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Household Storage and Disposal of Unused Medications in Southern Jordan: Socio-Demographic Determinants and Knowledge Gaps

Mette Sørensen[1], Jonas P. Nielsen[1]*

[1]Department of Clinical Pharmacy, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark.

***E-mail** ✉ jp.nielsen.pharm@gmail.com

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ABSTRACT

The inappropriate storage and disposal of unused medicines in homes have sparked worldwide concerns owing to their adverse effects on the environment, human health, and animal well-being. This research seeks to examine practices related to medication storage and disposal in southern Jordan, identify socio-demographic factors associated with the household accumulation of medicines, and assess public knowledge about proper medicine disposal. A cross-sectional study was carried out in southern Jordan from January to July 2023. An online questionnaire was developed based on an extensive review of existing literature. Data were analysed using the Statistical Package for the Social Sciences (SPSS). Chi-square tests and logistic regression were utilised to explore associations between socio-demographic variables and medication storage behaviours. Every participant reported keeping unused medications at home, with 43.4% being expired. The main reason for retention, reported by 49.8% of respondents, was expected future need. Analgesics represented the most frequently stored category and were commonly placed in kitchens and bathrooms. Logistic regression showed significant associations between storage practices and factors including age over 61 years (p-value <0.001), illiteracy (p-value = 0.006), large family size (p-value = 0.012), absence of health insurance (p-value <0.001), and high income (p-value = 0.027), whereas gender showed no significant influence. Half of the participants disposed of medications by throwing them in the garbage. Pharmacists served as the main source of information on disposal, but knowledge about the risks of improper disposal remained inadequate. Rates of unused medication storage and improper disposal were elevated in southern Jordan. The findings highlight the need for governmental regulations on medicine dispensing to limit quantities supplied and minimise excess household accumulation. Additionally, educational campaigns are required to inform the public about safe disposal options for unused medicines at home and to help reduce related hazards.

Keywords: Medication storage, Drug disposal, Unused medication, Public knowledge, Southern Jordan

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Introduction

Unused medication refers to medicines that patients no longer require, and their correct disposal is essential [1]. According to the World Health Organization (WHO), about 50% of patients fail to adhere to prescribed regimens [2]. High levels of non-adherence lead to the buildup of medicines in households, often due to treatment plan modifications, symptom resolution, drug ineffectiveness, or expiry [3, 4]. By keeping medicines at home, patients may unwittingly limit access for others who need them [5]. Many individuals also retain leftovers believing they could be useful for similar conditions later [6].

Storing medications at home carries serious risks. These include self-medication with incorrect dosing; self-treatment with antibiotics can promote bacterial resistance [7]. Additionally, consuming expired drugs—often due to unfamiliarity with checking expiry dates—raises the likelihood of adverse effects [8]. There is also a risk of accidental ingestion by children and teenagers [9-11]. For instance, unintended opioid intake by adolescents can

lead to addiction [12], while mistaken consumption of antihypertensives by children may cause bradycardia, coma, or death [13]. Such incidents pose substantial dangers.

Appropriate storage conditions are vital for preserving drug efficacy. Medications sensitive to light, moisture, or temperature must be shielded accordingly and, where necessary, refrigerated. Inadequate storage can render medicines ineffective, unusable, and wasted [14]. A recent Jordanian study found that unsafe household storage, frequently outside original packaging, resulted in 24.99% wastage of stored drugs [15].

Beyond health concerns, improper disposal of unused medicines poses significant environmental threats [16], affecting ecosystems, people, and wildlife [4, 17]. Pharmaceutical residues have been detected in drinking and surface waters since the 1990s [18]. In US waterways, compounds such as acetaminophen, ethinyl estradiol, and verapamil have been identified, damaging aquatic life [19]. The contraceptive component 17-α-ethinyl estradiol has been linked to disrupted sexual development in fish [20]. Antibiotics entering irrigation water can contaminate soil, fostering pathogens harmful to humans and animals [21] and contributing to antibiotic resistance over time [22]. Improper disposal also imposes economic costs. The United States, the largest generator of medical waste, produces around 3.5 million tons annually, including unused medicines, at a disposal cost of $790 per ton [23]. In Jordan, a major medical tourism hub in Asia and North Africa, increased patient inflows have driven up medical waste volumes and disposal expenses [24]. In 2008, monthly costs for medical waste management in northern Jordan varied from $70 to $1330 [25]. In this study, proper disposal is defined as returning medicines to pharmacies or hospitals, in contrast to common improper practices such as flushing down toilets or discarding in household trash [26].

Developed nations, including the United States and Australia, have introduced regulations and recommendations to encourage optimal approaches for handling and discarding leftover medicines [27]. These regulations highlight the value of delivering unused drugs back to medical facilities for suitable redistribution or safe elimination. The creation of such recommendations stems from escalating issues related to unsuitable storage of leftover medicines and their incorrect discarding, problems that have become particularly prevalent in advanced economies such as Canada, the United States, and European countries [15]. In contrast, nations in the developing world, including Saudi Arabia, Kuwait, and Qatar, have demonstrated through research that residents maintain considerable volumes of unused drugs in suboptimal environments [28-30]. Comparable to the situation in Jordan, these countries do not possess formal protocols for the appropriate elimination of surplus medicines [30, 31], coupled with a marked shortfall in enforcing robust strategies for pharmaceutical waste oversight, which contributes to suboptimal management of this waste [24].

The serious repercussions arising from unsuitable storage and elimination of medicines emphasise the urgent requirement for regulatory measures and the application of standardised protocols concerning correct storage and disposal in developing regions. Levels of community understanding about proper storage and disposal techniques continue to be limited in developing countries [28]. On the other hand, nations such as Germany and Sweden have recorded substantially higher rates of returns (about 50%) for unused drugs to pharmacies, attributable to enhanced community education on appropriate storage and disposal procedures [32]. As far as we are aware, there has been no earlier investigation into the habits of people living in southern Jordan concerning medication storage and disposal. Accordingly, the present research was designed to explore these habits, pinpoint socio-demographic characteristics related to the retention of unused drugs, and gauge the extent of community understanding regarding drug disposal.

Materials and Methods

Study design and setting

The investigation utilised a cross-sectional survey approach to explore habits surrounding medication storage and disposal among residents of southern Jordan. The instrument was shared digitally across social networking sites, namely Twitter, WhatsApp, and Facebook, via Google Forms. The data gathering period spanned January to July 2023. Inclusion was restricted to adults aged 18 years and above. To safeguard data integrity, the platform permitted a single entry per individual, and completion of every item was compulsory prior to submission, guaranteeing full records. The opening segment outlined the research goals, expected duration for finishing the survey, and commitments to protecting respondent privacy.

Survey instrument

The instrument comprised four distinct parts. The opening part featured the consent documentation. The following part gathered socio-demographic details (7 questions), encompassing aspects like gender (male, female), age categories (18–30, 31–45, 46–60, >61), education attainment (illiterate, elementary education, secondary education, bachelor's degree, MSc or PhD), household size (<3, 3–6, 7–11, >11), possession of health insurance (Yes, No), employment type (medical career, non-medical career, unemployment), and household monthly earnings (less than 500 JD, 501–1, 000 JD, more than 1, 000 JD). The subsequent part focused on medication storage behaviours (6 questions): presence of unused drugs (Yes, No), presence of expired drugs (Yes, No, I do not know), count of unused drugs (1–5, 6–10, more than 10, I do not know), count of expired drugs (1–5, 6–10, more than 10, I do not know), categories of unused drugs retained at home (antibiotics, analgesics, vitamins, antacids, antidiabetic, antihypertensive, antidepressant), locations used for storing unused drugs (custom cabinet, fridge, different places in household), and motivations for retaining unused drugs (prescription of large doses, symptoms of the disease have improved, medication is of bad smell or the taste, the doctor changes the treatment plan, the possibility of using them again). The final part examined community awareness of correct disposal for unused drugs (5 questions): approaches employed for discarding unused drugs (returning them to the pharmacy, giving them to friends or relatives, throwing them in the trash, flushing them down into the toilet), recognition of risks linked to incorrect disposal (Yes, No, I do not know), previous exposure to guidance on correct disposal of unused drugs (Yes, No), desire to acquire knowledge on secure disposal of unused drugs (Yes, No), and origins of information about appropriate disposal techniques (social media, physician, pharmacist, university courses, friends).

Reliability and validity

The development of this questionnaire drew on instruments from prior published research [15, 33, 34]. Items were modified from those sources and further improved through team discussions. Originally drafted in English, the survey was subsequently translated into Arabic—the primary language in Jordan—to facilitate comprehension and accurate responses among participants. Content validity was reviewed by three academic staff members from Al-Balqa Applied University, all of whom are pharmacists holding postgraduate qualifications and possessing specialised expertise in the area. Revisions were implemented based on their suggestions to improve the instrument's overall quality and suitability. To determine the content validity index (CVI), feedback was obtained from four faculty experts. A CVI of 1 reflected complete agreement on the high relevance of each item to the study aims, confirming strong content validity for the questionnaire.

Factorial validity was examined through principal component analysis (PCA). The Kaiser-Meyer-Olkin (KMO) measure reached 0.7, surpassing the recommended threshold of 0.5 and indicating sufficient sample adequacy. Bartlett's test of sphericity supported the appropriateness of factor analysis (p-value = 0.001). Examination of scree plots revealed four factors corresponding to the questionnaire sections, representing the most appropriate structure. Together, these factors accounted for 57.1% of the total variance. Internal consistency for the factors was evaluated via Cronbach's alpha, yielding a value of 0.72, which meets acceptable standards according to Taber's guidelines [35]. A pilot test involving 25 respondents was performed to verify the instrument's clarity and precision. Results from the pilot indicated that the questionnaire could be completed in approximately 10 minutes and was perceived as straightforward and comprehensible. Data from this pilot phase were excluded from the main analysis.

Sample size calculation

The required minimum sample was calculated using the Raosoft® online calculator [36]. With a 5% margin of error, 95% confidence level, and an estimated adult population (aged 18 years or older) of 3, 500, 000 in Jordan [37], the software recommended a sample of 384 participants.

Statistical analyses

Medication storage and disposal behaviours were examined through conventional statistical approaches. Analyses were conducted with the Statistical Package for Social Sciences (SPSS) Version 25. Descriptive statistics, primarily frequency distributions, were applied to summarise respondent profiles. Associations between socio-demographic characteristics and storage practices were tested using inferential methods, including the Pearson Chi-Square test (χ^2) and logistic regression. Statistical significance was defined at alpha ≤ 0.05.

Ethics approval statement

Ethical approval was obtained from the institutional review board at Al-Balqa Applied University (reference number: 26/3/2087). Informed voluntary consent was secured electronically in the opening section of the online survey before access was granted. Participants retained the right to withdraw at any stage, and submission was prevented without consent.

Results and Discussion

Socio-demographic data of the respondents

A total of 1019 individuals from different areas of southern Jordan completed the survey. As presented in **Table 1**, females constituted 61.8% of respondents, while 44.0% fell within the 18–30 age group. Households with 3–6 members accounted for 44.2% of participants. The most common educational attainment was a bachelor's degree (45.7%). Health insurance coverage was reported by 62.5%, and 70.6% of respondents were employed in non-medical fields with monthly earnings above 1000 JD.

Table 1. Socio-demographic features of the study sample. N=1019

Variables	All Participants	Number (Frequency %)
Gender	Male	389 (38.2%)
	Female	630 (61.8%)
Age	18–30	448 (44%)
	31–45	263 (25.8%)
	46–60	118 (11.6%)
	Over 61	190 (18.6%)
Education Level	Illiterate	27 (2.6%)
	Elementary education	311 (30.5%)
	Secondary education	125 (12.3%)
	Bachelor's degree	466 (45.7%)
	Master's or PhD	90 (8.8%)
Number of Family Members	Less than 3	155 (15.2%)
	3–6	450 (44.2%)
	7–11	311 (30.5%)
	More than 11	103 (10.1%)
Health Insurance	Yes	637 (62.5%)
	No	382 (37.5%)
Occupation	Medical career	260 (25.5%)
	Non-medical career	719 (70.6%)
	Unemployed	40 (3.9%)
Monthly Income	Less than 500 JD	160 (15.7%)
	501–1, 000 JD	309 (30.3%)
	More than 1, 000 JD	550 (54%)

Storage practices of the medications

Prevalence of storing medications

According to **Table 2**, every respondent reported having unused medications at home, with 17.8% confirming the presence of expired items. Among those with expired drugs, 55.8% possessed one to five such items, while 22.6% were unsure of the quantity. For unused medications overall, 43.4% of participants had six to ten items, 30.3% had one to five, 19.1% had more than ten, and 7.2% did not know the precise number.

Table 2. Frequency of medications kept in participants' households (N = 1, 019)

Variables	Category	Number (Frequency %)
Storing unused medications	Yes	1019 (100%)
	No	0 (0%)
Storing expired medications	Yes	181 (17.8%)
	No	736 (72.2%)
	Unsure / Do not know	102 (10.0%)

Number of unused medications	1–5	309 (30.3%)
	6–10	442 (43.4%)
	More than 10	195 (19.1%)
	Unsure / Do not know	73 (7.2%)
Number of expired medications	1–5	101 (55.8%)
	6–10	26 (14.4%)
	More than 10	13 (7.2%)
	Unsure / Do not know	41 (22.6%)

Storage rate of specific medications

Figure 1 illustrates that analgesics were the most frequently retained category (97.9%), followed by antibiotics (86.8%), antacids (63.5%), and vitamins (34.7%). Approximately 24% of respondents stored antidiabetic or antihypertensive medicines, whereas antidepressants were kept by no more than 0.4%.

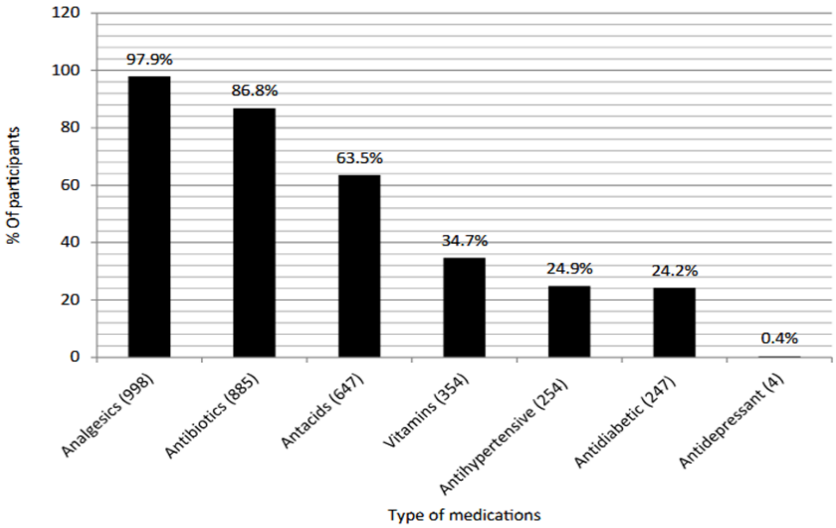

Figure 1. Storage rate for specific medications

Sources of information about the proper storage of unused medications

Figure 2 shows that pharmacists are the primary providers of guidance on appropriate storage conditions for medications (31.7%). Other sources, such as the internet and social media (22.1%), physicians (17.1%), and university courses (18.5%), were less frequently cited. The least common source was friends and family (10.6%).

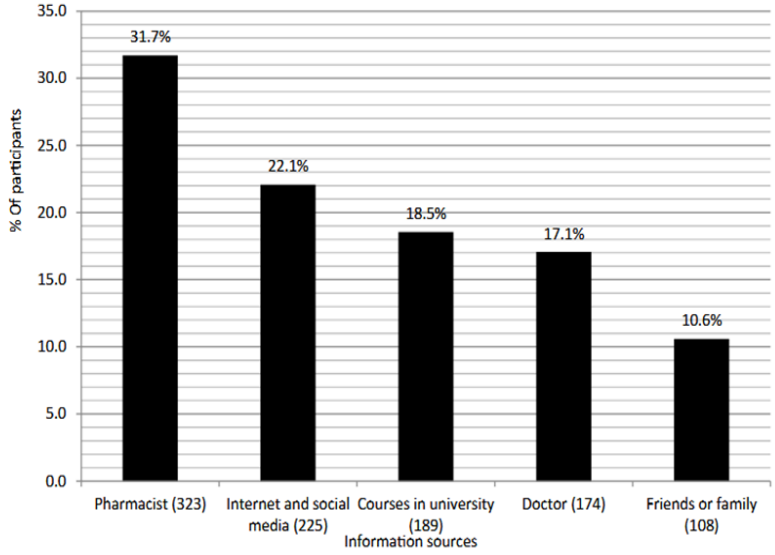

Figure 2. Participants' sources of information about storing unused medications properly

Places of storage for unused medications

As indicated in **Figure 3**, 51.4% of respondents kept unused medications in bedrooms, bathrooms, or kitchens. A smaller proportion (16%) used dedicated cabinets, while 32.6% stored them in refrigerators.

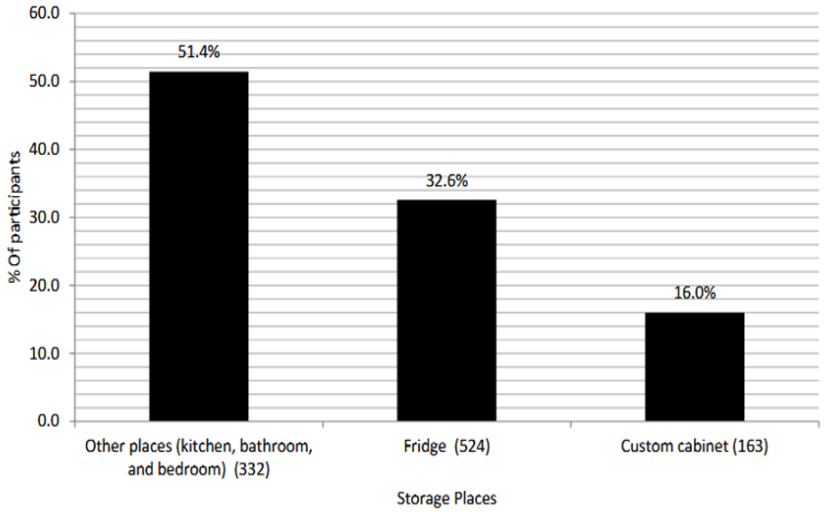

Figure 3. Places where participants store unused medications

Reasons for storage of unused medications

When asked why they retained medications at home, nearly half of the respondents (49.8%) mentioned favourable previous experiences with the drugs. Around 20.4% had leftovers because they had stopped taking them independently, either due to symptom improvement or perceived lack of efficacy. Further details on specific reasons are provided in **Table 3**.

Table 3. Reasons for storing unused medications among participants. N=1019

Reasons	Frequency	Percentage (%)
Physician prescribed higher doses of medication.	124	12.2%
Symptoms improved, or medication was ineffective.	208	20.4%
Medication has an unpleasant smell or taste.	84	8.2%
Physician changed the treatment regimen.	96	9.4%
Medications might be reused in the future.	507	49.8%

Participants' practices of medication disposal

Responses regarding disposal methods for unused medications are summarised in **Table 4**. Roughly half of the respondents (46.6%) discarded medications in household waste, while 24.3% flushed them down the toilet. Approximately 20.6% passed them on to relatives or friends, and only 8.4% returned them to a pharmacy.

Table 4. Methods for disposing of unused medications among participants. N=1019

Disposal Method for Unused Medications	Number (Frequency %)
Returned to the pharmacy	86 (8.4%)
Given to friends or relatives	210 (20.6%)
Disposed of in the trash	475 (46.6%)
Flushed down the toilet	248 (24.3%)

Participants' knowledge of medication disposal

Figure 4a presents responses concerning the consequences of incorrect disposal, revealing that 48% of participants believed there were no negative effects, whereas 27% recognised potential risks. **Figure 4b** shows that 60% had never received guidance on proper disposal methods. However, 74% indicated a desire to learn appropriate techniques **(Figure 4c)**. Preferred sources for such information are detailed in **Figure 4d**, with pharmacists selected by 39% of respondents.

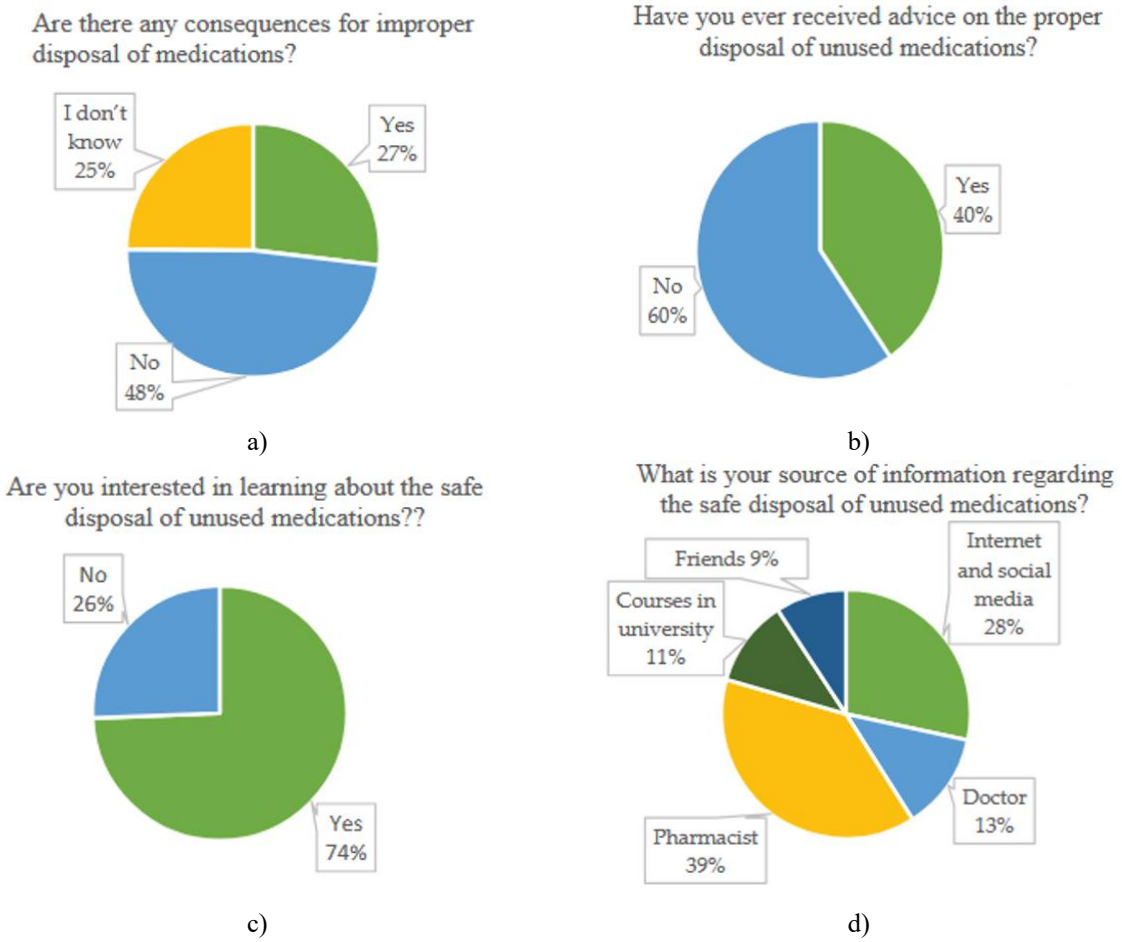

Figure 4. Responses to the questions assessing participants' knowledge of disposal of medications

Association between demographic factors and storing medications

Analysis focused on 784 participants who had taken medications in the previous year (out of 1019 total). Of these, 434 (55.4%) engaged in medication storage, compared to 350 (44.6%) who did not. **Table 5** reports chi-square test results exploring links between socio-demographic factors and storage practices. **Table 6** provides a logistic regression analysis, including adjusted odds ratios and 95% confidence intervals, to evaluate predictive factors. **Table 5** shows no significant association between gender and storage behaviour (P=0.11). In contrast, age groups exhibited marked differences in storage rates ($p < 0.001$), with the youngest cohort (18–30 years) displaying the lowest rate (48.1%).

Table 5. The relationship between socio-demographic characteristics and storage using chi-square analysis. N=784.

Variables	Total N (%)	Un-stored Medications N (%)	Stored Medications N (%)	X^2	P-value
Gender				2.55	0.11
Male	336 (42.9%)	161 (47.9%)	175 (52.1%)		
Female	448 (57.1%)	189 (42.2%)	259 (57.8%)		
Age				19.609	<0.001
18–30	318 (40.6%)	165 (51.9%)	153 (48.1%)		
31–45	197 (25.1%)	90 (45.7%)	107 (54.3%)		
46–60	96 (12.2%)	41 (42.7%)	55 (57.3%)		
Over 61	173 (22.1%)	54 (31.2%)	119 (68.8%)		
Education Level				19.24	0.001
Illiterate	26 (3.3%)	7 (26.9%)	19 (73.1%)		
Elementary education	240 (30.6%)	87 (36.3%)	153 (63.7%)		

Secondary education	96 (12.2%)	44 (45.8%)	52 (54.2%)		
Bachelor's degree	362 (46.2%)	175 (48.3%)	187 (51.7%)		
Postgraduate	60 (7.7%)	37 (61.7%)	23 (38.3%)		
Number of Family Members				13.703	0.003
Less than 3	124 (15.8%)	74 (59.7%)	50 (40.3%)		
3–6	350 (44.6%)	149 (42.6%)	201 (57.4%)		
7–11	237 (30.2%)	98 (41.4%)	139 (58.6%)		
More than 11	73 (9.3%)	29 (39.7%)	44 (60.3%)		
Occupation				6.537	0.038
Medical career	189 (24.1%)	94 (49.7%)	95 (50.3%)		
Non-medical career	564 (71.9%)	248 (44.0%)	316 (56.0%)		
Unemployed	31 (4.0%)	8 (25.8%)	23 (74.2%)		
Health Insurance				11.474	0.001
Yes	296 (37.8%)	155 (52.4%)	141 (47.6%)		
No	488 (62.2%)	195 (40.0%)	293 (60.0%)		
Monthly Income				9.646	0.008
Less than 500 JD	123 (15.7%)	69 (56.1%)	54 (43.9%)		
501–1, 000 JD	225 (28.7%)	104 (46.2%)	121 (53.8%)		
More than 1, 000 JD	436 (55.6%)	177 (40.6%)	259 (59.4%)		

Logistic regression indicated that individuals over 61 years had 2.4 times higher odds of storing medications, while those aged 31–45 had 1.7 times higher odds, relative to the 18–30 group. Educational attainment was significantly linked to storage (p-value = 0.001), with illiterate participants showing the highest rate (73.1%). Storage decreased with rising education: 63.7% for elementary level, 54.2% for secondary, 51.7% for bachelor's degree, and 38.3% for MSc or PhD holders. Family size was also associated with storage (p = 0.003), with rates rising alongside household numbers—from 40.3% in homes with fewer than three members to 60.3% in those with more than eleven. Occupation influenced storage significantly (p-value = 0.038). Non-medical career participants showed roughly double the likelihood compared to medical professionals. Lack of health insurance correlated with higher storage (60% vs. 47.6% for insured; p = 0.001), with regression confirming about 1.8 times greater odds for uninsured respondents. Monthly income exhibited a significant relationship (p-value = 0.008), generally showing higher storage among higher earners: 59.4% for incomes over 1000 JD, decreasing to 43.9% for those under 500 JD.

Improper storage and disposal of medications at home can result in various adverse outcomes. The risks associated with household storage and disposal of drugs have generated significant concerns [14]. Incorrect disposal practices can negatively impact human health, water supplies, wildlife, and the overall environment. Furthermore, such practices contribute to medication waste, particularly in countries with limited resources, such as Jordan [38].This study seeks to assess the storage and disposal practices for unused medications in southern Jordan, evaluate knowledge regarding appropriate disposal methods in the region, and investigate the influence of socio-demographic factors on medication storage.

All participants reported having unused medications at home. Approximately half possessed 6–10 unused medications, a finding comparable to a study conducted in BG Nagar [39]. In addition, 17.8% had expired medications, predominantly 1–5 in number. Notably, some participants were unaware of the exact quantity of expired drugs they owned. This unawareness may increase the risk of accidental ingestion, potentially causing harm due to alterations in chemical composition or microbial contamination [40]. According to the present study, 49.8% of participants retained leftover medications and reused them for similar symptoms. However, reusing medications without professional medical advice can be dangerous [41]. Patients' conditions may change, necessitating consultation with a healthcare provider to update treatment plans [42]. Moreover, 20.4% of participants kept leftover medications after recovery, while 8.2% cited unpleasant taste or odor as reasons for having unused drugs at home. These findings align with those from an earlier study in Jordan [34].

Among the participants, analgesics were the most commonly stored medications in households (97.9%). This high prevalence may stem from the over-the-counter availability of analgesics, facilitating easier acquisition and home storage [43, 44]. Additionally, 86.8% stored antibiotics, suggesting possible misuse, such as incomplete courses or self-medication, which can exacerbate antibiotic resistance [45]. Despite regulatory restrictions, antibiotics remain accessible without prescription in Jordan [46]. In contrast, antidepressants were stored in minimal amounts (0.4%), likely due to prescription requirements. These patterns indicate that non-prescription medications are more

prone to higher storage volumes, consistent with prior research [18, 44]. Proper storage in cool, dry conditions is essential to preserve efficacy and avoid risks [47]. However, the survey showed that only 16% utilized dedicated cabinets, while 32.6% stored medications in refrigerators. Approximately 50% kept unused drugs in bathrooms or kitchens, where fluctuating humidity and temperature may lead to reduced potency or toxic degradation [48].

Disposal methods among many participants mirrored those reported in Kuwait, Britain, and the United States, primarily involving discarding unused medications in household trash [29, 49]. Interestingly, about 25% flushed unused drugs down the toilet, a practice also documented in prior research [31]. Some believed flushing was preferable to trash disposal to prevent animal exposure [33]. However, guidelines from the White House Office of National Drug Control Policy (ONDCP) endorse trash disposal as acceptable, recommending mixing medications with unappealing substances like coffee grounds to deter accidental ingestion by animals [50]. Recent initiatives, such as take-back programs, promote returning unused medications to pharmacies for safe disposal and have proven effective in countries like Sweden and Korea [32, 33]. Surprisingly, only 8.4% of participants in this study returned medications to pharmacies. These results highlight the need for educational campaigns in Jordan to encourage pharmacy return programs and mitigate environmental risks.

Insufficient knowledge about the adverse effects of improper medication disposal influences disposal behaviors [51, 52]. In this study, 48% of participants did not recognize any environmental harm from incorrect disposal, and 25% had limited awareness of potential ecological consequences. Conversely, only 27% acknowledged health risks associated with improper disposal of unused drugs. Furthermore, 60% had never received instructions on proper disposal methods. Despite this, most participants expressed interest in learning safe disposal practices. Regarding preferred information sources for correct disposal methods, 39% favored pharmacists, whereas 28% preferred the Internet and social media. This pattern is consistent with another study [34]. To better address public queries on safe disposal, Jordanian authorities, including the Ministry of Health and the Pharmacists Association, should promote pharmacist-led awareness campaigns on social media and develop dedicated informational websites [53].

Medication storage was more prevalent among older participants, possibly due to higher rates of chronic conditions [54]. Elderly individuals often retain unused medications for specific needs, such as analgesics, laxatives, or ointments for skin conditions. Additionally, cognitive impairment and complex regimens in older adults can lead to non-adherence, resulting in accumulated unused drugs [55]. Individuals with higher education levels stored medications less often, demonstrating a significant association between education and reduced storage practices, likely attributable to greater awareness of risks related to non-compliance and self-medication [56]. Thus, more educated individuals tend to consult physicians and obtain appropriate prescriptions. However, Sharif *et al*. reported no significant link between education and storage practices [8]. In contrast, Abushanab *et al*. found higher storage among those with advanced education [15]. The current study also showed that storage of leftover medications increased with larger family sizes compared to smaller households. Larger families often purchase medications in bulk and engage more in self-medication, leading to greater accumulation of various drugs for future use [15, 57].

Based on the results of this study, individuals with health insurance are less likely to store medications compared to those without insurance, as it covers costs for drugs and medical consultations. Consequently, insured people prefer seeking professional medical advice over using leftover medications, a pattern observed in other studies as well [58, 59]. As participants' monthly income decreased, their medication storage rates also progressively declined. Furthermore, monthly income influences the practice of keeping medications at home. Due to financial constraints, lower-income participants tend to purchase medicines in smaller amounts and only when essential. A similar trend was reported in a prior study [15].

Ultimately, many unused medications are kept under improper conditions at home, and disposal practices are frequently unsafe. This underscores the necessity for governmental initiatives to promote appropriate storage and disposal through public health education campaigns and to discourage the accumulation of medications in households. Moreover, stringent regulations should be implemented to address unsafe disposal methods.

Limitations exist in drawing causal conclusions from cross-sectional studies. Various factors influence responses to online questionnaires, such as access to the internet and digital devices. The sample may not fully represent the general population, given the overrepresentation of females, younger individuals, and those with higher education. Further research is required to generalize these findings.

Conclusion

This study represents a pioneering attempt to investigate medication storage and disposal practices among residents of southern Jordan. Significant amounts of unused medications are stored under inappropriate conditions at home, and disposal methods for unused drugs are generally unsafe. The research emphasizes the importance of raising public awareness about safe storage and proper disposal of unused medications. It highlights the vital role of healthcare professionals, particularly pharmacists, in patient education during medication dispensing. Free awareness campaigns via social media platforms could promote responsible medication management. Additionally, regulations governing the purchase of over-the-counter medications for self-medication are needed, as they could help reduce the tendency to store drugs at home. Government and relevant institutions should develop and enforce guidelines that encourage safe disposal of medications among people in southern Jordan. Furthermore, authorities in southern Jordan can utilize these study results to identify socio-demographic factors influencing the unnecessary accumulation of unused medications and implement targeted measures to curb this behavior. Expanding health insurance coverage to a broader population is one potential effective strategy. Moreover, establishing explicit guidelines to promote responsible and safe disposal of unused medications by residents is essential.

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