



Investigating the Status and Causes of Storing Surplus Household Medicines in Tehran



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Highlights

- A significant amount of surplus medication is stored in Tehran households, with over 30% being expired or having a defective appearance, posing a potential public health risk, especially to children.
- The most common disposal method for expired or surplus medicine is inappropriate, with 86% of respondents disposing of them in household trash, highlighting the lack of a proper management system.
- Storage practices are often unsafe, with 13.7% of households keeping medicines in any accessible location, and nearly half (48.7%) storing surplus drugs until they expire, indicating a need for public education and national policy.

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ABSTRACT

Background: Surplus household medicines is a critical issue in public health. This study was investigated the status and reasons of the surplus household medicines in Tehran -Iran.

Methods: This cross-sectional and descriptive- analytical research was done in selected districts of Tehran. The questionnaire content validity was done by CVR and CVI indexes. The collected data were categorized using the ATC classification system. The sample size was 384 families, but 510 families were entered in research processes. Independent T tests and one-way ANOVA were used for data analysis.

Results: The selected districts had 1990000 populations. The response rate for questionnaire was 85.7% so, the 437 household were included in the final analysis. The 67.2 % of surplus medicine have valid date and safe appearance. The mean weight of excess drugs were 243.528 ± 36.361 grams. Over than 30% of excess medicines were kept at home. Based on Pearson correlation coefficient, the participants age and surplus medicine have negative correlation (-0.053). Increasing of the family dimension has no effect on weighted average of surplus medicine (p- value >0.05). Cabinet is the most common place to store surplus medication in studied households. The location of medication storage is somewhat consistent with the age of the participants. Education levels has not effects on surplus medication weight (p>0.05). Employment types in participants has significant effects on surplus medication amount(p<0.05) and the weighted mean of surplus medication is higher in government employees and retired & unemployed. Dispose of in household trash was the highest choice (86%).

Conclusions: Inappropriate storage of excess medicines can be dangerous in terms of public health. Inappropriate disposal can lead to emerging pollutants in environment. Due to economic value and elevation of public safety, management of surplus medication need for appropriate policy making with approaches to support the formulated policy.

Keywords: Surplus medicines, Pharmaceutical waste, Pharmaceutical storing



Introduction

Coining of the twenty-first century as the century of the elderly by the world health organization (WHO) shows significantly shifting of population pyramid. This phenomenon has led to one of the most important concerns in worldwide which need to multispectral policymaking, especially in health care services(1). Expenditure in health wards for improvement of healthcare services which lead to mortality and financial risk reduction with an emphasis on pharmaceutical ward is one of the requirements of this issue(2, 3). Rate of elderly population pattern in Iran shows that this path has high rate which occurred over 30 to 40 years versus 100 to 200 years in high income countries(4). Prevalence and cause of self-medication in Iran as a health issue related to population pattern, so in students was 67%, and in the elderly people 68%(5). High prevalence of self-medication in the elderly which includes home remedies can be considered as one of the causes of storing surplus household medicines (6).

Excess medications can remain in homes for various reasons the most important of which include: potential use in the future, financial concerns, acquisition without medical prescription, change of treatment or change in dosage leftover from previous treatment, patient's death, prescription of excessive dosage, and the possibility to donate to other people(7). Regardless of the root causes of excess medication in homes, surplus household medicines can become to pharmaceutical waste which can lead to several environmental perturbation as an emerging pollutant due to their low concentrations and the negative effects they pose to the environment(8). These pollutants have the potential to induce a large range of acute and chronic effects including endocrine disruption, immunotoxicity, neurological disruptions, cancers and etc., ... on human health and ecosystems. To prevent these damages, countries have developed several policies and regulations, but they have not been able to resolve issues related to problems caused by drug residues(9). Although, the WHO recommended several guidelines for the safe disposal of excessive and expired drugs which included return to donor, pharmacies or

manufacturer wherever practically possible, landfill after immobilization by encapsulation or neutralization, flushing liquid pharmaceuticals into sewers in small quantities over a period of time, incineration; but these recommendations are not applicable in most countries and are associated with several problems(10). Lack of statistics and information regarding the amount of surplus drugs is one of the major problems (health and environment) in developing appropriate policies for this issue, so this research examined the amount of surplus medicines in selected regions of Tehran (as a crowded and multicultural city) in order to develop a suitable plan for managing these problem.

Material and Methods

This was a cross-sectional research which done as descriptive- analytical. Data were collected from Aug 7, 2023 to Mar 5, 2024. The methodology specifies a standard procedure for collecting data and a method for obtaining valid information about surplus household medicines in selected districts of Tehran. The study population which selected purposefully, including households of people living in selected districts of Tehran (3,4 and 15) (Fig. 1). The districts selection was performed based on access to pharmacies, social classes, general services and the economic status of residents. Based on Iran statistical center information, the selected districts had 1990000 populations. Although based on Sharol and Cochrane procedures, the sample size was 384 families, but 510 families were entered in research processes. After questionnaire design based on literature review, its validity and reliability were tested. The questionnaire content validity was done by CVR and CVI indexes. Also, the reliability of data collection tool was performed by Cronbach alpha coefficient (0.815). The questionnaires were sent and completed by calling for them, and excess medications were collected during the data collection process. It was observed that 73 questionnaires were incomplete or had problems, which deleted from research's process. Finally, 437 families were entered in research process. Householders from each district were selected through a systematic, random sampling

technique to cover all parts of the selected district. The questionnaire contained questions on the demographic information, occupation, education, type of health care insurance, medicines storage and disposal methods(11). Data on collected medications recorded from the observation in the households were categorized using the World Health Organization (WHO) Anatomical Therapeutic Chemical (ATC) classification system(12). Data

were analyzed with EXCEL and SPSS (Ver. 26) software. Descriptive analyses were performed by frequency and mean. In the analysis of the association between socio-demographic as well as other related variables and medication storage practices, independent T test, one-way analysis of variance (ANOVA) were undertaken. A p -value cut off point of 0.05 at 95% CI was used to determine statistical significance of association(11, 12).

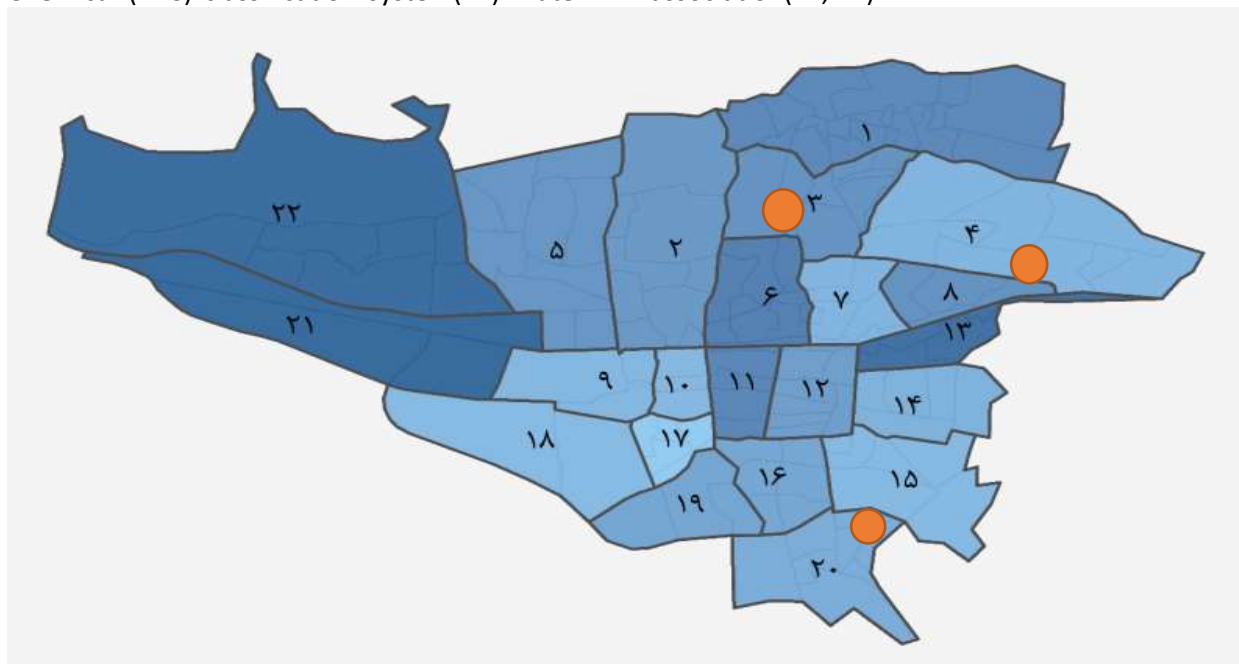


Fig 1: Map of Tehran's 22 districts and selected districts

Results

From the 510 households in the study, surveys of the 437 were deemed complete and included in the final analysis making the response rate 85.7%. Demographic data of participants were showed in Tab.1. Weight and status of surplus medicines in families are shown in Tab.2. Based on weight, 67.2 % of surplus medicine have valid date and safe appearance and 32.8% have expired date and defective appearance., which reveals 242.79 and 118.57g per capita. These results show that the participants keep over than 30% of excess medicines at home, regardless of expiration date and appearance, which can be dangerous in terms of public health for other members, including children. Based on Pearson correlation coefficient, the participants age and surplus medicine have negative correlation (-0.053) which revealed that increasing of participant age with non-significant effects can led to decreasing of surplus medicine. Also, T-test analysis showed

that the age of participants and weight of surplus medicine have not significant relationship ($p > 0.05$). This issue may be related to the consumption of household excess medications, as people may take their medications without consulting a doctor and based on their experiences during their illness. Economic status, knowledge, attitude and practice of the participants are other factors which may influenced the amount of the surplus medicine. Family dimension is other factor can be influenced the surplus medicine. Analysis of the relationship between these factors revealed that increasing of the family dimension has no effect on weighted average of surplus medicine (Data not shown with p - value > 0.05), but increasing of this factor led to decreasing of the surplus medicine per capita($p < 0.05$) (Table 3). The total weight of excess drugs ranged from 0 to 1000 grams with a mean weight and standard deviation of 243.528 ± 36.361 grams. Based on the calculation of quartiles, 25% of the excess drugs in the study population weighed less than

or equal to 200 grams (first quartile), 50% weighed less than or equal to 300 grams (second quartile), 75% weighed less than or equal to 500 grams (third quartile), and the rest of the study population had more than 500 grams of excess drugs.

Behavior of participants for about duration storage time of surplus medication are different (Tab 4). The duration of storage of surplus medicines varied among participants. Some participants stated that they do not store surplus medicines. But some of them keep excess medication until the expiration date. The location of excess medication storage is an important factor that affects family safety, especially children. The participants have different behavior on where medication storage and storage location has nearly significant differences in participants and the cabinet is the

most common place to store surplus medication in studied households (Table 5). Based on age and storage location of medication, it can be said that the location of medication storage is somewhat consistent with the age of the participants, as shown in Table1, the 17.6% of participants have >56 years and 13.7% of them are storage the surplus medications in available at each location (Table 5). Examining the effects of education levels revealed that this factor has not effects on surplus medication weight ($p>0.05$) (Data not shown). Employment types in participants showed that this factor has significant effects on surplus medication amount($p<0.05$) and the weighted mean of surplus medication is higher in government employees and retired & unemployed (Data not shown).

Table 1. Socio-demographic information of responders

Variable	Frequency (%)
Age	
<45	61
46-50	12.8
51-55	8.2
>56	17.8
Educational status:	437(100)
≤Diploma	33(7.6)
Postgraduate	104(23.8)
Basic Science	200(45.8)
≥Master of Sciences	100(22.9)
Employment:	437(100)
Government employee	128(29.3)
Private employee	25(5.7)
Worker	59(13.5)
Retired & Unemployed	150(34.3)
Freelance Job	75(17.2)

Table 2. Weight and status of surplus medicines in families

Status	Frequency	Percent	Total weight	Weight percentage	Per capita (g/family)
Valid date & safe	437	100	106101	67.2	242.79
Expired date & Defective appearance	437	100	51814	32.8	118.57
Total	437	100	157915	100	361.36

Table 3. The relationship between per capita surplus medicines and family dimension

Family dimension	Frequency	Percent	Weight (per capita)	SD	p- value
2	57	13	164.56	136.035	0.00
3	112	25.6	113.54	80.41	
4	229	52.4	92.62	57.97	
>5	39	8.9	79.47	53.07	
Total	437	100	106.19	81.52	

Table 4. Duration storage time of surplus medication

Storage time	Frequency	Percent
Up to 3 month	33	7.6
3-6 month	53	12.1
6-12 month	42	9.6
>12 month	70	16
Until the expiration date	213	48.7
Do not keep	26	5.9
Total	437	100

Table 5. Location of surplus medication storage

Storage location	Frequency	Percent	Weighted average (SD) (g)	p-value
First aid box	116	26.5	392.93±(269.97)	0.076
Refrigerator	109	24.9	325.50±232.51	
Cabinet	152	34.8	379.31±232.23	
AAL*	60	13.7	320±228.70	
Total	437	100	361.36±243.53	

- : Any available location

Table 6. Disposing of expired date and surplus medications

Disposing of method	Agree		Disagree		p-value
	Frequency(%)	Weighted Mean(SD)	Frequency(%)	Weighted Mean(SD)	
Dispose of in household trash	376(86)	374.51±(240.77)	61(14)	280.33±(246.77)	0.005
Storage at home	86(19.7)	411.4±(261.96)	351(80.3)	349.1±(237.57)	0.033
Delivery to recommended pharmacies	16(3.7)	272.5±(194.85)	421(96.3)	364.74±(244.74)	0.137
Delivery to local hospitals	13(3)	304.62±259.21	424(97)	363.1±243.14	0.394
Dispose of in sewages	117(26.8)	413.03±244.33	320(73.2)	342.47(240.85)	0.007
Handover to NGOs (Jihadist groups)	44(10.1)	409.09±279.59	393(89.9)	356.02±238.96	0.17

Conclusion

Contrary to expectations shifting of population pyramid and increasing of elderly population in Tehran lead to decreased excess medications in homes. The 32.8% of excess medications have expired date and defective appearance. Regardless of the root causes of excess medication in homes, surplus household medicines can become to pharmaceutical waste which can lead to detrimental effects on health and the environment, directly or indirectly(13). Sorensen and *et al.* were reported that increasing of medications stored in the home led to increasing of the risk of poisoning from

their use by other family members(14). This problem can be exacerbated by improper storage in homes.

As shown in Table 4, approximately 48.7% of the participants keep their surplus medicines at home until their expiration date, and based on the Table 5, 13.7% of the them keep their medicines in any accessible place, which indicates the possibility of access by children or other family members and the occurrence of drug poisoning accidents. Keeping excess medicines until their expiration date, which will eventually make them unusable, indicates a lack of national policies for managing excess

medicines in homes. This is a very important issue from the perspective of public health and environmental pollution, and preventing inappropriate disposal of excess medicines, including disposal in toilets or household trashes. Disposal pattern of household medication is a critical issues which considered in several researches, so in the European Union, half of household pharmaceutical waste is disposed of inappropriately via the sewage system or waste bins (15). Other researcher were reported that disposal of excess medication were performed via disposal in sinks, household solid waste, kitchen bins and sanitary wastewater collection systems(16, 17). Based on this research dispose of in household trash was the highest choice (86%) which revealed lack of an appropriate management system. Considering the problems of emerging pollutants in the environment and their health effects, and the possibility that these unregulated excess drugs are disposed of improperly and can eventually find their way into groundwater, adopting the appropriate policies at the national or international level to protect the environment and public health is a serious issue that must be addressed by responsible international organizations. Therefore, the people's response to agree or disagree with sewage disposal (Table 6) shows (26.8% versus 73.2% and $p=.007$) that if there is a suitable policy, people will support it. Because people are willing to donate surplus medicines to grassroots jihadist groups, even with a small percentage.

A very small number of participants hand over their surplus medicines to designated pharmacies (Tab. 6), which indicates that if there is an appropriate policy, especially one with incentive tools, the public will follow it and participate in appropriate management of surplus medicines.

A result that may not be related to the subject of the study, but is important from a demographic standpoint and should be noted is that more than 50% of the studied households have a household size of four people, which indicates the poor replacement rate situation in

the Iranian capital. It also shows that the fertility rate in the Iranian capital is below the population replacement level.

Although Iran has population growth policies in its plans and has adopted many incentive policies for this issue, after several years this issue has not improved and the replacement rate has not yet reached an acceptable level.

Because in many cases, patients do not take their medications in full and keep excess medications at home, development of appropriate policy for this issue is need(18). More than 30% of the medicines in the households studied were expired and had defective appearance, indicating that the lack of proper monitoring, policy and education systems in medicine management is a major issue(19).

Developing better methods for disposing of pharmaceuticals and reducing environmental damage is a very important concern because people often dispose of excess medicines in the sewage system or trash bins. Since conventional wastewater treatment systems are not able to completely remove pharmaceutical compounds, these compounds enter the environmental media through wastewater or landfills and cause numerous problems as emerging pollutants (20, 21).

Although in some countries, incineration is one of the disposing methods of excess medicines, this method is most expensive and unsustainable which requiring access to specialized equipment to reduce the environmental damages of toxic gases(22).

Based on previous studies, numerous reasons, including non-adherence to treatment, over-prescription of medication, changes in the treatment process, rapid patient recovery, or death, are the main causes of excess household medications, which lead to waste of pharmaceutical resources(23). These issues in the surplus medication management show that an appropriate response to this issue requires other careful studies and appropriate policies with health promotion, the environment, and helping the household economy approaches to support the formulated policy.

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