

Patients' Knowledge and Practice on Disposal of Medicines Kept in Households in South Africa: Findings and Implications

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ABSTRACT

Objective: The disposal of unwanted, unused, or expired medicines is a concern. Currently, there is little knowledge regarding their disposal among patients in South Africa. Consequently, there is a need to address this. **Methods:** This was a descriptive and quantitative study with patients conducted among 16 primary health-care clinics (PHCs) in South Africa. A structured questionnaire was administered to 171 conveniently selected patients. Data on ideal disposal methods were collected and compared to actual disposal practices. **Findings:** 74.9% of patients reported having unused medicines at home, of whom 34.4% wanted these medicines disposed of. However, 64.9% did not know how to dispose of them, with 95.3% reporting having never been informed by health-care professionals of disposal methods. While patients prefer to return medicines to their PHC, only 7.0% did so. Patients' ideal disposal practices included designated collection task teams (25.1%) and dissolving their unused medicines in water (38.6%). However, current practices indicated that patients flushed medicines down the sewer (31.6%) or disposed of them in municipal bins (23.9%). **Conclusion:** Patients disposed of their unwanted medicines using incorrect disposal techniques, which they thought were correct. This urgently needs to be addressed.

KEYWORDS: Household medicine disposal, patients, South Africa, unused medicines, unwanted medicine

INTRODUCTION

Patients increasingly have unwanted, unused, or expired medicines in their households with the growing use of medicines worldwide,^[1-3] enhanced by greater availability of medicines over-the-counter.^[4] Medicines can accumulate in households for many reasons. These include doubting their continued need, changes in prescriptions, forgetfulness, fear of future shortages, and reducing the costs of managing future illnesses.^[2-7] Evidence has shown that patients have medicines in their households that they want to dispose of, and in most cases, improper disposal techniques are used.^[1,2,5]

The most common disposal methods include garbage cans and flushing down toilets.^[1-3,5,8-11] Domestic burning

of medicines is also an increasing issue,^[12] reported to be common in Ethiopia and Sudan.^[1] This is a concern as inappropriate methods can lead to accidental poisoning, hazardous environmental exposure, and potentially increased antimicrobial resistance.^[2,5,8,11-13] Harmful effects on the environment include plants exposed to water containing pharmaceuticals and concerns with human development.^[14,15] Trace elements of pharmaceuticals have also been identified in surface, underground, and decontaminated water for drinking,^[15]

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with increasing concerns with concentrations of pharmaceuticals including ciprofloxacin, estriol, paracetamol, and sulfamethoxazole reported in African aquatic environments being up to 100–20,000 higher than the concentrations reported in European studies.^[16]

However, despite growing concerns about the disposal of medicines, studies have shown high rates of medicines stored in homes, especially among low- and middle-income countries (LMICs) [Table 1].

Currently, South Africa, similar to many other African countries, has no national legislation that governs medicine disposal for patients once they leave health-care facilities with their medicines. However, the Medicines and Related Substances Control Act stipulates that only authorized personnel can dispose of medicines or scheduled substances once medicines have been dispensed.^[17] Further, the National Environmental Management Waste Act (Act 59 of 2008), Medicines and Related Substances Control Act, and the Good Pharmacy

Practice Manual stipulated that no pharmaceutical waste should be discarded in municipal waste or in sewage systems in South Africa.^[17-19] More recently, the Department of Health in KwaZulu-Natal developed policies and procedures to dispose of medicines,^[20] and the Pharmaceutical Society of South Africa is producing guidance.^[19]

Previous studies in South Africa have reported that patients dispose of their medicines in the sink, toilet, and garbage bins.^[10,21,22] Consequently, given ongoing concerns, we wanted to determine current knowledge and disposal practices of medicines in patients' households to develop future strategies. This includes whether they finish their prescribed course of medicines and builds on ongoing research among health-care professionals (HCPs).^[23]

METHODS

This was a descriptive and quantitative study conducted among adults at 16 out of 30 primary health-care clinics (PHCs) in two subdistricts of Tshwane, Gauteng Province, typical of PHCs in South Africa. These included both rural and semi-rural areas. We chose PHCs as patients attending PHCs receive their monthly medicines free of charge^[24] and are more likely to have stored medicines in their households. The final sample of 171 participants was conveniently selected based on their availability and willingness to participate.

A structured questionnaire was developed based on previous studies.^[10,13,25] Firstly, information about patient characteristics, including their level of education, was collected. Patients with no education, i.e., those who did not complete primary school or those who completed but studied no further, were classified as having a low level of education. Patients who completed secondary school, and those attending an institution of higher learning, were classified as a high level.

Questions regarding knowledge on how the safe disposal of medicines should be undertaken, alongside current disposal methods, were asked but not clustered in the questionnaire to avoid questions potentially influencing future answers. The questionnaire was pretested among ten patients at another PHC for feasibility and to ensure the intended objectives of the study would be achieved. Appropriate amendments were subsequently made to the questionnaire.

Data were collected by the first author (KJM). Patients were recruited after they consulted with a HCP or after they had received their medicines at the pharmacy. Participation was voluntary, and potential participants were provided with information about the study's objectives

Table 1: Rates of unused and stored medicines especially among low- and middle-income countries

Country	Findings
Afghanistan (2017) ^[11]	95.3% of respondents admitted to be having quantities of unopened purchased medicines in their homes
Ethiopia (2018) ^[5]	66% of those surveyed had unused medicine stored at home. The most common being analgesics (62.7%) and antibiotics (24%)
Ethiopia (2020) ^[3]	52.4% of respondents had unused medicines stored at home. The most common being analgesics (41.5%) and antibiotics (36.7%)
Ghana (2014) ^[13]	98% of respondents reported having medicines at home which they wished to dispose of, with 80% expecting to have leftover medication in their homes over the next 6 months
Indonesia (2020) ^[2]	95% of respondents had unused medicines in their homes, with analgesics and antibiotics the most common
India (2020) ^[9]	87% of participants had unused medicines at home. The most common being analgesics (38.9%) and antimicrobials (27%)
Jordan (2020) ^[6]	58.1% of respondents reported that they had leftover, unused, or expired medicines in their homes
Jordan (2021) ^[1]	30.4% of respondents reported having between 1-5 medicines at home, whereas 20.8% had 6-10 medicines and 29.9% had over ten medicines
Malaysia (2020) ^[8]	70.6% of respondents reported purchasing some medicines that remain unused in their homes

and allowed to ask questions. Following agreement to participate, participants provided written informed consent. The questionnaire was administered in an interview conducted in a private consultation room at the facilities. Both the questionnaire and the consent forms were available in English, Setswana, and IsiZulu, as the most commonly spoken languages in the study sites.

Data were captured onto Microsoft Excel® spreadsheets, verified for accuracy by a second person, followed by data cleaning and import into the IBM Statistical Package for the Social Sciences (SPSS)® version 24 for statistical analysis.

This study was granted ethical clearance by Sefako Makgatho University Research Ethics Committee (SMUREC/P22/2017) and permission by Tshwane District Health Services Research Office.

RESULTS

One hundred seventy-one patients took part. The majority (135, 78.9%) were female, with 49.6% (85) having no education beyond primary school [Appendix Table 1].

Encouragingly, 86.5% (148) of participants said that they either “always” or “sometimes” finish their medicines; however, 74.9% (128) reported having medicines at home they are not using. Most participants received their medicines from PHCs (164, 95.9%), pharmacies (89, 52.0%), and/or medical practitioners' rooms (48, 28.1%), with participants able to choose more than one supplier.

While 77.8% (133) reported checking expiry dates when they receive their medicines from health-care facilities, 38.4% (63) confirmed that once these medicines are in their households, expiry dates are no longer checked [Table 2]. Most medicines were stored in cupboards (120, 70.2%) or the bedroom (104, 60.8%) to keep them out of the reach of children (65, 38.0%) and for safety and convenience (45, 26.3%) [Table 2].

Of concern is that 32.7% (56) of patients only sometimes finished their course of medicines and 13.5% (23) never [Table 2], with a critical reason not completing a course being to use them later (99, 71.3%).

Encouragingly though, 34.4% (44) of patients wanted to dispose of their medicines that were not used.

Another concern is that 95.3% (163) of patients reported never being counseled by HCPs on safely disposing of unwanted medicines, with 64.9% (111) indicating they do not know how to dispose of them safely.

Patients reported flushing their unwanted medicines down the toilet (44, 25.7%), in a basin/sink (10, 5.8%),

Table 2: Patient's handling of medicines in the household

Medicines in patient's homes	<i>n</i>	Number of patients, <i>n</i> (%)
Source where medicines are obtained*		
Clinic	171	164 (95.5)
Pharmacy	171	89 (52.0)
Medical practitioner's rooms	171	48 (28.1)
Hospital	171	14 (8.2)
Retail outlets	171	6 (3.7)
Left over medicines at home	171	3 (1.8)
Friends and family	171	1 (0.6)
Check expiry date when receiving medicines from HCPs	171	133 (77.8)
Storage of medicines at home*		
Cupboard	171	120 (70.2)
Bedroom	171	104 (60.8)
Fridge	171	43 (25.1)
Kitchen	171	35 (20.5)
Box/multiple storage boxes	171	15 (8.5)
Bathroom	171	2 (1.2)
Reasons for storing medicines in a particular place		
They are out of reach or children	171	65 (38.0)
Safe and convenient	171	45 (26.3)
Convenient	171	21 (13.3)
To help me remember	171	14 (8.2)
Safe and told by a HCP	171	4 (2.3)
Finishing medicines		
Never	171	23 (13.5)
Always	171	92 (53.8)
Sometimes	171	56 (32.7)
Check expiry dates of medicines kept in the household	164	63 (38.4)
Know how to safely dispose of medicines	171	60 (35.1)
Medicines at home		
Not being used	171	128 (74.9)
Have expired	128	17 (9.9)
Are damaged	128	8 (4.7)
Types of medicines at home not being used		
Chronic	128	60 (46.9)
Flu	128	66 (51.6)
Pain	128	58 (45.3)
Others	128	57 (44.5)
Plans for stored medicines not being used*		
Use them later	128	99 (71.3)
Wants to dispose of medicines not used	128	44 (34.4)
Plan to store them until they expire	128	32 (25.0)
Do not know what to do with these medicines	128	6 (4.7)

*Participants could choose more than one response. HCP: Health-care professionals

Table 3: Ideal and practical medicine disposal techniques according to patients (N=171)

	Number of patients, n (%)			P
	Low level of education	High level of education	Totals	
Patients' disposal practices of medicines*				
Flush down the toilet	21 (12.3)	23 (13.4)	44 (25.7)	0.760
Flush down the basin	5 (2.9)	5 (2.9)	10 (5.8)	0.958
Municipal bin	12 (7.0)	29 (16.9)	41 (23.9)	0.003
Pit toilet	18 (10.5)	10 (5.9)	28 (16.4)	0.920
Return to a health-care facility	8 (4.7)	4 (2.3)	12 (7.0)	0.186
Burning it	7 (4.1)	3 (1.7)	10 (5.8)	0.186
Bury it underground	5 (2.9)	2 (1.2)	7 (4.1)	0.241
Give to friends and family	0	1 (0.6)	1 (0.6)	0.319
Patients' ideal way to dispose of medicines*				
Dissolve in boiling water and pour down the drain	34 (19.9)	32 (18.7)	66 (38.6)	0.708
Return to health-care facility	26 (15.2)	19 (11.1)	45 (26.3)	0.207
Designated task team collecting from each household	19 (11.1)	24 (14.0)	43 (25.1)	0.403
In special collection containers	3 (1.8)	7 (4.1)	10 (5.9)	0.199
National pharmaceutical disposal scheme	2 (1.2)	3 (1.8)	5 (3.0)	0.659

* Patients were allowed more than one response; levels of education defined in the methodology

or into a municipal bin (41, 23.9%) as ideal or practical ways to dispose of medicines [Table 3], with only 7.0% (12) indicating they return unused medicines to the health-care facility [Table 3]. Table 3 also contains further details of disposal methods.

Most patients (152, 78.3%) confirmed that it is good practice to dispose of medicines in the manner they do, with 46.8% (80) stating they did not know about the impact of improper disposal of medicines. Of those that did, 72.5% (66) cited adverse drug reactions resulting from children who might intentionally or unintentionally get hold of and use these medicines as a concern.

When asked how they would ideally dispose of medicines, 25 of the 44 (56.8%) patients who flush their medicines down the toilet indicated dissolving them in boiling water and pouring them down the drain as an ideal disposal method [Table 3]. Only 26.3% (45) showed an ideal disposal method as returning medicines to a health-care facility; of these, only 13.3% (6) currently return unwanted medicines to such facilities. While 5.9% (10) of patients thought special collection containers would be an ideal disposal method, some patients commented that "special collection containers" could be a health hazard as they might be broken into.

Of the 12 (7.0%) patients who returned their medicines to health-care facilities for disposal [Table 3], 8 (66.7%) had a low level of education. Overall, out of the 82.3% (141) of patients who were found to be disposing of their unwanted medicines incorrectly, 39.7% (68) had a low level of education.

Alongside this, when patients were asked what role they can play in minimizing the accumulation of medicines at

home, 35.9% (61) suggested that the course of prescribed medicines should be completed. A minority (23, 13.5%) felt that HCPs should supply them with the exact quantities needed for a course of therapy, with 5.3% (9) suggesting they need to inform HCPs of the medicines they still have at home. However, 10.6% (8) indicated that they do not know what role they could play.

DISCUSSION

We believe this is the first study in recent years to assess how patients attending PHCs in South Africa collect, store, and dispose of their medicines, building on earlier studies.^[10,21,22] This is important, especially with the Centralised Chronic Medicines Dispensing and Distribution programme, where patients do not necessarily interact with HCPs,^[24] although there is growth in ward-based community outreach teams in South Africa.^[26]

The high rates of unused medicines in South African households mirror other LMICs [Table 1]. However, encouragingly, 86.5% of participants claimed to finish their medicines (always or sometimes), and they typically understood the importance of taking their medicines as prescribed, similar to other studies.^[13]

Having said this, the majority of patients in our study stored their medicines with the intention of using them at a later stage, similar to other studies.^[2,7,8] Such practices are a concern considering that over a quarter of patients in our study did not check the expiry dates of medicines stored at home, and 64.9% did not know how to dispose of them safely. Most patients disposed of unwanted medicines into sewage water through flushing in a sink or toilet (31.6%), similar to some studies.^[1,4]

This contrasts with other studies, including previous studies from South Africa, where disposal in the garbage can was the most common method.^[2,3,5,8-11,13,21,22] Our findings are reflected in the fact that 53.2% of patients were unaware of the environmental impact of improper disposal practices. This contrasts with the findings of Insani *et al.* and Vellinga *et al.* were between 53.1% and 72.0% of patients felt that the inappropriate disposal of medicines affected the environment and health.^[2,7] Ayele and Mamu also found that 86.0% of respondents felt improper disposal could affect the environment and health,^[5] with Bashaar *et al.* finding that 98% of participants believed improper disposal methods also harmed the environment.^[11] Patients in our study were most concerned about the immediate protection of children from unused medicines and not the environmental impact of incorrect disposal [Table 1].

Another concern is that an appreciable number of patients (95.3%) stated that HCPs did not provide education/counseling about safe medicine disposal, similar to other studies.^[2,13,27] This was higher than in Ethiopia, where only 50% of participants stated they received information on the safe disposal of medicines from HCPs.^[5]

Overall, we found no statistical significance between patients' level of education and how they dispose of their medicines. However, there was a statistical significance ($P < 0.003$) between the level of education and disposing of medicines in municipal bins. Since most participants had some form of education, integrating safe medicines disposal methods into the school curricula may improve disposal techniques in the future.^[28] In addition, greater involvement of government agencies and HCPs in educational programs, coupled with mass media campaigns, could reduce future inappropriate disposal of medicines in South Africa.^[2,3,5,8,11,13] Consequently, the safe disposal of medicines should be part of HCP curricula, and we are currently exploring this further. Our study has limitations, including conducting in only one area. However, we believe our findings are robust, providing future direction.

In conclusion, patients in South Africa are using inappropriate waste disposal methods. Consequently, there is a need for education and other strategies among patients. There is also a need for ongoing education among HCPs, and we will be following both up.

AUTHORS' CONTRIBUTION

K. J. Mahlaba, E. A. Helberg, and J. C. Meyer developed the concept for the paper and developed the questionnaire. K. J. Mahlaba and B. Godman undertook the literature review. K. J. Mahlaba administered and

oversaw questionnaire completion as well as entered the data onto Excel spreadsheets. K. J. Mahlaba, A. Kurdi, and J. C. Meyer undertook the analysis. All authors contributed to manuscript development.

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Conflicts of interest

There are no conflicts of interest.

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Appendix Table 1: Demographic characteristics of participants (n=171)

Characteristics	Number of patients, n (%)
Gender	
Male	36 (21.1)
Female	135 (78.9)
Age	
<25	31 (18.1)
≥25-<45	79 (46.2)
≥45-<65	39 (22.8)
≥65-<75	20 (11.7)
≥75	2 (1.2)
Race	
African	170 (99.4)
Colored	1 (0.6)
Lower level of education	
No schooling	4 (2.3)
Primary school not completed	4 (2.3)
Primary school completed	77 (45.0)
Higher level of education	
Secondary school completed	66 (38.6)
Tertiary completed	20 (11.7)