Review Article

Public knowledge about how to dispose drug waste in household setting: systematic review and meta analysis

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ABSTRACT

Background

The incorrect use of medications and/or non-adherence to drug therapy, which has an impact on health, the environment, and healthcare systems, make home medicine storage a global public health concern. The drug take-back programs are also common in some county to resolve this issue. Knowledge is one of predisposition of practice to dispose drug waste. Aim of this revies was to performed knowledge of public, prevalence of drug dispose method, and characteristics of variables within some resources.

Material and methods

This systematic review and meta-analysis were conducted with prisma (systematic review and meta-analyses) method. Eligibility cirteria was performed on 3 databases (pubmed, scopus, and sciencedirect).

Result

Total respondent on this review were 3.480 respondent in public or community. Respondent that obtained and had knowledge about how to dispose drug were 39,5%. The most frequent method for disposal is throwing to the houshold garbage (68,6%). Only 6,6% respondent who return the unused drug to the pharmacy. It can be concluded that the knowledge about method of dispose the unused drug were still poor. Common method to dispose the drug was throwing to the household garbage.

Conclusion

The knowledge about method of dispose the unused drug were still poor although education level is high. The need of people about proper guideance to dispose medicinal waste and information of take-back progam.

Keywords

Drug disposal; household; management drug; take-back program

INTRODUCTION

The incorrect use of medications and/or non-adherence to drug therapy, which has an impact on health, the environment, and healthcare systems, make home medicine storage a global public health concern.[1] while timely access to medications is crucial, there are concerns worldwide about the needless storage, improper use, and unsafe disposal of leftover medications.[2] some individuals store unwanted, unused, or expired prescriptions in their homes for an extended period of time, while others flush them down the toilet or dispose of them in common municipal trash cans or sinks. Inappropriate medication disposal leads to the potential risk of medication abuse related to narcotic pain relievers and sleep aids and could contribute to antimicrobial resistance.[3]

Several studies have revealed a lack of proper disposal of unused or expired medications, particularly in developing countries. For

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example, a study in india showed that only 39% of the studied sample were aware of appropriate disposal methods for expired medications.[4] a saudi arabian study found that 48.1% of participants discarded expired medications in household garbage.[5] in 2022, only 6.5% of saudis had proper knowledge of expired medication disposal.[6] household garbage disposal have significant influenced by knowledge.[7]

According to a recent study, there are various ways that consumers can get rid of unneeded or expired prescriptions. The most popular ones are discarding them in the trash and flushing them down the toilet, sink, or drain. It has also been demonstrated that there is a significant chance that liquid and solid medications will end up in the trash or drainage, respectively.[8] this is a concerning pattern because, unless they are broken down by the sewage treatment process, it might allow active pharmaceutical ingredients (apis) to get into the environment. Despite the fact that sewage is cleaned before being released into the environment, trace elements may remain in sewage effluents due to the fact that traditional sewage treatment facilities are not intended to handle apis, which are made up of a wide variety of physical and chemical compounds.[9] drug residues and their derivatives can permeate the aquifers, rendering water hazardous for plants, aquatic organisms and even humans. In lebanon, a study among people in all lebanese district, showed that 70,09% repondents throw away expired medication in household garbage, 15,1% flushing them in toilet/sink, even use them altough expired (12,5%). Only 19,9% respondent return it to the pharmacy.[10]

It is imperative to impart sufficient awareness to the majority of saudi citizens regarding the appropriate disposal of unwanted or outdated pharmaceuticals. Only 3 percent of outdated prescriptions were discovered to be returned to the medical facility that dispensed them, and the majority of saudis dispose of their medical waste in their domestic trash.[11] safely disposing of unused, unwanted, or expired medications—especially by consumers—is a major challenge on a global scale. There are initiatives in place in many wealthy nations to get rid of leftover medications. For example, the national return and disposal of unwanted medicines project in australia and canada has the full cooperation of both the government and the pharmaceutical industry[8]. The drug take-back programs are also common in the united kingdom, denmark, and greece.[12] therefore, this systematic review and metaanalysis aimed to performed knowledge of public, prevalence of drug dispose method, and characteristics of variabels within some resocurces.

METHODS

This systematic review and meta-analysis were conducted with prisma (systematic review and meta-analyses) method.

Eligibility criteria

Studies were included in this systematic review:

1. Invesigated public knowledge about drug disposal in household
2. Published journal article that available in full text
3. Were written in english

Studies were excluded if they:

1. Non-cross-sectional study
2. Only performed one information either knowlede or practice of drug disposal
3. Respondents weren't in public or household
4. Drug disposal method weren't in percentage of total respondent

Search sources and strategies were included pubmed, scopus, and science direct databases. Database were searched from 2016 to 2023. All keywords were in english using "public knowledge" and "drug disposal" and "household". Search result were imported to rayyan artificial inteligent (https://new.rayyan.ai). Duplicates removed, subsequently, eligible criteria were applied. Reviewer extracted data from articles: sosiodemographic; level of knowledge; practice of drug disposal in household.

Meta-analysis was conducted in order to syntesize the prevalence of practice of drug disposal in household, percentage of knowledge of drug disposal, and characteristic of respondents, then to calculate the significance difference (p value) between each variabels.

DATA ANALYSIS

Data extracted were characteristic variables, including gender, marital status, occupation, and education level. Knowledge about drug disposal and practice also obtained. Data were analyzed with one sample t-test to show differences between group in variables.

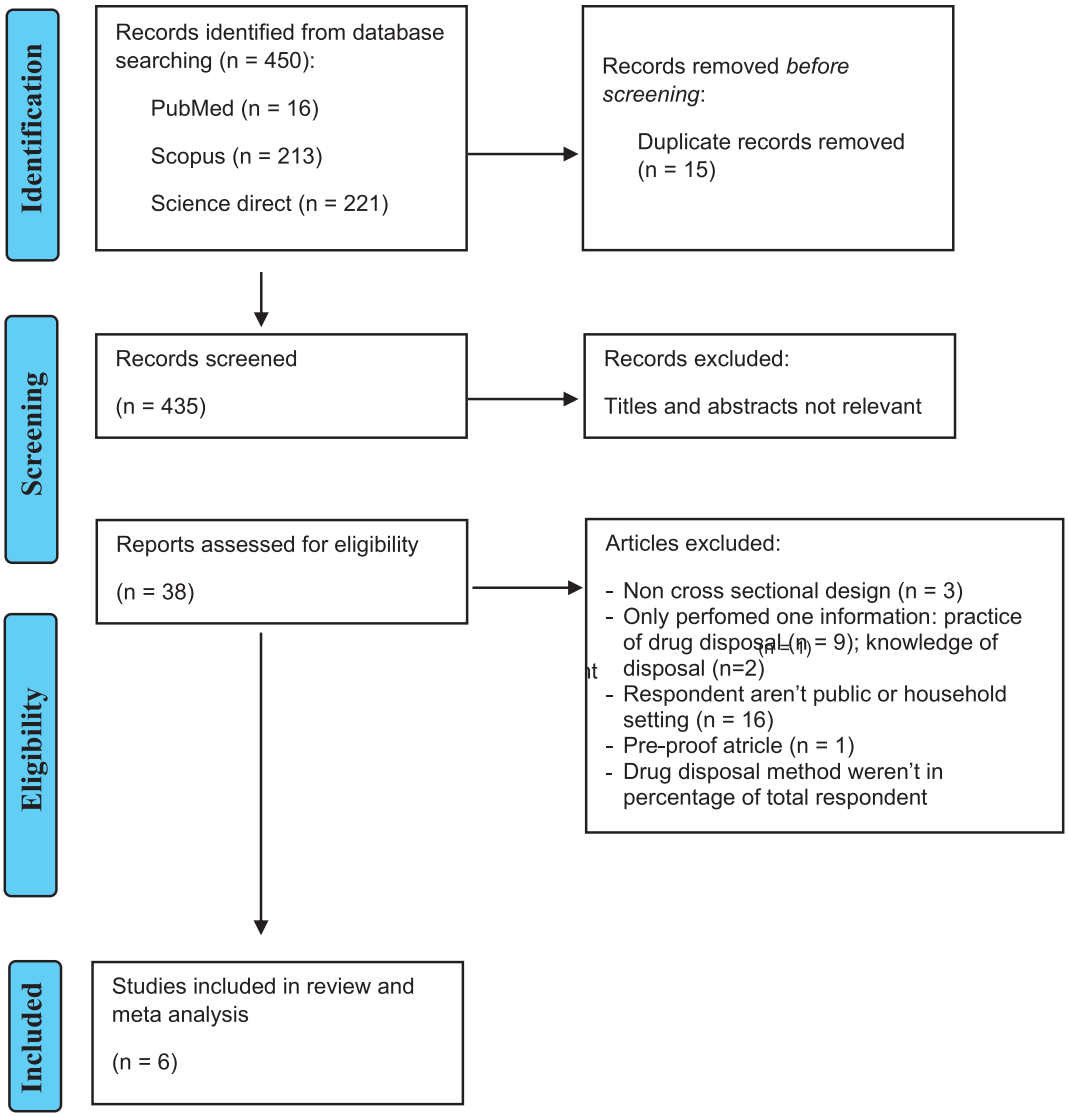

Figure 1. Prisma flowchart diagram

ETHICAL CLEARANCE

This review was part of the disertation research which has passed the ethics commission of the sultan agung islamic university with serial number 136/iv/2024/ komisi bioetik.

RESULTS AND DISCUSSION

From the total 450 initially articles, 15 were duplicates and 397 did not meet inclusion critesia. Finally, 38 full texts were completely assesed for eligibility and matching the exclusion criteria. Three articles were excluded because design of study wasn't cross-sectional, 11 articles recognized only perfomed one information either practice of drug disposal or knowledge od disposal. There were 16 articles that has respondent not from community, public, or houshold settings. Altough reports that asses were assured as a full text, on eligibility step author found that one of study still on pre-proof article which wasn't published when this study conducted. One article performed drug disposal method as multiple option.

CHARACTERISTIC OF INCLUDED STUDIES

All the studies were cross-sectional, which used a questionnaire for gathering the relevant data from the study subjects.

Table i. Characteristic of study

Author	Country	Setting	Study design	Sample size	Variables
Kahsay et al., 2020[13]	Northen ethiopia	Residents (community)	Cross sectional	359	Knowledge, attitude, disposal practice
Ong, ooi, shafie, & hassali, 2020[14]	Malaysia	General public	Cross sectional	483	Knowledge, attitude, disposing practice
Ayele & mamu, 2018[15]	Eastern etiopia	Residents (community)	Cross sectional	695	Knowledge, attitude, practice of disposal
Adedeji-adenola et al., 2022[16]	Nigeria	Public	Cross sectional	543	Knowledge, preception, practice of disposal
Althagafi et al., 2022[17]	Saudi arabia	Public	Cross setional	1100	Knowledge, awarness, disposal practice
Pramestutie, et al., 2021[18]	Indonesia	General public	Cross sectional	300	Knowledge and attitude

Table ii data extraction and statistical result (*p value)*

Variables	Articles						N (%)	P-value
	(kahsay et al., 2020)	(ong, ooi, shafie, & hassali, 2020)	(ayele & mamu, 2018)	(adedeji-adenola et al., 2022)	(althagafi et al., 2022)	(pramestutie, et al.,, 2021)		
N of each articles	359	483	694	534	1100	300	3492	
Gender								
male	207	152	368	186	428	63	1404 (40,21)	.406
female	152	331	326	348	672	259	2088 (59,79)	
Marital status								
single/divorced/widowed	152	338	332	N/a	438	N/a	1260 (36,08)	.028*
married	207	145	362	N/a	662	N/a	1376 (39,4)	
Occupation								
government employee	108		137			70	315 (9,02)	.071
self-employee/private	133	N/a	362	N/a	N/a	135	630 (18,04)	
unemployee (no work, housewife)	110		172			117	399 (11,43)	
other (farmers, etc)	0		18			0	26 (0,74)	
Education level								
primary/secondary	181	39	N/a	100	350	113	761 (21,79)	.027
college/university student/above	178	444	N/a	443	750	209	2024 (57,96)	
Knowledge about drug disposal								
know about how to dispose drug	180	118	506	225	92	253	1374 (39,5)	.135

Variables	Articles						N (%)	P-value
	(kahsay et al., 2020)	(ong, ooi, shafie, & hassali, 2020)	(ayele & mamu, 2018)	(adedeji-adenola et al., 2022)	(althagafi et al., 2022)	(pramestutie, et al.,, 2021)		
don't know	179	365	188	309	1008	69	2128 (60,5)	
Disposal practice								
Throwing in household garbage	226	367	369	391	874	159	2386 (66,67)	.088
Donating to the hospital	24	0	13	12	42	0	91 (2,61)	
Giving to relatives	50	152	13	42	142	0	360 (10,31)	
Returning to the pharmacy	25	135	7	18	44	0	188 (5,38)	
Keeping at home until expired	15	0	111	164	75	24	389 (11,14)	
Flushing in toilet/ pouring in the sink	12	51	166	103	38	12	460 (13,17)	
Burning	7	55	15	22	0	19	95 (2,72)	
Dispose in biomedical waste bin	0	74	0	0	0	0	74 (2,12)	
Prior processing	0	0	0	0	0	103	103 (2,95)	
Others	0	0	0	24	45	5	74 (2,12)	

***data are significance; n/a: not available data**

Sosiodemographic profile

Most of respondent are female (59,79%). And married (39,4%). Only marital status that show significance prevalence profile. Majoritiy occupation is self employee or work as private employee (18,04%). Educational elevel is dominated by college student or above those level (57,96%). There are 3 study that didn't performed the occupational profile of the respondents.[13,16,17]

Knowledge about drug disposal

There are 3 studies that have repondent who know about drug disposal more than don't know. Remain 3 shows the opposite result. After pooling the result, there is domination in "don't know" group with percentage 60,5% and know about how to dispose drug is 39,5%.

Disposal practice

According to the findings (table 2, fig. 2), the prevalence of method that use in removal medicine waste is dominated with throwing in a usual garbage (66,67%), this most of method was perfomed by all of studies. It follows with flushing in toilet/pouring in the sink (13,17%), keeping until expired and giving to relatives (11,4%), giving to relatives (10,31%). Only 1 study that capture dosposal in biomedical waste bin (2,12%).[14] one study captures there is prior processing before dispose medicine (2,12%).[18]

The inappropriate disposal of unused or expired medications poses significant risks to public health and the environment. This issue is exacerbated by the general public's lack of knowledge on proper disposal methods. The reviewed studies indicate a widespread tendency to dispose of medications improperly, with the majority of people opting to throw them in household garbage, flush them down the toilet, or pour them down the sink.

Based on characteristic, female is most common gender to participate on majority studies. All studies provide criteria for respondents in the form of having to have medication stored at home. Female tend to have medication stored at home, because there is some self-care activity in woman, such as vitamin, contraceptive, and analgesics. Based on recent studies, women common to take period pain like over the counter (otc) without seeking medical advice.[19]

The included studies highlight regional differences in drug disposal practices and knowledge. For instance, in

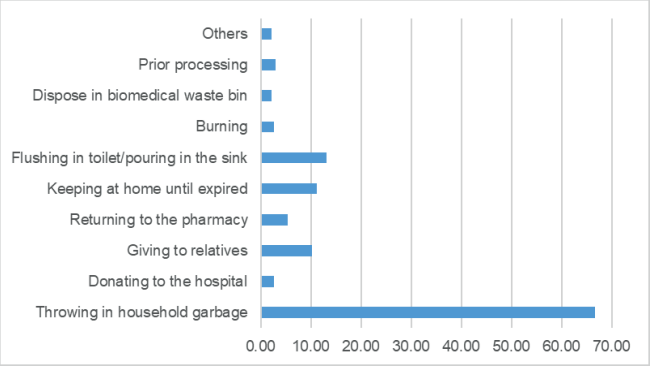

Figure 2. Prevalence of method use to dispose medicine waste

saudi arabia, only 6.5% of the population had proper knowledge of medication disposal, whereas, in lebanon, 70.09% of respondents threw away expired medications in household garbage. Such differences underscore the need for tailored educational programs that address specific regional practices and knowledge gaps.[17]

Public knowledge and awareness

This systematic review and meta-analysis reveal a concerning gap in public knowledge regarding proper drug disposal methods. Across the studies included, it was found that only 39.5% of respondents knew how to correctly dispose of medications, while a significant 60.5% did not have this knowledge. This gap highlights the need for more effective public education and awareness programs. For instance, in northern ethiopia, malaysia, and eastern ethiopia, studies demonstrated that a substantial portion of the population is unaware of the proper disposal methods, leading to improper practices.[13–15]

Even this study revealed that most of respondent have a high level of education, the medicine disposal knowledge still dominated with "don't know". Previous study has documented that knowledge wasn't seem linier with attitude of disposal practice. It may be influence by factors, such as normative beliefs and behavioral believe, which are differnet each individual. It can also by the absent of take-back program socialisation on practicing proper medication.[20] it shows in 2 studies, there are lage portion of respondents didn't know about drug-take-back system even in educated community.[13,15] study performed by ayele & mamu (2018) have positif result on take-back program of unsued and expired medicine should be mandatory and people need for proper guidance on those activity.

Common disposal practices

The analysis identified that the most common disposal method is discarding medications in household garbage, with 66.67% of respondents following this practice. This is followed by flushing medications down the toilet or pouring them down the sink (13.17%), and keeping them at home until they expire (11.14%). A smaller percentage of respondents resorted to giving medications to relatives (10.31%), donating them to hospitals (2.61%), or returning them to pharmacies (5.38%).

Disposal practice shows in all of study, that the respondent's common method is throwing in household garbage and pouring or flushing to the sink and sewage. Throwing unwanted mediations into the trash or pouring them into the sewage system has a negative impact on the environment and health.[21] there are direct and indirect health risks to humans associated with improper and dangerous medication disposal. Here, improper use, abuse, overuse, and misuse of the original medications are linked to direct health risks to humans, while human exposure to contaminated media, including drinking water, is linked to indirect health risks.[22]

CONCLUSION

The knowledge about method of dispose the unused drug were still poor although education level is high. Common method to dispose the drug was throwing to the household garbage. The need of people about proper guideance to dispose medicinal waste and information of take-back progam. This systematic review and meta-analysis highlight a critical need for improved public knowledge and practices regarding the disposal of drug waste in household settings. The prevalent improper disposal methods pose significant risks to public health and the environment. By implementing targeted education campaigns, establishing robust drug take-back programs, enforcing regulatory measures, and involving the community, it is possible to mitigate these risks and promote safer disposal practices. The findings underscore the importance of a coordinated effort to address this global public health concern effectively.

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CONFLICT OF INTEREST

The authors declared there is no conflict of interests

AUTHORS'S CONTRIBUTION

Contribution of authors

Data gathering and idea owner of this study : fathnin fh

Study design : fathnin fh, satibi, endarti d.

Data gathering : fathnin fh Writing and submission of manuscript : fathnin fh, satibi, endarti d., lazuardi

l. Editing and approval of final draft : fathnin fh, satibi

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