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HANDLING PROCEDURES OF PHARMACEUTICAL WASTE AMONG MEDICAL FACILITY IN NAKURU TOWN, NAKURU COUNTY, KENYA

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Abstract

The study aimed at handling pharmaceutical waste (anti-biotics) procedures among medical facilities and their contribution to environmental pollution in Nakuru town. There is growing public concern over pharmaceutical substances remnants in water and the environment. This pharmaceutical waste includes antibiotics, which interfere with the water treatment process since most depend on biodegradation. This was achieved by conducting a social survey. The Social survey was used to collect data on handling pharmaceutical waste (antibiotics) procedures among medical facilities. Data was then processed and analysed using descriptive statistics. In this study, 69.57 per cent of the respondents indicated that public health officers were responsible for pharmaceutical waste handling. A total of 83.12 per cent of the respondents indicated that they do not transport pharmaceuticals to other facilities since disposal is done on-site; hence, pharmaceuticals are handled at the point of generation. It was also noted that 75.03 per cent of those who transport pharmaceuticals for disposal outside the facility said they use government vehicles for transport, while 64.4 per cent indicated that they use all protective gear while handling pharmaceutical waste. Also, 89 per cent said that they use waste sacks when transporting pharmaceutical waste for disposal. The study provides information on handling procedures that can add information to the existing database and also serve as baseline data for researchers interested in related studies.

Key terms: Antibiotics, environmental pollution, handling procedures, medicine resistance, pharmaceutical waste.

1.0 INTRODUCTION

Pharmaceutical waste in healthcare is referred to as hazardous waste (Jovanovic et al., 2016). Pharmaceutical waste includes all expired pharmaceuticals, all unsealed syrups or eye drops, all cold chain damaged pharmaceuticals, all bulk or lose tablets and capsules also, includes all unsealed tubes of creams and ointment, whether expired or not (Oxfam, 1999). They also include pharmaceutical products, drugs, and chemicals that have been returned from wards, have been spilt, are outdated or contaminated, or are to be discarded since they are no longer required (Hoboy, 2011). In addition, abandoned items that are used to handle pharmaceuticals, such as bottles and boxes with pharmaceutical remnants, gloves, connecting tubes, and drug vials, are also forms of pharmaceutical waste (WHO, 1999). Healthcare facilities, including hospitals, clinics, dispensaries, laboratories, maternities, and pharmacies, are some of the primary sources of pharmaceutical waste (Pruss & Townend, 1999). They are generated daily during the provision of healthcare services to patients.

Pharmaceutical wastes form part of the 15 per cent of the global medical waste generated that poses an imminent danger that threatens both the environment and the safety of the public. (Oweis et al., 2005). Due to the hazardous nature of pharmaceutical wastes, there is a need for their safe handling during their generation and during disposal. Although some parts of the world, mostly in developing countries, there needs to be more attention compared to the developed countries on pharmaceutical waste handling (WHO, 1999). In Africa, pharmaceutical wastes handling in medical facilities are a serious concern, with only a few governments providing practical guidelines for their management (Environmentalists Sans Frontiers, 2005).

Unwanted pharmaceuticals can be a waste stream difficult to manage and generate in households and at different medical facilities. Even though Sanofi Report (2018) indicates that only a small proportion of medicines enter the environment through waste disposal in Belgium, Colombia, France, Greece, Japan, Mexico, Portugal, Spain, and North America, improper disposal of unused drugs may pose serious threats to human and environmental health. In case there is a generation of unused and expired medications, healthcare providers, patients, and family members require clear guidance about pharmaceutical disposal. Proper management of drugs reduces avoidable human poisoning, prevents intentional misuse of unwanted prescription drugs, and protects water quality and fish. However, improper disposal of unwanted medicines from households and healthcare facilities can be managed and controlled (Bashaar et al., 2017).

2.0 LITERATURE REVIEW

In 1999, the World Health Organization, in collaboration with partners, engaged with procurement and drug safety authorities to develop clear guidelines for the disposal of unwanted pharmaceuticals safely in and after emergencies (WHO, 1999). However, handling methods of unwanted pharmaceuticals varies from one country to the other and from place to place (Sanofi Report, 2018).

The Ministry of Health in Kenya, through the Pharmacy and Poisons Board (PPB), provides all healthcare providers, pharmaceutical manufacturers and distributors, and every other stakeholder linked to pharmaceutical waste disposal comprehensive guidelines for safe pharmaceutical waste management. The Guidelines for Safe Management of Pharmaceutical Waste document, which was availed to the general public in the year 2022, guides all stakeholders with appropriate explanations of how to classify

pharmaceutical waste and dispose accordingly. Proper pharmaceutical waste disposal means that all possible practical steps that need to be taken have been taken, and the waste is handled in a manner that protects the people and the environment against any adverse effects that result from pharmaceutical waste (Ferreira et al., 2009).

Handling pharmaceutical waste is a challenge, especially in low and middle-income countries, as they cannot afford the recommended technologies to dispose of it well. Most facilities in these countries end up using improper methods of disposal. They are three major methods of disposal that are commonly used; flushing, burning, and dumping with other wastes (Siler et al., 2010). In developed and developing countries, traces of prescribed and over-the-counter medications were found tossed in dumpsites or flushed in the drain (Khalid et al., 2013). When pharmaceuticals are improperly handled and get to the waterways, they become a risk to humans and the environment. Consumption of this kind of water can further contribute to the 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). Therefore, it is recommended that unwanted pharmaceuticals should be handled separately from other wastes. Pharmaceutical wastes should be rendered undesirable and unrecognisable by mixing them with household waste in unreadable packaging or by scratching out or removing any labelling identifying personal prescription information (Sanofa Report, 2018). High population, coupled with the high number of facilities, lack of awareness in the society, inadequate infrastructure, and poor waste management practices promote ill-management of pharmaceutical waste. Among the challenges that hinder proper pharmaceutical waste disposal is a lack of a legal framework that guides the stakeholders involved in the management of pharmaceutical waste (Sanofa Report, 2018).

Health care wastes require sound management, including staff training, proper use of tools, machines, and pharmaceuticals, adequate disposal methods inside and outside the medical facilities, and process evaluation (WHO, 2003). This ensures proper hygiene in the health institution and the safety of healthcare workers and communities (Sanitation Connection, 2002). Therefore, training for the appropriate and safe management of healthcare waste, including pharmaceutical waste in hospitals, is of great importance for dealing with these types of hazardous healthcare waste properly; this training has to comply with the legal framework and good practice guidelines on Health Care Waste Management, by abiding by rules set up by WHO's In Kenya. The National Health Care Wastes Management (HCWM) action plan was evolved to provide feasible options and a roadmap for managing healthcare waste for five years. This plan's main aim was to develop an instrument that could give health managers direction in planning, implementing, and monitoring activities of managing waste in health facilities (MoH, 2007).

Environmental Management and Coordination Act - Waste Management Regulations (2006) deals with waste management by giving provisions for setting standards, licensing waste disposal sites, and control of hazardous waste (NEMA, 2006). However, the practice of all legal requirements concerning pharmaceutical waste management has yet to be fully implemented in most health facilities, and this might be due to inadequate training of medical staff and lack of enforcement among the regulating authorities. As a result, pharmaceutical waste management practices in hospitals are inadequate when it comes to the collection, proper segregation, storage, and disposal of this waste stream (Jovanovic et al., 2016).

A study by Njiru et al. (2013) found that the level of awareness in managing pharmaceutical waste among medical staff members in Kenyatta National and Referral Hospital was 60 per cent. The promotion of proper handling and disposal of pharmaceutical waste is an important activity for medical facilities. Antibiotics are medicines used for treating infections and diseases caused by bacteria. According to a study carried out among households on pharmaceutical waste disposal, antibiotics were found to be the most disposed of pharmaceuticals (Orina et al., 2017). Availability of pharmaceuticals in drinking water can further contribute to the 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). Pharmaceutical waste management is a global challenge not only at the level of households but also at medical facilities. Hence, This study aimed to analyse pharmaceutical waste handling procedures among medical facilities and their contribution to environmental pollution in Nakuru town.

3.0 METHODOLOGY

This study used a cross-sectional study with purposive sampling to select health facilities for collecting data for a social survey. All types of staff in the chosen healthcare facilities were targeted, including administrators, doctors, nurses, laboratory technicians, pharmacists and waste handlers. Personnel from selected departments were also sampled so as to have a broad range of information on pharmaceutical waste types generated and their management practices. Healthcare facilities in Nakuru East and Nakuru West health centres and their personnel who were differently involved in pharmaceutical waste management and its disposal were included. Those who gave consent to participate were recruited for the study.

The sample size was determined using Daniel's formula 1999;

$$N = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)}$$

Where;

n=Sample size with finite population correction.

N=Population size.

Z = z statistic for the desired level of confidence. The desired level of confidence is 95%.

P = Expected proportion (in the proportion of one).

d= Precision (in the proportion of one).

Nakuru town has 122 health facilities, both government and private; since our total number of health facilities, which is our (N), is equal to 122, our sample size, which is (n), can be obtained from equation 3.1

Substitution: $n=\frac{122 \times 1.96^2 \times 0.5(0.5)}{0.05^2(121) + 1.96^2 \times 0.5(0.5)}$

n=92.77

n=92 health facilities.

This gave a sample size (n) of 92 health facilities.

The instrument that was used in generating primary data included questionnaires, which were administered to health personnel. In addition, observations during field visits were also done using an observation checklist to note down key aspects, which were later evaluated. With regards to health

care delivery, Nakuru town has two sub-counties, namely Nakuru East and Nakuru West. The 122 health facilities include government-owned-17, privately owned by individual-85, non-government organizations-5 and faith-based ones owned by religious body-15. Nakuru East has (77) health facilities; (6) government-owned, (3) non-government facilities, (8) Christian-owned health facilities and (60) privately owned health facilities. While on the other hand, there are 45 health facilities in Nakuru West, with (11) government-owned health facilities, (2) non-government, (7) faith-based owned health facilities and (25) private-owned health facilities.

4.0 RESULTS AND DISCUSSIONS

Handling Procedures of Pharmaceutical Waste

Pharmaceuticals are handled in two ways that include both proper and improper ways. When pharmaceuticals are handled in a proper way, then they will not get to the environment and hence will not contaminate the environment, but when handled improperly, they are likely to be unsafe to both the environment and humans hence affecting them negatively.

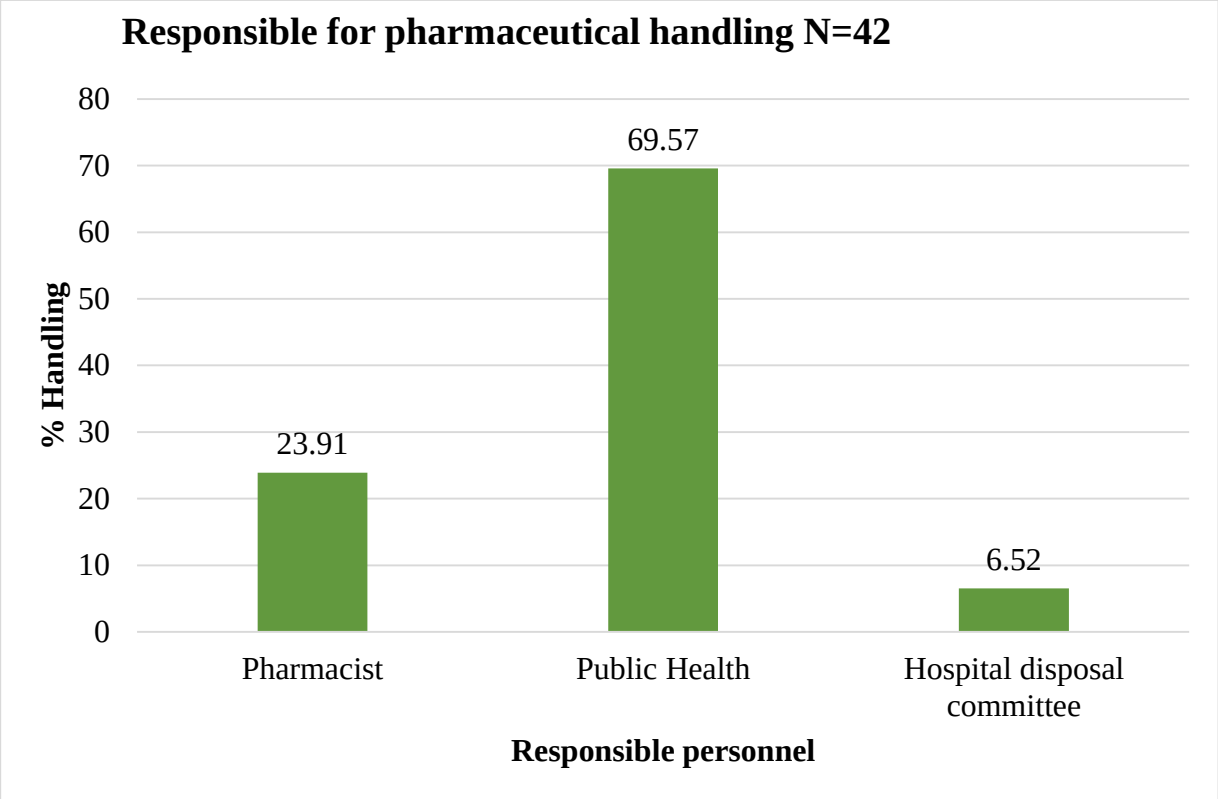

Figure 1: Responsible Personnel for Pharmaceutical Handling

From the figure above, we can identify that 69.57 per cent of the respondents tend to believe that public health officers are responsible for the disposal of pharmaceutical handling among medical facilities, followed by pharmacists, with 23.91 per cent of those who believed that the hospital disposal committee was responsible only 6.52 per cent. However, various studies (e.g., Kuchibanda & Mayo, 2015; Tope et al., 2018) suggest that hospitals should have a dedicated person that is trained in the proper disposal of medical waste to be responsible for disposal. If the people who are responsible for disposal are

knowledgeable enough on matters related to the composition of the pharmaceuticals and their dangers to the environment and humans if they are improperly disposed of, then they are likely to advise the facilities on which methods to use for disposal and even offer education and training on proper handling of pharmaceutical waste. When facilities are aware of the consequences of improper disposal, they are likely to use proper and recommended disposal methods, such as incineration, which will not predispose the environment to pharmaceutical contamination.

Handling during Transportation

83.12 per cent of the respondents do not transport pharmaceuticals out of the facility for disposal since they do disposal on-site. 75.03 per cent of those who transport unwanted pharmaceuticals for disposal said they use county government vehicles to transport the unwanted pharmaceuticals. The government vehicle will tend to have been licensed by NEMA, be roadworthy, and fulfil the recommended and approved criteria to transport such kind of waste. By doing so, the leakages of waste out of the vehicles are not likely to occur, and the safety of the staff handling it will be ensured. This implies that the environment will not be contaminated, protecting the health of both the public and the environment.

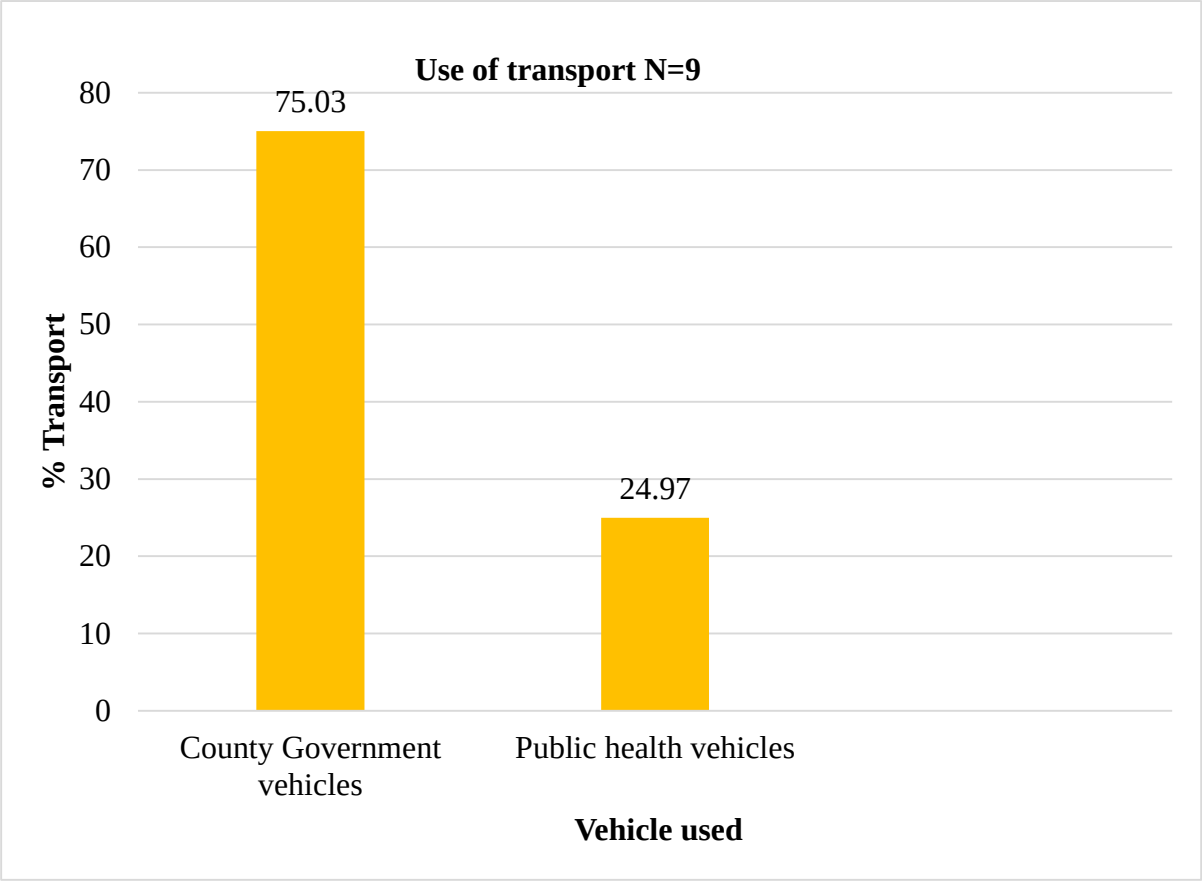

Figure 2: Vehicles used to Transport Pharmaceuticals

Protective Gear Use

The respondents were interviewed on the use of protective gear, and the majority, 64.4 per cent, indicated that they use all the protective gear (overalls, gloves, masks, caps, and boots). This is consistent with a

study by Basak et al. (2019), who found high use of protective equipment, especially gloves (45%) and boots (67%), among medical practitioners while handling unwanted pharmaceuticals in Bangladesh. Since a majority of the respondents use protective gear when handling pharmaceutical waste, it implies that occupational safety and workers' health during the handling of this waste is guaranteed in both the collection and disposal process.

Table 1: Protective Gears Used When Handling Pharmaceutical Waste

Types of gears used	**Frequency**	**Percentage**
Overalls	1	1.26
All of them	47	64.4
Gloves, masks, caps	2	2.74
Except for boots	3	4.12
Boots, Gloves, Masks	4	5.48
Overalls, gloves, masks	3	4.12
Except for caps	13	17.81
Total	**73**	**100**

When interviewed on the use of waste sacks, 89 per cent of the respondents suggested that they use waste sacks when transporting the pharmaceutical for disposal. A total of 39 per cent of them further indicated that the waste sacks used to carry unwanted pharmaceuticals are not subjected to tear. A total of 97 per cent also confirmed that the waste sacks are always fastened before the pharmaceuticals are transported. Also, 97 per cent said that the waste sacks prohibit liquids from running out. The high use of proper disposal bags (waste sacks) is consistent with other studies (such as (Eren & Tuzkay, 2019; Al-Khatib et al., 2020; Oduro-Kwarteng et al., 2021) who found the use of proper waste disposal bags was prevalent in their specific studies in Turkey, Palestine, and Ghana respectively. The use of waste sacks during the transportation of pharmaceutical waste prevents the waste from leaking into the environment before proper disposal. If the leakages happen, then the environment will be contaminated with pharmaceuticals, even if proper disposal of the pharmaceuticals will be done offsite if there are leakages during transportation, then proper disposal will not be of any importance. This implies that handling pharmaceuticals even before disposal is critical since it will determine whether the pharmaceuticals will get to the environment. If they leak and get into the environment, they could have predisposed the environment to pharmaceutical contamination. The presence of pharmaceuticals in the environment raises the potential of eventual soil, groundwater, and surface water contamination due to improper handling of pharmaceuticals even before disposal.

Table 2: Waste Sacks in Transporting the Pharmaceutical for Disposal

Waste sack use, tear, fastening, prohibition of liquids running out	**Percentage**
Waste sack use	
Yes	89.04
No	10..95
N	73
Total	100.0

Waste sack tear	
Yes	39.01
No	60.99
N	41
Total	100.0
Waste sack fastening	
Yes	97.75
No	2.25
N	45
Total	100.0
Prohibition of liquids running out	
Yes	97.70
No	2.30
N	**44**
Total	**100.0**

5.0 CONCLUSIONS AND RECOMMENDATION

Conclusions: The results on handling the majority indicated that public health officers are responsible for unwanted pharmaceutical handling among medical facilities. Also, the majority of pharmaceutical waste handlers use all protective gear during the handling and disposal of pharmaceutical waste among medical facilities. Nevertheless, there is still a necessity for more knowledge on pharmaceutical waste handling, and this has influenced unwanted pharmaceutical waste handling. Other factors that have influenced how the medical facilities handle unwanted pharmaceuticals include the lack of incinerators in the facilities, which has led the facilities to transport the pharmaceuticals to other facilities for incineration. This poses high occupational risks to the staff and the environment that occurs during the handling of the waste before and during the transportation of pharmaceutical waste to the disposal site.

Recommendation: There is a need to establish more public awareness and educational programs regarding managing and handling unwanted pharmaceutical waste among medical facilities that would highlight the effects on humans and the environment if they are poorly handled and disposed of.

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