

Original Article

Health-Care Professionals' Knowledge and Practice Regarding Disposal of Medicines in Primary Health-Care Facilities in South Africa: Impact and Implications

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INTRODUCTION

Nurses, pharmacists, and doctors typically undertake the disposal of medicines within health-care facilities across countries;^[1,2] however, there can be concerns.^[3,4] In South Africa, the South African Pharmacy Council (SAPC) stipulated in 2010 that only a pharmacist, inspector, officer of the South African Police Service, or a person in charge of a medicine's destruction site, authorized by the director general, may dispose of medicines of any quantity, upon which they need to produce a certificate of

ABSTRACT

Objective: Professional nurses, pharmacists, and medical practitioners are responsible for disposing of medicines within health-care facilities. South African regulations stipulate that medicines should not be disposed of through sewage systems because of the potential impact on patients and the environment. Consequently, our objective was to determine knowledge and practices among health-care professionals (HCPs) in South Africa and the information they provide to patients regarding the safe disposal of unused/expired/damaged medicines to provide future guidance with identified concerns. **Methods:** A descriptive study was conducted among 165 HCPs at 16 primary health-care clinics in two subdistricts of the city of Tshwane in Gauteng Province through self-administered questionnaires. **Findings:** Only 23.5% of HCPs stated that they participated in destroying medicines within their facilities. More than half (65.1%) also reported that they always counsel patients regarding the safe storage of their medicines in their homes, with 27.9% indicating they counsel patients on the safe disposal of their medicines during consultations. More than half (65.1%) also reported that patients never asked about the disposal of medicines. Of concern is that incineration (31.9%), flushing down the toilet (20.6%), and flushing down the sink (9.9%) were regarded by HCPs as correct disposal methods, while 9.6% stated that they did not know the correct methods. In addition, 71.1% reported never receiving training regarding the safe disposal of medicine. **Conclusion:** There is an urgent need to educate HCPs regarding appropriate medicine waste disposal in South Africa. This can start with including this topic in the curriculum of HCPs, including pharmacists, and continuing post qualification.

KEYWORDS: Expired medicines, household medicine disposal, unused medicines, South Africa

destruction to be stored in a facility for a minimum of 5 years.^[5]

In South Africa, medicines' disposal are primarily regulated by the Medicines and Substances Control Act, Policy and Procedure Documents, and the Environmental Management Waste Act.^[6-8] These regulations stipulate

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that medicines should not be discarded in municipal waste or sewage systems. Furthermore, SAPC requires that all pharmacies should have a dedicated standard operating procedure (SOP) regarding the safe disposal of unused/expired/damaged medicines. The legislation stipulates that medicines for disposal should be incinerated and or landfilled only in authorized facilities.^[7,9]

Disposing medicines into municipal sewage systems result in trace amounts of these medicines in wastewaters and decontaminated water for drinking,^[10] which hinders the effectiveness of water purification chemicals.^[11-13] Furthermore, burying medicines underground may lead to leaching into underground water.^[11,14,15] Pomati *et al.* reported that wastewater medicines affected human cell proliferation of the embryonic kidney cell line HEK293 by 40% in humans during *in vitro* studies.^[16] Of equal concern is that Tong *et al.* in New Zealand found that most pharmacies' biomedical waste, health-care waste, waste requiring special attention, and liquids were reported to be typically disposed of in the basin,^[15] with pharmacists not knowing how authorized disposal companies dealt with expired or unused medicines.^[15] Lack of knowledge by health-care professionals (HCPs) results in patients not being correctly counselled on the safe disposal of medicinal waste or not being advised, negatively impacting the environment and patients themselves.^[4,9] Alongside this, patients may not be knowledgeable about the safe storage of medicines in their households with concerns that the majority store their nonexpired, expired, and unwanted medicines together.^[12,17]

We are aware of a South African study published in 2008, reporting that 50% of surveyed HCPs did not have regular pharmaceutical waste removal systems in place in their facilities,^[18] with other studies suggesting that the disposal method of choice for unwanted medicines among households was household trash bins, followed by flushing down the toilet and the sink.^[9,12] The majority of HCPs reported receiving on-the-job training regarding the proper disposal of medicines after graduation and to be advising patients regarding the safe disposal of medicines.^[9]

Consequently, we sought to build on these studies to determine current knowledge among HCPs in South Africa on the safe storage and disposal of medicines in the public health system. Furthermore to determine the information HCPs routinely provide to patients regarding safe disposal practices given current concerns, and to identify which SOPs as well as legislative documents that health-care facilities have for the disposal of medicines and are known about. Concurrent with this, as a separate objective, we will be interviewing patients

on their knowledge and current disposal methods. The joint findings will be used to suggest future strategies to improve the safe disposal of medicines in South Africa and broader.

METHODS

This was a descriptive and quantitative study conducted among HCPs from 16 randomly selected primary health-care clinics (PHCs) in two subdistricts of the City of Tshwane, Gauteng Province, as representatives from 30 clinics in the region. HCPs include nurses, who typically manage patients within PHCs in South Africa under the direction of physicians.^[19]

HCPs were selected conveniently on the interview day based on their availability and willingness to participate in expediting the research. This resulted in a final sample size of 166 HCPs. Willing participants were verbally informed of the aim and objectives of the study. They subsequently provided written informed consent, which was available in English, Setswana, and IsiZulu, as these are the commonly spoken languages in the area. Data collection took place for four consecutive weeks, Mondays to Thursdays.

A self-administered questionnaire was used, which was compiled based on previous questionnaires and studies.^[10,14,15,20] The questionnaire [which is available as an Appendix] was designed to gather general background information about the clinic and the availability of SOPs on the disposal of medicines within the clinics. In addition, participants demographics, their knowledge regarding disposal practices, and any information they currently provide to patients about medicine disposal. The questionnaire was tested for feasibility during a pilot study among HCPs, with subsequent suggestions to improve understanding of the questions. All questionnaires were completed in the presence of the data collector to help further clarify any questions without any follow up sessions.

Data were captured on Microsoft Excel™ spreadsheets and verified by a second person for accuracy, followed by data cleaning, and subsequently analysed using IBM SPSS Statistics (Version 24) predictive analytics software, in consultation with a statistician. Correct answers were identified for all knowledge questions. These were subsequently counted and converted to percentages for analysis. The knowledge measure was calculated based on previous studies: HCPs were considered "Not knowledgeable" with a score <50%, "Partly knowledgeable" if they scored between 50% and 70%, and "Knowledgeable" if they scored above 70%.

Sefako Makgatho University Research Ethics Committee granted ethical clearance, and permission was granted by the Tshwane District Health Services Research Office.

RESULTS

Table 1 presents the demographic characteristics of the study participants, of whom the majority were professional nurses (109, 65.7%) and female (154, 92.8%), aged between 45 and 65 years (83, 50.0%), with most having over 10 years work experience (95, 57.2%).

Overall, 86.8% (144) of HCPs surveyed dispense medicines to patients either always or sometimes, with 57.8% (96) stating that they always counsel patients about its safe storage [Table 2]. However, 29.5% (49) indicated that they never counsel patients about the safe disposal of medicines once dispensed, with 65.1% (108) suggesting that patients never asked about the safe disposal thereof [Table 2].

Of concern is that 76.5% (127) of HCPs do not currently participate in medicines' destruction at PHCs. However, most knew the designated staff member managing disposals, with pharmacist assistants cited as mostly involved [Table 2].

Table 1: Demographic characteristics of health-care professionals

Characteristics	n (%) of HCPs (n=166)
Gender	
Male	12 (7.2)
Female	154 (92.8)
Race	
African	164 (98.8)
Colored	1 (0.6)
Indian	1 (0.6)
Age	
<25	2 (1.2)
≥25-<45	80 (48.2)
≥45-<65	83 (50.0)
≥65	1 (0.6)
Qualifications	
Pharmacist	2 (1.2)
Pharmacist assistant	19 (11.4)
Medical practitioner	9 (5.4)
Professional nurse	109 (65.7)
Enrolled/staff nurse	20 (12.0)
Auxiliary nurse	4 (2.4)
Dental therapist	3 (1.8)
Work experience (years)	
≤1	4 (2.4)
>1-3	16 (9.6)
>3-5	8 (4.8)
>5-10	43 (25.9)
>10	95 (57.2)

HCPs=Health-care professionals

Of equal concern as well is that only 28.9% (48) of HCPs stated that they had received training (formal or informal) about the safe disposal of medicines [Table 3], and only 12.8% (5) of HCPs who participate in medicines disposal at the facility level, were knowledgeable about medicine disposal.

Table 2: Medicines management and information provided to patients by health-care professionals

Medicines management and information given to patients	n	n (%) of HCPs
Dispensing of medicines to patients by HCPs	166	
Never		22 (13.3)
Sometimes		81 (48.8)
Always		63 (38.0)
Patient counseling regarding safe storage of medicines at home by HCPs	166	
Never		9 (5.4)
Sometimes		61 (36.7)
Always		96 (57.8)
Patients counseling regarding safe disposal of medicines by HCPs	166	
Never		49 (29.5)
Sometimes		71 (42.8)
Always		46 (27.7)
HCPs who have been asked by patients on how medicines should be disposed of	166	
Never		108 (65.1)
Sometimes		52 (31.3)
Always		6 (3.6)
HCPs who have received medicines returned to the clinic by patients for disposing purposes	166	
Never		44 (26.5)
Sometimes		106 (63.9)
Always		16 (9.6)
HCPs who participate in the destruction of medicines	166	
Never		127 (76.5)
Sometimes		33 (19.9)
Always		6 (3.6)
Titles of HCPs who participated in the destruction of medicines at the PHC facility level		
Professional nurses	109	26 (23.9)
Pharmacist assistant	19	8 (42.1)
Enrolled/staff nurse	20	4 (20.0)
Medical practitioner	9	1 (11.1)
HCPs who knew the designated staff member managing medicines disposal at the clinic	166	
Yes		114 (68.7)
No		21 (12.7)
Do not know		31 (18.7)
Position of the HCP who manages unused/expired/damaged medicines at the clinic	114	
Pharmacist assistant		104 (91.2)
Pharmacist		5 (4.4)
Professional nurse		5 (4.4)

HCPs=Health-care professionals

However, most HCPs were aware of waste disposal SOPs (112, 90.3%).

Another concern is that 20.5% (34) of HCPs perceived flushing medicines down the toilet as a correct method of medicine disposal despite the majority being aware

Table 3: Knowledge and information regarding disposal and storage of medicines

	n	n (%) of HCPs
Knowledge of HCPs who participate in medicines' destruction regarding correct disposal method	39	
Partially knowledgeable	24	(61.5)
Not knowledgeable	10	(25.6)
Knowledgeable	5	(12.8)
Common medicine storage instructions given to patients by HCPs*	158	
Store in the fridge	89	(56.3)
Store in a cool dry place	81	(51.3)
Store out of reach of children	73	(46.2)
Store away from direct sunlight	56	(35.4)
Other	87	(55.1)
Details on other storage instructions given to patients by HCPs	87	
Store on floor in absence of a fridge	17	(19.5)
Check expiry dates regularly	10	(11.5)
Store reconstituted antibiotics on the fridge door	10	(11.5)
Store in original containers	7	(8.0)
In a safe place/lockable cupboard	5	(5.7)
Store reconstituted antibiotics for 7 days only	4	(4.6)
Do not store in a moist place	4	(4.6)
Close the lids of the containers tightly	4	(4.6)
Avoid excessive heat	4	(4.6)
Training received on the safe disposal of medicines	166	
No training	118	(71.1)
Formal training	18	(10.8)
Informal training	30	(18.1)
Information provided to patients by HCPs who received formal training on safe disposal of medicines	18	
Return medicines back to the clinic for disposal	4	(22.2)
I was only taught about segregation of medicines	2	(11.1)
I dispose unwanted medicines into the drain	1	(5.6)
Information provided to patients by HCPs who received informal training on safe disposal of medicines	30	
Return medicines back to the clinic for disposal	9	(30.0)
Do not dispose medicines into sewage systems	1	(3.3)
Flush medicines in the sink	1	(3.3)
Knowledge regarding waste disposal documents at the clinic	124	
GPP	48	(38.7)
Waste disposal SOP	112	(90.3)

*HCP could choose >1 answer. HCPs=Health-care professionals, GPP=Good pharmacy practice, SOP=Standard operating procedure

of waste disposal SOPs; however, 31.9% (53) correctly answered incineration [Figure 1].

DISCUSSION

We believe our study builds on earlier studies in South Africa to provide future guidance.^[9,18,21,22] Of concern is that while 57.8% (96) of HCPs always counsel patients on the safe storage of medicines at home, and 36.7% (61) sometimes, only 27.7% (46) indicated that they always counsel patients about their safe disposal [Table 2]. Consequently, it is not surprising that only 9.6% (16) of HCPs said that patients always return medicines to the health-care facility for destruction. Similarly, Seehusen and Edwards found that 80.3% (240) of surveyed patients said that a HCP has never advised them on how to dispose of medicines safely.^[20] This is reflected in the high disposal rate of unwanted medicines in garbage cans (102, 52%) or the sink/toilet (66, 34%) in a previous study in South Africa.^[9]

The low rates of returned unwanted medicines could also be a consequence of lack of training, with 71.1% (118) of HCPs indicating this [Table 3]. Furthermore, 61.5% (24) of HCPs who said they participated in the destruction of medicines were partially knowledgeable, with 25.6% (10) not knowledgeable regarding correct disposal techniques [Table 3]. Similar findings were reported in New Zealand, where 53.7% of pharmacists did not know how medicinal waste was destroyed.^[15] In Ghana, over 98% of respondents also said that they never received advice on medicines disposal.^[14] Our results further indicated that HCPs perceived incorrect disposal techniques as correct [Figure 1], similar to the earlier study in South Africa where HCPs disposed of expired medicines by dissolving them in water and flushing the contents down the drain.^[21] This is reflected by the fact that 76.5% (127) of HCPs in our study reported that they do not participate in any part of the destruction of medicines [Table 2] despite knowing of

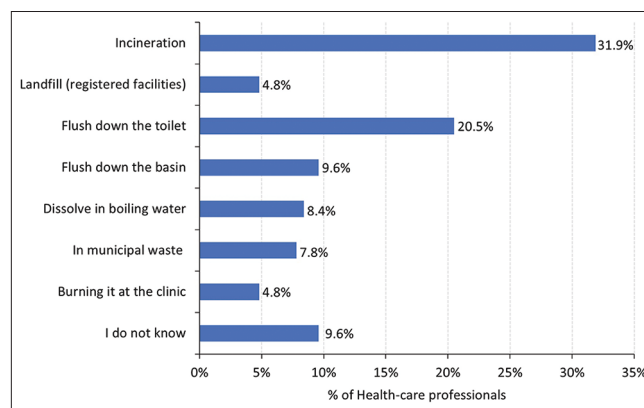


Figure 1: Disposal methods perceived as correct by health-care professionals

the existence of a waste disposal SOP in their respective facilities [Table 3].

Lack of correct disposal of unwanted medicines is enhanced by 65.1% (108) of HCPs, reporting that patients never ask how leftover medicines should be safely disposed of [Table 2].

Potential ways to improve unwanted medicine disposal include innovative educational strategies to improve HCP knowledge. Such activities could include greater Internet use and building on necessary actions during the current COVID-19 pandemic.^[23] Similar complementary activities are also needed among patients to improve their safe disposal of unwanted or expired medicines. In addition, there could be more frequent reviews of national and regional government disposal protocols, including groups such as the South African Pharmacy Council and local Departments of Health, with guidance actively disseminated.^[8,22] Alongside this, relooking at medicine take-back programs at health-care facilities for unused/expired/damaged medicines and potentially fining persistent patient polluters.^[18,24,25] Media (TV and radio) can also be used to encourage patients to safely dispose of their unwanted medicines through HCPs and other trusted sources. We will be following these suggestions up in future with all key stakeholder groups.

We know that the study was only conducted in two subdistricts in South Africa. In addition, the knowledge of the volunteer HCPs may be biased. However, despite these limitations, we believe the study provides valuable insight into future ways to improve on this suboptimal situation.

In conclusion, HCPs in South Africa had poor overall knowledge regarding safe disposal practices for medicines. Over three-quarters of HCPs still do not counsel patients about the safe disposal of medicines despite agreed SOPs and documents. Consequently, it is recommended that the curriculum for all HCPs be strengthened regarding medicine management, with universities also looking at innovative ways to address poor knowledge of HCPs to reduce future environmental pollution. This is especially important with the growing rates of noncommunicable diseases in South Africa and the resultant impact on medicine use exacerbated by the current COVID-19 pandemic.

AUTHORS' CONTRIBUTION

Kesentseng Jackson Mahlaba, Elvera Anna Helberg, and Johanna C Meyer developed the concept for the article and developed the questionnaire. Kesentseng Jackson Mahlaba and Brian Godman undertook the literature review. Kesentseng Jackson Mahlaba administered and

oversaw questionnaire completion as well as entered the data into Excel spreadsheets. Kesentseng Jackson Mahlaba, Amanj Kurdi, and Johanna 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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