S.R. 823(E) dated-17th November, 2022} mentioning "The manufacturers of drug formulation products as specified in Schedule H2 shall print or affix Bar Code or Quick Response Code on its primary packaging label or, in case of inadequate space in primary package label, on the secondary package label that store data or information legible with software application to facilitate authentication." According to the notification, stored data

shall include: (i) unique product identification code, (ii) proper and generic name of the drug, (iii) brand name, (iv) name and address of the manufacturer, (v) batch number, (vi) date of manufacturing, (vii) date of expiry, and (viii) manufacturing licence number.

The NCR, as a densely populated and medically diverse region (Economic Profile of NCR Report, 2015), (SHLC Research Summary, 2020), (National Health Profile, 2023) offers a unique opportunity to study the medication usage patterns of VI patients. Data from this region could provide critical insights and serve as a cornerstone for improving pharmaceutical services and healthcare strategies aimed at this vulnerable population.

This study is designed to fill this critical gap by providing a comprehensive analysis of medication usage among VI adults in Delhi NCR. Through an interview based questionnaire survey of 313 VI individuals, we aimed to document the specific challenges they face in medication management and propose innovative solutions to improve adherence and safety. By doing so, this research seeks to address a long-neglected issue in healthcare, ultimately contributing to the betterment of pharmaceutical services for VI patients in India.

Aim and Objective:

To study medication usage pattern in visually disabled patients in National Capital Region of India

Materials and Methods:

This cross-sectional observational study was carried out among 313 visually disabled individuals over the age of 18 years for a period of 12 weeks. Schools/colleges, hostels, nongovernmental organizations (NGOs), vocational training centers for VI individuals, ophthalmology clinics, public parks, and metro stations (near these establishments) were selected as the study settings purposively as they were the main institutions in Delhi NCR catering for the residential and academic/vocational training needs of visually disabled people.

Study design: Cross-sectional observational study

Study duration: 12 weeks

The list of concerned establishments (name, contact details, and address) was made on the basis of information available in social media and personal network. Informed consent document (ICD) was developed in English and Hindi and translation (and back translation) was authenticated by certified translator. ICD was developed in compliance with guidelines (CDSCO Informed Consent Guidelines, 2012) by Central Drugs Standard Control Organization (CDSCO).

The permission was obtained from officials of establishments where the study was conducted. Informed written consent (Hindi & English) was obtained from the participants before the interview was conducted. Only VI individuals having disability certificates (issued by competent authority) and those who were able to read braille alphabets were included in this study. The questionnaire (available in Hindi & English) was explained to the participants in their preferred language and their queries were clarified by the investigator. The study questionnaire was also developed in Hindi (local language) & English. Procedure of explaining and obtaining ICD; and recording of responses to questions were carried out in presence of an independent witness. An interviewer-administered questionnaire developed and pretested by the investigators was used. Thumb impression/signature of each study participant was taken on individual's ICD and study questionnaire in presence of an independent witness.

In addition to questions on sociodemographic characteristics, it had questions to study their medicine use-related attitudes, challenges faced during medicine use, self-coping strategies, and their attitude towards emerging innovative technological solutions to their concerns.

Results: Three hundred forty eight VI individuals were contacted for this study. But, only 313 fulfilled the inclusion criteria and were included in the study. Six did not give their consent, 24 failed to read braille alphabet, 5 didn’t have visual disability certificate (issued by competent authority). Out of 313 study participants, 252 (80.5%) were males and 61 (19.5%) were females. Only 15.02 % of total participants were employed somewhere. 65.5% were blind from birth the rest lost their sight later on. Table 1 presents the distribution of participants according to age groups.

Age group (years)	Number of participants	Percen of participants
18-28	184	58.79
29-39	92	29.39
40-50	30	09.58
51-61	05	1.60
62-72	02	0.64
73-83	00	0
84-94	00	0

Table 1:Age group wise distribution of participants

Education level is shown in Table 2.

Highest level of education achieved	Number of participants	Percentage (out of 313)
Primary school	37	11.82
Junior High School	43	13.74
High School	61	19.49
Intermediate	96	30.67
Diploma	3	0.96
Graduate	50	15.97
Masters	22	7.03
Doctorate	1	0.32

Table 2: Highest level of education achieved

(A) General information/preferences about medication and frequency of visits to doctor and pharmacy

On analyzing responses, we noted that 87.96% preferred to take oral solid dosage forms (tablet, capsule, etc.), 7.67% and 4.47% preferred to take oral liquid dosage forms (syrups, suspensions, etc.) and through injection, respectively. 2.9% of total study participants were not even aware about the rule of printing/mention of expiry date on medicine container/package. 83.3% were

themselves liked to purchase medicines from offline stores, 2.56% and 14.06% were liked to obtain medicines through e-pharmacies and their kin/friends, respectively.

Frequencies of both medication usage and visits to doctor and pharmacy are mentioned in Table 3.

Frequency	How often you visit doctor?	How often you use medications?	How often you visit pharmacy?
Daily	0	7	0
Weekly	0	0	0
Monthly	0	0	13
Half Yearly	0	0	4
Yearly	0	0	2
As and when required	313	306	294

Table 3: Frequency of medication usage and visits to pharmacy and doctor

(B) Pharmaceutical services offered

No participant had ever been provided pamphlets printed in braille. Only 12.14% found touchable-differentiating mark offered on the package or label. 6% had received instructions for drug administration in audio format. 3.19% had found medication label printed with braille alphabet. No one had ever received blindness-specific assistive devices/software.

(C) Sources of medication information and participants' reliance

Pharmacists, doctors, internet, television/radio, and relatives/friends act as main source of medication information for 48.24%, 28.12%, 18.53%, 0%, and 5.11% participants, respectively. Figure 2 shows participants' reliance on sources of medication information.

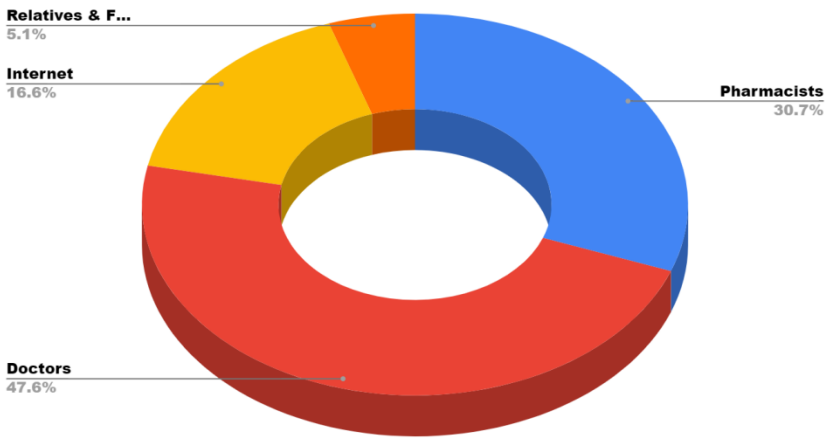


Figure 2: Reliance on medication information sources

(D) Challenges with medication use and coping with them

Unsurprisingly, 96.49% had faced challenges while identifying medicines and required assistance by person with normal vision. 91.37% had faced difficulty with dose recognition and measurement. 87.22 % required assistance by person with normal vision for the same. 84.35% used to guess about expiry date. Coping strategies ever practiced for identifying medicines are given in Table 4. 69.97% reported that printing of audio QR code on prescription/medication to listen recorded instructions will be helpful.

Coping strategies	Ever practiced by % participants
Putting touchable-differentiating mark on package	38.34
Keeping different medicines at different places	17.89
Identifying medication on the basis of memory	98.44
Any other coping method	0.60%

Table 4: Coping strategies for medication identification

(E) Effect of visual disability on medication adherence

Responses regarding medication adherence are presented in table 5.

Reported frequency of non-adherence	% participants took wrong medicine	% participants took wrong dose of medication	% participants took medication at wrong time	% participants forgot to take medication
Always	0	0	0	0
Sometimes	08.95	0	42.49	0
Rarely	76.68	90.73	0	04.47
Never	08.95	02.88	55.91	80.83
Often	05.43	06.39	1.60	14.70

Table 5: Reported frequency of medication non-adherence

(F) Solutions to improve medication use

93.61% liked to get extra explanation by pharmacist during drug dispensing. 100% were willing to get braille alphabet labelling on medicines and touchable-differentiating mark on medicine package. 88.50% were liked to get medication usage information pamphlets in braille alphabet. 72.52% considered telephone helpline as a helpful service. 83.07% 7.6 liked to receive medication information in an audio format. 12.14% were willing to get facility of special help counter at community healthcare centers.

Discussion: The findings from this study reveal significant challenges faced by visually impaired (VI) individuals in managing their medications, highlighting an urgent need for targeted interventions to improve medication adherence and safety in this population. The results align with existing literature while providing unique insights specific to the Delhi NCR region, which hosts a significant population of VI individuals.

The study uncovered that the overwhelming majority of participants faced challenges related to medication identification, dose measurement, and recognizing expiration dates. These challenges are consistent with previous studies conducted in other regions, such as Sri Lanka and Saudi Arabia, where similar difficulties were reported among VI individuals . However, the prevalence of these issues among our study population is notably higher, with nearly all participants reporting

difficulties in these key areas, underscoring the severity of the problem in the context of Delhi NCR.

One of the most striking findings is that 100% of participants expressed a desire for braille labeling on medicines, while 83% preferred receiving medication information in audio format. These preferences reflect a critical gap in existing pharmaceutical services, which largely rely on visual cues for medication management. The lack of accessible medication information—whether in braille, audio, or other formats—leads to a heavy reliance on caregivers or persons with normal vision, which can diminish the autonomy of VI individuals and contribute to non-adherence.

This study also highlights the inadequacy of self-adopted coping strategies. For example, while 98% of participants reported relying on memory to identify medications, this method is prone to errors and can lead to serious health consequences, particularly when multiple medications are involved. Additionally, 84% of participants indicated that they guess the expiration dates of their medications, a practice that could lead to the use of expired or ineffective drugs.

The implications of these findings are significant. The high rates of medication non-adherence observed, particularly in relation to taking medications at the wrong time or in the wrong dose, point to substantial risks for adverse health outcomes among VI individuals. Given that medication management is a critical component of chronic disease control, these findings raise concerns about the broader impact on public health.

Our study participants overwhelmingly supported the integration of emerging technologies, such as audio QR codes and braille labeling, to address these challenges. The introduction of such solutions, alongside tailored pharmaceutical services (e.g., extra explanations from pharmacists, special help counters at healthcare centers), could greatly enhance medication safety and adherence. The recent government notification regarding barcodes and QR codes on medication packaging is a step in the right direction, but further steps are needed to ensure these solutions are accessible and user-friendly for VI individuals. Regulatory authorities may direct pharmaceutical manufacturers to provide a audio QR code (containing a pre-recorded audio information about brand name, salt composition, batch number, expiry date, maximum retail price of product) on medicine strip/container. A doctor/pharmacist can record necessary instructions in audio format that can be converted to QR code (Brodie et al., 2020) **,** (Svensk et al., 2021) that QR code can be

affixed at a definite place on prescription. A VI person can scan the same for listening recorded instructions whenever required. During our interaction with VI people, we witnessed their interest towards operating android phones. Akkara and Kuriakose (2019) suggested that smartphone applications can bring a certain level of independence and self-confidence in VI people.

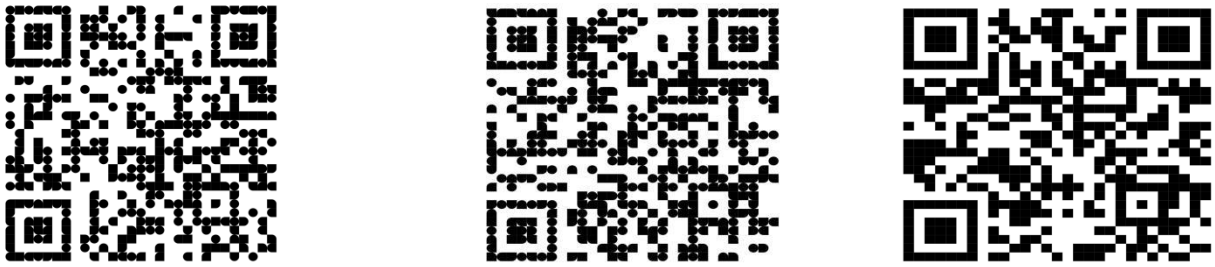
The innovative approach of utilizing 3D-printed tablets (Awad et al., 2020), known as "Printlets," offers a significant advancement. This study (Awad et al., 2020) was focussed on the development of Printlets incorporating Braille and Moon patterns directly onto the tablets. This technology enables visually impaired patients to identify their medications independently, thus reducing reliance on others and minimizing the risk of medication errors. By integrating tactile information directly onto the dosage form, this method not only enhances medication adherence but also empowers patients by providing them with greater autonomy in their healthcare management.

In light of these findings, we recommend a multi-pronged approach to improving medication adherence among VI patients in India. First, pharmaceutical services must be adapted to include braille labeling and audio instructions as standard practice. Second, pharmacists should be trained to provide tailored support to VI patients, ensuring that critical information is communicated effectively. Third, policy-makers should consider subsidizing or mandating the availability of assistive devices and technologies that support medication management for the visually impaired.

Overall, this study provides a comprehensive understanding of the medication management challenges faced by VI individuals in Delhi NCR and underscores the need for urgent and targeted interventions. The insights generated can serve as a foundation for developing policies and practices that promote equitable access to healthcare for visually impaired populations across India.

Conclusion: This study highlights the profound medication management challenges faced by visually impaired (VI) individuals in Delhi NCR, underscoring an urgent need for tailored pharmaceutical services. The high prevalence of issues such as difficulty in identifying medications, measuring doses, and recognizing expiration dates reflects a significant gap in current healthcare practices. The findings emphasize that conventional coping strategies, like relying on memory or caregiver assistance, are often inadequate and can lead to severe health consequences.

Importantly, the study reveals a strong demand among VI individuals for more inclusive solutions, such as braille labeling, audio QR codes (samples in Figure 3), and touchable differentiation marks on medicine packages. These preferences point to a critical opportunity for integrating emerging technologies and personalized pharmaceutical services to promote medication safety and adherence in this population.



(a) (b) (c)

Figure 3: (a) Prescriber's instructions (b) Medicine 1 information (c) Medicine 2 information

Our research calls for a multi-faceted approach, including policy changes, enhanced pharmacist training, and the adoption of assistive technologies, to ensure equitable healthcare access for VI patients. By addressing these gaps, we can move closer to a healthcare system that truly accommodates the needs of all, including those who have long been under-served. The insights generated from this study provide a foundation for future interventions, aiming to improve the quality of life and health outcomes for visually impaired individuals across India.

Ethical disclosure: Ethics approval (Ref: IEC-SGTCOP/2023-05-19/P1) was obtained from the Institutional Ethics Committee (DHR Registration number: EC/NEW/INST/2022/3046) of SGT College of Pharmacy, SGT University of Gurugram (located in Delhi NCR). Informed consent was obtained from each participant.

Conflicts of Interest: The authors declare no conflicts of interest.

Acknowledgement: We acknowledge support provided by NGOs, government officials, social activists who guided and connected us with VI individuals for successful conduct of this study.

Abbreviations:

CDSCO: Central Drugs Standard Control Organization

DHR: Department of Health Research

IEC: Institutional Ethics Committee

NCR: National Capital Region

NGO: Non-Governmental Organization

QR: Quick Response

VI: Visually Impaired

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