



PRACTICE OF HOUSEHOLD STORAGE AND DISPOSAL OF MEDICINES BY GENERAL PEOPLE IN GUJARAT-AN IMPORTANT ISSUE ON ENVIRONMENTAL AWARENESS AND HEALTH

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ABSTRACT

Background: Improper household storage and disposal of medicines by the users may lead to certain problems like irrational use and environmental hazards.

Objectives: To identify the practice of storage and disposal of medicines by the users at homes.

Methods: A house to house survey was carried out in Anand district of Gujarat. One responsible person from the house with prior consent was interviewed. The inventory of medicines available in the house was noted. Storage conditions of medicine and accessibilities by children were checked. The methods of disposal of medicine practiced by them were noted down.

Results: 91.13% houses were found to have stored medicines. A significant number of medicines were found stored at appropriate place and temperature in urban houses than in rural. ($p < 0.00001$). A less number of medicines had easy accessibility by children in urban houses (1.88%) compared to rural (4.4%). The commonest practice of the disposal of medicines was in the garbage (60.25% - urban and 65.75% - rural). Advice regarding the disposal of medicines by the prescribers was given only with 3.85% medicine formulations.

Conclusion: There is lack of knowledge and awareness on storage and disposal of unwanted medicines which might be the factors leading to irrational use, adverse drug reaction and finally to environmental pollution. Hence, health education on storage and disposal of unwanted medicines and creating awareness on environmental problems and development of a policy guideline with immediate implementation are needs of the day.

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INTRODUCTION

Improper household storage of medicines is considered to be one of the factors of irrational use due to loss of efficacy and potency, which may lead to more adverse drug reactions (Wondimu *et al*, 2015). The term "Hazard" connotes to intrinsic capacity, associated with an agent or process which can cause harm, ill health, damage to environment. Improper disposal of medicines may lead to such hazards causing environmental pollution with increased risk of poisoning, misuse and abuse for pets and humans (Bergen *et al*, 2015; Fatma *et al*, 2016).

This study was aimed to assess the practice of drug storage in houses and disposal of unused medicines in Gujarat with the specific objectives of exploring the type of medicines available at houses and also to know the extent of adherence of prescribers' advice regarding disposal of medicine.

METHODOLOGY

It was a cross sectional study, conducted as house to house survey of 800 houses (400 each from urban and rural area) in Anand district of Gujarat during the year 2012- 2014. This study was approved by Human Research Ethics Committee of the institute.

The participants aged more than 18 years, capable of giving information on medicine use within the family were included for interview with prior consent. Any health care professional (who by education, training, certification or license qualified to and engaged in providing health care) in the family members of visited house and participants who refused to give consent or take part in the study were excluded. The interview was held in local language maintaining confidentiality. The details of inventories of all medicines present in the houses were noted down.

Information on knowledge and practice of storage and disposal of medicine were collected using pretested questionnaire. Data collected for the home medication storage included the list of medicines with legal status whether prescribed by doctor or

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self medicated. Moreover, storage condition of medicine was also inspected physically by the investigator. Accessibilities of medicine by children or demented patients were also checked. The methods of disposal of medicine practiced by them were noted down.

Collected data were compiled in Microsoft excel format and were subjected to number, percentage and chi- square test as applicable. P values less than 0.05 was considered as significant.

RESULTS

Out of total 800 houses visited, 729 (91.13%) houses were found to have stored medicines. In urban area, 375 (93.75%) houses and in rural area, 354 houses (88.50%) were found to have medicines stored at home. The percentage of prescribed medicines were more (65.50%) in rural houses as compared to urban houses (55.50%); whereas medicines without prescriptions were found in higher in urban houses (8.25%) compared to rural houses (5.50 %). Of the total 3438 medicine formulations found to be available in 729 houses, 1594 medicine formulations were from urban and 1343 from rural area. Most of them (3371, 98.05%) were of modern medicines (Allopathy). Only 32 & 35 medicine formulations were from other system medicines (Complimentary and Alternate Medicine) from urban and rural area respectively.

A significant number of medicines were appropriately stored in urban area (94.78% for place & 92.43% for temperature) than in rural area (87.39% each for place & temperature) i.e. $\chi^2 = 59.526$; $p < 0.00001$ for storage place & $\chi^2 = 24.3234$; $p < 0.00001$ for storage temperature (Table 1).

Table 1 Storage condition of medicines (Place and temperature)

Storage condition of medicine	URBAN n = 1915	RURAL n = 1523	χ^2	P
Appropriate place	1815 (94.78%)	1331 (87.39%)	59.526	< 0.00001
Appropriate temperature	1770 (92.43%)	1331 (87.39%)	24.3234	< 0.00001

Less number of medicines were stored appropriately in order to avoid easy accessibility by children in urban houses (1.88%) compared to rural (4.4%) ($\chi^2 = 31.1599$, $p < 0.00001$) (Table 2).

Table 2 Accessibility of medicines by children/ demented persons

Accessibility	Urban n (%)	Rural n (%)	Total n (%)
Yes	36 (01.88)	67 (04.40)	103 (03.00)
	1120 (58.49)	671 (44.06)	1791 (52.09)
No	759 (39.63)	785 (51.54)	1544 (44.91)
	1915 (100)	1523 (100)	3438 (100)

The commonest practice of the disposal of medicines was observed in the garbage, both in urban (60.25%) and rural (65.75%) houses. This was followed by disposing the medicines in dustbin, 30.75% in urban and 8.75% in rural. The other ways of disposal were in open space or outside the house (2.25% & 14.75% in urban and rural area respectively). 'Ukardo', in local language known as a place of cow-dung

disposal, was considered as another method of disposal by 0.75% in urban and 3% in rural study participants (Table 3).

Table 3 Practice of disposal of medicines

Place Of Disposal	Urban n (%)	Rural n (%)
Dustbin	123 (30.75)	35 (8.75)
Garbage	241 (60.25)	263 (65.75)
Open Space/Outside the House	9 (2.25)	59 (14.75)
Ukardo (Cowdung)	3 (0.75)	12 (3.00)
Mixed Of Above	7 (1.75)	20 (5.00)
Gutter/ Toilet	4 (1.00)	2 (0.50)
Unused Well	0 (0.00)	3 (0.75)
Pond	3 (0.75)	0 (0.00)
Dig In The Soil/ Garden	6 (1.5)	5 (1.25)
Given Back To Doctor/ Pharmacist	4 (1.00)	1 (0.25)
Total	400 (100)	400 (100)

Four study participants from urban and two from rural area preferred to throw the medicine in gutter/ toilet. Six (1.5%) and 5 (1.25%) participants were preferring to dispose the medicines under the soil while 4 (1%) and 1 (0.25%) persons respectively from urban and rural area wanted to give back the medicine to either doctor or pharmacist as the way of disposal. Ponds were preferred by 3 (0.75%) urban participants while unused well were preferred by the same number of rural participants.

Advice regarding the disposal of medicines by the prescribers was given for only in 113 of 2937 (3.85%) medicine formulations (Table 4). Though it was less in number, in urban area, it was significantly more, 5.58% compared to rural area, 1.79% ($\chi^2 = 28.3967$; $P < 0.00001$).

Table 4 Percentage of medicines for which advice regarding its disposal was given by prescriber

Advice given	Urban n (%)	Rural n (%)	Total n (%)
Yes	89 (5.58)	24 (1.79)	113 (03.85)
	1505 (94.42)	1319 (98.21)	2824 (96.15)
No	1594 (100)	1343 (100)	2937 (100)

DISCUSSION

The appropriate storage condition of drugs refers to adequate space with proper ventilation-lighting, temperature controls and refrigeration when needed, and being out of reach of children. If medicines are not stored properly they get degraded and the potency of the drugs is reduced. Therefore, they may not be effective in the way they were intended, and so pose a potential risk to the health and wellbeing of the person receiving the medicine.

In our study an appropriate storage condition was defined as keeping the medicines in cool dry place and, if needed, under refrigeration, exposed to a ventilated area but not exposing to sunlight. A large number of medicines in this study were stored in appropriate places and temperature both in urban and rural area. But, some of the inappropriate storage locations identified were in the kitchen near stove, above the refrigerator beside stabilizers with higher temperature, along with unused items, near window with direct exposure to sunlight. This finding was similar to the Serbian study (Kusturica *et al*, 2012)

while comparing storage place (89.8 % in urban and 89.0 % in rural). Inappropriate storage condition was also found to be high in countries like Brazil (Mastroianni *et al*, 2011), Belgium (De-Bolle *et al*, 2008), Basrah, Iraq (Jassim, 2010) and Cebu city (See *et al*, 2014) compared to this study. If dangerous drugs are not stored in proper places and are easily accessible by children, it may lead to accidental poisoning, due to ingestion of oral drugs. A study from Northern UAE by Sharif *et al* (2010) reported to have a home pharmacy to keep medication (5.6%) out of the reach of children whereas in Serbian study (Kusturica *et al*, 2012) there were more number of medicines (19.6 % in urban and 23.1 % in rural) accessible by children compared to our study (1.88% in urban and 4.4% in rural area). Another study conducted in Turkey (Erkal and Safak, 2006), reported that 50% of accidental poisoning were due to the storage of medicines within reach of children.

FDA (Food and Drug Administration) mentioned that many unwanted and expired medicines in the communities are disposed of via general waste or sewerage. The popular methods for medication disposal are in the garbage, flushing down in toilet or sink which ultimately damaging the environment. In the past decade, more than 100 different medications, including fluoxetine, gemfibrozil, and ibuprofen, have been discovered in the environment, detected in wastewater (Monteiro and Boxall, 2010). It often leads to problems such as health risks, medicine resistance, and overall decreases the quality care of population and increases morbidity and mortality, also excessive spending on pharmaceuticals and wastage of financial resources, by both patients and health care system (Atinafu *et al*, 2014).

In this study it was found that, garbage was the commonest means of disposal for unwanted or leftover medicines by both rural and urban people, followed by throwing them in dustbin by urban people while rural people consider throwing them in open space near home. Similar reports were also there in Serbia (Kusturica *et al*, 2012), Northern UAE (Sharif *et al* 2010), Nigeria (Auta *et al*, 2011), Qatar (Kheir *et al*, 2011), and also in other states of India (Radhakrishna *et al*, 2014; Swaroop *et al*, 2015). Two participants admitted that their children consumed the medicines that were disposed in open space near house that led them to hospitalization. Of the currently available means, the most environmentally sound way of disposing of pharmaceutical waste is incineration. Dumping in the soil/ garden, giving back to doctor/ pharmacist, throwing in gutter / toilet / ponds are other proper means of disposal but in this study, very less number of participants were aware of these. Medicines discarded down sinks and toilets not only enter waterways affecting marine life, but also enter the water table via the sludge component of the sewage treatment process thereby potentially affecting human and animal life. Numerous medications have been found in trace amounts in groundwater, surface bodies of water, and drinking water (Auta *et al*, 2011). In recent years, the existence of pharmaceuticals and their metabolites in water has been recognized as potentially dangerous. Acetaminophen, verapamil, and estradiol are just a few of the chemical routinely found in American waterways (Dean and John, 2006). Unfortunately, current water treatment systems do not remove many pharmaceuticals from drinking water.

All these definitely add to the complexities to water, soil pollution and thereby increasing incidence of diseases which were not common in past and the most threatening problem of

drug resistance. The concentrations of these medications might be negligible; but long-term exposure to even low levels of multiple medications could be hazardous (Dean and John, 2006). It is therefore critical that unwanted drugs are disposed of safely and it is prudent to minimize the contamination as much as possible. Only a small proportion of storage and disposal of medicines in use have so far been investigated, and there is a great need to understand how these substances affect the environment.

Health professionals often focus on giving information on use of medicine to patients but limited information is offered on storage of medicines and their disposal (Kheir *et al*, 2011). Advice regarding the disposal of medicines by the prescribers was not given for 90% of medicine formulations. About 80% of participants from the studies in Fort Lewis, Washington by Dean and John (2006) and a medication disposal survey of 2009 from Chicago reported that they had never received information about proper medication disposal. The health care professionals must have enough interaction with patients and consumers on use of medicines and therefore, increase in awareness and education on disposal of medicine by common people that can be very well advocated through them.

There can be various ways of imparting education either in the forms of discussion with patients or by distribution of written leaflets regarding storage and disposal. This can be done during consultation by doctors or while dispensing by pharmacist. Educating patients on proper medication disposal can affect patients' beliefs about medication disposal and is the first step toward changing their behavior. Pharmacist may be able to facilitate the proper disposal of unwanted medications. Thus it is believed that education can positively affect patients' disposal behaviors.

Present study also showed that the practices followed, were due to lack of knowledge and awareness towards the disposal of medicines, the medical laws or regulations even among the health care providers especially doctors, pharmacists, village professionals. There is lack of Drug Disposal Guidelines in India unlike other countries like US. The medicine take back programs are run by some countries like Australia, US, Europe. Such programs definitely can enhance the safe disposal of medicines and thereby can improve the environment from hazards caused by medicinal products. The reason for low rates of medication return to pharmacies might be due to less promotion by pharmacists or health workers who must be well aware of these issues and educate the community on right ways of disposal of medicines.

CONCLUSION

Improper ways of storage and disposal of medicines found in our study suggest the role of education on storage and disposal of unwanted medicines and creating awareness on environmental problems for common people as the need of the day. This calls for immediate intervention through health education including effect of environment on health by health care providers especially doctors, pharmacists, nurses and health workers in the community at large and most importantly development of a policy guideline with immediate implementation.

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