

Storage, reuse, and disposal of unused medications: A cross-sectional study among rural households of Singur, West Bengal

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ABSTRACT

Background: Medicines can often make the difference between life and death. With recent advances, the use of medicines has increased drastically. The WHO reports that 50% medicines are prescribed, dispensed, or sold inappropriately and that half of all patients fail to consume them correctly giving rise to a large proportion of households possessing unused medicines. **Objectives:** The present study was done to find out the proportion of unused medicines present in the households of a village in Singur, West Bengal, and the reasons behind medications left unused. It also aimed to study their practice of storage, disposal, and reuse of left over medicines. **Materials and Methods:** It was a rural community-based, cross-sectional study conducted among 143 households. Data were collected with a pre-tested schedule and checklist. Frequency distribution, binary, and multivariable logistic regression were used to interpret the data. **Results:** Among the surveyed households, 67.1% had unused medicines, of which 34.4% were antacids followed by antipyretics (31.25%) and antibiotics (28.1%). Age ≥ 40 years' odds ratio (OR) (confidence interval [CI]) - 2.8 (1.2-6.7), joint family OR (CI) - 4.1 (1.7-9.7), and households with under-5 children OR (CI) - 3.1 (1.1-9.1) were found to be significantly associated with the presence of unused medications. The most common reason cited for keeping drugs was discontinuation of the drugs due to recovery from illness. Plan to reuse the medicines in near future was the predominant reason for storage. **Conclusion:** Drug take-back initiatives should be encouraged in our country and a community pharmacy may be organized so that unused medicines can be channelized to the needy patients.


KEY WORDS: Unused Medicines; Storage; Disposal; Drug Take-back Initiatives; Expired

INTRODUCTION

Medicines have become part and parcel of our day-to-day lives. Be it minor ailments such as headache, chronic diseases such as hypertension, diabetes, or fatal diseases such as ischemic heart disease, or cancer, medicines can often make the difference between life and death.

Consumption of medicines has increased over the years worldwide due to greater availability, accessibility, and affordability as well as growing health awareness and health-seeking behavior among the people. However, more use of drugs leads to the problem of irrational use in the community which has currently become a major problem worldwide. As per the WHO, 50% medicines are prescribed, dispensed, or sold inappropriately and that half of all patients fail to take them correctly.^[1] When they are not consumed, they are left unused and wasted.

The efficiency and success of overall health-care system can be directly measured by drug wastage.^[2,3] The risks of drug waste come from three primary sources: Incorrect use, improper storage, and indiscriminate disposal.

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In most households, medicines are not used as prescribed by the physician. Many patients discontinue them on resolution of the medical condition or occurrence of side effects. These drugs are kept for reuse in the future often without consulting the doctors. This encourages the malpractice of wrongful self-medication or sharing of medicines among friends, families exposing the community to potential health hazards such as adverse drug reactions and the emergence of antimicrobial resistance leading to ineffective treatment, poor quality of healthcare and also wastage of pharmaceutical resources.^[4,5]

Storing unused medication at home is a hidden hazard. Most medicines deteriorate with time leading to changes in their chemical composition rendering them less effective or, in some cases, potentially harmful if expired. Hence, accidental intake by children or elderly could be dangerous.^[6] Indiscriminate disposal of garbage and sewage system can eventually release these harmful chemicals into the water supply which can adversely affect our health and environment in the long run.^[7-9]

In developing countries like India where accessibility of health insurance is scarce, medicine financing is mainly out-of-pocket. The rising incidence of catastrophic expenditure due to health-care costs has now become a significant contributor to poverty.^[10] Three-fourth of out-of-pocket expenditures (74% rural and 67% urban) are drug-related.^[11] Hence, most of the burden of economic loss due to unused/expired medications lies on household members themselves. Therefore, it is of utmost importance that lifesavers such as medicines should be properly prescribed, dispensed, and used to prevent drug resistance.^[12] When these medications are left unused, they should be correctly stored or disposed to avoid environmental pollution, prevent accidental poisoning, avoid drug abuse, and thus save lives.

In India, very few studies have been done to study the status of unused medicines in the community, almost none in the rural area. With this background, the present study was undertaken to find out the proportion of unused medicines present in the households of a village in Singur Block, West Bengal and the reasons behind medications left unused. Moreover, it also aimed to study their practice of storage, disposal, and reuse of leftover medicines.

MATERIALS AND METHODS

This was a community-based, cross-sectional study conducted in the service area of the Rural Health Unit and Training Centre, Singur which is the rural field practice area of All India Institute of Hygiene and Public Health, Kolkata serving 61 villages through 2 union primary health centers and 4 sub-centers.

The study was conducted during July 2016 to August 2016. One village was selected conveniently, and all the 178 households

of the village were included in the study. The member of the household who took care of the medicines at home was taken as the respondent. Finally, members of 143 households who had given written informed consent participated in the study.

Study Tools

1. Questionnaire for interview was designed according to the WHO Manual on "How to investigate the use of medicines by consumers."^[13] It consisted of two parts:
 - a. Background information of the households
 - b. Pattern of unused medicines: Medicines which were not being used at the time of survey were considered as unused medicine items.
 - Amount (If more than one type of drug within a single pharmacological category were found, the drug with greater leftover amount was reported)
 - Mode of procurement
 - Reasons for left unused
 - Plan for disposal of each unused medicine item.
2. A checklist to assess safe storage of the drugs
 - Expiry date
 - Storage within range of children
 - Availability of prescriptions
 - Storage of currently used and unused drugs together
 - Visibility of labels

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

It was translated into Bengali pretested on 30 households in an adjacent village and modified accordingly. Data were collected through interview of the respondents through the door-to-door visit.

Statistical Analysis

Data were analyzed using SPSS version 16.0. Descriptive statistics (mean standard deviation [SD] and median for the continuous variables and frequency in percentage for the categorical variables), bivariate, and multivariable logistic regression were used for data interpretation. Force entry method was used and multicollinearity was checked before putting independent variables into the final model by variation inflation factor after taking the cutoff value of 10. Results were considered significant at conventional $P < 0.05$ level.

RESULTS

The mean (SD) age of the study participants was 40.2 (8.9) years. All the respondents were females. 84.6% were Hindus

and 46.84% belonged to OBC. 36.4% were educated to middle. Of 143, 69.9% belonged to joint family. The mean (SD) per capita income (PCI) was 2236.5 (01611) international normalized ratio (INR) and median interquartile range was 2000 (1200-2000) INR. 32.1% belonged to Class IV according to Modified BG Prasad Scale. 28% households had under-5 children while 25.9% had elderly family members.

The present study revealed that among 143 surveyed households, 96 (67.1%) households possessed unused medicines with 210 unused medicine items at the time of survey.

Among the households in which unused medicines were found, 34.4% had unused antacids followed by antipyretics (31.25%) and antibiotics (28.1%) (Figure 1).

Among the unused medicine categories, majority were prescribed for adults (20-64 years) except antihistamines which were prescribed for children (0-9 years). Most frequent disease for which antibiotic remained unused was diarrhea whereas for analgesics it was backache and for antihistamines acute respiratory infections (ARIs).

Of these, 70.9% unused medicines were procured from medical personnel, 61.4% were leftover due to resolving of medical condition, and 57.4% were stored to reuse in the future (Table 1).

53% of antipyretics, 48.5% of antacids, and all Ayurvedic drugs were bought over the counter (OTC). 25% of skin ointments and ear/eye drops were procured after from quacks/traditional healers.

41.2% vitamin supplements were left due to excess supply while 60% of homeopathic drugs were left due to inconvenience/difficulty in following instructions. 75% of antidiabetics and 50% of antihypertensives were left due to change in treatment.

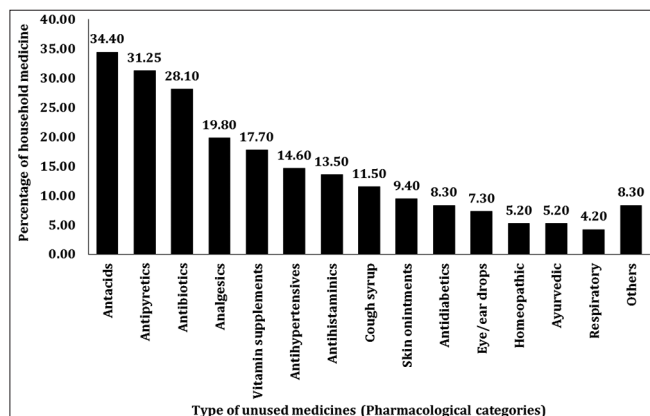


Figure 1: Bar diagram showing the distribution of households according to types of unused medications ($n=96$), *Others: Antigout, laxatives, steroids, antiemetics

35.7% of antihypertensives and 60% of Ayurvedic drugs were planned to sell back to pharmacy. 60% of homeopathic drugs were stored to share with friends. 40.7% of antibiotics, 71.4% of eye/ear drops, and 47.1% of vitamin supplements were planned to throw with garbage.

All the households (96) with unused medications had at least one of the five unsafe storage practices of unused medicines assessed, of which 50 (52.1%) had four or more unsafe storage practices. 67.7% stored them along with currently used drugs and 16.7% stored within reach of children. 41.67% households had expired medications or were with inadequate labels (Table 2).

On bivariate analysis, age ≥ 40 years, PCI (>1200 INR), joint family, households with under-5 children, and households with elderly were found to be significantly associated with the presence of unused medications. On multivariable logistic regression, PCI and the presence of elderly lost

Table 1: Distribution of unused medications according to source of procurement, reasons for unuse, and plans for disposal ($n=210$)

Sources of procurement	Number of unused medicine items n (%)
Medical personnel	149 (70.9)
OTC	55 (26.3)
Quack/traditional healer	6 (2.8)
Reasons for unuse	
Medical condition improved or resolved	129 (61.4)
Excess quantity supplied	31 (14.8)
Change to another treatment	21 (10)
Side effects of medication	17 (8.1)
Inconvenience/difficulty following instructions	12 (5.7)
Plans for disposal	
Reuse	121 (57.6)
Throw away in the garbage	38 (18.1)
Share with friends	29 (13.8)
Sell back to pharmacy	22 (10.5)

OTC: Over the counter

Table 2: Distribution of households with unused medications according to unsafe storage practices ($n=96$)

Unsafe storage practice*	Number of households n (%)
Did not check for expiry dates	47 (49)
Stored used and unused together	65 (67.7)
Expired drugs found or labels not visible	40 (41.67)
Did not preserve prescription	58 (60.4)
Drugs within reach of children	16 (16.7)

*Multiple responses

their significance while age ≥ 40 years' odds ratio (OR) (confidence interval [CI]) - 2.8 (1.2-6.7), joint family OR (CI) - 4.1 (1.7-9.7), and households with under-5 children OR (CI) - 3.1 (1.1-9.1) were found to be significantly associated with the presence of unused medications. The independent variables can explain 28.2% of variation. Model was fit as shown by the non-significant Hosmer-Lemeshow statistic (Table 3).

DISCUSSION

Among the surveyed 143 households, 96 (67.1%) had unused medicines, of which 34.4% households had stored antacids followed by antipyretics (31.25%) and antibiotics (28.1%). 70.9% of the total 210 unused medicine items were procured from medical personnel whereas 26.3% drugs were procured OTC. The most common reason (61.4%) cited for unused drugs present at home was "discontinuation of the drugs due to recovery from illnesses" before the prescribed duration. Plan to reuse the medicines in near future was the predominant reason (57.6%) for storing and not disposing in trash. 18.1% drugs were planned to throw in the garbage. 13.8% unused drugs were planned to share with friends whereas a surprising 10.5% were planned to sell back to pharmacy. Of 96 households with unused drugs present, none of the households met the criteria for safe storage practices as considered in the present study. 41.67% households were found to have expired medications or drugs with missing labels, at the time of survey. 16.7% households had stored drugs randomly within the reach of children. Age ≥ 40 years OR (CI) - 2.8 (1.2-6.7), joint family OR (CI) - 4.1 (1.7-9.7), and households with under-5 children OR (CI) - 3.1 (1.1-9.1) were found to be significantly associated with the presence of unused medications.

This cross-sectional study found that 67.1% of the households possessed unused medicines, which is similar to the findings of Banwat *et al.* in Nigeria (65.8%) where study participants were urban households.^[14] Studies done by Aditya in Chandigarh found 95% participants had stored leftover drugs. This difference may be due to the medical background of the participants in the latter. Atinafu *et al.* found higher proportion (89.1%) of unused medicines as their study participants were

patients who had greater tendency to store medicines than rural people.^[2,15] In our study, 34.4% households had unused antacids followed by antipyretics (31.25%) and antibiotics (28.1%). Antacids and antipyretics are commonly stored to relieve minor dyspepsia and pain which are easily procured. The presence of unused antibiotics reflects either non-adherence to prescribed therapy or availability OTC both being hazardous. These findings were similar to that of Aditya, Auta *et al.*^[2,5] 70.9% of unused medicines were advised by medical personnel implying that prescribed course for the prescribed duration was not completed. 55 (26.3%) medicines were reportedly bought OTC of which 32 (58%) comprised antipyretics and antacids which is not surprising as they are the commonly purchased OTC drugs. Most commonly (61.4%) reported reason for leftover of drugs was resolving of the medical condition which is in concurrence with the findings of Osei-Djarbeng *et al.* in Ghana which emphasizes that patients do not consume medicines as prescribed. The moment their sickness is resolved, they would stop the drugs. This malpractice is dangerous for the individual as though initially relieved, he is not completely cured and is harmful to the community as pathogens are growing resistance against the pharmaceuticals.^[16] On investigating, the plan of disposal of the unused drugs, most (57.6%) were kept for reuse in the future similar to findings by Banwat *et al.* in Nigeria.^[14] Only 18.6% intended disposal into garbage, in this study similar to study by El-Hamamsy in Egypt.^[17] This indicates that there is a lack of correct knowledge regarding the ways of disposal of the drugs in different parts of the world. None of the households practiced safe storage in this study. 41.67% of households possessed expired medications or with inadequate labels. This may be due to lack of knowledge and practice of checking expiry date in our study participants. 67.7% households stored currently used and unused medicines together. 16.7% households had stored drugs randomly within the reach of children which could lead to accidental poisoning. It was found that households with under-5 children had 3.1 times more odds of having unused medications as this age group usually suffer from frequent episodes of diarrhea, ARI. Households with joint family had 4.1 times more odds of storing unused medicines as more the family members; more are the chances of ailments in the future.

Table 3: Factors associated with presence of unused medications among households ($n=143$)

Variables	<i>n</i>	Unused medications present <i>n</i> (%)	OR* (95% CI)	AOR** (95% CI)
Age (≥ 40 years)	82	62 (75.6)	2.5 (1.2-5.0)	2.8 (1.2-6.7)
Education - above middle	73	49 (67.1)	0.99 (0.5-2.0)	-
PCI (>1200 INR)	103	75 (72.8)	2.4 (1.1-5.2)	2.4 (0.99-5.6)
Joint family	100	77 (77.0)	4.2 (2.0-9.2)	4.1 (1.7-9.7)
Households with under-5 children	40	33 (82.5)	3.0 (1.2-7.4)	3.1 (1.1-9.1)
Households with elderly (≥ 65 years)	37	32 (86.5)	4.2 (1.5-11.6)	1.6 (0.5-5.1)
Nagelkerke R Square		-	-	28.2
Predicted accuracy rate		-	-	74.1

OR*: Odds ratio, AOR**: Adjusted odds ratio, CI: Confidence interval, PCI: Per capita income, INR: Indian rupee

The present study was a detailed study done in a rural setting. It has its strength in finding out reasons of leftover medications and their ways of disposal. The safety of storage of unused drugs was also assessed. However, it has some limitations, i.e., chances of recall bias in case of self-reported information could not be ruled out, and the sample size was small.

The present study revealed that a major proportion of rural households had stored unused medicines at home for reusing among family and friends and about none of them had safe storage; hence, being susceptible to various health hazards and accidental poisoning. Most of them did not follow the prescribed dose and duration completely, especially the adults thereby seeding antibiotic resistance in the community unknowingly. The physicians should explain, emphasize and ensure the disadvantages of not following the prescribed dose and duration of the medicines to the patients. Stringent regulations to sell and buy drugs only on prescription and on proper drug disposal methods should be implemented. Well-defined policies and programs such as drug take-back initiatives and community pharmacy should be encouraged. Field level workers like Accredited Social Health Activists Anganwadi Workers should be trained to increase the awareness of the individuals regarding the hazards of storing unused medications. Studies with large sample size and broader conceptual framework are warranted in the future to put forth substantial evidence for policymakers to address this untouched issue of unused medications.

CONCLUSION

Drug take-back initiatives should be encouraged in our country, and a community pharmacy may be organized so that unused medicines can be channelized to the needy patients.

REFERENCES

- World Health Organization. Promoting rational use of medicines: Core components. WHO Policy Perspectives on Medicines, No. 5. Geneva: World Health Organization; 2002. Available from: <http://www.who.int/medicines/publications/policyperspectives/ppm05en.pdf>. [Last accessed on 2016 Oct 10].
- Aditya S. Safe medication disposal: Need to sensitize undergraduate students. *Int J Pharm Life Sci*. 2013;4(3):2475-80.
- Tong AY, Peake BM, Braund R. Disposal practices for unused medications around the world. *Environ Int*. 2011;37(1):292-8.
- Wondimu A, Molla F, Demeke B, Eticha T, Assen A, Abrha S, et al. Household storage of medicines and associated factors in Tigray region, Northern Ethiopia. *PLoS One*. 2015;10:e0135650.
- Auta A, Omale S, Shalkur D, Abiodun AH. Unused medicines in Nigerian households: Types and disposal practices. *J Pharmacol Pharmacother*. 2011;2(3):195-6.
- Kusturica MP, Sabo A, Tomic Z, Horvat O, Solak Z. Storage and disposal of unused medications: Knowledge, behavior, and attitudes among Serbian people. *Int J Clin Pharm*. 2012;34(4):604-10.
- Lagishetty R, Nagarajan P, Vijayanandhan SS. Practice towards disposal of medicines (left out/expired drugs) among the patients visiting tertiary care teaching hospital and primary health centre in South India. *Asian J Biochem Pharm Res*. 2013;4(1):175-82.
- WHO. Pharmaceuticals in Drinking-Water. Available from: http://www.who.int/water_sanitation_health/publications/pharmaceuticals_20110601.pdf. [Last accessed on 2016 Oct 10].
- Kummerer K. Pharmaceuticals in the environment. *Annu Rev Environ Resour*. 2010;35:57-75.
- Ministry of Health & Family Welfare. National Health Policy 2015 Draft. Government of India; 2014. Available from: http://www.nhp.gov.in/sites/default/files/pdf/draft_national_health_policy_2015.pdf. [Last accessed on 2016 Oct 29].
- Garg CC, Karan AK. Reducing out-of-pocket expenditures to reduce poverty: A disaggregated analysis at rural-urban and state level in India. *Health Policy Plan*. 2009;24(2):116-28.
- Ganguly NK, Arora NK, Chandy SJ, Fairoze MN, Gill JP, Gupta U, et al. Rationalizing antibiotic use to limit antibiotic resistance in India. *Indian J Med Res*. 2011;134:281-94.
- Hardon A, Hodgkins C, Fresle D. World Health Organization and University of Amsterdam. How to Investigate the Use of Medicines by Consumers; 2004. Available from: http://www.who.int/drugresistance/Manual1_HowtoInvestigate.pdf. [Last accessed on 2016 Oct 23].
- Banwat SB, Auta A, Dayom DW, Buba Z. Assessment of the storage and disposal of medicines in some homes in Jos North local government area of Plateau State, Nigeria. *Trop J Pharm Res*. 2016;15(5):989-93.
- Atinafu T, Takele A, Kassie A, Yehualaw A, Tesfaw G, Desseno T, et al. Unused medications disposal practice: The case of patients visiting university of gondar specialized teaching hospital, Gondar, Ethiopia. *Int J Pharm Sci Res*. 2014;5(12):999-1005.
- Osei-Djarbeng SN, Larbi GO, Abdul-Rahman R, Osei-Asante S, Owusu-Antwi R. Household acquisition of medicines and disposal of expired and unused medicines at two suburbs (Bohyen and Kaase) in Kumasi - Ghana. *Pharm Innov J*. 2015;4(8):85-8.
- El-Hamamsy M. Unused medications: How cost and how disposal of in Cairo, Egypt. *Int J Pharm Stud Res*. 2011;2(1):21-7.

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