

Prevalence and Determinants of Household Medication Storage During the COVID-19 Outbreak in Southwest Ethiopia

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Background: Most households worldwide keep medicines on hand for various reasons, including emergency use, treatment of acute and chronic diseases, and anticipated future use. Being infected or fear of getting COVID-19 in the current pandemic could increase the storage of drugs at home. Thus, this study aimed to assess the prevalence of household storage of medicines and associated factors in southwest Ethiopia during the COVID-19 outbreak.

Methods: A cross-sectional household survey was conducted from February 1 to May 30, 2022. Data on the extent of storage, storage conditions, their current status, disposal methods, among others, were collected through structured interviews and observations. The data were entered into EPI info, exported, and analyzed using Statistical Packages for Social Sciences (SPSS). Bivariate followed by multivariate logistic regression was used to identify associated factors. P-value <0.05 was used as a cut-off point to decide statistical significance.

Results: The magnitude of household medication storage was 48% (95% CI). Analgesics (28.7%) and antibacterial (21.1%) agents were the most predominant class of drugs stored in the households. The most significant proportion of the home-stored medications (34.7%) was reserved for future use, and 31.8% were for treating current medical conditions. The majority of the respondents (84.1%) had never heard/learned about the safe disposal ways of drugs. The presence of children aged less than 5 years in a household [AOR = 1.90 (1.19, 3.05)] and the existence of chronically sick patients in a household [AOR = 4.3 (2.25, 8.45)] were factors significantly associated with household medication storage.

Conclusion: The current study revealed a high prevalence of home medication storage; thus, to lessen or eliminate the negative consequences of storing medications at home, it is necessary to review the medication utilization chain and offer community-based training on proper medication storage and disposal techniques, including establishing take-back programs.

Keywords: medication storage, disposal, COVID-19, household, southwest Ethiopia

Background

Medicines are kept on hand in most households for different reasons, including emergency use and treatment of acute and/or chronic disorders. In addition, treatment change, non-adherence/death, the high cost of medicines, lack of knowledge on appropriate medication disposal methods, and saving medicines for future use are common reasons for patients to keep medicines at home.^{1,2}

Poor medication storage practices, use of medications from different prescribers, reuse of discontinued medicines, and keeping expired or no longer required drugs are common irrational drug use at home reported in developing countries. These are attributed to patients' lack of information on proper storage conditions, proper disposal of unused medicines, and risks associated with inappropriate/irrational drug use.^{3,4}

Globally, studies in different countries revealed a high prevalence of irrational household medication storage, ranging from 35.1% to about 100%.⁵ The commonly household stored classes of drugs were systemic anti-infective drugs, nervous system drugs, gastrointestinal drugs followed by drugs of the cardiovascular and respiratory systems. This increases the risk of treatment failure, antimicrobial resistance, accidental intoxication, inappropriate self-medication, and unsafe disposal of medications which can endanger public health by causing environmental pollution and accidental poisoning of animals and humans.^{5–9}

Most COVID-19 patients have mild illnesses and can rehabilitate at home with over-the-counter drugs, such as paracetamol and ibuprofen.¹⁰ Besides, despite warnings from CDC and NIH, COVID-19-positive outpatients use antiviral and supporting agents such as antibiotics and corticosteroids to manage symptoms of the disease.^{11,12} Thus, being infected or fear of acquiring COVID-19 could increase the storage of drugs at home.

Having evidence on the extent, source, use, and storage conditions of medicines at household level and associated factors are vital to take actions toward assuring rational use of drugs. In Ethiopia, few studies, specifically in northern Ethiopia, were conducted at the household level to assess medications' storage practice. Therefore, this study aimed to explore the prevalence of household medicine storage practices and associated factors among households in Mizan-Aman town, Southwestern Ethiopia.

Methods and Materials

Study Area and Design

A community-based cross-sectional study was done in some selected households of Mizan-Aman Town from February 1 to May 30, 2022, Southwestern Ethiopia. The town is located about 561 km away from the capital Addis Ababa. The administrative division of the town includes a total of 10 Woredas (districts) and 246 kebeles (smallest administrative units) (229 rural and 17 urban) (18). The present study was undertaken in the urban areas of the town (Mizan-Aman administrative).

Sample Size Determination and Sampling Procedure

The number of households included in the study was determined using a single population proportion formula. To get the maximum possible sample size, the proportion (p) of households with at least one medicine during data collection was taken to be 50%. The margin of error (δ) was taken to be 5%, and the $z_{1-\alpha}$ at 95% confidence interval (CI) was set at 1.96. Based on this, the sample size was calculated using the formula:

$$n = \frac{(Z_{\alpha/2})^2 P(1 - P)}{d^2}$$

$$n = \frac{(1.96)^2 0.5(1 - 0.5)}{(0.05)^2}$$

$n = 384$, adding 5% for non-response rate ($0.05 * 384 = 19$) the final sample size was 403.

The households were selected by using a simple random sampling method after proportional allocation of the sample size to each district.

Data Collection Tool and Procedure

To assess the research theme, a questionnaire that included socio-demographic factors, history of illness in the month preceding the study, home storage of medications, their disposal methods, and other important variables was prepared ([Supplementary Material](#)). Data were collected in a face-to-face interview using a structured questionnaire and by observation. Whenever selected houses were found closed or missing adult members, they were revisited continuously for three subsequent days in order to collect data. For households that were missing adult members, the nearest houses were selected, while houses which were found closed during the three subsequent days were considered as non-response cases. When multiple adults were present in the same household, lottery method was applied to select a single adult.

Data Processing and Analysis

The data were entered into Epi Info Version 3.5.1 and checked for completeness, and then it was transported to Statistical Software Package for Social Science (SPSS) version 22. Descriptive analysis was done, and findings were presented with percentages, tables, and graphs. GraphPad prism version 9.4.0 was used to draw graphs. To determine the variables influencing the storage of medications in homes, bivariate followed by multivariate logistic regression were used. After bivariate analysis, predictor variables with a p-value of less than 0.2 were considered in multivariate logistic regression analysis. Predictor variables in multivariate logistic regression were regarded to have a significant connection with the outcome variable if their p-value was less than 0.05. Finally, adjusted odds ratio (AOR) with its 95% CI was reported.

Definition of Terms

Medications: Any prescribed or over-the-counter drugs stored in households for any purpose.

Appropriate storage conditions: Storage of medications in a dry, clean, and well-ventilated area at an appropriate temperature and away from reach of children.

Adequately labeled: If the label on the medication contains at least the drug's name, strength or unit dose, frequency, and duration of administration, then the drug was deemed adequately labeled.

Results

A total of 367 households were included in the present study, with a response rate of 91%. The majority of the respondents were male, 228 (62%), and in the age group between 18 and 29, 155 (42%). Most of the respondents, 212 (69%), cannot read and write. More than half of the respondents (60.8%) have above five family members. On the other hand, about half of the respondents (50.4%) had a monthly income that ranged from 1500 to 5000 ETB (equivalent to 28–93 US dollar) (Table 1).

Table 1 Sociodemographic Characteristics of the Respondents and Households in Southwest Ethiopia, 2022, (n=367)

Variables		Frequency	Percentage (%)
Category of age (years)	18–29	155	42
	30–39	106	29
	40–49	63	17
	50–59	30	8
	≥60	13	4
Sex	Male	228	62
	Female	139	38
Religion	Orthodox	118	32
	Islam	73	20
	Protestant	173	47
	Catholic	2	1
	Other	1	0
Marital status	Single	125	34
	Married	227	62
	Divorced	15	4

(Continued)

Table 1 (Continued).

Variables		Frequency	Percentage (%)
Level of education	Illiterate	212	69
	Literate	115	31
Number of family members	≤5	144	39.2
	>5	223	60.8
Category of HH monthly income (ETB)	<1500	108	29.4
	1500–5000	185	50.4
	>5000	74	20.2

Abbreviations: HH, households; ETB, Ethiopian birr.

Medical and Health Status of Household Members

Of the respondents, 56 (15%) had at least one chronic patient in their family. Of those who were sick in the last 3 months, the majority (70.8%) of them had an acute illness. Hypertension (32%) followed by diabetes mellitus (25%) and bronchial asthma (25%) were the most common chronic diseases for which medicines were kept in the households (Table 2).

Prevalence, Disposal, and Situation of Home Stored Medicines

From a total of 367 households visited, 176 (48%) had stored drugs. As depicted in Figure 1, from a total of 251 medication types observed in households during data collection, analgesics (28.7%), antibacterial (21.1%), antimalarial (17.53%), and anthelmintics (12.75%) were the predominant class of drugs stored in the households. The largest proportion of the home-stored medications (34.7%) was reserved for future use, and 31.8% were stored for treating

Table 2 Medical and Health Status of Household Members in Southwest Ethiopia, 2022, (n=367)

Health Status of Households	Response	Frequency	Percentage (%)
Do you have any chronic patient(s) in your home?	Yes	56	15%
	No	311	85%
Is there any family member who got sick in the last 3 months?	Yes	192	52%
	No	175	48%
If yes, what is the disease condition?	Acute illness	136	70.8%
	Chronic disease	47	24.5%
	Both	9	4.7%
If chronic disease, which type(s)?	Hypertension	18	32%
	Diabetes mellitus	14	25%
	CVD	4	7%
	Bronchial asthma	14	25%
	Epilepsy	6	11%

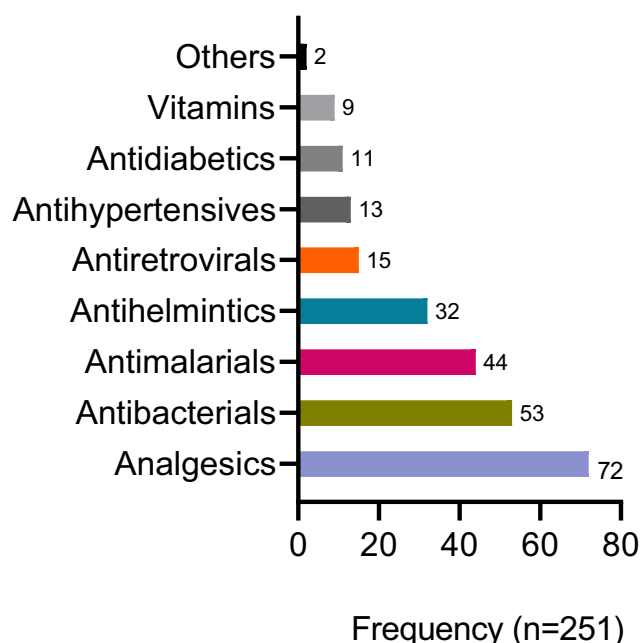


Figure 1 Types of medication stored in the households of southwest Ethiopia, 2022.

current medical conditions. Most of the households (36.9%) kept the medications on a shelf, followed by inside a box (26.7%) and in a bedroom (18.75%). Solid dosage forms were the most common medication formulations, of which tablets and capsules account 73% and 11.1%, respectively. About half of the households (50.6%) obtained the medications from public hospitals, followed by private pharmacies (42.6%) and family/friends (6.8%). Regarding the number of drugs stored in households, about 40% of the households stored two types of medications. Though most of the medications (84.8%) were not expired, 62.5% of them lacked clear instructions on how to use them. Besides, 9.2% of the households stored drugs with their primary package damaged, and 75.6% stored the medications inappropriately (Table 3).

As portrayed in Figure 2, planned methods for disposal of home-stored medication were throwing it into the garbage/dust bin (38.6%), flushing it down the toilet (30.7%), and burning it (6.8%). A significant proportion of the respondents (21%) had no idea how to discard leftover or expired medications. The majority of the respondents (84.1%) had never

Table 3 Information on Medications Stored in the Households, Southwest Ethiopia, 2022, (n=176)

Information on Medications Kept	Response	Frequency (%)
If yes, where did you get the medicine?	Family, friend	12(6.8)
	Public hospital	89(50.6)
	Private pharmacy	75(42.6)
Where do you store your medicine?	Bedroom	33(18.75)
	Box	47(26.7)
	On shelf	65(36.9)
	Refrigerator	10(5.68)
	Cupboard	17(9.69)
	Other places	4(2.27)

(Continued)

Table 3 (Continued).

Information on Medications Kept	Response	Frequency (%)
Why do you store the medicines?	Current treatment	56(31.8)
	Left from past treatment	59(33.5)
	Anticipate future need	61(34.7)
Number of types of medicines per household	1	67(38.1)
	2	72(40.9)
	3	25(14.2)
	≥4	12(6.8)
Storage conditions of the medicines?	Appropriately stored	43(24.4)
	Inappropriately stored	133(75.6)
Storage conditions of the inappropriately stored medicines	Directly exposed to sunlight	23(12.2)
	Contaminated with dust	49(25.9)
	Within reach of children	117(61.9)
Dosage form of the drugs	Tablet	183(73)
	Capsule	28(11.1)
	Semisolid	8(3.2)
	Liquid (oral)	22(8.7)
	Injections	6(2.4)
Situation of the primary package	Intact (OK)	228(90.8)
	Damaged (not OK)	23(9.2)
Labeling	Adequately labeled	94(37.5)
	Not adequately labeled	157(62.5)
Situation of the expiry date	Expired	27(10.8)
	Not expired	213(84.8)
	Unknown	11(4.4)

heard/learned about the safe disposal ways of drugs. Only a few of them (15.9%) had information from neighbors/friends, e-media, literature, and healthcare providers (Figure 3).

Factors Associated with Medication Storage at Household Level in Southwest Ethiopia

In bivariate analysis, variables such as education, number of family member, HH monthly income, presence of children less than 5 years in HH, presence of elders greater than 65 years in HH, and presence of health professionals in HH were associated with medication storage in HH at p-value less than 0.2. In multiple variable regression, the presence of children less than five years in HH and the existence of chronic patients in HH were significantly associated with medication storage in HH at P-value less than 0.05 (Table 4).

In this study, the odds of household medication storage was 1.90 times higher among households with children less than five when compared with those households that do not have children less than five [AOR = 1.90 (1.19, 3.05)]. In

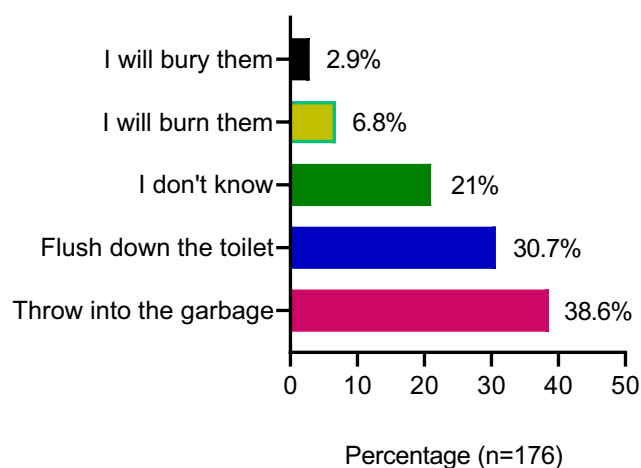


Figure 2 Planned methods of disposing unused or expired medications.

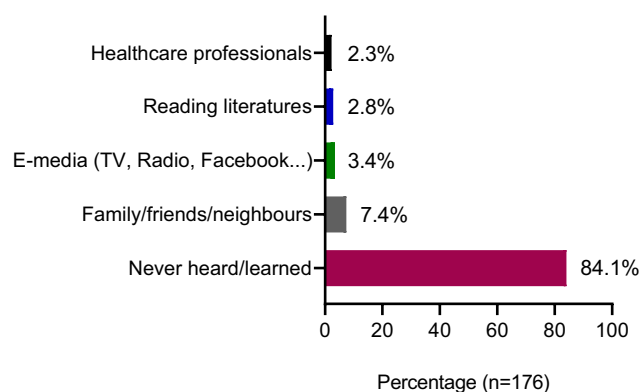


Figure 3 Sources of information on how to dispose of medications.

addition, the odds of household medication storage was 4.3 times higher among households in which chronically sick patients exist [AOR = 4.3 (2.25, 8.45)].

Discussion

Despite variations in the reasons behind it, household medication storage is a common practice worldwide with both prescription and over-the-counter medications.¹³ The findings of the present study revealed that the prevalence of household medication storage during the COVID-19 outbreak was 48%, which is higher than the studies done in similar areas before the COVID-19 era. For instance, studies from Tigray,¹⁴ northern Ethiopia; Gondar,¹⁵ northwest Ethiopia; and Northern Uganda¹⁶ showed a prevalence of 29%, 44.2%, and 35.1%, respectively. Thus, the COVID-19 outbreak could be one potential factor for the relatively high prevalence of household medication storage in the present study area.

The finding of the current study disclosed that largest proportion of the home-stored medications (34.7%) were reserved for future use, 31.8% of them stored for treating current medical conditions, and the rest 33.5% were left over from past treatments. Similar studies from Iraq,¹⁷ Tigray (Ethiopia),¹⁴ and Northern Uganda¹⁶ showed a large percentage of stored drugs were for ongoing use, whereas leftover and standby drugs make up relatively small percentages. The large percentage of medications set aside for future use could be attributed to the stockpiling of medications in case of acquiring COVID-19.

In the present study, analgesics (28.7%) followed by antibacterial (21.1%) were the most common drugs hoarded in households which is in line with the studies done in Northwest Ethiopia,¹⁸ Northern Uganda,¹⁶ and Riyadh (Saudi Arabia).¹⁹

Table 4 Factors Associated with Medication Hoarding at Household Level in Southwest Ethiopia, 2022

Variables		HH Stored Medication, N (%)	HH Not Stored Medication, N (%)	COR (95% CI)	AOR (95% CI)
Education	Illiterate	128(60.4)	84(39.6)	1	1
	Literate	48(41.7)	67(58.3)	0.75(0.37–1.51)	0.68(0.31–1.43)
Family member	≤5	55(38.2)	89(61.8)	1	1
	>5	121(54.3)	102(44.7)	1.94(1.17–3.22)	1.89(1.08–3.10)
Monthly income (ETB)	<1500	48(44.4)	60(55.6)	1	1
	1500–5000	86(46.5)	99(53.5)	0.85(0.53–1.37)	0.71(0.41–1.55)
	>5000	42(56.8)	32(43.2)	1.6(1.00–2.89)	1.34(0.33–5.48)
Children <5 years	Yes	62(57)	47(43)	1	1
	No	114(44)	144(56)	1.66(1.06–2.61)	1.90(1.19–3.05)*
Elder >65 years	Yes	29(16)	19(10)	1	1
	No	147(84)	172(90)	1.78(0.96–3.31)	1.46(0.75–2.63)
Chronic patient	Yes	47(84)	9(14)	1	1
	No	129(41.5)	182(58.5)	4.28(2.29–7.98)*	4.3(2.25, 8.45)*
Health worker	Yes	35(68.6)	16(31.4)	1	1
	No	141(44.6)	175(55.4)	1.24(0.61–2.57)	1.132(0.73–3.61)

Note: *Indicates statistical significance at $P < 0.05$.

Abbreviations: HH, households; COR, crude odds ratio; AOR, adjusted odds ratio.

This is because most COVID-19 patients develop mild illnesses and can rehabilitate at home with over-the-counter analgesics. Besides, large proportions of COVID-19 patients are reported using antibiotics for managing their symptoms.¹¹ The higher percentage of stored antibiotics at home might also be an indicator of poor adherence, which could lead to antibiotic resistance and treatment failure.

Most of the households in our study (36.9%) kept the medications on shelf followed by inside a box (26.7%) and in bedroom (18.75%). Besides, 9.2% of the households stored drugs with their primary package damaged, and 75.6% of them stored the medications inappropriately. Observation of the storage conditions of the inappropriately stored medicines revealed that 61.9%, 25.9%, and 12.2% were stored within reach of children, contaminated with dust, and directly exposed to sunlight, respectively. Reports from West Bengal,⁷ Brazil,²⁰ and Qatar²¹ disclosed that 16.7%, 26.5%, and 90% of home-stored medications were easy to reach/within reach of children. Inappropriate storage of medicines and damage of the primary packaging have the potential to cause physical, chemical, and microbiological changes, which cause loss of effectiveness and safety of the medications. Moreover, storing drugs within reach of children increases the risk of accidental poisoning and suicide attempts.¹³ To promote safe utilization of stored medications, especially in households with chronic patients, it should be recommended to use a home medication cabinet with a lock and key.

Solid dosage forms were the most common medication formulations stored in this study, of which tablets and capsules account for 73% and 11.1%, respectively, followed by liquid (8.7%) and semisolid formulations (3.2%). Almost all of the studies done in the area reflect our findings. This is because solid and liquid dosage forms are standard discharge formulations; besides, many individuals use over-the-counter medications in these dosage forms.

This study showed that about half of the households (50.6%) obtained the medications from public hospitals, followed by private pharmacies (42.6%) and family/friends (6.8%). A study done in Awi Zone (Ethiopia) reported that most (95.9%) home hoarded medications were obtained from public health facilities and about 2.5% from a friend.¹⁸ Similarly, a report from Iraq revealed that private pharmacies were the primary source of home-stored medications,

followed by public health centers.¹⁷ In all cases, almost all of the households had contact with at least one healthcare provider (pharmacist); thus, pharmacists' provision of a full package of information about the drug they dispense with appropriate labeling would promote safe utilization and disposal of medications.

Though in our study, most of the medications (84.8%) were not expired, 62.5% of them lacked clear instructions on how to use them. The percentage of expired drugs in our study is relatively lower than the reports from South India (17%) and higher than Gondar (3.14%). Families could possibly keep expired medications due to a lack of information about such substances and their appropriate disposal methods.

The current investigation documented unneeded or expired medications being disposed of in dustbins (38.6%) and toilets (30.7%). These were uninformed decisions because most respondents (84.1%) uncovered that they had never heard about the proper disposal methods of drugs. This finding is in line with the studies done in Tanzania,²² Northern Ethiopia,¹⁸ and Saudi Arabia.²³ These environmentally harmful disposal techniques could cause detrimental effects in human and animal health; thus, awareness creation or campaign on the safest disposal methods of home stored medications such as returning expired or unneeded drugs to pharmacies and initiating take-back programs should be carried out. Though the Food, Medicine and Healthcare Administration and Control Authority (FMHACA) of Ethiopian, now called the Ethiopian Food and Drug Authority (EFDA), has developed a guideline on medicines waste management and disposal, there needs to be more awareness creation and enforcement of its implementation.²⁴

The presence of under-five children and chronically sick individuals in households were the two factors that significantly affected home storage of medications in the current study. This finding strengthens the assumption that being infected or fear of getting COVID-19 to be the potential reason for the high prevalence of household medication storage in the present study. This is supported by different studies which revealed that children who are black and under the age of 5, and individuals with comorbid conditions are at high risk of severe COVID-19.^{25–27} Therefore, being more vulnerable to coronavirus may prompt the stockpiling of medications for home management of the disease.

Limitation of the Study

The study's cross-sectional design makes it difficult to establish a causal connection between the predictor and outcome variables. Besides, the absence of studies on the prevalence of household medication storage in the current study area before the COVID-19 outbreak makes it difficult to compare our findings and clearly show the effect of coronavirus pandemic on the prevalence of home stored medications.

Conclusion

As per our finding, the prevalence of home-stored drugs was high (48%) in southwest Ethiopia, where around two-thirds of the stored drugs were not for ongoing treatment. Some drugs were also expired, and their primary package was damaged. Besides, most of the respondents were not aware of the proper methods of medication storage and disposal. The presence of under-five children and chronically sick individuals in households were the two factors that significantly affected home storage of medications. Based on the findings of the present result, it is possible to say that COVID-19 outbreak could be one primary factor for the relatively high prevalence of household medication storage in the current study area. Thus, to lessen or eliminate the negative consequences of storing medications at home, it is necessary to review the medication utilization chain and offer community-based training on proper medication storage and disposal techniques, including establishing take-back programs in developing nations like Ethiopia. The Ethiopian Food and Drug Authority (EFDA) should take these initiatives for their enactment.

Data Sharing Statement

All data are within the manuscript.

Ethical Approval and Consent to Participate

This study was approved by the Research Ethics Review Committee (RERC) of Mizan-Tepi University (SP-01627/22). Before the start of the study, a written consent to participate was obtained from all respondents after

clarifying the objectives, purpose, and the harm and benefits of the study. Also, confidentiality, anonymity, and freedom to withdraw from the study at any time were maintained throughout the study. Our study complies with the declaration of Helsinki.

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Disclosure

The authors declare that they have no competing interests in this work.

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