



Methods of pharmaceutical waste management disposal practiced in sanitation value chain by community pharmacies and households in Nkubu town

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ABSTRACT

KEY WORDS

community pharmacies

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Introduction: Pharmaceutical Waste Management (PWM) has emerged as a challenging issue, with both health and environmental negative impacts. The study assessed the common methods of pharmaceutical waste management disposal in Nkubu town among community pharmacies and households in the sanitation service chain.

Methods: The study area was Nkubu town, where data was collected by use of structured questionnaires. The sample size was 19 community pharmacies and 380 households. Descriptive statistics were used for data analysis. Results are presented in tables.

Results: The study showed that 23.9% (n=91) of the households use pit latrines while 73.5% (n=14) of the community pharmacies use burning as the common methods of pharmaceutical waste disposal.

Conclusion: The common method of pharmaceutical waste disposal being practiced in community pharmacies was burning while for households was emptying in the pit latrine. Disposal of unwanted pharmaceutical products through unsafe methods along the sanitation chain was prevalent among the respondents.

Recommendation: There is need to create public awareness and establish educational programs regarding management and handling of unwanted pharmaceutical wastes among community pharmacies and households in Nkubu town.

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Introduction

Globally, there lacks standard procedure for dealing with pharmaceutical waste disposal. In the US, there was variation among the different states in some aspects of PWM. Many states for instance allow some form of reuse or resale of returned pharmaceuticals considered to be safe but under varying conditions (Gualtero *et al* 18661).

Pharmaceutical wastes are drugs that can no longer be used because of being expired, unused, spilled, withdrawn, recalled, damaged, contaminated, or for any other reason. Pharmaceutical products have been used in increasing quantities globally citation (WHO, 2013). However, studies have shown that a large number of these products eventually went unused or expired (WHO, 1999). According to World Health Organization (WHO, 2013), more than half of all medications are inappropriately prescribed and sold, which causes unnecessary storage in CPs and households creating environmental threats that jeopardize efficiency of sanitation service chain. WHO (2004) notes that the consumers (patients) and households are not able to use all the dispensed medications from community pharmacies because of several reasons that may include adverse effects, alteration of dosage, feeling healthy, medications reaching the expiration date, promotional practices by manufacturers', physicians' prescribing practices and dispensers' practices. Non-adherence to medication canals result to storage of left over medicines at home. According to WHO (2010) 50% of patients fail to take medicine correctly, hence these medications end up as pharmaceutical wastes in the sanitation value chain. Cormicanetal., (2010) has emphasized the issue of drug mismanagement in Households. He reiterates that possession of unused or expired medications pose great risks to sanitation and have gained global attention in the recent past.

When pharmacies and households dispose the pharmaceutical waste into the sinks, drains, sewer sand toilets, they pose a great challenge to animal and human health (Giusti, 2009). In addition, disposal of the pharmaceutical waste such as disinfectants, antibiotics, antiseptic improperly into sewerage systems leads to ineffective treatment of sewage (Orina, 2018). Furthermore, there is possibility of drug toxicity/addiction resulting from open dumping of pharmaceutical waste from community pharmacies and households (Jones et al., 2001).

Pharmaceutical wastes calls for significant attention in underdeveloped nations, with the finest available technologies being employed to provide options for proper disposal by households and community pharmacies (Khojah,H.M.J.etal.(2013) According to Harhay et al, (2019),the world's most prominent environmental and health problem is unsafe sanitation,

particularly in emerging countries.

Ghosh (2020), emphasizes that Management of Pharmaceutical waste from households and community pharmacies poses a serious challenge because of the environmental damage it causes and the health concerns. Managing pharmaceutical waste is fundamental and critical to prevent the ecosystem and public health dangers posed. Furthermore, Pharmaceutical waste remains a serious issue in most Low and Middle-income Countries (LMIC) due to the economic, social, technological difficulties and insufficient training on waste management (Ghosh (2020). Pharmaceutical waste handling should be done to promote safe sanitation system as a goal to achieve the Sustainable Development Goal (SDG) 6 (CUE, 2018).

India generates around 60 metric tons of pharmaceutical waste from pharmacies and a household, making their disposal and sorting a great challenge. Pharmaceutical waste is usually discarded into landfills or drains except for the chemotherapy agents which are incinerated (Hinchey,2017) Improper disposal and handling of unused pharmaceutical products has become a growing problem worldwide as cited by Cormican et al.,(2010). Iosue (2020), argues that there are limited studies that have been conducted to determine how pharmaceutical waste generated by community pharmacies and households is managed effectively

Michael et al.,(2019) cites that animals and human can be exposed to toxicities from pharmaceutical products in the environment through usage of contaminated water, this is mainly because many community pharmacies and households keep unused, unwanted and expired drugs which they frequently discard through sinks, toilets, and the municipal or garbage waste bins.

A systematic review by Iosue (2020), on comparing the disposal of pharmaceutical waste at industry, household and community levels Kenya, Ethiopia, Sudan and Uganda revealed that Kenya has a comprehensive and Standard operating procedure for management of pharmaceutical waste yet little information is recorded under households and community pharmacies management practices. This constitutes a research gap that can shed light across the sector. This review found that many pharmacies collect waste and transport pharmaceutical waste to private hospitals for private incineration services. Many of these incinerators are in bad working conditions whereas others are located in inaccessible areas (Njenga, 2008).

Generally, pharmaceutical waste in most households is not handled properly. For instance, a study conducted at Kenya's Embakasi Division community pharmacies by Oboyo & Mutai (2014) shows that pharmaceutical waste generated at the pharmacy

level was 34 percent solids and 59 percent liquid forms, which were disposed of by waste disposal businesses. Approximately 19.2 percent of semi-solid pharmaceutical waste was disposed of by sewage and incinerator.

Mugumura(2015) cites poor practices of disposing unwanted/expired pharmaceuticals in households and community pharmacies are responsible for a large portion of pharmaceuticals in water. The majority of consumers flushes unexpired drugs into sinks, toilets or disposes then into garbage bins. This was demonstrated in a number of investigations in Tacoma, Washington.

Information on pharmaceutical waste disposal methods and management in African is scarce. Tanzania is one of the African countries where guidelines for pharmaceutical waste management were available (titled "Guidelines for disposal of unfit medicines and cosmetic products, First Edition, 2009"). The guidelines were developed by the Tanzania Food and Medicines Authority (TFDA), which is the equivalent of the Kenyan PPB. However, enforcement and compliance with the guidelines was poor, even for government HFs (Matiko, 2012). This study reported that 72.4% of the respondents buried their PW at the Dares Salaam dumpsite while 31% burned their PW. Only 37.9% mentioned incineration as one of the options for PW disposal. This practice was at variance with the TFDA guidelines which required PW to be either land-filled or incinerated save for a few specified exceptions.

Nkubu is a growing town in terms of population and economy, which means increased volumes of pharmaceutical waste generated due to the new upcoming pharmacies and the indiscriminate over the counter purchase of drugs. Most of this can be found in local dustbins and open pit and garbage sites. It is against this background that this study was being conducted to determine the common methods of pharmaceutical waste management disposal in sanitation service chain in Nkubu town, Imenti south of Meru.

Methodology

A descriptive cross-sectional study design was utilized where structured questionnaires were used for data collection. The study was conducted in Nkubu town, Meru County-Kenya during the months of January to April 2022. The study population was community pharmacy managers and household heads above the age 18 years, who were residents of Nkubu town at the time of data collection. A total of 380 household heads and 19 community pharmacies managers were sampled to participate in this study. All questionnaires were double-checked for accuracy

and collected data were entered into Statistical Package for Social science (SPSS) version 22 for analysis. Descriptive statistics were used for analysis and findings were presented in tabular form. Written informed consent was obtained from all the respondents. Participation in this research was voluntary and the identity of respondents was kept confidential.

Ethical approval and clearance was obtained from Meru University Institutional Research and Ethics Review Committee, MIRERC Number: MU/1/39/28 Vol. 2(58) and the National Commission for Science, Technology & Innovation (NACOSTI/P/22/16821). Permission was sought from Imenti South Sub county health department to carry out the study.

Results

The study findings showed that 23.9% (n=91) of the households use pit latrines as the most common methods of pharmaceutical waste disposal. Other methods used by households include burning 20.5% (n=78), sewer 17.4% (n=66), dumping the wastes in the nearby bushes 10% (n=38), burying 9.7% (n=37), use of compost pit 5.5% (n=21), disposing in litter bins 4.5% (n=17), 4.2% (n=16) use toilets) while 3.2% (n=12) never specified which method of waste disposal as shown in table 1.

Method of PW Disposal	F	%
Pit Latrines	91	23.9%
Burning	78	20.5%
Sewer	66	17.4%
Throw in the bush	38	10%
Burying	37	9.7%
Composting	21	5.5%
Bins	17	4.5%
Toilets	16	4.2%
Not specified	12	3.2%
Draining in the Sink	4	1.1%
Total	380	100%

Table 1: Common Methods of pharmaceutical waste disposal among the households

On the hand, in Community Pharmacies, the most common method of pharmaceutical waste disposal was Burning 73.5% (n=14) followed by composting 15.9% (n=3)

The study results of the methods of pharmaceutical waste disposal adopted by Community Pharmacies are as summarized in table 2

Similarities were observed from the study that showed burning, composting and pit latrines were the most commonly used methods of pharmaceutical

Methods of PW disposal	Frequency (n)	Percentage (%)
Burning	14	73.5
Composting	3	15.9
Pit latrine	1	5.3
Municipal collection	1	5.3
Total	19	100%

Table 2: Common Methods of pharmaceutical waste disposal among the CPMs

waste disposal in both the households and the community pharmacies.

Discussion

Currently, pharmaceutical waste management and disposal methods are issues that have gained attention of major stakeholders because it has been realized that indiscriminate and improper disposal can contaminate the environment and pose the risk to water, air, agricultural products, food chain, even harm animals/ livestock and eventual effects on sanitation chain Harhay et al, (2019). The various methods of disposal of unwanted pharmaceuticals that are practiced determine their presence in the environment and their potential to contaminate water Giusti, L. (2009). Households and community pharmacies contribute to environmental concerns related to pharmaceutical waste since they dispose the unwanted pharmaceuticals through sink, toilet or in a trash bins All of these methods have detrimental impacts on the environment and the sanitation chain Cormican et al.,(2010). Globally, the disposal methods currently used are evident in various studies which have been conducted worldwide (Beckel *et al.*, 2011).

Previously, it was believed that the most appropriate disposal methods of unused or expired medications was to flush them down the toilet / drain, as opposed to discarding them in the trash, where animals or humans would be more likely to encounter them (Chasler, 2011). Therefore, studies have been conducted throughout the world on this significant public health and sanitation issue to find the policy

solutions. Iosue (2020) retaliates that there are limited studies that have been conducted to determine how pharmaceutical waste generated by community pharmacies and households are managed. This is the first study to be conducted at Nkubu town in Meru County-Kenya.

The results of this study found that majority of the households disposed the pharmaceutical waste by emptying in the pit latrines. This is contrary to a study conducted in Nairobi-Kenya by Mugumura

(2015) who cites poor practices of disposing unwanted/expired pharmaceuticals in households as being responsible for a large portion of pharmaceuticals in water. The majority of consumers flush expired and unexpired drugs into sinks, toilets or dispose them into garbage bins (Ghosh, 2020). According to the report by Ghosh (2020), 54% of participants kept medications in homes and 35% flushed drugs into the sink or toilet which is comparable to this study where 4.2% of the respondents flushed in the toilets and the majority disposed in latrines at 23%. Studies conducted in Southern California revealed that 45% of the respondents were disposing expired drugs in the trash and 28% in sinks or toilets, Pollo et al, (2019). In King County Washington, 52% of people threw away unused medications, while 20% flushed expired drugs in sinks and toilet. Pollo et al, (2019) indicates that only 1% of people return people return expired/unused drugs to pharmacists.

The results of this study also differ from a similar study where Rogowska et al., (2019) carried out 2-case studies on household pharmaceutical waste practices in Poland. The first survey focused on identification of the consumption scale of pharmaceuticals and disposal of pharmaceutical waste where 68% of the participants reported to be disposing the household pharmaceutical waste by flushing them into toilets and sinks. The second survey reported that 35% of the population disposed waste into toilets, less than 30% practiced return of expired medication to pharmacies.

Similarly, a study carried out in households, from Ethiopia found that unwanted pharmaceuticals are thrown into trash, flushed down the toilet, burnt, buried, given to a sick neighbor or thrown to the environment. Others keep them in the house for the next use because they don't know the right way to dispose unwanted pharmaceuticals (Mekonnen & Fentie, 2014). Flushing pharmaceuticals in the toilets ends up in water purification systems which are not sufficiently equipped to handle them hence contaminating drinking water which can further contribute to development of antibiotics resistance, or exposure of populations to irritant or mutagenic anticancer drugs and the possible link between endocrine disrupting compounds and failing fertility of the aquatic life (Mekonnen & Fentie, 2014)

Disposing unwanted pharmaceuticals using methods such as burning, burying, throwing in the bushes, dumping together with other garbage are undesirable in the sense that they contribute to environmental pollution to both human and animals, for instance presence of hormones and steroids in water are linked to the reproductive problems and lowers immune response in fish and frogs and they may find their way into water bodies and drinking water. This is clearly shown in a 2002 study in the US geological survey (Simon 2010). The results of these surveys and those of this study differ because of differences in socio economic status of the populations and countries involved.

The results of this study also revealed that majority of the community pharmacies practiced burning as the preferred method of pharmaceutical waste disposal. This results concurs with those of a cross sectional descriptive study conducted on 25 community pharmacies in upper hill, hurlingham, central business district and Downtown area of Nairobi- Kenya (Njenga, 2008) that focused on disposal and handling of pharmaceutical waste by community pharmacies outlets. The findings revealed that 95% of the community pharmacies generate a substantial amount of pharmaceutical waste. In the same study Njenga (2008) also noted that 36% of the community pharmacies did not know how to dispose the generated pharmaceutical waste. The other third relied on high and medium temperature incineration, and nearly 34% practiced open dumping, sewer disposal and open burning. Burning, sewer disposal and open dumping is thus practiced in both the urban and rural areas of the country hence contamination of the sanitation service chain.

Similarly, Tanzania is one of the African countries where guidelines for PWM were available (titled "Guidelines for disposal of unfit medicines and-cosmetic products, First Edition, 2009"). The guidelines were developed by the Tanzania Food and Medicines Authority (TFDA), which is the equivalent of the Kenyan PPB which is the drugs regulatory authority in Tanzania. However, enforcement and compliance with the guidelines was poor, even for government health facilities (Matiko, 2012). Matiko (2012), in his study in Tanzania reported that 72.4% of the respondents from community pharmacies buried their pharmaceutical wastes at the Dares Salaam dumpsite while 31% burned their pharmaceutical wastes. Only 37.9% mentioned incineration as one of the options for pharmaceutical waste disposal which was at variance with the Tanzania food and medicines authority (FDA) guidelines which required Pharmaceutical waste to be either land-filled

or incinerated save for a few specified exceptions. This results differ with the findings of this study that revealed that of the community pharmacies practiced burning as the preferred method of pharmaceutical waste disposal.

In conclusion, the literature reviewed showed a generally poor state of pharmaceutical waste management disposal methods in developing countries (Matiko 2012, National Healthcare Waste Management Plan-2008, Mugoyela & Ally 2002, Wafula 2013). Pharmaceutical waste management disposal is a fairly recently recognized and evolving sanitation and environmental areas of concern. Safe disposal of pharmaceuticals waste plays a significant role in reduction of contamination across the sanitation service chain. Pharmaceutical waste management disposal is a serious issue that has gained both county government and national Government attention due to their various effects on both the human population, the environment and across the sanitation chain (MOH national health care waste management plan 2008-2012).

Conclusion

The common method of pharmaceutical waste disposal being practiced in community pharmacies was burning while for households it was emptying in the pit latrines. Disposal of unwanted pharmaceutical products through unsafe methods along the sanitation chain was prevalent among the respondents. Moreover, community pharmacists are in an excellent position to educate patients on pharmaceutical waste disposal methods, therefore leveraging their knowledge through training programs and continuous education is of importance.

Recommendations

There is need to create public awareness and establish educational programs regarding management and handling of unwanted pharmaceutical wastes among community pharmacies and households in Nkubu town. In addition a detailed national study is recommended to investigate the magnitude of pollution with Pharmaceutical waste across the sanitation chain in Kenya.

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