ORIGINAL RESEARCH ARTICLE

Storage, Reuse and Disposal Practices of Home - Stored Medicines in Urban Households in Pune, India

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ABSTRACT

Background: Improper home medicine storage is a global issue that leads to medicine wastage contributing to adverse effects. There have only been a few community-based research studies for in-home drug storage methods, reasons for use and its disposal ways among the consumers of India, until date.

Methodology: A descriptive, cross-sectional study was done from April 2023 to June 2023. Data were collected by face-to-face interview of household representative using pretested structured questionnaire on medicines in households, their utilization, storage and disposal practices.

Results: Most of the participants (78.3%) were educated to the level of graduation and above and their common reported source of procurement for stored medicines was doctor's previous prescriptions (61.79%) where 42.5% of them stored medicines for anticipated future use. Commonly stored drugs in households were analgesics and antihistaminics and drugs for digestive system while only 5.3% stored antibiotics mostly for ongoing treatment. Unsafe storage practices like storing medicines without proper labelling (65%) and within reach of children (33.49%) were found in the study. Also, 42.45% participants reported to share stored medicines with family members and friends. Major practice for drug disposal was reported as throwing in household garbage (93.1%).

Conclusion: In current study, 100% prevalence of in-home storage medication practices among the well-educated consumers without proper care taken for their use, storage and disposal which may pose a risk to the environment as well as humans.

Keywords: storage, medicine, disposal, household, developing countries

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INTRODUCTION

Worldwide new drugs are coming to market which provides important benefits in reducing morbidity and mortality, with their wide accessibility.[1] There has been a steady increase in of both over-the counter (OTC) and prescription drugs.[2,3]

In India, increasing self-medication practices and the tendency to self-manage symptoms, rising healthcare costs, and easy access to health-related information online and through social media advertisements are the main factors driving up home drug storage. The convenience of visiting a pharmacy rather than a hospital is also seen to be the main justification for keeping medications at home.[4,5]

According to the WHO, 50% of medicines are prescribed, delivered, or sold incorrectly and a half of those patients fail to consume them properly, resulting in a significant number of families having unused medicines.[6] In most households, medicines are stored for various purposes including emergency and ongoing usage.

However, regardless of the treatment's goal, the subjects' and the medications' features have an impact on how well medication is stored at home. Although timely access to medications is essential there are significant global issues about unnecessary medicine storage and misuse, as well as incorrect disposal of leftover medicines.[7-10]

Due to easy access and inappropriate storage of medicines at home increases the risk of irrational drug related problems such as inappropriate self-medication, serious health hazards, adverse drug reactions and may result in wastage of resources.[11,12] It is also associated with sharing of drugs which further increase the risk of inappropriate drug use. If the recommendations for storage are not followed, the drug stability can be affected which in turn leads to ineffective drug therapy.[3,13,14]

It is evident that unpleasant effects for both individuals and societies emerge from a variety of causes by analyzing the medicines utilization chain. It typically begins with over prescribing by doctors[9,15], continues with wrong choices like excessive purchasing[16], non-compliance with treatment[3,17], and saving medications for future usage[18,19], and ceases with improper disposal[8,11].

Apart from few studies, General publics' understanding of safe storage conditions, rational drug use, and dangers associated with indiscriminate use and incorrect disposal of medicines is largely lacking in developing countries including India.[20,21] With this background, the present community-based study was undertaken to collect information on the prevalence and factors associated with medicine storage at home. Furthermore, it aimed to investigate practices addressing the storage, disposal, and reuse of unused medicines by general public in Pune, western Maharashtra. India.

METHODOLOGY

This was a community-based, cross-sectional study conducted in randomly selected two large housing societies around medical college and tertiary care teaching hospital in Pune city and all the 268 households of the societies were included in the study. The study was conducted during April 2023 to June 2023 to evaluate storage, reuse, and disposal of unused medications by general public. After approval by ethics committee (Reference No BVDUMC/IEC/15 dated 19.4.22), the purpose of the study was explained to the study participants, confidentiality was ensured and finally, members of 212 households who had given written informed consent were included in the final survey.

Data were collected through interview of the respondent by home visit who was the main health care decision maker and was knowledgeable about health and medicines utilization by household members.

Questionnaire for interview was designed according to the WHO Manual on "How to investigate the use of medicines by consumers"[22] and similar surveys carried out previously.[2,11,20] The questionnaire was translated into local language and to validate, it was pretested on 20 households in similar setups. Before the actual data collection and modified accordingly to make it more user friendly.

It consisted of two parts:

a) Data on socio-demographic characteristics, sources of various drugs, and reasons for stocking drugs at home were collected.

b) Data about the particulars of drug such as name, storage condition, dosage form, expiry date and situation of packaging with labelling and plan for disposal of each unused medicine item was also collected.

To assess safe storage of the medicines following checklist was utilized-

- Safe storage place
- Appropriate storage condition (temperature, humidity, in packets /separate for each household member)
- Precautions to keep medicines out of reach from children
- Adequate labelling (drug name, dosage, frequency, expiry date and patient name)
- Check for expiry date

If the household with stored medications followed all the above-mentioned practices simultaneously, then the household was considered to have safe storage of medicines.

Data was coded, checked for completeness and consistency.

Statistical analysis: Data was analyzed by using SPSS statistical software (version 28). Quantitative variables were shown in descriptive statistics and

Qualitative variables were calculated with frequency and percentages. Data were analyzed to find out the association between factors associated to unsafe storage of medicine by using Chi-Square test. The P value less than 0.05 was considered as significant throughout the result with 95% confidence limit.

RESULTS

Distribution of socio-demographic characteristics of the evaluated a total of 212 willing participants is shown in Table 1.

Out of total 268 households, 212 (79.10%) participants responded to the interview where all of these stored medicine at home (100%).

Table 1: Socio-demographic characteristics of households based on the prevalence of home storage of medicines (n=212)

Characteristic	Respondents(%)
Gender	
Female	83 (39.2)
Male	129 (60.8)
Age	
18-30 years	36 (17.0)
31-40 years	53 (25.0)
41-50 years	66 (31.1)
51-60 years	33 (15.6)
>60years	21(11.3)
Education level	
Primary school	4(1.9)
Secondary school	42(19.8)
Graduation and above	166(78.3)
Occupation	
Government service	16 (7.5)
Private sector service	82 (38.7)
Retired	18 (8.5)
Self-employed	51 (24.1)
Unemployed	45 (21.2)
Members in household	
1-2	24 (11.3)
3-4	137 (64.6)
5 or above	51 (24.1)
Senior citizens in family (60 years & above)	
0	118 (55.7)
1	51 (24.1)
2	41 (19.3)
>2	2 (0.9)
Children in family (< 6 years)	
0	146 (68.9)
1	42 (19.8)
2	23 (10.8)
>2	1 (0.5)
Monthly Family Income (in Rupees)	
<10,000/-	2 (0.9)
10.000 – 20,000	12 (5.7)
21,000 – 50,000	42 (19.8)
>50,000	156 (73.6)
Presence of health professional in family	
No	171 (80.7)
Yes	41 (19.3)

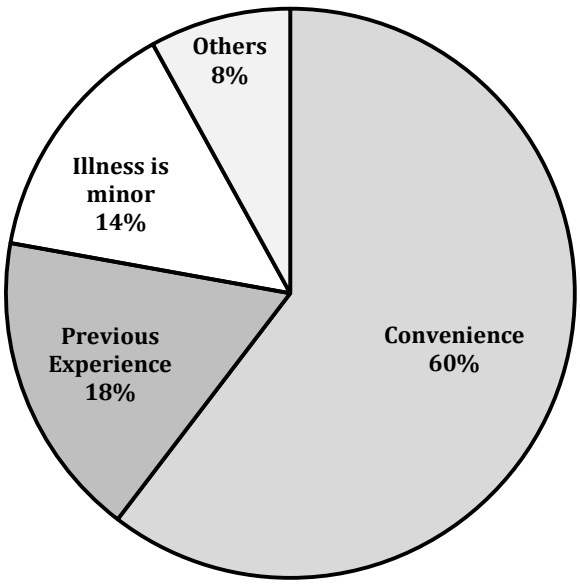
Among the participated households, majority were males (60.8%), the primary member of the household who took care of the medicines at home and was taken as the respondent and majority of them belonged to the age group of 41-50 years (31.1%). 64.6% of the households had 3 to 4 members in the family and 44.5% had senior citizens in the family. Nearly 68% of the households had no children less than six years old.

Most of the participants were educated to the level of graduation and above (78.3%), with predominance of private sector service (38.7%) with respect to occupation and monthly income more than fifty thousand (73. 6%). Out of the surveyed households,19.3% of them had health professional(s) as a family member. (Table 1)

As seen in Figure 1, Majority (60%) of the participants' stored medicines for the sake of convenience followed by some having previous experience (18%) with the medicine.

The most commonly reported sources for procurement of stored medicines were doctor's previous prescriptions (61.79%) and recommendation by pharmacists (19.33%). Only few participants bought medicines suggested by family members or friends or by seeing advertisements about medicines (5.66%).

Allowed for multiple responses, study participants revealed that, analgesics (32.8%), anti-histaminics (28.7%) and drugs for digestive system ailments (14.5%) were among the major stored medicine categories and prescription medicines like antibiotics (5.3%) and drugs for chronic disorders (diabetes, hypertension) were kept for ongoing treatment. (Table 2)



Note: Others – lack of time, cost saving

Figure 1: Reasons for home storage of medicines as opted by the study participants

Table 2: Categories of medicines and utilization status found in households**

Category	Anticipated future use	Leftover medicines	Ongoing treatment	Total (%)
Analgesics/Antipyretics	84	76	8	168(32.8)
Antihistaminic	74	70	3	147(28.7)
Antibiotics	-	9	18	27 (5.3)
Digestive Remedies	68	3	3	74 (14.5)
Antihypertensive drugs	-	-	39	39 (7.6)
Antidiabetic drugs	-	-	23	23 (4.5)
Minerals and Vitamins	3	-	12	15 (2.9)
Other	-	7	12	19 (3.7)

**Multiple Responses

Table 3: Factors associated with unsafe storage practices of unused medications at households participating in the study

Medicine Storage Questions	Age (>=40) (n=123)	Educational Status (Graduation and above) (n=166)	Family with children (Under 6 Years) (n=66)	Family with Senior Citizens: (60 years & above) (n=94)
Storage place for medicines at home				
Unsafe	15 (12.2%)	23(13.9%)	12(18.2%)	8(8.5%)
Safe	108 (87.8%)	143(86.1%)	54(81.8%)	86(91.5%)
P Value	0.637	0.027*	0.034 *	0.249
Storage Condition of medicines at home				
Unsafe	10 (8.1%)	12(4.2%)	4(6.1%)	4(4.3%)
Safe	113 (91.9%)	34(95.8%)	62(93.9%)	90(95.7%)
P Value	0.618	<0.0001*	0.32	0.032*
Precautions to keep medicines out of reach from children				
Unsafe	40(32.5%)	17(32.5%)	15(22.7%)	31(33.0%)
Safe	83(67.5%)	29(67.5%)	51(77.3%)	63(67.02 %)
P Value	0.725	0.57	0.026 *	0.888
Check for expired medicines				
No	8(6.5%)	8(4.8%)	4(6.1%)	11(11.7%)
Yes	115(93.5%)	158(95.2%)	62(93.9%)	83(88.3%)
P Value	0.34	0.001*	0.48	0.078

Note: *p < 0.05 using Chi square test

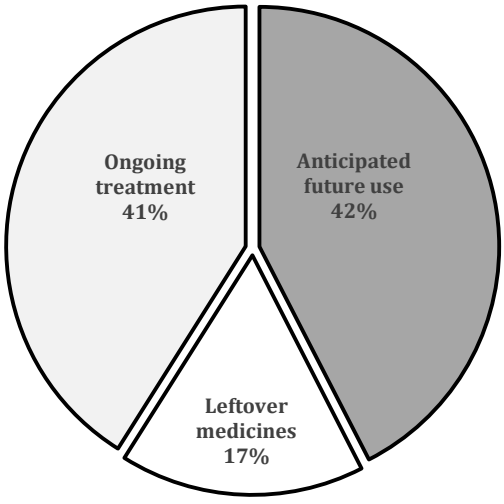


Figure 2: Utilization status of stored medicines found in households

When asked as single best option for purpose of medicine storage, majority of the households in the study had stored drugs for anticipated future use (42%) followed by ongoing treatment of chronic illnesses (41%) while 17% households had leftover medicines from resolved medical conditions. (Fig 2)

Table 3 depicts that among the households participating in the study, storage of unused leftover medicines was significantly safe (p=0.027) among educated participants (graduation and above) and also in those households where there were children below 6 years of age (p=0.026) or citizens above 60 years of age (p=0.032).

All the households with medicines stored at home had at least one of the four unsafe storage practices where 65% of these had stored them without proper labelling and 33.49% stored medicines within reach of children. (Table 4)

Most of the study participants had stored medicines in their bedroom (57.5%) either in cupboard or drawer and 42.45% participants reported to share these stored medicines with their family members and friends.

Current study also revealed that the major practice with regards to disposal of unused medicines was found to be throwing it in the household garbage (93.1%) while very few participants returned the unused medications to the pharmacy (4.2%) or flushed them in the toilet or sink (1.8%).

Table 4: Distribution of households with stored medications according to unsafe storage practices

Practices for storage of medicines at home**	Households with unsafe storage practices (%)
Storage place of medicines at home	24 (11.32)
Labelling of medicines	138 (65.09)
Precautions with children	71 (33.49)
Checking of expiry date of medicine	7 (3.3)

**Multiple responses

DISCUSSION

With recent advances, medicine usage has increased drastically and medication storage at home has become a common practice in the community.[2] Irrational in-home medicine storage is a widespread problem that results in medicine waste and other adverse impacts. Consumer knowledge and importance of drug storage and disposal have remained a less focused concern in developing countries. This cross-sectional, questionnaire-based study therefore was conducted among 212 willing participants in residential areas of Pune city, Western Maharashtra, India with the purpose to evaluate the prevalence and factors associated with the storage of medicines and ways of their disposal in urban homes.

Results of the present study revealed that all participants of the total surveyed households stored medicines at home. Similar prevalence was reported by studies carried out in Saudi Arabia, Hong-Kong and another place in India where medicines were available in most of the households.[17,20,23] According to the World Health Organization (WHO), more than 50% of medicines are inappropriately prescribed and dispensed, which causes unnecessary storage of the leftover medicines.[24,25] Self-medication practices and buying them over-the-counter increases the possibility of such medicine storage at home. Participants of this study have agreed to store medicines for the sake of convenience or with previous experience and commonly reported source of procurement of these medicines were doctors' previous prescriptions. (Fig.1)

Effective medicine storage at home can be determined by properties of the drugs and also attitude of the patients. If the recommendations for storage are not followed, drug stability can be affected which in turn leads to ineffective drug therapy.[3]

In current study participants reported one of the unsafe practices of storage of medicines in multiple responses mainly for storage place, adequate labelling of medicines, storage out of reach to children and checking expiry date. (Table 4)

According to WHO guidance on good storage practice, the appropriate storage condition for medicines is keeping the medicines in a clean and dry place, maintained within acceptable temperature limits, and out of the reach of children.[26] This is also important in order to maintain their effectiveness and safety. For example, when pharmaceuticals are improperly packaged, they can lose effectiveness or their toxicity can increase. Chemical, physical, and microbiological changes may be caused by extremes of temperature, humidity, and light, especially if the medicinal product is kept out of its original packaging, or stored near food and chemicals. The present study depicted that storage of unused leftover medicines was significantly safe by our educated participants also in households with children below 6 years of age or citizens above 60 years of age. (Table 3)

Majority of the medicines stored by the current study participants were analgesics, antihistaminics, and digestive system medications. These medicines relieve minor pain, allergy and dyspepsia respectively which may be common clinical problems of senior citizens (>60yrs old). Firstly, most of the study households had this age population as family members and secondly these are easily procured over-the-counter (OTC) medicines, so they might have been stored at home. All the prescription medicines for chronic illnesses and in some households, antibiotics comprised totally of 5.3%; mainly for ongoing treatment. (Table 2) This observation regarding antibiotics storage and usage differs from studies by Aditya et al and Auta et al.[27,28], who found presence of leftover antibiotics in their study households which indicated either noncompliance with prescribed therapy or availability of these drugs as OTC, both of which are risky.

Authors from Ghana and West Bengal have revealed that most commonly reported reason for stored drugs in their study households was leftover ones from the treatment of previous medical condition which depicts that patients did not consume medicines as prescribed.[2,29] The present study findings reflect good awareness among our more educated study participants to complete treatment as prescribed. Majority of the households in present study had stored drugs for anticipated future use of family members or for ongoing treatment of chronic illnesses while only 17% had them from resolved medical conditions in past (Figure 2). Reuse of stored unused medicines for anticipated future use or sharing it with family members or friends' favors wrong self-medication practice and with drug sharing, exposing those around them to health risks like adverse drug reactions and the emergence of antimicrobial resistance, resulting in ineffective treatment and the waste of pharmaceutical resources.[3,30]

The major practice with regards to disposal of unused medicines was found to be throwing it in the household garbage while very few participants returned them to the pharmacy or flushed them in the toilet or sink. These findings are similar to the results from previous studies conducted in Indian population from Delhi and Karnataka.[31,32] Authors around the world have also revealed in their research articles that a significant number of unused drugs were

discarded in garbage by their participants.[3,33,34] This indicates that there is a lack of correct knowledge regarding the ways of disposal of the drugs among consumers.

In India and Nigeria, where there are no rules or drug take-back policies, it has been demonstrated that the rate of returning medications to pharmacies or health centers is 0%.[35,36] Even in nations where families adhere to medicine take-back programs, this number was just 3% to 8%.[37,38] Studies have highlighted that most countries have no guidelines for disposal of medicines, which not only imposes a financial burden on society but also creates environmental hazards.

The risk of drug waste comes from three major contributors: incorrect usage, improper storage, and inappropriate disposal. Rigorous regulations to the sale and purchase of medicines only with prescriptions and safe drug disposal should be put in place, policies and programs for drug take-back initiatives should be encouraged and community pharmacists and medical personnel should be trained for the same. Training programs should be offered to raise people's knowledge of the risks associated with inappropriate use, storage and disposal of drugs.

Strength of the Study

Many previous studies with similar objectives either used telephonic interviews or distributed online forms to collect data about drug storage at home; but the current study conducted direct face-to-face interviews by visiting households, so real scenarios regarding the status of stored medications would have been evaluated.

Limitations

As the study included households in urban area with coverage of educated participants from middle class societies, the results cannot be generalized to all households of different educational and socioeconomic strata.

Conclusion

The prevalence of household drug storage in Pune, Western Maharashtra, India was 100% where analgesics, antihistaminics and drugs for digestive system were stored most commonly for anticipated future use or leftover medicines from previous illness. Major practice with regards to unused medicine disposal was found to be throwing them in the household garbage.

It is necessary to increase consumer understanding and behavior about the use, storage, and disposal of unused and expired medications. Consumers should be educated and trained by health care providers, government, and policymakers on appropriate usage, storage, and disposal practices of expired or unused medications.

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