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Original Research

Knowledge and Behavior of Household Medicine Storage: A Study from the Urban area of Jakarta, Indonesia

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Abstract

Background: The prevalence of self-medication has significantly increased the amount of medicine stored in households. Many individuals remain unfamiliar with proper medication storage procedures, which can compromise the stability and effectiveness of the medicine.

Objective: This study aimed to assess the knowledge and behavior of urban households in Jakarta regarding medicine storage.

Methods: An analytical approach using a cross-sectional method was employed. Data were collected through face-to-face interviews and observations. A total of 329 respondents and 1686 medicines were obtained through purposive sampling. The collected data were analyzed using univariate and bivariate analyses with SPSS 26.

Results: The findings indicated that a majority of individuals had low knowledge (56.53%) and exhibited inappropriate behavior (57.45%) regarding medicine storage. Most respondents obtained their medicines from pharmacies or drugstores. The most commonly stored therapeutic classes were cough and cold medicines, including analgesic-antipyretics. A significant relationship was observed between age group and level of knowledge, as well as between education, knowledge, and behavior related to household medicine storage (p-value < 0.05).

Conclusion: The urban community in Jakarta demonstrates poor knowledge and inappropriate behavior regarding medicine storage in households. This underscores the need for continuous education to promote proper medication storage practices.

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Background

In recent years, there is a significant change regarding the pattern of medication use in society, leading to a rise in medicine purchases (García-Goñi, 2022). This phenomenon occurs due to a combination of several variables, such as technical developments resulting in higher prices, population aging, and changes in prescription practices (Dilokthornsakul et al., 2014). Millions of lives have been saved and improved throughout the world because of increased access to important medications and other healthcare products (Dubois et al., 2021), leading to, large amounts of medicine storage in

households. However, household medicine storage is a global public health problem caused by inadequate medication usage or non-adherence to drug therapy. This issue has a detrimental influence on people's health, the environment, and access to healthcare facilities (Jafarzadeh et al., 2021), including economic losses, unfavorable clinical outcomes, and reduced treatment adherence (Colberg et al., 2017).

The prevalence of medicine storage in households is significantly high, as indicated by previous investigations. A total of 13 studies in several countries found that the prevalence was more than 70%, with 90% reporting half of the incidence (Jafarzadeh et al., 2021). In most households worldwide, medicines are stored for various purposes, including for urgent use and treatment of chronic or acute illnesses. This practice includes both prescription and over-the-counter (OTC) medications designed for acute and chronic conditions (Martins et al., 2017). Another study showed that most individuals stored medicine in households due to the possibility of future use, leftovers from previous treatments, and self-medication (Constantino et al., 2020).

In Indonesia, medicine storage also remains a problem. Data reported that 103.860 or 35.2% of 294.959 households store medicine for self-medication. Among these households, Jakarta has the highest proportion, consisting of 56.4% among regions in the country (Kemenkes, 2013). As reported in Indonesian Basic Health Research data (2013), 35.7% of households stored prescription medicines. Meanwhile, 27.8% stored antibiotics, indicating an irrational use of medicines. The results also showed that 32.1%, 42.2%, and 47% of households stored medicines for use, stock, and due to leftover from previous treatment (Kemenkes, 2013). The increasing rate of medicine storage in households has the potential to lead to irrational drug use. Inappropriate medicine storage can also lead to drug damage, decreased drug effectiveness and drug safety.

Research conducted in Pucang Sewu Village, Gubeng District, Surabaya City by Savira et al., (2020) which was attended by 140 respondents obtained results: 132 respondents (94.3%) stored medicine at home and 19 of 132 respondents (13.6%) stored expired medicine at home (Savira et al., 2020). Then, research conducted by Fajrin (2019) in Babakan Sari Village, Bandung City, found that there are still many people who store medicines in places that are easily accessible to children (Fajrin et al., 2019). From this data, it can be seen that there are still many people who do not know how to store medicines properly.

Application of the knowledge-behavior model in health education has an effect in changing bad habits, increasing healthy behavior and improving self-management behavior in patients (Liu et al., 2016). Knowledge is the result of someone knowing objects through their senses (Notoatmodjo, 2018). Good knowledge will be used as a basic reason for a person to make choices or act (Fajrin et al., 2019). One of the reasons for poor medicine storage is limited information and knowledge about safe medicine storage (Huang et al., 2019). Research conducted by (Hassan, 2022) reported that the factors of age, gender and education level can affect medicine storage behavior in the household. Therefore, knowledge about medicine storage is likely to influence behavior in how to store drugs, thus affecting the stability, safety and effectiveness of a drug.

Good medicine storage can maintain the stability of the drug during storage so that the effectiveness and safety of the drug will be maintained until the time of use. The effectiveness and success of drug therapy will be impaired if drug stability decreases. A drug is said to be stable if during storage until the time of use it does not undergo physical, chemical, microbiological, toxicological changes, and still has the same therapeutic effect in accordance with the provisions set by the pharmaceutical industry (Herawati, 2012; Noviani, 2021)

Several studies have been carried out on medicine storage in Indonesia, with the majority being conducted in rural areas and did not measure variables influencing behavior (Isnenia, 2021; Pratiwi et al., 2022; Savira et al., 2020; Zulkarni et al., 2020). Therefore, the aim of the study was to measure the knowledge and behavior of medicine storage in households in Jakarta, Indonesia. Knowledge was evaluated based on the information individuals possessed within a certain behavioral domain, which significantly influenced their decisions. The results were expected to provide valuable insight for stakeholders to improve their efforts in maximizing the benefits and minimizing the adverse effects of medicine storage in households.

Method

Study Design

This cross-sectional study was conducted in Jakarta, Indonesia. The city was selected due to its distinction as the province with the highest proportion of household medication storage at 56.4% (Kemenkes, 2013).

Setting
This study was conducted in Juni– August 2022, West Cilandak, South Jakarta, Indonesia.

Sample/Participants
The sample was selected using purposive sampling due to the absence of a sampling frame and this study required a population that stored medicine in accordance with the research objectives. This is based on the research objectives that require a population that stores medicine in households. Inclusion criteria were respondents living in West Cilandak, South Jakarta, the head of the family or a member responsible for storing medicines in the household, the ability to communicate, and having medication stored in the household. Exclusion criteria are respondents not answering the questionnaire completely. Respondents were recruited by door to door, then selected based on inclusion and exclusion criteria.
The population includes 1.780 households in Cilandak, South Jakarta, Indonesia. Based on the results of sample calculations using the Slovin formula with a 95% confidence level, the minimum sample size required was 327 respondents. However, for this study, the sample taken was 329 respondents who met the inclusion criteria, with a total of 1686 medicines stored in households. This study was conducted by visiting the home of each respondent who met the inclusion criteria. Then observations and interviews were conducted regarding the way medicine was stored. Furthermore, respondents answered questions on a questionnaire sheet that had been tested for validity and reliability.

Instrument
The data used in this study were collected using a survey form, which consisted of four parts. These included 1) the identity of the respondent, including questions about age, gender, education, occupation, and family income, 2) the medicine storage profile, such as the name/brand, source of acquisition, purpose for storage, class, dosage form, therapeutic category, storage location, conditions (light, humidity, temperature), accessibility to children and expiration date, 3) knowledge of medicine storage, which includes general knowledge about storing medicines, specific storage guidelines, expiration date, BUD (Beyond Use Date), and damaged medicine, 4) behavior of medicine storage, including information seeking before household storage, separate storage of oral and topical medicine, adherence to storage conditions, as well as handling of damaged or expiration medicine. This study used a 4-point Likert scale to measure household medicine storage behavior, consisting of categories of never, sometimes, often, and always.

The instrument used in this study is the result of the development of "Cara Cerdas Gunakan Obat" (Kemenkes, 2017) and has been tested for validation and reliability using SPSS Version 26. The validity of the instrument was tested on 30 respondents with the same characteristics. A question is considered valid if the calculated r value is more than the predetermined r table value with a significance level of 5% or 95% confidence interval (Sani K, 2018). Validity test was conducted on each question, where the knowledge questionnaire consisted of 13 questions and behavior consisted of 10 questions. Valid questions (r-value>r-table) were used for this study. The reliability score of the questionnaire is Alpha's Cronbach > 0.70, indicating that the instrument has acceptable reliability (Budiastuti & Bandur, 2018).

Behavior is categorized into two groups, namely good and bad medicine storage. Meanwhile, good behavior entails keeping medicine away from direct sunlight, dry humidity, appropriate temperature, out of reach of children, and preventing expiration (Kemenkes, 2022). Knowledge of household medicine storage is considered good when the total score ranges from 75-100% and poor at a value <75% (Agus, 2013). Appropriate household medicine storage is when the total score ranges from 75 to 100% and inappropriate at <75% (Agus, 2013). Before data collection, the validity of the instrument was tested on 30 respondents with the same characteristics. The reliability score of the knowledge questionnaire is 0.715, indicating that the instrument has acceptable reliability (Budiastuti & Bandur, 2018).

Data Collection
Data were collected in in April – August 2022, West Cilandak, South Jakarta, Indonesia. Data were collected through face-to-face interviews and observation using the survey and observation forms conducted research assistant. Interviews were conducted to fill in personal identity, medicine storage profile, knowledge, and behavior. Meanwhile, interviews and observations were carried out simultaneously to obtain data on medicine storage behavior. Before data collection, permission to survey residents' homes was obtained from the West Cilandak authority, and ethics permit. During the collection process, respondents were informed about the study procedure. Respondents who agreed signed the informed consent and became participants in the study sample. Subsequently, interviews and observations were carried out regarding the knowledge and behavior of storing medicines at home.

Data analysis

Univariate and bivariate analyses were carried out in this study using SPSS Version 26. These analyses were performed to examine the number and percentage of respondents' characteristics, knowledge, and medicine storage behavior in households. Chi-Square test was conducted to examine the relationship between sociodemography characteristics and knowledge and behavior of medicine storage in households.

Ethical Considerations

Throughout the study, confidentiality and anonymity were maintained, while ethical approval was received at the Health Research Ethics Committee of Syarif Hidayatullah Islamic State University Jakarta Number Un.01//F.10/KP.01.1/KE.SP/06.08.037/2022.

Results

Respondents' characteristics

A total of 329 respondent stored medicine in households. The study respondents ranged in age from 17 to 83 years. The results presented in Table 1 showed that approximately 83.28% of respondents were female The majority (28.57%) of respondents were in the range of 46-55 years, (44.38%) had senior high school education, 61.70% were housewives, 71.12% had low income.

Table 1. Respondents' characteristics

Characteristics	Total	
	N	%
Total	329	100
Age (years)		
17 – 25	19	5.78
26 – 35	52	15.81
36-45	88	26.75
46-55	94	28.57
56-65	49	14.89
>65	27	8.21
Sex		
Male	55	16.72
Female	274	83.28
Level of education		
No School	5	1.52
Elementary School	57	17.32
Junior High School	40	12.16
Senior High School	146	44.38
University	81	24.62
Work		
Student	8	2.43
Housewife	203	61.70
Teacher/Lecturer	8	2.43
Police	2	0.61
Private sector employee	51	15.50
Entrepreneur	18	5.47
Trader	13	3.95
Retired	11	3.34
Others	15	4.56
Income (in Indonesian Rupiah)		
Low (< 1.500,000)	234	71.12
Moderate (1.500,001-2.500.000)	8	2.43
High (2.500.001-3.500.000)	20	6.08
Very high (> 3.500.000)	67	20.36

Description of respondents' knowledge and behavior

Regarding knowledge, Table 2 showed that 47.4% of respondents did not know about storing syrup at room temperature, 45.6% of respondents did not know about storing cold and cough syrup medicines in the medicine box, not in the refrigerator. Approximately 52.3% of respondents did not know about storing suppository dosage form in the refrigerator, 48% of respondents did not know about expired date is the deadline when the medicine still have efficacy and is safe to use as long as the primary

packaging has not been opened, 56.8% of respondents did not know about pulveres left over from treatment that is still good should be discarded Knowledge of household medicine storage is considered good when the total score ranges from 75-100% and poor at a value <75% (Agus, 2013). From the results of the study, it was found that respondents who had good medicine storage knowledge were 43.47% and poor medicine storage knowledge were 56.53%.

The researcher measured the behavior of respondents using a questionnaire consisting of 10 questions covering aspects: information seeking before household storage, separate storage of oral and topical medicine, adherence to storage conditions, as well as handling of damaged or expired medicine. Appropriate household medicine storage is when the total score ranges from 75 to 100% and inappropriate at <75% (Agus, 2013). From the results of the study, it was found that respondents who had appropriate medicine storage behavior were 42.44% and inappropriate medicine storage behavior were 57.45%.

Table 2. Respondent's correct knowledge per item question related to household storage of medicine

Question	n	%
Sources of medicine storage information can be obtained from doctors and pharmacists	224	68.1
Medication stored in a dry place may cause damage	273	83.0
Humid places can damage the medicine	300	91.2
Keeping medicine in the car for too long can damage the medicine	267	81.2
Syrup medicine should be stored at room temperature	156	47.4
Cold and cough syrup medicines should be stored in the medicine box, not in the refrigerator	150	45.6
Suppository dosage form need to be stored in the refrigerator	172	52.3
Expired date is the deadline when the medicine still have efficacy and is safe to use as long as the primary packaging has not been opened	158	48.0
As long as it has not been opened, the medicine can be stored according to the expired date	308	93.6
Eye drops after opening the package can only be stored for a month	213	64.7
Pulveres left over from treatment that is still good should be discarded	187	56.8
Syrup that is cloudy and smells but has not expired should be discarded	323	98.2
Ointment dosage form should not be used when they have hardened, separated, and expired	297	90.3

Medicine Storage Profile & Condition

Table 3 showed the storage profile in the household, the results showed that the source of medicines is the pharmacy or drugstore (50.42%) and supply purposes (44.72%). The most commonly stored medicine class is prescription (39.38%), while the dosage forms are tablets/caplets (67.85%). As presented in Table 3, the most medicine therapy class is cold and cough (17.56%).

Table 3. Medicine Storage Profile (n= 1686)

Medicine Storage Profile	n	%
Sources of Obtaining Medicines		
Pharmacy or drug store	850	50.42
Hospital	271	16.07
Primary Healthcare	96	5.69
Non-healthcare shop	469	27.82
Storage Reason:		
Being used	586	34.76
Remaining treatment	346	20.52
Preparation	754	44.72
Medicine Class		
Free medicines or over-the-counter drugs (OTC)	375	22.24
Limited free medicines	323	19.16
Prescription medicines	664	39.38
Psychotropic medicines	4	0.24
Narcotic drugs	2	0.12
Traditional medicine	98	5.81
Health supplement	191	11.33
Medicine not identified	29	1.72
Dosage form		
Tablets/caplets	1144	67.85
Capsules	144	8.54

Pulveres	25	1.48
Syrup/solution/suspense/emulsion	303	17.97
Cream/ointment/gel	45	2.67
Suppositories	6	0.36
Inhaler	1	0.06
Drops	17	1.01
Injection	1	0.06
Therapy Class		
Cold and Cough	296	17.56
Antipyretic-analgesics	290	17.20
Vitamins and minerals	254	15.06
Cardiovascular medicines	148	8.78
Antiacids and other antiulcer medicines	133	7.89
Anti-infective agents	105	6.23
NSAIDs (Nonsteroidal anti-inflammatory medicines)	91	5.40
Herbal Medicine	81	4.80
Antidiarrhea, laxatives, others	61	3.62
Steroid preparations	56	3.32
Nausea and Vertigo	42	2.49
Antidiabetic	40	2.37
Antiasthmatic and bronchodilator agents	15	0.89
DMARDs (disease-modifying agents used in rheumatic disorders)	12	0.71
Others	64	3.68

Mean:5.12, SD (Standard Deviasi): 4.28, Min-Max: 1 – 35

Table 4 shows storage conditions, where 1.3% of medicines are exposed to sunlight, 11.15% are stored in a humid place, 15.18% are placed in inappropriate storage temperatures, and 52.79% are accessible to children. Approximately 5% of expired medicines are stored in households. Meanwhile, 33.10% of medicines are stored in good conditions, namely avoiding direct sunlight, dry humidity, appropriate storage temperatures, kept out of reach of children, and have not expired.

Table 4. Condition storage medicine based on observation (n= 1686)

Medicine Storage Conditions	n	%
Sunlight		
Protected	1664	98.70
Exposed	22	1.30
Humidity		
Dry	1498	88.85
Moist	188	11.15
Temperature		
Appropriate	1430	84.82
Inappropriate	256	15.18
Children's Outreach		
Avoid reach out of children	793	47.03
Accessible for children	893	52.97
Expired		
Not yet	1352	80.19
Already	88	5.22
Not known	246	14.59
Total fit		
Appropriate	558	33.10
Inappropriate	1128	66.90

Relationship Between Knowledge and Behavior of Medicine Storage

Table 5 showed that the characteristics of knowledge and behavior of storing medicines storage in the household were evaluated in this study. The results showed that poor knowledge was dominated by the age group 56-65 years old (75.51%) and >65 years old (70.73%) showed inappropriate behavior. Among male respondents, poor knowledge (58.18%) and inappropriate behavior (58.18%) was prevalent. According to education level, a respondent who completed elementary school has poor knowledge (78.95%) and inappropriate behavior (78.95%). Furthermore, the majority of traders have poor knowledge (76.92%) and retired respondents (72.73%) showed inappropriate behavior. Most of the respondents with moderate income (1.500.001-2.500.000) showed poor knowledge and inappropriate

behavior. Table 5 showed that there was a significant relationship between age group and level of knowledge (p-value <0.005), education and knowledge (p-value <0.005), as well as education and behavior (p-value <0.005) using chi-square test analysis.

Table 5. Knowledge and behavior of storing medicines at home based on the characteristics of the respondents

Characteristics	Level of Knowledge					Behavior				
	Good		Poor		p-value	Apporiate		Inappropriate		p-value
	N	%	N	%		N	%	N	%	
Total	143	43.47	186	56.53		**140**	42.55	**189**	57.45	
Age (in years)					**0.002***					**0.076**
17 – 25	7	36.84	12	63.16		9	47.37	10	52.63	
26 – 35	28	53.85	24	46.15		29	55.77	23	44.23	
36-45	49	55.68	39	44.32		43	48.86	45	51.14	
46-55	33	35,11	61	64,89		33	35.11	61	64.89	
56-65	12	24.49	37	75.51		18	36.73	31	63.27	
>65	14	51.85	13	48.15		8	29.63	19	70.37	
Sex					**0.904**					**1.000**
Man	23	41,82	32	58,18		23	41.82	32	58.18	
Female	120	43.80	154	56.20		117	42.70	157	57.30	
Level of education					**0.000***					**0.002***
No School	2	40	3	60		1	20	4	80	
Elementary School	12	21.05	45	78.95		12	21.05	45	78.95	
Junior High School	14	35	26	65		16	40	24	60	
Senior High School	66	45.20	80	54.80		69	47.26	77	52.74	
University	49	51.85	32	39.51		42	51.85	39	48.15	
Work					**0.271**					**0.495**
Student	3	37,5	5	62,5		3	37.50	5	62.50	
Housewife	89	43.84	114	56.16		85	41.87	118	58.13	
Teacher/Lecturer	5	62.5	3	37.50		2	25	6	75	
Police	2	100	0	0		2	100	0	0	
Private sector employee	26	50.98	25	49.02		25	49.02	26	50.98	
Entrepreneur	6	33.33	12	66.67		9	50	9	50	
Trader	3	23.08	10	76.92		4	30.77	9	69.23	
Retired	5	45.45	6	54.55		3	27.27	8	72.73	
Others	4	26.67	11	73.33		7	46.67	8	53.33	
Income (in Indonesian Rupiah)					**0.25**					**0.472**
< 1.500.000)	100	42.74	134	57.26		94	40.17	140	59.83	
1.500.000-2.500.000	1	12.5	7	87.5		3	37.5	5	62.5	
2.500.001-3.500.000	9	45	11	55		9	45.0	11	55.0	
> 3.500.000	33	49.25	34	50.75		34	50.75	33	46.25	

**p-value <0.05*

Table 6 shows that there is a relationship between knowledge and behavior of medicine storage (p-value < 0.05) using chi-square test analysis. Respondents with poor knowledge had a 2.9 times chance of inappropriate behavior in storing medicines in the household (OR, 2.967; 95% Cl, 1.884 – 4.671).

Tabel 6. The Relationship Between Knowledge Level and Medication Storage Behavior in Household

Variable	**Behavior**				**Total**		**p-value**	**OR (95% Cl)**
	Appropriate		**Inappropriate**					
	N	**%**	**N**	**%**	**N**	**%**		
Knowledge								
Good	82	57.3	61	42.7	143	100	0.000*	2.967
Poor	58	31.2	128	68.8	186	100		(1.884 – 4.671)

**p-value <0.05*

Discussion

In this study, there were still respondents who poor knowledge and inappropriate behavior regarding medicine storage practice. More than 50% of respondents did not know about storing syrup at room temperature, in

the refrigerator, and expiration date. Approximately 43.47% of respondents have good knowledge regarding household medicine storage. As previously reported, 44% of respondents know about medicine storage (Castro Espinosa et al., 2019). Another study in Indonesia showed that 16.1% of respondents had good knowledge about medicine storage practice (Okta Muthia Sari, 2021), indicating a relatively low result. Based on the results, approximately 68.1% of respondents knew that medicine storage information could be obtained from pharmacists and doctors. This proportion required improvement in the provision of information by pharmacists, who played an important role in improving medicine safety, preparation, distribution, use, and disposal (Quality, 2019). However, previous studies in Indonesia reported that providing information from health workers regarding medicine storage was still not optimal (Anggriani et al., 2022).

Storage of syrup dosage form including solutions, emulsions, and suspensions in households was mostly found in refrigerators. In this study, only 47.4% of respondents knew about the storage of syrup dosage form at room temperature. Syrup dosage is stored at room/room temperature, away from sunlight, humidity, and the reach out of children. However, refrigeration ranging from 2 – 8^{0}C should be avoided to prevent freezing and precipitation, potentially rendering the medicine unstable (Departemen Kesehatan RI, 2007). For storage of special medicines such as suppositories, 52.3% of respondents answered correctly, refrigerating at a temperature between 2 – 8^{0}C. Meanwhile, 47.7% provided incorrect answers due to a lack of familiarity with suppository dosage forms and storage requirements. Suppositories dosage form should be stored in the refrigerator at a temperature between 2 – 8^{0}C, as storage at room temperature can lead to melting (Afqary et al., 2018).

Powdered medicine (pulverized) is often used in the treatment of children. However, its administration should not be continued unless specific instructions are received from doctor, resulting in leftover powdered medicine. In this study, the knowledge of respondents on handling showed that 56.8% dispose of, 39.8% store and 3.3% reuse the leftover powdered medicine. These results indicated that some respondents tend to store and reuse the medicine due to the absence of packaging information. To ensure the safety and effectiveness of treatment, leftover powdered medicine should be disposed of.

The results showed that the eye drops were stored in households by the respondents. The storage time limit for eye drops is 1 month after the packaging is opened (Noviani, 2021) (Oselia et al., 2020) to prevent contamination (Savira et al., 2020). In this study, 64.7% of respondents knew that eye drops after opening packages can only be stored for a month.

Based on the results, 66.90% of respondents did not store medicine in households properly, as the majority (52.97%) kept it at a location easily accessible to children. Another study also reported that 42.9% of respondents kept medicine in an easily accessible (Savira et al., 2020), resulting in the risk of accidental ingestion and poisoning (Lee & Schommer, 2022). According to CDC data (2023), 35.000 children are hospitalized each year due to accidental ingestion of medicines. To prevent and minimize harm by pediatric medication poisoning, the CDC recommends storing medicine out of sight, ensuring proper monitoring when children are present, and having the Poison Help number readily available in the household (CDC., 2023).

Prescription medicines that are stored for supply allow for irrationality in purchasing medicines by the public. This is because the use of prescription medicines requires an understanding of their indications, dosage, and side effects (Khairiyati, 2015). Therefore, the purchase of prescription medicines should be based on examination and doctor's recommendation to minimize medication errors. Engaging in the practice of purchasing medicine without a prescription as supplies can also increase the number of leftover medicine in households (Isnenia, 2021).

The results showed that there was a significant relationship between age group and level of knowledge (p-value <0.05). This confirms previous research findings which reported that age influences respondents' knowledge (Huang et al., 2019). Knowledge and information about storing medicine in household will increase with age (Huang et al., 2019). Increasing knowledge and information will increase respondents' attention regarding proper storage of medicines.

The results showed that there was a significant relationship between education and knowledge (p-value <0.05). This confirms the findings of previous studies which reported that education influences knowledge about medicine storage (Huang et al., 2019). Poor knowledge and inappropriate behavior are often caused by low levels of education. This phenomenon significantly influences medicine storage in the household (Hassan et al., 2022), as people with higher education tend to easily obtain more information (Desmariani et al., 2021; Nasrul, 2019; Pramestutie et al., 2021). The results also showed that there was a significant relationship between education and behavior (p-value <0.05). This confirms previous research findings which reported that age influences respondents' behavior (Huang et al., 2019). Respondents who have higher education are likely to increase health awareness related to medicine storage behavior (Huang et al., 2019). The level of education is related to knowledge and behavior, which directly affects the selection of medicine.

Then, there was a relationship between knowledge and behavior of medicine storage (p-value < 0.05). Respondents with poor knowledge had a 2.9 times chance of inappropriate behavior in storing medicines in the household (OR, 2.967; 95% Cl, 1.884 – 4.671). This indicates that our research hypothesis was accepted. This indicates that knowledge is a factor influencing the behavior of individuals. Therefore, there is a need to enhance public knowledge regarding proper medicine storage in households. Increasing knowledge and information will increase respondents' attention regarding proper storage of medicines. Correct medicine storage can maintain drug stability during storage, thereby reducing the risk of undesirable effects and achieving the effectiveness of drug therapy. Therefore, a higher level of education enhances the practice of good medicine storage in households (Fajrin

et al., 2019). Proper storage of medicine can maintain the stability of the medicine during storage, thereby reducing the risk of undesirable effects and achieving the therapeutic effectiveness of the medicine.
This study has limitations in terms of sample selection since it uses a non-probability sampling technique that does not provide equal opportunity to each population because the sample is selected based on inclusion criteria. This causes the frequency distribution for each respondent's characteristics to be disproportionate.

Conclusion

This study found a relationship between knowledge and medicine storage behavior in households. Proper medicine storage can maintain drug stability during storage so that drug effectiveness is achieved. Age and education play an important role in household medicine storage. Previous studies have also documented the significant impact of age and education on household medicine storage practices (Hassan, 2012). Additionally, this study showed that the majority of respondents had poor knowledge (56.53%) and inappropriate behavior (57.45%) regarding proper medicine storage in the household. This indicated that further efforts should be carried out to educate and increase public awareness in the urban area of Jakarta, regarding knowledge and behavior related to medicine storage so as to maintain the stability, safety and effectiveness of drugs. Providing education about medicine storage can involve pharmacists, pharmaceutical health workers at community health centers, hospitals, pharmacies or universities. Apart from that, education can also be done using social media. advertisements on television, posters and other communication media thereby increasing public awareness about the importance of proper storage of medicines. After educating the community, it is necessary to conduct monitoring and evaluation related to medicine storage.

Declaration Conflicting Interest
The authors have no conflicts of interest to declare.

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Author contribution

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