



Disposal Practices of Unfit Medicines in Public Health Facilities and Community Pharmacies: A Case of Nyamagana District in Mwanza, Tanzania

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Abstract

Introduction: The environment should be protected against dangerous pollutants for a sustainable life. This involves the prohibition of unfit pharmaceuticals from entering sewage systems or drinking water infrastructure. This study aimed to determine how unfit medicines are disposed of in public health facilities and community pharmacies in Nyamagana District, Tanzania.

Methods: A structured questionnaire was used to conduct a cross-sectional study of 76 facilities to determine how unfit medicines were disposed of. Participants in the study were all healthcare workers who were in charge of the respective facility. STATA version 14 was used to analyze the coded data.

Results: A majority of facilities, 45 (59.2%), had never disposed of unfit medicines. The common disposal method in community pharmacies was burning in open containers (64.0%), while the common method in public health facilities was incineration (83.3%). These results were statistically significant, with P-values of 0.007 and 0.003, respectively. High disposal costs were identified by half of the facilities as a barrier to proper disposal of unfit medicines, while long and complex disposal procedures were mentioned by 20 (26.3%).

Conclusion: The Nyamagana district's community pharmacies and public health facilities were found to have poor practices for disposing of unfit medicines. Almost half of the participants who discarded unfit medicines did so by burning them in open containers. This has the potential to pollute the environment. It is recommended that all personnel in charge of medicine management follow the Tanzania Medicines and Medical Devices Authority's (TMDA) unfit medicine disposal guidelines.

[#]**Deceased:** This paper is dedicated to the memory of my dear friend and co-author, pharmacist Mtani Njegere (RIP)

Subject Areas

Public Health

Keywords

Disposal, Unfit Medicines, Health Facilities, Community Pharmacies

1. Introduction

Medicines are considered unfit when they are expired, improperly sealed, damaged, improperly stored, improperly labeled, counterfeit, substandard, adulterated, prohibited, and unauthorized [1]. In the 1970s, pharmaceuticals were first identified as possible environmental pollutants [2]. The National Environmental Management Act of Tanzania advocates the need to protect the environment [3]. The environment should be protected against dangerous pollutants for a sustainable life [4] [5]. This involves the prohibition of unwanted pharmaceuticals from entering sewage systems or drinking water infrastructure [6]. The presence of discarded pharmaceuticals in streams and drinking water is a severe and multidimensional problem that has attracted national and worldwide attention from the public, legislators, and regulators [7]. Antibiotic resistance has been linked to the presence of antibiotics in the water [8] [9] [10].

The majority of previous research on the disposal of unfit medicines was undertaken in private health facilities and households. Disposing of unfit medicines in dustbins or trash cans and dumping them into pit latrines were the two most common discarding procedures mentioned by households [11] [12]. Mwita *et al.* conducted a study in private health facilities that reported improper disposal of unfit medicines in health facilities, whereby commonly reported methods of disposal were pouring into the sink and putting into the street dustbin/dumpsites [13]. From the point of origin to the final disposal, pharmaceutical waste requires specific treatment and management. Disposing of it in dustbins, drains, and canals, or eventually dumping it on the city's outskirts, poses severe public health and environmental risks [14]. Pharmaceutical waste should be burned at appropriate temperatures in well-built incinerators with emission controls [15]. To burn off potentially harmful exhaust gases, the temperature of combustion should be more than 1000°C. Toxic contaminants may be emitted into the air if pharmaceuticals are destroyed by burning at low temperatures in open containers [16].

The competence of people managing medications in hospitals and pharmacies is linked to appropriate medication waste management [17]. Personnel managing medicines should be equipped with knowledge and skills in medicine management and the proper disposal of medicines [18]. As disposal of unfit medicines varies in different settings, there is a need for evaluation of practices within diverse areas. The aim of the study was therefore to determine the disposal prac-

tices of unfit medicines in public health facilities and community pharmacies in Nyamagana District in Mwanza, Tanzania.

2. Methods

2.1. Study Design and Population

This was a descriptive, cross-sectional study. It was conducted in Nyamagana district, which is among the six districts of the Mwanza region, Tanzania. All community pharmacies, public hospitals, health centers and dispensaries located in the Nyamagana district were included. Participants in the study were all healthcare workers who were in charge of the respective facility, directly involved in medicine management, and present at the time of data collection. This study excluded healthcare personnel with less than six months of expertise in pharmaceutical management.

2.2. Data Collection

Data was collected through the use of a self-administered, structured questionnaire. The questionnaire was used to assess the frequency of disposal of unfit medicines among facilities, the most common disposal methods, barriers to proper disposal, factors for the presence of unfit medicines, handling of unfit medicines before disposal, and training needs for personnel managing unfit medicines.

2.3. Sample Size and Sampling Procedure

The sample size was 18 public health facilities and 58 community pharmacies, which were calculated using the Yamane Taro formula of 1967. Thus, the study involved 76 facilities. Convenient sampling was used to recruit study participants.

2.4. Data Analysis

Coded data was entered into a Microsoft Excel sheet and analyzed using STATA version 14. Tables were created to summarize descriptive data as frequencies and percentages. The Chi-square test or Fisher's exact where appropriate we used for the statistical analysis of categorical variables. A p-value of less than 0.05 was considered statistically significant.

2.5. Ethical Consideration

Ethical clearance for the study was obtained from and approved by the ethical committee of the Open University of Tanzania. Participants signed an informed consent form before being enrolled in the study. Participation in the study was voluntary.

3. Results

Table 1 presents the present practice regarding the disposal of unfit medicines. In total, 76 facilities met the inclusion criteria (58 pharmacies and 18 public health facilities). A majority of facilities, 45 (59.2%), had never disposed of unfit

medicines ever, while 23 (30.2%) had disposed of unfit medicines only once in the previous five years. Of 31 facilities that had disposed of unfit medicines, 16 (51.6%) burned them in open containers while only 8 (25.8%) used incinerators. High disposal costs were identified by half of the facilities as a barrier to proper disposal of unfit medicines, while long and complex disposal procedures were mentioned by 20 (26.3%).

Inadequate demand was stated by 36 (47.0%) of participants as a reason for the existence of unfit medicines, while procurement of medicines with short expiry dates was mentioned by 29 (38.0%) of participants. The majority of participants, 36 (47.0%), either segregate unfit medicines from usable medicines or keep them in a separate location before disposal, 36 (47.0%).

Table 2 shows the training requirements for individuals who manage pharmaceuticals. Of the 76 respondents, 40 (52.6%) needed training on both management and disposal procedures for unfit medicines, while 25 (32.9%) needed training on disposal procedures only.

Table 1. Practice regarding disposal of unfit medicines.

Variable	Frequency, n	Percentage, %
The frequency of disposal of unfit medicines among facilities (N = 76)		
Less than 5 years	23	30.2
5 - 10 years	4	5.3
Over 10 years	4	5.3
Never disposed	45	59.2
Disposal methods (N = 31)		
Burning in open containers	16	51.6
Incineration	8	25.8
Others (e.g., Sewer, pour into sink and landfill)	7	22.6
Barriers to Proper Disposal (N = 76)		
High Cost	38	50.0
Long and complex disposal procedures	20	26.3
Others (e.g lack of knowledge, lack of incinerators and difficulties in getting disposal permits)	18	23.7
Factors for the presence of unfit medicines (N = 76)		
Inadequate demand	36	47.0
Short expiry dates	29	38.0
Others (e.g., Donated medicines, change of treatment regimen, returned by clients)	11	15.0
Handling of unfit medicines before disposal (N = 76)		
Segregated from usable medicines	36	47.0
Store them in a separate place	36	47.0
Do not know how to handle	4	6.0

Table 2. Training needs for personnel managing unfit medicines.

Areas to be trained	Frequency, n	Percentage, %
Management of unfit drugs and disposal procedure	40	52.6
Disposal procedure	25	32.9
How to apply for disposal	2	2.6
Disposal cost	2	2.6
Danger of not disposing drugs	2	2.6
Disposal procedure and time to stay with unfit drugs	3	4.0
No need	2	2.6

Table 3. Disposal of unfit medicines based on the type of health facility.

Disposal	Type of health facility		P-value
	Public Health Facilities, n (%)	Community Pharmacies, n (%)	
Never Disposed (N = 76)	12 (66.7)	33 (56.9)	0.461
Burning in open containers (N = 31)	0 (0.0)	16 (64.0)	0.007
Incineration (N = 31)	5 (83.3)	3 (12.0)	0.002
Others (e.g., Sewer, pour into sink and landfill) (N = 31)	2 (33.3)	5 (20.0)	0.413

Table 3 presents the disposal of unfit medicines based on the type of health facility. Compared to community pharmacies, the majority of public health facilities had never disposed of their unfit medicines (66.7% versus 56.9%), P-value = 0.461. The common disposal method in community pharmacies was burning in open containers (64%), while the common method in public health facilities was incineration (83.3%). These results were statistically significant, with P-values 0.007 and 0.003, respectively.

4. Discussion

The study showed that most health facilities (59.2%) had never disposed of unfit medicines. Almost half of facilities that had disposed of unfit medicines burned them in open containers, while a quarter of health facilities used incinerators. The common disposal method in community pharmacies was burning in open containers, while the common method in public health facilities was incineration. These findings are in line with results from previous studies done in Dar es Salaam, Tanzania [17], Sudan [19], and Ethiopia [20]. The preference for burning in open containers in community pharmacies raises environmental concerns due to the potential release of toxic substances [21]. Both community pharmacies and public health facilities should improve their disposal practices to ensure environmentally safe methods are employed. Providing better access to appropriate disposal facilities, such as certified incineration plants or take-back programs, can help health facilities dispose of unfit medicines more effectively [22].

High disposal costs and long and complex disposal procedures were identified as the main barriers to the proper disposal of unfit medicines. Inadequate demand and procurement of medicines with short expiration dates were stated by the majority of participants as reasons for the existence of unfit medicines. The improper handling of waste in healthcare facilities has increased as a result of underfunded healthcare systems, inadequate training, and a lack of knowledge about the regulations and policies regulating the disposal of unfit medicines [23]. In all of East Africa's nations, there is a problem with incorrect pharmaceutical management and disposal. There is a chance that this will contaminate the environment, harm people's health, and cause antibiotic resistance [24].

Proper disposal procedures for unfit medicines are critical for the protection of the environment and living beings. Tanzania Medicines and Medical Devices Authority (TMDA) regulations clearly define proper disposal procedures [1]. Despite the recommendation of disposing of unfit medicines by incineration at a temperature above 1000°C, a previous study, which was conducted in Ghana by Sasu *et al.*, reported similar findings as the current study. The majority of health facilities that participated in that study carried out open burning of waste at temperatures below the recommended temperature of 1000°C [25]. Manyele *et al.* conducted a study in Tanzanian hospitals and found that the main disposal methods for pharmaceutical waste were open-pit burning (50%) and burying (30%). In addition, the majority of the hospitals in that study had limited incineration capability, with only a few possessing firebrick incinerators [26]. Open burning may result in hazardous pollutants being released into the atmosphere. Dioxins, furans, and heavy metals produced as fumes or vapors are examples of harmful emissions [27]. The burning of unfit medicines should be done in well-constructed incinerators at recommended temperatures with facilities to control emissions.

Disposal of unfit medicines through sewage systems and landfills was also adopted by facilities in the current study. It is quite unsafe to dispose of waste drugs in this manner, given the types of sewage systems and landfills that exist in Tanzania. The majority of these sewer and landfills were not designed or constructed adequately to safeguard groundwater resources and avoid runoff into surrounding water bodies [28]. Moremi *et al.* found that more than 70% of sequenced bacterial isolates in fish from Lake Victoria, Mwanza-Tanzania, had quinolone and aminoglycoside resistance genes, implying that sewage effluents from human and animal sources contaminated the environment due to improper pharmaceutical waste disposal [29].

A previous study conducted in public health facilities located in Dar es Salaam, Tanzania, identified factors like poor quantification of needs (54.4%), short expiry dates (52.7%), donation drugs (49.1%), prescribing patterns (50.9%), inadequate law enforcement (47.3%), inadequate pharmaceutical management skills (40%), lack of efficient incinerators (43.6%), and change of treatment regimen (50.9%) as factors contributing to the accumulation of unfit medicines within a facility [17]. To avoid pharmaceuticals expiring before being

consumed, custodians of medicines in health facilities must undertake a thorough survey before procuring drugs. A majority of participants in the current study stated the need for training on management and procedures for the disposal of unfit medicines. This observation is consistent with previous studies that recommended regular training on the management of unwanted medicines for healthcare workers managing pharmaceuticals [30] [31].

This study is limited by the heterogeneity of study units, which includes community pharmacies, hospitals, health centers, and dispensaries, which may limit the study's interpretation because each has distinct capacities for managing unfit medicines.

5. Conclusion

The Nyamagana district's community pharmacies and public health facilities were found to have poor practices for disposing of unfit medicines. Almost half of the participants who discarded unfit medicines did so by burning them in open containers. This has the potential to pollute the environment. It is recommended that all personnel in charge of medicine management follow the Tanzania Medicines and Medical Devices Authority's (TMDA) unfit medicine disposal guidelines.

Conflicts of Interest

The authors declare that they have no competing interests.

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