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Assessment of Pharmacists' Knowledge, Attitude, and Practice on Drugs Disposal in a Sample of Iraqi Community Pharmacists: A Cross-Sectional Study

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Abstract

Pharmacists with sufficient knowledge about the right methods for disposing of unnecessary medications can reduce serious consequences, such as the buildup of chemical compounds and hazardous substances from pharmaceuticals within the surrounding environment. Additionally, for the public's health, pharmacies must be aware of proper methods to eliminate expired medications. The first aim of this study was to evaluate the level of knowledge among community pharmacies regarding the suggested strategies for drug disposal and the potential hazards associated with improper disposal of pharmaceutical waste. Additionally, the study aimed to ascertain the attitudes and practices of community pharmacies toward the appropriate disposal of pharmaceutical waste. The study utilized an observational cross-sectional design, conducted within the time frame of February 28th to May 11th, 2023. The data were acquired through the implementation of an online questionnaire. The study included 385 Iraqi pharmacists. On average, the participants in the current study showed a low level of knowledge score of 2.49 out of 8 in the knowledge section. A significant proportion, specifically 91%, of the pharmacists who took part in the study acknowledged employing improper methods for disposing of expired medications within their respective community pharmacies. However, it is worth noting that the majority of these participating pharmacists exhibited a favorable disposition toward recognizing the importance of implementing appropriate disposal practices for expired medication within community pharmacy settings. A significant proportion (86-87%) of the participants exhibit a good level of attitude regarding their involvement in the awareness/educational program concerning the tack-back program and the safe disposal of materials. Community-based pharmacies lack expertise and skills regarding drug disposal.

However, most pharmacists acknowledge the environmental damage caused by medication disposal. They also showed a willingness to learn about safe medicine disposal. A proper strategy for collecting and disposal of outdated, unused, and expired pharmaceuticals should be implemented.

Keywords: Knowledge, Attitude, Practice, Pharmacists, Drugs Disposal.

Introduction

Appropriate medication disposal is a widely recognized difficulty that has garnered growing interest in various contexts [1, 2]. Insufficient awareness of medical staff regarding the proper disposal methods for unneeded medication can result in significant implications, including the buildup of chemicals and harmful substances derived from the medicine within the surrounding environment, inadvertent overdose incidents, and the potential for misuse of prescription drugs [3, 4]. Several nations have adopted regulations regarding properly disposing unused or expired medication [5]. The efficacy and safety of medicinal products can be ensured by adhering to the recommended storage conditions indicated on the label and using them before their expiration date [6, 7]. Suppliers and certain healthcare organizations recommend the disposal of medications based on their expiration date [8, 9]; this is due to the possible decomposition and subsequent loss of effectiveness or even dangerous effects that expired medicines could exhibit [10].

Moreover, considering their escalating global demand, there is an increasing emphasis on the prudent utilization of these resources. Prescribed medications often are not utilized due to different variables such as modifications to treatment, adverse reactions, improvements in the well-being of patients, or additional factors [11-14]. As per the World Health Organization's (WHO) findings, a significant quantity of drugs have been prescribed or offered for sale inappropriately, accumulating substantial amounts of solid waste comprising

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expired and unused medications. Consequently, a burden exists associated with the disposal of these drugs [15]. The Food and Drug Administration (FDA) in the United States has provided standards to the public regarding the appropriate disposal of unused drugs. According to the FDA, the most effective method of disposing of unused or expired medications is to deposit them at designated drug take-back places, which can be found in different medical facilities such as retail pharmacies as well as health centers [16]. In addition, it is worth noting that certain drugs may be disposed of by flushing them into the toilet, provided that they are included in the FDA's list of drugs that may be safely flushed. This list encompasses opiates such as buprenorphine, morphine, other opioid derivatives, diazepam, and methylphenidate [17]. On the other hand, drugs unsuitable for flushing must be combined with an unattractive material such as soil, feline litter, or previously used coffee grounds. Subsequently, they should be enclosed within an airtight plastic bag and disposed of in the garbage [18].

The WHO has issued guidelines regarding the safe disposal of unwanted pharmaceuticals. These guidelines advocate for the adoption of the return to donor or manufacturer method as a means to address unused or expired medications. Alternatively, the landfill disposal, which involves the direct placement of waste into a specified land disposal site without any prior treatment or preparation. Encapsulation, a process that entails enclosing medicinal substances inside a solid block housed in either a plastic or steel drum, may be considered a kind of immobilization. Inertization, on the other hand, is a variation of encapsulation wherein the packaging materials such as paper, cardboard, and plastic are eliminated from the medicines. The extraction of pills from their blister packaging is necessary. Pharmaceuticals falling under the category of quickly biodegradable organic substances include liquid vitamins that possess the ability to be diluted and afterwards disposed of by flushing into a sewage system. Various amounts of specific salts, amino acids, lipids, or glucose may be safely disposed away in sewage systems. In the case of ampoules, the recommended procedure involves crushing the ampoules and disposing of the diluted fluid by flushing it into the sewer system, and the last recommended method is using the incineration option [19].

There is a lack of awareness among pharmacists regarding the appropriate methods for disposing of drug waste within pharmacy settings. According to Khan et al., pharmacy staff in Pakistan believe that the conventional method for disposing of medications is to flush them down the toilet or sink [20]. Therefore, inadequate disposal of non-biodegradable medicines, such as chemotherapy and disinfectant substances, results in wastewater pollution and heightened resistance to certain antimicrobial agents employed in sewage treatment [21]. Also, a study by Michael et al [22] found that empirical research backs up the idea that certain pharmaceutical substances, like painkillers and hormones, in water sources may play a role in the development of renal failure in people.. Hence, ensuring the proper disposal and segregation of drug waste is imperative to mitigate pollution and the associated detrimental consequences [20].

Limited research has been conducted on the understanding, beliefs, and behaviors among pharmacy professionals regarding waste handling in various countries. In a study conducted in Iraq, it was found that pharmacy staff exhibited a limited comprehension of pharmaceutical disposal approaches; approximately two-thirds of the participants agreed that the sink and trash were suitable means for disposing of various types and dosage varieties of drugs [23]. Furthermore, a research project conducted among pharmacies in Libya revealed that over 50% of the respondents indicated they disposed of medicines that had expired by discarding them in the trashcan. Furthermore, a minority of participants adhered to the World Health Organization's drug disposal guidelines when disposing of unused medications. Moreover, it was found that a significant proportion, specifically around two-thirds, of the participants exhibited a limited understanding of the Take-Back program, as indicated by the study conducted by Atia et al. [24].

Numerous studies have been conducted to investigate the awareness and implementation of easy methods for pharmaceutical disposal. However, it is important to recognize that a considerable proportion of the first study mostly concentrates on the general population, comprising Iraq as well as a number of other countries. Insufficient data exists pertaining to the comprehension and execution of medication recycling within the healthcare sector, particularly among community pharmacists, who hold a pivotal position in the provision of healthcare services. Therefore, the present study, which was carried out among community pharmacists in Iraq, would make a valuable contribution to the existing body of research through making insight to the knowledge, attitude, and practices toward disposal of unused and expired pharmaceuticals.

Methods

Study Design

The present study employed an observational cross-sectional design and was carried out between February 28th and May 11th, 2023. The research sample consisted of 385 community pharmacists from Iraq. The data were obtained via an online questionnaire executed voluntarily without providing any reward to encourage involvement.

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Sample Size

The sample size was determined using the Raosoft® online software calculator.The calculation was derived from the requirement establish a 95% confidence interval, and maintain a 5% margin of error. The survey portal was closed upon reaching the required number of responses. It was considered that a sample size of 385 participants would be suitable.

Inclusion criteria

Certified community-based pharmacists registered at the Syndicate of Iraqi Pharmacists with a minimum of two years of experience operating in Iraq who agreed to participate in the study will be included in the study.

Exclusion criteria

The research didn't involve pharmacist assistants or students.

Questionnaire

The questionnaire, consisting of 31 items, was partitioned into four separate parts. The initial segment encompassed socio-demographic data, encompassing variables such as age, gender, level of education, years of professional experience, and how individuals obtained information regarding drug disposal. The three remaining parts encompassed a set of conceptual inquiries that evaluated individuals' knowledge (9 questions), attitudes (14 questions), and practices (8 questions) regarding the disposal of medications. The present study extensively reviews the existing literature to identify relevant inquiries about knowledge, attitudes, and practices (KAP) regarding waste management. These questions were adopted from various studies [25-32] and subsequently adapted to align with the specific objectives of the current investigation. The acquisition of knowledge is quantified by a scoring system, where a single point is awarded for each right response. We collected the accurate responses, awarding one point for each right answer, with the exception that selecting the "I do not know" option was considered an incorrect answer. The attitude score was measured using a 5-point Likert scale.

A panel of five experts who are members of the Central Scientific Committee of the clinical pharmacy department at the College of Pharmacy, University of Baghdad, evaluated the face and content validity of each survey item. The survey language underwent certain modifications, while the questionnaire underwent revision to enhance its suitability for Iraqi pharmacists. The experts reached a consensus regarding the significance and comprehensibility of the items within the question. Subsequently, the survey underwent a pilot phase involving fifteen pharmacists to assess its clarity and reliability. Moreover, pharmacists who participated in the pilot trial (fifteen) were eliminated from the final research analysis. The internal consistency values indicated that the scales were reliable (Cronbach's alpha >0.7). The survey was administered biweekly on Facebook groups specifically for pharmacists. Additionally, a group of fifteen pharmacists conducted a pilot study to ensure the clarity and reliability of the questionnaire.

Data collection

An online questionnaire was created using the Google Forms platform to evaluate the knowledge, attitude, and practice of pharmacists about drug disposal. Subsequently, the questionnaire was disseminated through various social media platforms (Facebook, WhatsApp, Telegram). The survey was posted twice a week on pharmacist Facebook groups (Al Multaqa Al Sadalany and Al Sadalany House), considering that the majority of pharmacists join these groups. In addition, to meet pharmacists in person, the researcher traveled to five hospitals in the Thi-Qar governorate, provided them the link, and requested that they complete the survey. From these visits, the researcher received one hundred and fifteen responses. The data were gathered using a convenience sampling method. The individuals who participated were informed that their involvement in the research project was entirely voluntary and that their responses would be treated with anonymity and confidentiality. The survey consisted of both closed-ended and open-ended questions, intending to gather data on the participants' socio-demographic characteristics, knowledge, attitudes, and practices. The completion of the questions typically requires a time frame of approximately 5 to 10 minutes.

Statistical analysis

The data underwent analysis using SPSS software, version 25. Descriptive statistics were performed on all variables included in the research. The means ± standard deviation (SD) were used to express continuous variables, while frequencies and percentages were used to express categorical variables. The independent t-test assessed the disparities in the means of continuous variables between males and females. The chi-square test was employed to determine the disparity in the categorical variables, namely knowledge and practice, based on the gender of the participants. A P-value below the threshold of 0.05 was deemed to have statistical significance. Furthermore, the final research analysis excluded the participation of fifteen pharmacists involved in the pilot trial.

Results

This study recruited 385 community pharmacists, of whom more than half (57.4%) were male. The average age of the participants was 30.90 (±5.98) years, with an average year of experience of 6.55 (±4.99) years. Approximately three-quarters (76.4%) had a bachelor's degree in pharmacy. On average, they scored below average (2.49 out of 8) in the knowledge section. (Table 1).

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Table 1. The descriptive Statistics of the participating pharmacists

	N	Minimum	Maximum	Mean	Std. Deviation
Age in years	385	23	55.0	30.90	5.98
Years of practice as a community pharmacist	385	2	26.0	6.55	4.99
Total knowledge score	385	0.00	7.00	2.49	1.73
Total attitude score	385	14.00	70.00	52.81	8.88
Characteristics	**Subcategories**		**%**	**N**	
Gender	Male		221	57.4	
	Female		164	42.6	
Education degree	BSc		294	76.4	
	Diploma		21	5.5	
	MSc		58	15.1	
	Ph.D. or Board		12	3.2	
Sources of information on drug disposal	Internet		185	48.1	
	College/Education		176	45.7	
	Book/journals		137	35.6	
	Senior pharmacist		134	34.8	
	Medical Representative		84	21.8	
	None		40	10.4	

Unfortunately, more than half of the participating pharmacists incorrectly answered seven out of eight knowledge questions about the proper disposal of medications. The only question that received more than half the correct answers (59.5%) was, "Does the improper disposal of antibiotics lead to antimicrobial resistance?". More than three-quarters (78-84.7%) of the participants were unaware of how to dispose of medications. Additionally, 78.2% of them have not heard about the medication take-back system for expired or unused medications, which is implemented in developed countries (Table 2).

Table 2. The frequency of correct and incorrect answers for the knowledge questions

	Knowledge item	Answer	Frequency	Percent
1	Prescription medication should be disposed of differently than over-the-counter or non-prescription medication..	False	235	61.0
		Correct	150	39.0
2	What is the "medication take-back system" used in some countries?	False	301	78.2
		Correct	84	21.8
3	Does the improper disposal of antibiotics lead to antimicrobial resistance?	False	156	40.5
		Correct	229	59.5
4	What type of medications can be flushed down the Sink/toilet?	False	193	50.1
		Correct	192	49.9
5	What is the best method for the disposal of parenteral?	False	301	78.2
		Correct	84	21.8
6	What is the best disposal method for solid dosage forms like tablets, capsules, etc.?	False	300	77.9
		Correct	85	22.1
7	What is the best method to dispose of liquid dosage forms like syrup, eardrops, mouth wash, etc.?	False	326	84.7
		Correct	59	15.3
8	What is the best method to dispose semi-solid dosage forms like ointment, gel, etc.?	False	309	80.3
		Correct	76	19.7

The participants did not answer well to the knowledge questions as more than half (54%) scored one or two out of eight knowledge items. On the other hand, only 3.6% of the participants scored seven out of eight (Figure 1).

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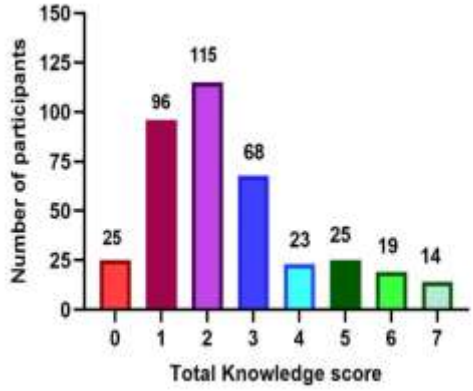

Figure 1.The distribution of the total knowledge scores (out of 8) among the participants

In general, the majority of the participating pharmacists had a positive attitude toward the necessity of appropriate disposal of expired medication in community pharmacies. More than two-thirds agreed with different strategies, including the essential role of community pharmacists in properly disposing of expired or unused medications, raising awareness of taking them back to community pharmacies, and the responsibility of pharmaceutical companies to provide special boxes for these medications. More than three-quarters of the pharmacists agreed that "there is a lack of adequate information on the safe disposal of unused medicines among pharmacists and customers/patients." More than 80% of the pharmacists agreed there is a need for an awareness program about the proper disposal method(s) and the harmful effects of improper disposal of expired medications.

Table 3.The attitude of the participating pharmacists toward the disposal of expired medications

	Attitude Items	Strongly disagree, N (%)	Disagree, N (%)	Neutral N (%)	Agree N (%)	Strongly agree, N (%)	M	St Dev
1	Pharmacists should provide advice on the safe disposal of unused and expired household medicines.	29 (7.5)	14 (3.6)	55 (14.3)	155 (40.3)	132 (23.3)	3.90	1.14
2	Awareness programs about how to dispose of unused and expired medicines should be initiated."	16 (4.2)	9 (2.3)	41 (10.6)	183 (47.5)	136 (35.3)	4.08	0.96
3	There should be a public awareness program about the harmful effects of improper medicine disposal practices."	13 (3.4)	13 (3.4)	34 (8.8)	191 (49.6)	134 (34.8)	4.09	0.93
4	Community pharmacists have an important role in mitigating the problem of improper medicine disposal practices."	22 (5.7)	38 (9.9)	81 (21.0)	179 (46.5)	65 (16.9)	3.59	1.06
5	Take-back programs to the community pharmacy for unused and expired medications should be implemented and made mandatory at community pharmacies.	13 (3.4)	21 (5.5)	91 (23.6)	195 (50.6)	65 (16.9)	3.72	0.92
6	Take-back programs to the community pharmacy for unused and expired medications should be implemented and made mandatory at pharmaceutical companies.	10 (2.6)	26 (6.8)	74 (19.2)	203 (52.7)	72 (18.7)	3.86	.81

https://doi.org/10.31351/vol33iss1pp69-79

7	Returning unused or expired medications by patients to the pharmacy for disposal should be convenient."	24 (6.2)	54 (14.0)	100 (26.0)	168 (43.6)	39 (10.1)	3.37	1.05
8	If there is monetary incentive for customers to return unused medicines, they are more likely to do so."	15 (3.9)	52 (13.5)	78 (20.3)	173 (44.9)	67 (17.4)	3.58	1.05
9	There is a lack of adequate information on the safe disposal of unused medicines among pharmacists. "	17 (4.4)	10 (2.6)	68 (17.7)	191 (49.6)	99 (25.7)	3.90	0.96
10	There is a lack of adequate information on the safe disposal of unused medicines among the customers."	15 (3.9)	15 (3.9)	38 (9.9)	156 (40.5)	161 (41.8)	4.12	1.01
11	There is a need for a program to educate people on how to deal with unused medicines at home.	13 (3.4)	16 (4.2)	34 (8.8)	187 (48.6)	135 (35.1)	4.08	0.95
12	Unused and expired medications present a potential risk at home."	10 (2.6)	23 (6.0)	38 (9.9)	197 (51.2)	117 (30.4)	4.01	0.94
13	Children are more vulnerable to the risks associated with unused and expired household medicines."	10 (2.6)	8 (2.1)	44 (11.4)	170 (44.2)	153 (39.7)	4.16	0.90
14	It is the responsibility of the pharmaceutical companies that manufacture the medications to provide a safe way in community pharmacies for people to dispose of unused or expired medications.	20 (5.2)	22 (5.7)	85 (22.1)	186 (46.8)	78 (20.3)	3.71	1.02

The vast majority (86-87%) of the participants have positive intentions towards participation in the awareness/educational program about the tack-back program and safe disposal of expired or unused medications. In contrast, only some of them (14.3-48.8%) have followed the proper practices related to the disposal of these medications (Table 4). For example, less than one-half (48.8%) of the pharmacists had collection boxes for unused or expired medications in their pharmacies. Approximately one-third have provided information about how to dispose of unused or unwanted medicines to their customers. Furthermore, 85.7% of them had no poster in the pharmacy about the safety of the disposal of medications (Table 4).

Table 4. The Intention and actual practice of disposing medications by community pharmacists

Intention Items	**Subcategories**	**N**	**%**
If an educational course on take-back program is conducted, will you participate in it?	Yes	331	86.0
	No	54	14.0
If an awareness program on safe disposal of expired and unused medications is conducted, will you attend it?	Yes	335	87.0
	No	50	13.0
Practice items	**Subcategories**	**N**	**%**
Do you have collection boxes for unused drugs/expired drugs in your pharmacy?	Yes	188	48.8
	No	197	51.2

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In your area, are there designated collection containers where you can dispose safely of your unused or expired medication?	Yes	107	27.8
	No	239	62.1
	I do not know	39	10.1
Have you given information about how to dispose unused and unwanted medicines to your customers?	Never	105	27.3
	Rarely	113	29.4
	Sometimes	131	34.0
	Most of the times	20	5.2
	Always	16	4.2
Do you have any poster in your pharmacy about safety disposal of drugs?	Yes	55	14.3
	No	330	85.7

More than 91% of the participating pharmacists have used inappropriate ways to dispose expired medications in their community pharmacies (TableA1 in the Supplementary Appendix). The most common way to dispose solid (78.4%) and semi-solid (77.1%) dosage forms was throwing them in the regular rubbish bin (garbage can). On the other hand, more than half (51%) were disposing liquid dosage form by pouring them into sink. In other words, the vast majority of the participating community pharmacists (91.7-94.5%) have used improper disposing ways for the expired medications such throwing/pouring them into rubbish bin, sink or toilets (Table A1 in the Supplementary Appendix).

Only three attitude items were significantly ($P< 0.05$) associated with having no collection boxes for expired drugs in the community pharmacy (Table A2 in the Supplementary Appendix). According to an independent T-Test, pharmacists who did not have collection boxes for expired medications in their pharmacies were significantly ($P < 0.05$) more likely to believe "there is a lack of adequate information on the safe disposal of unused or expired medicines among pharmacists". Those with no collection boxes were also more likely to believe "there is a need for a program to educate people on how to deal with unused medicines" and "it is the responsibility of the pharmaceutical companies to provide a safe way in community pharmacies to dispose of unused or expired medications." (Table A2 in the Supplementary Appendix).

Discussion

Although the research was conducted in Iraq, the results of this study have worldwide significance. The rapid growth of the pharmaceutical industry and the consequent increase in the utilization of medical items have led to their escalating presence in the environment, followed by a diverse array of biological sequelae.

The proper disposal of medicine is a crucial concern in preserving the natural environment and human health. Pharmaceutical products ultimately reach the end-users, including consumers and patients [33]. Not all pharmaceutical products distributed to consumers are eventually consumed, resulting in excess often retained within households. According to a report by the World Health Organization (WHO), it has been found that over 50% of medications are not appropriately prescribed and dispensed this phenomenon may result in the accumulation of leftovers and useless pharmaceuticals within residential settings [34].

There is a limited body of research regarding the responsibilities of pharmacists on the topic of safe medicine disposal. However, it is worth noting that pharmacists' knowledge level regarding safe disposal procedures may not be adequate to consistently offer accurate knowledge to consumers [35]. Interestingly, most pharmacists in the questionnaire responded to seven of eight drug disposal knowledge-based questions incorrectly. The only question that received 59.5% correct answers was if improper drug disposal causes antimicrobial resistance. Most respondents (78-84.7%) were unaware of proper drug disposal. 78.2% of people are unaware that industrialized countries have a prescription take-back system for expired or unused medicines. The current findings are inconsistent with previous studies showing pharmacists' awareness of the potential pollution of soil and water due to improper medication disposal. These studies include those conducted in Kuwait (82%) [36], Delhi, India (84.0%) [37], and Saudi Arabia (78.9%) [38]. However, The current results showed higher scores from a study conducted in Brazil, where only 16.8% of pharmacists had knowledge about the adverse effects on the environment caused by the contamination of medicinal waste [39].

Most participating pharmacists in the present study had a favorable attitude regarding the importance of properly disposing of expired medicine in community pharmacies. More than two-thirds of respondents supported a variety of tactics, including the critical function of neighborhood pharmacists in properly disposing unused or expired medications. This finding aligns with the results reported in a study conducted by Albaroodi in Karbala, Iraq [23], in which the vast majority of the respondents (85.3%) agreed that educational courses focused on a take-back program could enhance knowledge about medication disposal. The same attitude reported in a separate study conducted in

https://doi.org/10.31351/vol33iss1pp69-79

Kuwait examined the attitudes and behaviors of patients about the safe removal of medication [40].

Concerning the current implementation of medication disposal, this study revealed that only 48.8% of pharmacists possessed collection boxes within their pharmacies to deal with unused or expired medications. In research conducted by Nagasubramanian et al. in Tamil Nadu, India, findings revealed a lower percentage of collection boxes. In the group being interviewed population, most community pharmacists, specifically 74%, reported the absence of collection boxes within community pharmacies [29]. In 2014, federal legislation in the United States enabled chain pharmacies to obtain authorization as collection agencies for unused medications. Consequently, these pharmacies have been able to set up drop boxes within their stores, facilitating the year-round collection of residual medicines. As a result of this legislative development, pharmacies nationwide have readily embraced this opportunity. As an illustration, the Walgreens Drugstore chain presently operates drop boxes in approximately 1,500 locations across 46 states [41]. In prior research done in Sulaimani, Kurdistan Region, Iraq, a majority of 58.1% of community pharmacists expressed their agreement to use their workplace as a designated collection station for the purpose of gathering expired or unused pharmaceuticals [42].

In the current study, the most common approach of solid (78.4%) and semi-solid (77.1%) dosage form disposal entailed disposal in conventional waste containers, commonly known as garbage bins. In contrast, most participants (51%) reported disposing of liquid dosage forms by pouring them into a sink. To clarify, a significant proportion of community pharmacists (ranging from 91.7% to 94.5%) have been observed to employ inadequate methods to dispose of expired medications. The results of this study align with the outcomes of a previous study conducted in Pakistan, where the vast majority of pharmacists expressed the belief that the recommended method of disposal for all types of medicines, including solid, liquid, and semi-solid, is to flush them into the toilet or sink [20]. The present finding demonstrated a deficiency in the participants' understanding of the recommended techniques for drug disposal.

Research carried out in Erbil governorate; Iraq shows that pharmacists have implemented several initiatives aimed at mitigating medicine waste across the whole of the pharmaceutical distribution system. Nevertheless, not all viable strategies aimed at reducing drug waste have been effectively applied in routine clinical practice. There are deficiencies present in the current methods related to the disposal of medication [43].

When comparing our study findings with studies performed in various countries, it is evident that several of our results align with a study in Nigeria. This alignment suggests that pharmacists in Nigeria also expressed a need for a dedicated disposal facility. In Nigeria, many pharmacists dispose of unused medication by flushing it into the toilet [44].

A number of pharmacists in the United Arab Emirates have indicated that returned drugs are disposed of through methods such as discarding them in waste bins, sinking, or incineration [45]. Similarly, knowledge regarding the disposal methods employed by contractors or distributors for returned medications was lacking among pharmacists in New Zealand. It was observed that certain pharmacists speculated that incineration, a process involving the treatment of solid hazardous waste at elevated temperatures, might be utilized. This process results in the formation of residue or gas products [46].

It is recommended to initiate a public awareness campaign to educate individuals about the hazards associated with inadequate drug disposal systems. Educating healthcare professionals, particularly community pharmacists, regarding the importance of safe drug management and optimal procedures could enhance their ability to effectively communicate this knowledge to their clientele [47, 48]. Furthermore, it is imperative that the pharmacy curriculum adequately encompasses this significant subject matter. This study represents one of the initial investigations conducted to evaluate drug disposal protocols and attitudes within a community setting. In regions with a need for pharmacist education efforts; professional regulatory bodies may use the data to strategize and implement such initiatives.

Study limitations and strengths

It is important to acknowledge that this study encountered limitations. The findings were dependent on the precision and honesty of the respondents' answers, potentially introducing a source of information bias. Moreover, due to the nature of the descriptive cross-sectional methodology used in this study, it was not possible to ascertain any potential variables connected with the participants' knowledge, attitude, and practice. Furthermore, while the current sample size was deemed sufficient to attain statistical significance, it is advisable to employ a larger sample size to enhance the generalizability of the outcomes to the broader population of Iraqi pharmacists.

Nevertheless, the significance of our work lies in its contribution to an underexplored topic of research in our country. It is imperative for the Ministry of Health to address the issue of medicine waste. Additionally, our study offers a potential direction for future research about the recycling and

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disposal methods used by Iraqi pharmacies for unneeded pharmaceuticals that are returned to them.

Conclusion

In the current study, the lack of knowledge and the improper practices of community-based pharmacies in effectively dealing with the disposal of unwanted and expired medications is evident. However, a significant proportion of the participating pharmacists demonstrate a comprehensive awareness of the adverse effects associated with the improper disposal of pharmaceuticals in the natural environment. Furthermore, they demonstrated a positive attitude towards learning information about safe methodologies for the disposal of unwanted and expired pharmaceuticals. The implementation of an appropriate system is crucial for the efficient collection and subsequent disposal of unused and expired medications in accordance with established protocols. While the research was carried out in Iraq, the findings of this study have global relevance. The exponential expansion of the pharmaceutical sector and the subsequent rise in the use of medicinal products have resulted in their expanding prevalence within the environment, accompanied by a wide range of biological consequences.

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Conflicts of Interest

None to declare

Funding

None to declare

Ethics Statements

The research proposal obtained approval from the Central Scientific Committee of the College of Pharmacy at the University of Baghdad. The ethical committee waived the requirement for obtaining written informed consent, as all participants voluntarily participated in the study. All the procedures were conducted in adherence to the appropriate guidelines and regulations.

Author Contribution

The authors confirm their contribution to the paper as follows: study conception and design: Abd-ul Munaf Mohammed and Fadya Al-Hamadani; data collection: Abd-ul Munaf Mohammed; analysis and interpretation of results: Abd-ul Munaf Mohammed and Fadya Al-Hamadani; draft manuscript preparation: Abd-ul Munaf Mohammed and Fadya Al-Hamadani. All authors reviewed the results and approved the final version of the manuscript.

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تقييم معرفة الصيادلة ومواقفهم وممارستهم للتخلص من الأدوية في عينة من صيادلة المجتمع العراقي: دراسة مقطعية

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الخلاصة

المعرفة غير الكافية بالطرق المناسبة للتخلص من الأدوية غير المستخدمة يمكن أن يؤدي إلى عواقب وخيمة ، مثل تراكم المواد الكيميائية والمواد الخطرة المشتقة من الأدوية في البيئة المحيطة. بالإضافة إلى ذلك من أجل صحة الجمهور ، يجب أن تكون الصيدليات على دراية بالطرق المناسبة للتخلص من الأدوية منتهية الصلاحية. كان الهدف الأول من هذه الدراسة هو تقييم مستوى المعرفة بين صيدليات المجتمع فيما يتعلق بالاستراتيجيات المقترحة للتخلص من الأدوية والمخاطر المحتملة المرتبطة بالتخلص غير السليم من النفايات الصيدلانية. بالإضافة إلى ذلك ، هدفت الدراسة إلى التأكد من اتجاهات وممارسات الصيدليات المجتمعية تجاه التخلص المناسب من النفايات الصيدلانية. استخدمت الدراسة تصميم المقطع العرضي للرصد ، والذي تم إجراؤه في الإطار الزمني من ٢٨ شباط إلى ١١ ايار ٢٠٢٣. تم الحصول على البيانات من خلال تنفيذ استبيان على شبكة الإنترنت. اشتملت الدراسة على ٣٨٥ صيدلياً عراقياً. في المتوسط ، حصل المشاركون على درجة أقل من المتوسط ٢,٤٩ من ٨ في قسم المعرفة. أقرت نسبة كبيرة ، وتحديداً ٩١٪ ، من الصيادلة الذين شاركوا في الدراسة باستخدام طرق غير مناسبة للتخلص من الأدوية منتهية الصلاحية في الصيدليات المجتمعية الخاصة بهم. ومع ذلك ، تجدر الإشارة إلى أن غالبية هؤلاء الصيادلة المشاركين أظهروا تصرفًا إيجابيًا تجاه إدراك أهمية تنفيذ ممارسات التخلص المناسبة للأدوية منتهية الصلاحية داخل إعدادات الصيدلية المجتمعية. أظهرت نسبة كبيرة (٨٦-٨٧٪) من المشاركين نوايا إيجابية فيما يتعلق بمشاركتهم في البرنامج التوعوي / التعليمي المتعلق ببرنامج العودة والتخلص الآمن من المواد. الصيدليات المجتمعية تفتقر إلى الخبرة والمهارات فيما يتعلق بالتخلص من الأدوية. ومع ذلك ، يعترف معظم الصيادلة بالضرر البيئي الناجم عن التخلص من الأدوية. كما أظهروا استعدادًا لمعرفة المزيد عن التخلص الآمن من الأدوية. يجب تنفيذ إستراتيجية مناسبة لجمع الأدوية القديمة وغير المستخدمة والمنتهية الصلاحية والتخلص منها.

الكلمات المفتاحية: الموقف ، التخلص من الادوية ، المعرفة ، الصيادلة ، الممارسة.