

Evaluation of public knowledge and attitude towards how to use, store and discard expired pharmaceutical drugs in Saudi Arabia

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ABSTRACT

This study aimed to evaluate the public knowledge and attitude toward how to use, store and discard unused and expired pharmaceutical drugs among the Saudi population. A descriptive cross-sectional study design was used to evaluate the knowledge, attitude, and practice of participants toward the usage and disposal of expired pharmaceutical products among the Saudi population via an online survey distributed throughout social media sites during the period of two months from March 2020 to May 2020. Microsoft Excel and graph pad software analyzed the cleaned data. Descriptive statistics on sample characteristics were computed in frequencies and percentages and presented using tables and figures. 650 participants enrolled in the study. 75% of the participants had unused medicine stored at home during study time. The common types of medications kept in households were analgesics (90%) and antibiotics (67%). Most participants showed a well understanding of medication waste (70%) and the potential risks associated with improper drug disposal (85%). There was a lack of received information about safe usage, storage, and disposal practice. About 55% of the participants discarded the unused and expired medications by throwing them in the trash. In light of this study's results, which showed a large percentage of participants kept unused or expired medications in their homes despite their knowledge of the seriousness of this situation. Therefore, it is essential to plan educational programs about the rational use and expiry date of drugs to improve their awareness, attitudes, and practices regarding the safe disposal of unused and expired medications. Guidelines on safe disposal are required, and an organized method of collecting unused and expired pharmaceuticals such as the "drug take-back program" is needed. The pharmacist also has a significant role as a drug expert in educating patients about the drug's uses and how to store and discard it.

Keywords: Knowledge, attitude, expired pharmaceutical drugs.

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INTRODUCTION

Pharmaceutical products are used increasingly every year for diagnosis, treatment, or prevention of health conditions. This growth comes with the fate and effects of these products on the environment and human health (Bound and Voulvoulis, 2005). According to WHO, more than 50% of medications are prescribed incorporated, or prescribed and sold, which leads to being stored at home

unnecessarily or disposed of inappropriately and create an environmental threat (WHO_EDM_2004.5_eng.Pdf; Ananth et al., 2010). Large quantities go unused or expire. Accumulation of medications in the household could be due to improved patient's health, change prescription due to a side effect, lack of therapeutic effect, forgetfulness, or patient death (Bound and

Voulvoulis, 2005; Stericycle UK, nd).

The expiration date of pharmaceutical drugs refers to the latest day that the producer guarantees drugs' complete safety and potency. Drug expiration points could be found on many product labels, including over-the-counter (OTC) and nutritional (herbal) dietary supplements. Pharmaceutical organizations needed by law rules and regulations to put expiration dates on prescription medications for legitimate and liability causes (<http://www.medscape.com/viewarticle/472851>).

Regarding the product type, the expiry date is set after manufacturing or after medication dispensing, or after the opening of the medication's container (Ali et al., 2010). Since 1979, every pharmaceutical industry must have a defined package pamphlet with all the necessary information, including drug usage, side effects, drug interactions, and expiry date (Abdo-Rabbo et al., 2009).

Much of what is known about stability testing to drug expiration dates are derived from a US FDA study (Food and Drug Administration in the United States). In that study, military stockpiles of drugs were tested to attempt to calculate the drugs' stability after the expiration dates have passed. According to their research, of 119 drug products tested, all four to five drugs were stable even beyond their initial expiration dates. Some medicines' quality and efficiency extended to even longer than ten years past their expiration dates (<https://www.winchesterhospital.org/health-library/article?id=73446>).

Although some medications may show less efficacy, less potency, or less stability after the expiration date, there is no scientific evidence that these medications may cause toxicity (Sarla, 2019). If an expired drug is designed for some health condition, for instance, for a headache, too high a fever, or maybe mild pain, it might also be safe to get it; however, drug potency may not be 100% not function as well. For instance, if using ibuprofen (Advil) or perhaps acetaminophen (Tylenol) expired does not relieve a headache or do its action correctly, it could have dropped its potency. The study indicates numerous stockpiles of medications kept around 90% of their potency in their classic stock bottle (<http://www.medscape.com/viewarticle/472851>).

Moreover, there exists the question of whether or not patients should use expired medications. Doctors recommend that it is usually better to utilize medications that are not outdated. Suppose a medication is essential for a persistent and potentially life-threatening condition, for instance, a heart condition, cancer treatment, seizure, or maybe life-threatening hypersensitivity reaction. In that case, it is most probably a good idea to obtain a brand-new medication before it expires and also keep up with refills as required. Nevertheless, if a drug is necessary, the client cannot change the expired drugs. There is little to no evidence that expired drugs are hazardous. The individual must be mindful; it might not create the desired therapeutic outcome. The safety of expired drugs has to

be considered. Drugs might alter their chemical and actual physical attributes, as is apparent when tablets disintegrate and fluids separate into layers or perhaps change color within the dispensed bottle (Kuspis and Krenzelok, 1996). Sometimes, it is observed by the moisture content or increased level of the microbial index, which influences the non-utilization of the drug (Bajaj et al., 2012).

To illustrate the financial burden the medications in a general cause for the governments and low-income individuals, so many studies have turned towards the possibility of using these drugs even after the expiration date, a rare exception, such as tetracycline as it cause renal failure, which have mixed opinions about its safety use after its expiration, but other drugs such as nitroglycerin, insulin and liquid antibiotics that have not been used can be used after their expiration date with good efficiency if stored well in a low temperature, such as in the refrigerator (Sarla, 2019).

Most often, the patients are counseled about the proper use of medication including the administration way, duration of treatment, and conditions that need to be concerned. But information about storage or disposal of the medicine lacks (Sharif et al., 2010; Jassim, 2010). Any mistakes in medication storage and handling eventually lead to loss of potency and efficacy (Ogle et al., 2016; Pingel and Volund, 1972; Grajower, 2014).

Incorrect discarding of medications as drained in waterways leading to hazardous effects. A study conducted in the USA found that many drugs such as ethinylestradiol, verapamil, and acetaminophen are found in waterways; ethinylestradiol affects the sexual development of fish and causes a genetic defect in marine life. Besides, the disposal of antibiotics in water, leading to the development of bacterial resistance (Eltaib and Alanazi, 2020; Jobling et al., 2006; Costanzo et al., 2005). Another study conducted in southeast Queensland recognizes a considerable level of antibiotic and multiple antibiotic resistance in *Escherichia coli* (*E. coli*) at wastewater treatment plants (WWTPs). *E. coli* was identified to be resistant to ciprofloxacin, tetracycline, ampicillin, and sulfamethoxazole (<https://espace.library.uq.edu.au/view/UQ:151291>).

Many studies were conducted to evaluate people's awareness, attitude, and practices regarding unused and expired medications. One of them conducted in India found that 72% of the sample size does not check the expiry date when purchasing or even taking the pills (Eltaib and Alanazi, 2020). While opposite findings in the Nigerian study state that (93.3%) of participants were well aware regarding expired drugs (Auta et al., 2013). The pharmacist has a great responsibility towards the community in explaining the risk of storing expired medicines and adequately disposing of them to reduce their risk to health and the environment (Sarla, 2019).

Till now, numerous studies indicated the existence of pharmaceuticals within water forms as within surface

water, groundwater, coastline, and aquatic environments, as well as recipient waters, wastewater, and sludges (Huber et al., 2016).

The majority of the researches on that topic were carried out within North America, Europe, and China. Assessed pharmaceuticals concentrations within the influents and leakage of treatment plants of wastewater have shown that those systems eliminate many dangerous pharmaceuticals insufficiently (Verlicchi et al., 2012).

Other various studies have indicated active pharmaceutical ingredients as well as metabolites at levels of nanogram within different water potable plants (Kookana et al., 2014).

A Serbian study indicated that home antibiotics are a possible source of environmental and health risks. Besides being harmful to the aquatic creatures, pharmaceuticals trace concentrations have been spotted previously within the water used for drinking in Greece and the United States and cooked seafood (Kusturica et al., 2015; McEneff et al., 2013).

Pharmaceutical wastes involve non-hazardous and hazardous waste, controlled materials, and expired pharmaceuticals. Those wastes may originate from various sources as from the industrial factories, from wastes generated from medical and healthcare centers, as well as laboratories, and from home unused medications by evacuation following infusion, injection, or ingestion; besides to washing topical drugs out at the time of bathing; as well as discarding leftover or unwanted pharmaceuticals (Jaseem et al., 2017).

Awareness and practices of adequate disposal of home leftover medications within the least developed, the developing, and the developed countries are so upsetting and presented poor outcomes of careless disposal. The studies carried out within Saudi Arabia, Yogyakarta, Indonesia, Austria, Ghana, Nigeria, as well as India indicated negligence and gaps present in the disposal of home medications, besides that developing awareness, is highly required for all the countries regarding their economic statuses (Bashatah and Wajid, 2020; Chunga and Brooks, 2019).

The commonest practice in the disposal of medications within Saudi Arabia was through discarding the unused drugs within the house garbage or through flushing them into the toilet. Other different practices involved keeping the drugs to the collection of hazardous wastes, distributing them to friends, or even burning the leftover ones. Moreover, rarely, people within Saudi Arabia provide these leftover drugs to non-Saudi ones who are not eligible for health-care governmental access or couldn't afford these treatments (Lucca et al., 2019; Alazmi et al., 2017).

The purpose of this research is to evaluate the public knowledge and attitude toward how to use, store, and discard unused and expired pharmaceutical drugs among the Saudi population.

METHODOLOGY

Study design

A descriptive cross-sectional design was used to evaluate participants' knowledge, attitude, and practice toward the usage and disposal of expired pharmaceutical products among the Saudi population via an online survey distributed throughout social media sites. The study was conducted during the period of two months, from March 2020 to May 2020.

Sample size

The sample size was calculated using an online software assuming that the number of students at Umm Al-Qura University is 100,000 at least, resulting in a minimum sample size of 383 participants. After sharing the link to the online questionnaire, a total of 650 participants were involved and completed the questionnaire. And according to the nature of this web-based study, the questionnaire link was distributed at Umm Al-Qura university's medical and non-medical Facebook groups and invited them to volunteer in this study after explaining our study aims.

Inclusion criteria

Participation in this study did not require specific criteria unless the Saudi nationality, age not less than 18 years, and participants agreed to complete the questionnaire.

Study tool

A structured questionnaire was developed after an excessive review of similar previous published studies (Eltaib and Alanazi, 2020; <https://www.consumerreports.org/drug-safety/the-problem-with-expired-medication>; Temu-Justin et al., 2002). It consists of four parts: assessing socio-demographic data (as age, sex, and residence); assessing knowledge; assessing the attitude; determining the practice of participants toward disposal of expired medications.

The questionnaire was developed in two language forms: Arabic and English, to cover all educational types of the study population.

A pilot study was conducted on a small population ($n = 30$) to test the study tool's validity, and reliability was tested using Cronbach's alpha test. The value for reliability was found to be 0.89, which is acceptable to meet our study's goals.

On the first page, there was a summary describing the study's aim, and then the participant was forwarded to conduct the study questions.

Ethical consideration

Ethical approval was obtained from the review board at Umm Al Qura University (UQU). All the participants freely participated with the ability to withdraw whenever they want to, with no consequences on them, in addition to preserving their confidentiality.

Data collection and analysis

The data were clarified and organized, then analyzed by using GraphPad software and Microsoft Excel version 2016.

Descriptive statistics, including frequencies and percentages,

were computed to describe the characters of the sample size. All results were presented using tables and figures.

The sample size was determined at the level of 95% confidence interval (CI 95%) and a 5% margin of error (E 5%) with a probability value of 0.5 (p-value < 0.5 was determined to be statistically significant).

RESULTS

Socio-demographic data of the participants

Almost all individuals (n=650) agreed to volunteer in the study giving a 99.8% response rate. Among the total respondents, 344 (53.0%) were males, and 306 (47.0%) were females. The majority were married 357 (55.0%) as described in Table 1.

Reported classes and dosage forms of the stored medications

More than 90% of the stored medication in Saudi houses were analgesic, antipyretic, and non-steroidal anti-

inflammatory drugs (NSAID), followed by antibiotics, cold preparations, and chronic disease medications, as shown in Figure 1.

Reasons for the unused medications at homes were estimated, finding that most of the participants (55.3%) stopped taking medicine after feeling symptoms improved and others (17.7%) forgetting to take it, as shown in Figure 2.

Participants attitude toward unused and expired medications disposal

55.4% of participants "strongly agreed" that the presence of unused and expired drugs at home increases the potential risk, and 63.8% "strongly agreed" that children are at higher risk if the expired or unused medicine remains at home. While 40% of participants "strongly agreed" to the insufficient information regarding safe disposal practices. For take-back programs, 47% "strongly agreed" and 35% "agreed" that tack-back programs should be applied mandatory, as shown in Table 2.

Table 1. Socio-demographic characteristics of the study population (n = 650), n (%).

Age (years)		Gender		Residence	
18–24	181 (27.8)	Male	344 (53.0)	Makkah	487 (75)
25–31	200 (30.8)	female	306 (47.0)	Jeddah	65 (10)
≥ 32	269 (41.4)			Taif	52 (8)
				Afif	46 (7)

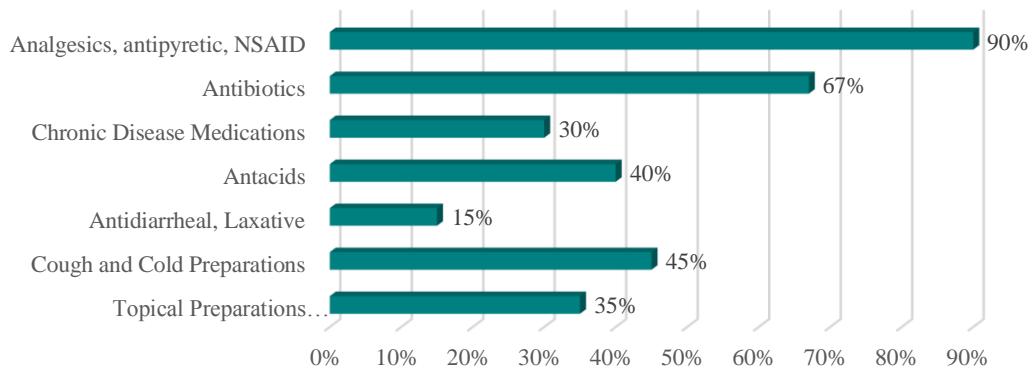


Figure 1. Participants' reasons for medicine remaining unused at homes (n = 650).

Participants' knowledge toward unused and expired medication disposal

As shown in Table 3, 70% of participants knew about medication waste, 85% agreed that incorrect disposal of unused or expired medicine harmed the environment,

and 72% of them suggest the need for the availability of specific instructions guiding them toward the correct disposal of medication. For increasing awareness in our society, 50% of participants choose an electronic method, 25% choose that it is doctor's responsibility, and only 13% thought that was pharmacist role.

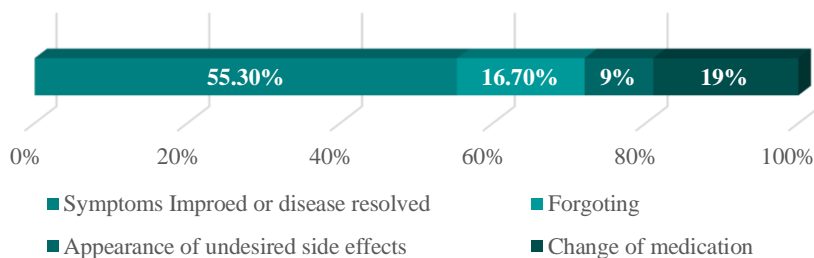


Figure 2. Reported classes of the stored medications among the study population in Saudi Arabia (n = 650).

Table 2. Perceptions of unused and expired pharmaceuticals among study participants, n (%).

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Unused and expired medications are a potential risk at home	25 (3.8)	34 (5.2)	7 (1.1)	224 (34.5)	360 (55.4)
Children are at risk to manipulate with unused and expired household medications	14 (2.2)	22 (3.4)	6 (.9)	193 (29.7)	415 (63.8)
There is a lack of proper information on the safe disposal of unused and expired household medications.	28 (4.3)	27(4.2)	23(3.5)	312 (48)	260 (40)
Health care specialists make advice on the safe disposal of unused and expired household medications.	107 (16.5)	162 (25)	62 (9.5)	221 (34)	98 (15)
Training programs of unused and expired medications should be mandatory	27 (4.2)	52 (8)	37 (5.8)	228(35)	306 (47)

Table 3. Participants' knowledge toward unused and expired medication disposal.

Questions	n (%)
Do you have enough information about medication waste?	
Yes	455 (70)
No	195 (30)
Do you ever read medication disposal guidelines and safety measures?	
Yes	318 (49)
No	332 (51)
Incorrect disposal of unused and expired medications has an impact on the environment and health?	
Yes	552 (85)
No	97 (15)
How will the harmful effect of unused and expired medications decrease or be controlled?	
Providing proper guidance to the consumer.	468 (72)
Prescribing in quantities and for a duration that ensures patient compliance.	97 (15)
Lowering the number of prescribed medicines by the doctor.	28 (4.3)
Donating or sharing the unused medicines.	29 (4.5)
Other (keeping in a safe place, disposing of in the toilet, burning).	27 (4.2)

Table 3. Continues.

Did you receive any information about the correct and safe disposal techniques of medications?	
Yes	552 (85)
No	97 (15)
Stakeholder for developing the awareness among the community about the proper disposal of unused and expired medications	
Electronic Media	325 (50)
Physician	163 (25)
Pharmacy	84 (13)
All sources	78 (12)

Disposal practice of unused and expired pharmaceuticals

The majority of participants had unused medicine at their homes during the study period. 55% of them disposed of the unused and expired drug throughout throwing it in the

trash. Only 2% state that they return the unused drug to the pharmacy. 14% crushed the pill before disposing of it, but the majority of participants disposed of the expired and unused drug in its original formulation, and 13% do not know the correct way about unused and expired medication disposal practice (Table 4).

Table 4. Disposal practice of unused and expired pharmaceuticals.

Questions	(%)
Don't you use any bought medications at home?	
Yes	75
No	25
How was your act toward unused medications?	
Throw away in household garbage	55.2
Flush unused medications in toilet/sink	21.9
Keep at home until expired	15
Burn	2
Donate to hospital	1.9
Give to friends or charity centers	1.9
Return to the pharmacy	2.1
How was your act toward expired medications?	
Throw away in the garbage	55.2
Flush unused medications in toilet/sink	35.3
Return to pharmacy	2.2
Give to friends or charity centers	.5
I don't know what to do	3.8
Others (landfill, burn, keep at home)	3
Do you separate unused medications before disposal?	
Yes	68
No	32
How method that you used to discard expired medications?	
Crashed before discarding	14.2
Diluted with water	4.8
As it is	68
I don't know what to do	13

DISCUSSION

The expiration date of pharmaceutical drugs refers to the latest day that the producer guarantees drugs' complete safety and potency. Incorrect discarding of medications as drained in waterways leading to hazardous effects. Many studies evaluated people's awareness, attitude, and practices regarding unused and expired medications.

This study evaluated the knowledge, attitude, and disposal practices of unused and expired medication among the Saudi population in the Makkah region.

Regarding the knowledge of the participants, 70% of them stated that they had sufficient information about medications' waste, as well as 49% stated that they read guidelines and safety measures on the disposal of medications, while the rest of them did not. In addition, (85%) stated that incorrect disposal of unused and expired medications affect the health and the environment and that they received information about correct and safe techniques for disposal of medications, which agrees with what consumer reports stated as many interventions as storing unused medicines on high shelves out of children sight will help in protecting them, as well as regular disposal of expired and unused medications reduce risks for all the ages (<https://www.consumerreports.org/drug-safety/the-problem-with-expired-medication>).

In addition, more than 80% of participants knew about the potential risk of unused and expired drugs toward children and the environment in this study. Still, most of them never received information for the correct and safe disposal of medications. That confirms the results of the study conducted by Shivaraju and Gangadhar (2017), which stated that 75.51% of the participants knew the consequences of storing drugs as well as improper disposal, that is a good sign which recommends their knowledge and awareness that likely leads to abuse and misuse of drugs for recreational aims, unintentional poisoning among children, as well as environmental dangers (Temu-Justin et al., 2002).

Regarding the stored drugs at home, analgesics (90%) and antibiotics (67%) were the most prevalent medication type presented in houses. Reasons for this remaining quantity varying from condition and symptoms resolve to forgetting and developing of undesirable side effects. That meets Jassim's (2010) study, which stated that antibiotics were the main stored medications at home (26.43%), then comes the analgesics (19.58%), and non-steroidal anti-inflammatory drugs (11.45%). Those drugs formed 57% of the overall stored drugs. The high antibiotics percentage within that study refers to the high consumption rate of drugs of that group (Jassim, 2010).

Regarding the attitudes, the majority of the participants strongly agreed that the presence of unused and expired drugs at home increases the possible risks. Moreover, Alazmi et al. (2017) stated that over 70% of the participants stated that the ideal way for disposing of

leftover drugs was through giving them back to a healthcare organization or providers of healthcare. Those participants stated their need for having safe containers for collecting leftover drugs from pharmacies, government hospitals, as well as primary care institutions. Also, 50% of the participants thought the right technique for disposing of medications was through giving them to charitable organizations or giving them to poor ones or non-Saudi ones who were not eligible for governmental free treatment or didn't have the treatment cost (Alazmi et al., 2017).

Regarding the practice, the majority of participants (75%) had stored the unused medications in their homes during the study period. This result nearly meets another study conducted by Jassim (2010) in Iraq, which stated that most of the households (94%) stored the medications at home (Jassim, 2010). Also, other various studies stated that pharmacies were the main source for the storage of medications at home (Grigoryan et al., 2006; McFee and Caraccio, 2006).

Finding an increased number of leftover medications indicates that prescriptions often are not always associated with usage. People may keep the leftover medications as many of them were prescribed for the first infection. However, many others may keep the leftover medications for other users in the future. Moreover, the majority of the community-acquired diseases are respiratory and urinary, for which various prescribed antibacterial drug courses are longer than the required (Lambert, 1999).

Storing medications within child-resistant containers cannot totally prevent children from reaching the medications. That was the finding from a study that studied cases of accidental children's exposure to medications, and it was stated that about half of the grandparents' medications were stored within child-resistant containers. Furthermore, many studies show that most of the patients store unwanted, unused, or expired drugs, thus increasing chances for non-medical usage as self-prescription (McFee and Caraccio, 2006; Lam et al., 2018).

Inadequate storage of medications was stated among 30% of participants within the Begum et al. (2021), study. Also, a past study within China and the United States supported behaviors of home storage of medications. Furthermore, the management of medication wastes has become a significant challenge to the medical field within Bangladesh. The overall manners of disposal of medications across the participants were hazardous as well (Begum et al., 2021; Lam et al., 2018).

Also, the study within Ethiopia indicated that throwing in the trash, flushing to the toilet, and throwing in the environment were the commonest practices of disposal of medications, besides to within Australia and Turkey, the home medications were inappropriately discarded as well; in addition to, a similar scenario was observed within Bangladesh (Atinafu et al., 2014; Akici et al.,

2018).

This study showed that about 55% of the participants discarded unused and expired medications by throwing them in the trash. Similar findings were reported in many studies. A study conducted in Riyadh found that 79% of participants disposed of their medication in the garbage (Al-Shareef et al., 2016).

Also, A survey conducted within the United Kingdom indicated harmful practices of 400 households in which they disposed of expired and unused pharmaceuticals either through the toilet or sink or as home waste. In addition, an Indian study suggested improving their knowledge about prudent and safe disposal methods (Aditya, 2013).

A sequence of tragedies, as exposure to opioid discarded medications within the trash or opioids stored carelessly and ingested by children, led to poisoning. In extreme other cases, deaths were reported as well (Grissinger, 2009).

Toilet, sink, and trash bins are the most used commonly, but they are unfriendly-to-environment methods of disposal of drugs. Many unused and expired medications within the drug cabinets across the public show ignorance regarding techniques of disposal (Ruhoy and Daughton, 2008).

Despite that, only one governmentally funded program was developed since 1998 to return expired or unwanted medications to the retail pharmacies, 'The Return Unwanted Medicines'. The systematic take-back program for medications is acceptable within Australia and the United States. On the other hand, within Croatia, services for the disposal of pharmaceutical wastes are not satisfactory (Jonjić and Vitale, 2014).

RECOMMENDATION

Thus, there is a need for educational programs to educate the proper and safe disposal ways of medication. Most participants suggest learning materials throughout social media will be effective. Also, pharmacists have an essential role in providing information about medication disposal when dispensing it.

Another suggested method is to establish a take-back program. In the USA, they have a well-established national program for the safe disposal of expired prescription drugs through the Drug Enforcement Administrations' (DEA) National Prescription Drug Take-Back Initiative. They organize Drug Take-Back events since 2010 to promote proper drug disposal. In reality, within Saudi Arabia, only a few pharmacies freely take back expired or leftover medications for adequate disposal. The department of pharmaceutical services at 'King Abdullah Medical City' within Jeddah possesses a policy that enables receiving and disposing of medications returned from patients. Nevertheless, the patients rarely knew of the presence of that service (Al-

Shareef et al., 2016).

The US FDA developed some recommendations for satisfactory storage and disposal of unused medications. The FDA recommended performing the inventory two times per year, or once a year, at least. Also, it recommended recognizing the details of every item within the inventory as checking the expiry dates, looking for dried out, faded, or smashed drugs, and disposing of them in addition to taking out the unneeded prescription medications from a disease treated previously. Then, they must be stored with a dry and cool medications cabinet, away from the children's reach. Moreover, the family members must separately keep the medications to avoid inappropriate or mistaken medications selection. Also, it is good to stock the medications within their original bottles, as well as not mixing various medicines within a similar bottle. In addition, the lids of bottles of pills must be closed tightly, and the cotton must be removed from the bottles' interior as the cotton may absorb the moisture and it may lead to spoiling of the medications ([https://www.fda.gov/files/about%20fda/published/How-to-Dispose-of-Unused-Medicines-\(PDF\).pdf](https://www.fda.gov/files/about%20fda/published/How-to-Dispose-of-Unused-Medicines-(PDF).pdf)).

CONCLUSION

Medications are chemicals that respond to external stimuli as light, heat, dust, humidity, etc. Within various cases, these reactions may result in cosmetic alterations as fading, or the response may affect the trafficking of drugs, more seriously resulting in elimination or reduction of its efficacy, thus, enhancing deterioration of the medication quality, generation of toxic degradation compounds, as well as increasing mortality or morbidity.

The appropriate required conditions for storing drugs involve adequate spaces with appropriate ventilation and lighting, controlling temperature and using refrigeration, and being away from children.

Moreover, health education programs must be given to the patients as well as to the entire general public on the appropriate usage, safety, date of expiration, and proper storage of drugs; to improve their awareness, attitudes, and practices regarding the safe disposal of unused and expired medications. In addition, guidelines on safe disposal are required, and an organized method of collecting unused and expired pharmaceuticals is needed. Moreover, the pharmacist also has a significant role as a drug expert in educating patients about the drug's uses and how to store and discard it.

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