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The Study of Drug Storage Behavior in Indonesia: A Scoping Review

(*Studi Perilaku Penyimpanan Obat di Indonesia: Scoping Review*)

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ABSTRACT

Background: Poor home drug storage techniques can worsen the issue of antibiotic resistance, lower therapeutic efficacy, and raise the risk of toxicity. The purpose of this study was to use a scoping review technique to map the knowledge, attitudes, and practices of Indonesians with regard to drug storage at home. **Objectives:** This study aims to map and identify Indonesians' knowledge, attitudes, and habits regarding the storage of household pharmaceuticals using a scoping review methodology. **Methods:** This study use a scoping review methodology by looking at relevant scientific literature that was obtained from the Google Scholar, PubMed, and Scopus databases using the Publish or Perish tool. **Results:** Of the 615 records, twenty-two articles met the inclusion requirements. According to the report, most Indonesian families keep four to five drugs in potentially dangerous locations such as bedrooms and kitchens. These medications are primarily cough suppressants, antibiotics, and pain relievers. Many people may not know how to properly preserve and dispose of outdated medicines, so they simply throw them away. Despite the fact that educational programs have improved people's understanding and performance, disparities persist and are determined by age, income, and education. Finally, many Indonesian houses continue to store drugs improperly. To make drug management safer and more effective in the community, medical personnel, adequate storage facilities, and educational initiatives are required. **Conclusion:** Indonesian families continue to store their medications in unsanitary locations. To make drug management safer and more effective in the community, medical personnel, suitable storage facilities, and educational initiatives are required.

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INTRODUCTION

The maintenance and improvement of public health status heavily depend on medications. However, proper storage procedures at the household and medical facility levels have not fully kept pace with the increasing availability of pharmaceuticals. The negative effects of improper drug storage techniques include reduced therapeutic efficacy, risk of toxicity, and increased antimicrobial resistance due to irrational drug use.

According to a study, the Indonesian population still has very few people who know the proper and safe procedures for storing medicine. healthcare providers and pharmacy students. According to a study conducted in Jakarta by Cokro et al. (2021), only 38.3% of people have been informed about how to store medications, and the majority store them in inappropriate places such as living rooms, kitchens, and wardrobes, which do not guarantee that the medications will remain stable against changes in humidity, light, and temperature.

Recent studies confirm that medication storage issues also occur among healthcare workers and pharmacy students. Research by Lovendri & Kristina (2023) on Pharmacy students at Gadjah Mada University shows that although 87.88% of respondents have good knowledge about drug storage, as many as 85.85% actually have low knowledge regarding drug expiration times, including understanding expiration dates (ED) and beyond-use dates (BUD). This knowledge does not seem to be influenced by sociodemographic factors such as age or gender, but is correlated with the semester of education and current place of residence.

Meanwhile, research by Mubarok et al. (2023) in Mulyorejo Village, Surabaya, revealed that although the majority of families had a moderate to high level of knowledge, their medication storage practices still did not meet standards. Out of the 278 medications observed, only 30.9% were stored in a medicine box, while the rest were kept in inappropriate places. This shows a gap between knowledge and actual actions in society.

Similar conditions were also observed in the Philippines, where a study conducted by Manupac & Cruz (2024) on Rural Health Units (RHU) in Zamboanga Del Sur revealed that although the environmental conditions and storage facilities were generally good, most RHUs lacked adequate storage equipment, such as refrigerators, labeling tools, and calibrated thermometers. Additionally, the pharmacy section of many Community Health Centers (Puskesmas) is run by non-pharmacy staff, such as nurses or midwives, which affects the implementation of Good Storage Practices (GSP). It is interesting to note that healthcare workers with formal training have much higher storage practice scores.

The Philippines and Indonesia are not the only countries experiencing this issue. Similar issues arise internationally in several countries. Althagafi et al. (2022) found that only a small percentage of Saudis have received instructions on how to store medications properly, and these medications are often kept in bathrooms and kitchens. According to Toe et al. (2023) in Liberia, the low level of education in the community causes medications to be stored in hot and humid environments, accelerating their deterioration. Adedeji-Adenola et al. (2022) found that almost all Nigerian participants were unaware of how to appropriately store leftover or expired drugs. Magagula et al. (2022) conducted study in South Africa and discovered that many people continue to hold prescriptions without knowing when they will expire.

Many sections of South and Southeast Asia continue to lack effective drug storage. According to Aryal et al. (2023), many Indians take their prescriptions in kitchens or refrigerators without thinking about the potential consequences. Even Malaysian medical professionals, according to Hiew & Low (2025), do not have the necessary knowledge or habits about how to store medications at home. Meanwhile, Veiga et al. (2023) observed that although Portugal has implemented a drug return system to pharmacies, there is still a lack of public knowledge regarding the dangers of storing unnecessary medications. Globally, Rogowska & Zimmermann (2022) state that although educational and training systems are available, pharmaceutical manufacturing practices have not yet reached their full potential.

It is clear from these diverse findings that improper pharmaceutical storage practices continue to be a significant public health issue in Indonesia and around the world. Until now, there has been no comprehensive literature review mapping the knowledge, attitudes, and practices of the Indonesian community regarding home medication storage. Therefore, the aim of this review is to describe the level of knowledge possessed by the Indonesian community regarding the storage of medications at home and to identify information gaps that can be used to develop effective preventive interventions and educational strategies. This study aims to map the knowledge, attitudes, and practices of the Indonesian community regarding home medicine storage through a scoping review approach.

MATERIAL AND METHODS

Methods

This study conducted a scoping review of the literature on drug storage behavior. Information was gathered from comparable studies conducted in other countries, as well as national and international scientific publications on Indonesia's pharmaceutical storage procedures. Because of inclusion criteria, the study focused on articles published between 2020 and 2024. Online databases such as Google Scholar, PubMed, and Scopus were coupled with the Publish or Perish tool to locate scholarly papers. "Household Medication Storage Patterns," "Medication Storage Behavior," "Medication Stability," and

"Medication Expiration Dates were among the search phrases employed. To combine phrases and filter down search results, boolean operators such as AND and OR were used. For example, "Medication Storage Behavior" + "Indonesia." Publications in other languages were not considered; only English and Indonesian were.

Twentytwo of the sixhundredfifthen publications identified met all inclusion criteria and were chosen for the final evaluation.

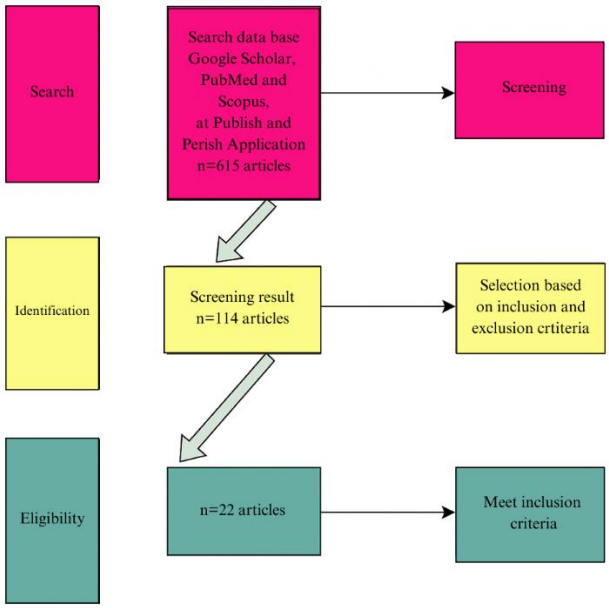

Figure 1. Prisma Diagram Selection of Articles on Drug Storage Behavior in Indonesia

RESULTS AND DISCUSSION

Managing medications at home is very important to maintain their effectiveness and safety, as well as to reduce the possibility of misuse and environmental pollution. There are still many areas in Indonesia and other countries where improper pharmaceutical storage and disposal methods are still common. A review of several scientific publications examining the knowledge, attitudes, and practices of the community regarding pharmaceutical storage has been conducted to gain a better understanding. The research findings are summarized in the table below.

Table 1. below presents a summary of the journal review based on the literature sources obtained according to the stages of writing a scoping review.

Table 1. Research on medication storage behavior

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
1	(Pramestutie et al., 2021)	Malang City , Indonesia. Respondents is population 322 people.	Analytical Observational Research. Data sampling using questionnaires .	1. Proper storage prevents drug damage. 2. Store in a special container, separate from other objects. 3. Improper storage can cause damage and expiration.	Medications are kept for self-medication, supplies, and leftover prescriptions, but most are thrown away in household waste, while 58% of respondents are quite aware of drug storage.
2	(Sari et al., 2021)	Banjar Baru, Indonesia. This study involved 247 respondents . The subjects of the study were the general public with various educational and occupational backgrounds.	Descriptive analytical research with a *cross-sectional approach.* Data collection with *quota sampling* .	1. Respondents' level of knowledge about storing medicines at home 2. General and specific drug storage methods 3. The relationship between drug storage and BUD (*Beyond use date)* 4. Duration of drug storage .	Some respondents did not know how to store liquid medicines, the shelf life after the packaging was opened, and some still stored medicines past their expiration date or threw away leftover medicines without removing the primary packaging, although 44.5% of respondents were quite knowledgeable about storing medicines.
3	(Isnenia, 2021)	South Lampung , Indonesia . Total 100 houses the stairs that become subject . In Sidosari Village.	Quantitative research with a *cross-sectional approach* The sampling technique used was purposive, with a sample size of 100 samples.	1. Average number of drugs stored 2. Drug categories based on safety level 3. Types of drugs stored based on therapeutic effects 4. Status of stored drugs 5. How to get medicine before it is stored	The average number of drugs stored was 4.9 (1-19 drugs), with the most drugs being over-the-counter drugs (68%), followed by prescription drugs, limited over-the-counter drugs, OWA, unidentified drugs, and narcotics. Based on therapeutic effects, the most drugs were analgesics-anti-inflammatories, coughs-colds, and antibiotics. As many as 65% of drugs

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
					were prescription residues, with antibiotics being the most, and drugs obtained through prescriptions (42%), without prescriptions (35%), and prescriptions-non-prescriptions (24%).
4	(Insani et al., 2020)	Bandung , Indonesia.Society general as many as 497 to subject .	Descriptive research with a *cross-sectional approach* . Data collection using a questionnaire .	1. Number of medicines stored at home 2. How to get medicine before storing it at home 3. Classes of drugs stored at home .	As many as 94.3% of respondents store medicines at home, an average of 4.9 medicines (1–19), dominated by over-the-counter medicines (68%) and leftover prescriptions (65%) such as antibiotics, obtained through prescriptions (42%), without a prescription (35%), and a combination (24%). Although 58% understand storage, 44.5% do not know the correct way to store them, 57.9% have not disposed of medicines properly, 42.9% store them in a place accessible to children, and this practice is influenced by age (p=0.023) and income (p=0.045).
5	(Azmi Hassali & Shakeel, 2020)	Selangor, Malaysia . 426 respondents from the general public	research with cross-sectional methods using validated structured surveys.	1. Classes of drugs stored 2. How to get medicine stored at home 4. Practice of disposing of expired and no longer used drugs	More than 80% of respondents were aware of drug waste, but 47.4% threw away unused drugs and 84.9% threw expired drugs in the trash, indicating a gap between awareness and practice.
6	(Zulkarni R et al., 2020)	Padang Pariaman, West	Descriptive analytical research with	1. Reasons for storing medication at home.	The results showed that 95% of respondents kept unused drugs, 82.1% threw

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
		Sumatra . 100 families become subject in study This .	a cross-sectional approach. Data collection using questionnaires	2. Source of acquisition of medicines stored at home. 3. Respondents' knowledge and behavior regarding the management, use, and storage of drugs.	them into household waste, and 79.5% had never received information about proper drug disposal. More than half of respondents (53.1%) were unaware of the negative impacts of unsafe drug disposal on the environment and health.
7	(Septiani ngrum et al., 2021)	Magelang , Indonesia. Respondents as many as 202 people .	This research is observational with simple random sampling method in data collection.	1. Amount of medication stored 2. Types of drug preparations 3. Types of drugs based on indications 4. Reasons for storing drugs 5. Storage 6. How to dispose of expired/unused drugs	Respondents (63.87%) store drugs in the form of tablets/capsules for supplies (66.80%) with the most common indications being coughs and colds (28.81%). As many as 61.80% throw away drugs in the trash, and 65% have never received socialization on how to properly dispose of drugs.
8	(Novitri et al., 2024)	Jakarta, Indonesia. A total of 329 people from urban households	research with cross-sectional design, and data collection methods were conducted through face-to-face interviews and observations.	1. Source of acquisition and purpose of drug storage. 2. Drug category, location, condition, and accessibility of storage.	The findings showed that 56.53% of respondents had low knowledge, 57.45% had inappropriate drug storage behavior, and a significant relationship was found between age, education, knowledge, and drug storage behavior ($p < 0.05$).
9	(Azis et al., 2023)	Duren Jaya Village, Bekasi, East Bekasi, Indonesia . Respondents 95 people aged	This study uses a descriptive method with a *cross-sectional approach and*	1. Separate storage of household items. 2. Do not store for long periods of time. 3. Do not store in a damp place.	As many as 96.8% of respondents have good drug storage behavior, while 65.3% have poor drug disposal behavior, with 55% of respondents storing expired or unused drugs.

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
		between 17-55 years and have carried out storage and disposal of drugs .	*purposive sampling* technique by filling out a questionnaire .	4. In original packaging and tightly closed container. 5. Check expiration date before use.	
10	(Ambianti et al., 2022)	Palu City, Central Sulawesi. Subject 100 households in Palu City .	research is a descriptive study, with a cross-sectional research method.	1. Proper storage of medications prevents damage and expiration. 2. Respondents' knowledge of storage methods and BUD. 3. Factors that influence: quantity of drugs, type, location, and disposal of drugs.	The majority of respondents had less knowledge (56.53%) and inappropriate behavior (57.45%) in storing drugs. Drugs were often obtained from pharmacies (50.42%) and stored for supplies (44.72%). Inappropriate storage such as exposure to sunlight (1.3%), damp places (11.15%), inappropriate temperatures (15.18%), and easy access for children (52.79%).
11	(Wibowo et al., 2024)	District X, Indonesia. The subjects in this study were 67 kiosks and 52 minimarkets, with a total of 119 respondents participating in this study.	The research method is a cross-sectional study and the type of research is descriptive.	Compliance with storage standards , drug sources , drug management , and storage of prescription and non-prescription drugs .	As many as 88.1% of kiosks and 100% of minimarkets met drug storage standards, but no drug information was provided.
1 2	(Nastiti et al., 2022)	Bandung and Jabodetabek , Indonesia. The subjects in this study were 262 parents living in the Jabodetabek	Types of exploratory research and online survey research methods.	1. Identify the drugs stored 2. Classification of stored drugs 3. The type of medicine that is mostly stored 4. Variations of medicines stored	Survey to 262 parents stated that acetaminophen was the most commonly stored medication at home, and 78.6% of respondents disposed of unused or expired medications as household waste.

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
		and Bandung areas with children aged ≤5 years.			
13	(Kusuma et al., 2023)	Lamongan , Indonesia, and involved 100 families .	Descriptive research with cross - sectional design . Method household survey using the ReDiUM (Return and Disposal of Unused Medications) questionnaire .	1. Household medicine storage places 2. Storage conditions of drugs 3. 3. Medication management at home 4. Practices for storing and handling medicines at home	Whereas 37% of families obtain medicines from official pharmacies, 57% still have leftover medicines, and economic losses due to drug waste are estimated at around $2 per family, with a significant relationship between knowledge and attitude ($p < 0.05$).
1 4	(Kurnia wan, 2020a)	Central Jakarta, Indonesia. 116 community respondents who received treatment at the Central Jakarta sub-district health center.	Type of research: Quantitative, observational , cross-sectional . Research method: Cluster random sampling. .	1. Essential medicine storage box. 2. Pillbox aids compliance. 3. Useful medicine box. 4. Medicine box for storage and remember.	Family support ($p = 0.001$; OR = 5.092) had the greatest influence, followed by knowledge ($p = 0.034$; OR = 4.855), drug disposal box ($p = 0.019$; OR = 3.009), and drug storage box ($p = 0.025$; OR = 2.974).
15	(KM et al., 2023)	area in North Karnataka, India. This study involved 433 subjects who were household participants.	Descriptive with survey method. Data were collected using questionnaire s given to respondents.	1. Household drug status 2. How to store medicine at home 3. Practices regarding unused drugs and hoarding of drugs at home 4. Reasons to keep unused medications at home	Of the 433 households surveyed, 412 had unused drugs, mostly antihypertensives (25.6%) and antidiabetics (20.6%). Most drugs were purchased with a prescription (84.7%) and thrown away in the trash (96.9%). Drug storage was

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
				5. The amount of unused or remaining medication at home	due to prescription changes (52.7%) and self-discontinuation (35.1%). A total of 92.1% checked the expiration date, and 63.5% stopped taking the drug after symptoms subsided.
1 6	(Hassan et al., 2022)	region of Saudi Arabia. The research subjects consisted of 820 respondents	Cross - sectional survey, and this type of research is descriptive .	1. Drug storage methods 2. Checking the expiration date 3. Understanding storage instructions 4. Types and forms of drugs	This study shows that people in the eastern region of Saudi Arabia are less aware of proper storage and disposal of medicines. Most keep medicines in their original containers and check expiration dates, but few read the instructions or ask the pharmacist. Age, gender, and education factors influence medicine storage practices.
17	(Ong et al., 2020)	General public in Malaysia, with a total of 483 participants involved in the survey.	research . The research method is a cross-sectional survey using a questionnaire with a non-probability convenience sampling technique.	1. Disposal into trash and drains. 2. Drug return program. 3. Factors influencing drug disposal practices.	The study found that only 13.8% of respondents had good knowledge about proper drug disposal, although the majority (over 94%) were aware of the negative impacts of unused drugs on the environment, living things, and families. Common reasons for having leftover drugs included feeling cured (76.9%), changing medications (50.3%), side effects (49%), not following the instructions (47.2%), and not feeling cured (46%). There was a relationship between low knowledge and improper disposal practices.

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
1 8	(Rahayu & Rindarwati, 2021)	Bandung, Indonesia , subject 100 houses ladder	A quantitative analysis by collecting data through interviews using questionnaires .	date of the drug.	Research in Bandung City shows that 86% of households store medicines, and 25.53% of them are no longer used, especially analgesics-antipyretics (6.28%) and cough and flu medicines (6.69%). As many as 93% of respondents throw away leftover medicines in the trash without proper procedures, risking environmental pollution.
19	(Meidia Savira et al., 2020)	Pucang Sewu Subdistrict , Gubeng , Surabaya City, Indonesia, with subject 140 citizens .	research with cross-sectional design and using accidental sampling method.	1. Reasons for storing medication at home 2. The presence of expired drugs that are still stored 3. The correct way to store medicines 4. Storage conditions for drugs stated on the packaging 5. Arrangement of drugs currently in use and stored 6. Providing special labeling for stored drugs	study found that drug storage and disposal practices in the community are not good. Of the 140 respondents, 13.6% still store expired drugs and 57.9% do not dispose of drugs properly.
20	(Egyita Sitepu et al., 2024)	Central Lampung, Indonesia, number subject as many as 220 respondents .	Study Quantitative with method Cross-sectional approach	1. Keep away from children. 2. Store in original packaging, tightly closed. 3. Stored in a cool place, away from direct sunlight. 4. Don't leave it in the car for long.	Research shows that level of knowledge DAGUSIBU respondents were dominated by the "sufficient" category (68.18%), followed by "less" (25%) and "good" (6.82%). There was a significant relationship between age, occupation, And education with

No	Author, Year	Location and Subject Study	Types of Research & Research Methods	Storage Aspects	Results
				5. Do not store if it has expired.	DAGUSIBU's level of knowledge (P value < 0.05).
21	(Hastuti et al., 2024)	Tambakrejo Village, District Waru, Sidoarjo Regency (East Java Province, Indonesia) , Number Respondents were 120 people, all of whom is Mother House ladder .	This research is a quantitative research with a quasi-experimental method using a One Group Pretest-Posttest design.	1. Number of medicines stored: the majority of respondents (75.8%) store 1–5 types of medicines at home. 2. Storage location: most medicines are stored in cupboards or medicine boxes (65.7%). 3. Source of drug acquisition: most drugs were obtained from pharmacies (78.3%). 4. Reasons for storage: the main reasons for storing medicines are for supplies (34.2%) and emergencies (26.7%).	There was an increase in knowledge after the intervention, from an average value of 44.4 to 70.8. Providing education can increase community knowledge in storing and disposing of drugs in the household.
22	(Hestrivina Puren et al., 2024)	Buli Village, Maba District, East Halmahera Regency (North Maluku, Indonesia)	This type of research is quantitative research with a quasi-experimental method using a One Group Pretest-Posttest design.	Aspect knowledge in storage drug before and after given intervention .	The results of the study showed that before education, most respondents had sufficient knowledge about DaGuSiBu (70%), and after education, most had good knowledge (89%). Data analysis showed a significance value of 0.000 which was smaller than 0.05, meaning that education had an effect on increasing knowledge about DaGuSiBu.

Many studies show that there are still many barriers to overcome in terms of knowledge, habits, and environmental factors related to the behavior of storing and disposing of pharmaceuticals in households. To better understand the trends, recurring issues, and variables that influence these practices in society,

key findings from various studies have been compiled in this review. The authors have reviewed 22 literature searches and compiled these household medication storage practices.

Motives and Types of Medications Stored at Home

Based on several studies, the general public often uses additional medication recipes, citing emergency needs. However, some research reveals that this behavior is ineffective and raises ethical concerns (Azis et al., 2023; Meidia Savira et al., 2020; Ambianti et al., 2022). This is caused by the socioeconomic and regional variations within a society. Cross-section has advantages in analyzing these trends. Meanwhile, quasi-experimental research provides more convincing validity regarding the benefits of educational interventions, but is less generalizable (Hastuti et al., 2024; Hestrivina Puren et al., 2024).

Looking at this from a cross-country perspective is quite relevant. Despite the long-term use of antidiabetic and antihypertensive medications, they are quite often stored in India with factors of non-adherence, changes in prescriptions, or sudden discontinuation of therapy (KM et al., 2023). In Indonesian society, there is a tendency to store medications for a relatively short period of time (Isnenia, 2021; Insani et al., 2020; Septianingrum et al., 2021). Because in the practice of self-medication for mild illnesses in Indonesia, it significantly influences how medications are stored, such as antibiotics being stored for too long, and observing the management of chronic conditions in India provides a clear picture of the difficulties in managing medication storage at home.

Knowledge and Behavior of Drug Storage

Generally, when conducting structured surveys, the use of scoring algorithms is divided into three categories: poor, moderate, and good. In its implementation among the population in Jakarta, Novitri et al. (2024) showed that 48% of respondents had moderate knowledge and 32% had strong knowledge. The results show that the urban population tends to be educated. However, in a study conducted on people in non-urban areas, Ambianti et al. (2022) showed that 62 percent of respondents answered that they did not have sufficient information. In the study conducted by Sari et al. (2021), no more than 30% of respondents regularly check the expiration dates on their medications, indicating a lack of knowledge. The results above indicate the presence of regional and demographic factors that differentiate the public's response, whether it's due to living in urban or rural areas, or differences in education, which lead to varying responses.

In terms of methodology, the majority of studies used a cross-sectional survey design, which has limitations in proving causality but is useful for mapping prevalence. However, in the quasi-experimental study, pre- and post-intervention questionnaires showed a significant increase in knowledge, with scores after the intervention increasing by more than 40% in accurate responses

(Hestrivina Puren et al., 2024; Hastuti et al., 2024). This shows that although basic knowledge is typically low to moderate, targeted teaching can significantly improve awareness and behavior.

For comparison, a study conducted in Saudi Arabia showed a similar trend, with only 28% of respondents checking expiration dates, while less than 40% of respondents in Malaysia did so, despite having sufficient knowledge (Azmi Hassali & Shakeel, 2020). The results of this study suggest that sufficient information is not enough for management behavior.

Location and Condition of Medicine Storage

Although the storage of medicines is placed in containers such as medicine cabinets, medicine boxes, or similar containers. The majority of people often store it in unsuitable places, such as kitchen areas, bedrooms, and damp or directly sunlit rooms (Ambianti et al., 2022; Azis et al., 2023). This habit is quite dangerous and can be caused by many factors, including insecurity, lack of adequate storage space, limited information or ignorance, and the belief that storage location does not directly affect drug safety. More than half of households kept pharmaceuticals in places where children could get them, increasing the risk of poisoning. Additionally, due to unsuitable environments, adults and the elderly are vulnerable to medication errors and reduced drug efficacy (Novitri et al., 2024; Ambianti et al., 2022).

In a study on medication storage practices conducted by Kurniawan (2020), the results showed a 37% increase in proper storage practices among respondents. This study provides additional evidence that regular use of medication boxes can help improve medication storage management and adherence. Meanwhile, in the study conducted by Wibowo et al. (2024), where medications were sold in retail locations such as shops and minimarkets, it showed fairly good compliance with storage regulations, but there were still gaps in the necessary information, such as a discrepancy between awareness and behavior. This can therefore affect drug storage behavior in households. This problem cannot be solved by relying solely on knowledge; it requires behavioral patterns, continuous public education, and infrastructure.

Practices for Disposing of Leftover and Expired Medications

In the review literature, there are quite a few instances of improper disposal of unused or expired medications. Most Indonesian households discard these pharmaceuticals, often without removing the original packaging and without contemplating the potential threats to their health or the environment (Sari et al., 2021; Kusuma et al., 2023). In a study conducted by Meidia Savira et al. (2020) and Azis et al. (2023), it was shown that expired medications are intentionally kept at home. Although the public is aware of the environmental impact, practical knowledge about proper disposal, such as returning prescriptions to pharmacies, is still quite lacking (Septianingrum et al., 2021). Improper disposal has a significant impact, as active pharmaceutical compounds can contaminate water and soil. For example, in practice, people in Malaysia are believed to dispose of medication incorrectly, even tho they are aware of the environmental risks that will result (Ong et al., 2020). Similarly, most households in India dispose of their medications in the trash. This indicates that basic knowledge does not guaranty good management practices (KM et al., 2023). Therefore, based on these results, knowledge-behavior gaps are still quite common and planned interventions are needed to change medication disposal management.

Effectiveness of Education and Supporting Factors Change Behavior

This literature study shows that educational programs aimed at increasing public awareness of drug storage and disposal can yield optimal results. In practice, communities that have received education have shown an increase in knowledge scores from the "sufficient" to "good" category in research conducted by (Hestrivina Puren et al., 2024; Hastuti et al., 2024) in East Halmahera and Sidoarjo. Based on evidence compared to descriptive studies, it shows how effective the therapy is by looking at gradual changes. Other support that has a significant positive impact on medication management practices includes family support, access to information, and the availability of suitable storage devices, such as medicine boxes (Kurniawan, 2020; Kusuma et al., 2023). However, most studies do not track long-term behavioral changes or demonstrate a direct correlation between higher awareness and better disposal methods. Furthermore, while some communities have demonstrated this, there is no evidence that increased awareness following education leads to consistent real-world implementation. Overall, a clear pattern emerges: better management of household drugs necessitates structured, community-based education, family involvement, and readily available services.

CONCLUSION

Based on the results of this literature review, the majority of people in Indonesia still store medicines in a less effective way. Medicines are often stored in communities as emergency supplies and for self-medication, but many people are unaware of the proper storage techniques. Medications are often stored in inappropriate places, including damp areas or locations easily accessible to children, and are frequently disposed of carelessly when expired without considering the consequences. Age, education,

and lack of information obtained are some factors contributing to the low level of public knowledge. However, it has been proven that education improves public knowledge and practices regarding the storage and disposal of pharmaceuticals. Therefore, continuous education, provision of safe drug storage and disposal facilities and support from skilled health workers are needed to increase the effectiveness of household medication management.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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