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.[11] 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]
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. 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. 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. More recently, the Department of Health in KwaZulu-Natal developed policies and procedures to dispose of medicines, and the Pharmaceutical Society of South Africa is producing guidance. Previous studies in South Africa have reported that patients dispose of their medicines in the sink, toilet, and garbage bins. 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).

### 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 medicines free of charge and are more likely to have unused 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. 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.
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** | **n** | Number of patients, **n (%)** |
| **Source where medicines are obtained** | 171 | 164 (95.5) |
| Clinic | 171 | 89 (52.0) |
| Pharmacy | 171 | 48 (28.1) |
| Medical practitioner’s rooms | 171 | 14 (8.2) |
| Hospital | 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 | 171 | 120 (70.2) |
| Cupboard | 171 | 104 (60.8) |
| Bedroom | 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 | 171 | 65 (38.0) |
| They are out of reach or children | 171 | 45 (26.3) |
| Safe and 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 | 171 | 23 (13.5) |
| Never | 171 | 92 (53.8) |
| Always | 171 | 56 (32.7) |
| Sometimes | 164 | 63 (38.4) |
| Check expiry dates of medicines kept in the household | 171 | 60 (35.1) |
| Know how to safely dispose of medicines | 171 | 128 (74.9) |
| Medicines at home | 128 | 17 (9.9) |
| Not being used | 128 | 8 (4.7) |
| Types of medicines at home not being used | 128 | 60 (46.9) |
| Chronic | 128 | 66 (51.6) |
| Flu | 128 | 58 (45.3) |
| Pain | 128 | 57 (44.5) |
| Others | 128 | 99 (71.3) |
| Plans for stored medicines not being used | 128 | 44 (34.4) |
| Use them later | 128 | 32 (25.0) |
| Wants to dispose of medicines not used | 128 | 6 (4.7) |
| Plan to store them until they expire | 128 | 111 (64.9) |
| Do not know what to do with these medicines | 128 | 44 (34.4) |

*Participants could choose more than one response. HCP: Health-care professionals.
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. This is important, especially with the Centralised Chronic Medicines Dispensing and Distribution programme, where patients do not necessarily interact with HCPs, although there is growth in ward-based community outreach teams in South Africa.

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. 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. 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.

| Patients’ disposal practices of medicines* | Low level of education | High level of education | Totals | P |
|------------------------------------------|------------------------|------------------------|--------|---|
| 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
This contrasts with other studies, including previous studies from South Africa, where disposal in the garbage can was the most common method.\cite{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.\cite{2,7} Ayele and Mamu also found that 86.0% of respondents felt improper disposal could affect the environment and health,\cite{5} with Basshaar et al. finding that 98% of participants believed improper disposal methods also harmed the environment.\cite{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.\cite{12,13,23} This was higher than in Ethiopia, where only 50% of participants stated they received information on the safe disposal of medicines from HCPs.\cite{8}

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.\cite{26} 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.\cite{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.

**References**

1. Añahas F, Yeboah P, Fliedel L, Abdin AY, Alhareth K. Expired medication: Societal, regulatory and ethical aspects of a wasted opportunity. Int J Environ Res Public Health 2020;17:787.
2. Insani WN, Qonita NA, Jamnah SS, Nuraliyah NM, Supadmi W, Gatera VA, et al. Improper disposal practice of unused and expired pharmaceutical products in Indonesian households. Helinyon 2020;6:e04551.
3. Kahsay H, Ahmed M, Kebede B, Gebrezihir K, Araya H, Tesfay D. Assessment of knowledge, attitude, and disposal practice of unused and expired pharmaceuticals in community of Adigrat City, Northern Ethiopia. J Environ Public Health 2020;2020:6725423.
4. Makki M, Hassali MA, Awaisu A, Hashmi F. The prevalence of unused medications in homes. Pharmacy 2019;7:61.
5. Ayele Y, Mamu M. Assessment of knowledge, attitude and practice towards disposal of unused and expired pharmaceuticals among community in Harar city, Eastern Ethiopia. J Pharm Policy Pract 2018;11:27.
6. Naser AY, Amara N, Dagash A, Naddaf A. Medications disposal and medications storage in Jordan: A cross-sectional study. Int J Clin Pract 2021;75:e13822.
7. Vellinga A, Cormican S, Driscoll J, Furey M, O’Sullivan M, Cormican M. Public practice regarding disposal of unused medicines in Ireland. Sci Total Environ 2014;478:98-102.
8. Hassali MA, Shkeel S. Unused and expired medications disposal practices among the general public in Selangor, Malaysia. Pharmacy 2020;8:196.
9. Manocha S, Suranagi UD, Sah RK, Chandane RD, Kulhare S, Goyal N, et al. Current disposal practices of unused and expired medicines among general public in Delhi and National Capital Region, India. Curr Drug Saf 2020;15:13-9.
10. Amod F, Chetty K, Essa AS, Hlela L, Maharaj C, Oosthuizen F. A pilot study to determine public trends in storage and disposal of medicines. SAPJ 2008;75:7.
11. Basshaar M, Thawani V, Hassali MA, Saleem F. Disposal practices of unused and expired pharmaceuticals among general public in Kabul. BMC Public Health 2017;17:45.
12. Shealy KM, O’Day P. Eagerton DH. The needs and opportunities for medication disposal programs. J Pharm Technol 2014;30:147-50.
13. Abraquah AA, Drewry JA, Ampratwum FT. What happens to unused, expired and unwanted medications? International Journal of Development and Sustainability. 2014;3:2175-85.
14. Nuel M, Laurent J, Bois P, Heintz D, Wanko A. Seasonal and ageing effect on the behaviour of 86 drugs in a full-scale surface treatment wetland: Removal efficiencies and distribution in plants and sediments. Sci Total Environ 2018;615:1099-109.
15. Glassmeyer ST, Furlong ET, Kolpin DW, Batt AL, Benson R, Boone JS, et al. Nationwide reconnaissance of contaminants of emerging concern in source and treated drinking waters of the
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)                 |

16. Fekadu S, Alemayehu E, Dewil R, Van der Bruggen B. Pharmaceuticals in freshwater aquatic environments: A comparison of the African and European challenge. Sci Total Environ 2017;581-582:909-22.

17. Republic of South Africa. Medicines and Related Substances Act. Pretoria; 2002. Available from: https://www.hpcsa.co.za/Uploads/Legal/legislation/medicines_and_related_sub_act_101_of_1965.pdf. Accessed 10 October 2021.

18. Republic of South Africa – Government Gazette. The National Environmental Management Waste Act; 2009. Available from: https://www.gov.za/sites/default/files/gcis_document/2014/09/32000278.pdf. Accessed 11 October 2021.

19. PSSANO. Comment on Board Notice 100 of 2020 – Draft Rules Relating to Good Pharmacy Practice: Minimum Standards for the Disposal and Destruction of Medicines and Scheduled Substances; 2020. Available from: https://www.pssa.org.za/download/pssa-comment-bn100-2020-disposal-destruction-meds.pdf. Accessed 10 October 2021.

20. DOH KWAZULU-Natal. Policy and Procedures for the Disposal of Pharmaceutical Waste; 2015. Available from: http://www.kznhealth.gov.za/mehw/Polio/KZN_Policy_Procedures_Disposal_Pharmaceutical_Waste.pdf. Accessed 11 October 2021.

21. Oluchi OI. Disposal of Unused Medicines from Households in Cape Town; 2019. Available from: https://etd.uwc.ac.za/bitstream/handle/11394/7935/oluchi_m_nsc_2019.pdf?sequence=1&isAllowed=y. Accessed 10 October 2021.

22. Rashiane MM. Disposal Practices for Unwanted Medicines from Households in Johannesburg; 2017. Available from: https://etd.uwc.ac.za/xmlui/bitstream/handle/11394/6110/719-1329-1-RV.pdf?sequence=1&isAllowed=y. Accessed 10 October 2021.

23. Mahlaba K, Helberg E, Godman B, Kurdi A, Meyer J. Health-care professionals’ knowledge and practice regarding disposal of medicines in primary health-care facilities in South Africa: Impact and implications. J Res Pharm Pract 2021;10:185-90.

24. Meyer JC, Schellack N, Stokes J, Lancaster R, Zeeman H, Defty D, et al. Ongoing initiatives to improve the quality and efficiency of medicine use within the public healthcare system in South Africa: a preliminary study. Front Pharmacol 2017;8:751.

25. Seehusen DA, Edwards J. Patient practices and beliefs concerning disposal of medications. J Am Board Fam Med 2006;19:542-7.

26. Schneider H, Daviaud E, Besada D, Rohde S, Sanders D. Ward-based primary health care outreach teams in South Africa: Developments, challenges and future directions. SAHR 2018;1:59-65.

27. AlAzmi A, AlHamdan H, Abualezz R, Bahadig F, Abonofal N, Osman M. Patients’ knowledge and attitude toward the disposal of medications. J Pharm 2017;2017:8516741.

28. Thach AV, Brown CM, Pope N. Consumer perceptions about a community pharmacy-based medication take back program. J Environ Manage 2013;127:23-7.