LAIKIPIA UNIVERSITY JOURNAL OF SCIENCE AND APPLIED TECHNOLOGY

Disposal Practices of Pharmaceutical Waste among Medical Facilities in Nakuru Town, Nakuru County Kenya

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Abstract

There is growing public concern over presence of pharmaceutical substances remnants in water and the environment. This pharmaceutical waste includes antibiotics, which interfere with water treatment process since most depend on biodegradation. Antibiotics have immense effects on non-target organisms, both human beings and aquatic life, when they get exposed; such effects include medicine resistance to humans, increase in morbidity and mortality of the population due to unintentional poisoning, and failing fertility of the aquatic life. The study aimed at disposal practices of pharmaceutical waste (anti-biotics) among medical facilities and their contribution to environmental pollution in Nakuru town. This was achieved by conducting a social survey. The Social survey was used to collect data on disposal practices of pharmaceutical waste among medical facilities. Data was then processed and analysed using descriptive statistics (percentages, frequencies). The study revealed that 11 percent of metronidazole are disposed on site both Benzyl penicillin with 7 percent and ceftriaxone with7 percent. Other antibiotics are highly disposed in the on -site with 36 percent. In the offsite disposal other antibiotics are disposed with 8 percent and only metronidazole was found to be disposed offsite with 3 percent. On methods of disposal incineration (50%) was the most practiced method of disposal. 8 percent of those who choose incineration as the most practiced method of pharmaceutical wastes disposal said that though they practice incineration it is done outside their facility, other methods used for disposal were burning 9% followed by burying 5 percent. The study provides information on disposal practices that can add information to the existing database and also serve as a baseline data for researchers interested in related studies.

Keywords: Anti-biotics, disposal methods, incineration, medical facilities, pharmaceutical waste

Volume 1, Number 2, 2022 ISSN N0 2791-1926

Introduction

Pharmaceutical waste in healthcare is referred to us 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 loose tablets and capsules also includes all unsealed tubes of creams and ointment whether they are expired or not (Oxfam, 1999). They also include pharmaceutical products, drugs, and chemicals that have been returned from wards, have been spilled, are outdated or contaminated, or are to be discarded because they are no longer required (Hoboy, 2011). In addition, abandoned items that are used to handle pharmaceuticals, such as bottles and boxes with pharmaceutical remnant, gloves, connecting tubes, and drug vials are also form of pharmaceutical wastes (WHO, 1999). Health care facilities including hospitals, clinics, dispensaries, laboratories, maternities, and pharmacies, are some of the primary sources of pharmaceutical wastes (Pruss and Townend, 1999). They are generated daily during the provision of healthcare services to patients.

Pharmaceutical wastes form part of the 15 percent of the global medical wastes generated that are a threat to the environment and public health (Oweis et al., 2005). As a result of the hazardous nature of pharmaceutical wastes, there is need for their safe handling and disposal. Although some parts of the world, mostly in developing countries, there has been less attention compared to the developed countries on pharmaceutical wastes 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).

There are various Factors contributing to the accumulation of unwanted pharmaceuticals, this includes changes in dose, death of patient, non--adherence to therapy or non--completion of course of therapy, over-prescribing of pharmaceuticals and discontinuation of treatment due to unpleasant side effects (Daughton & Ruhoy, 2008).

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

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institution and the safety of healthcare workers and communities (Sanitation Connection, 2002). 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 be in accordance with the legal framework and good practice guidelines on Health Care Waste Management, by abiding to rules set up by WHO's recommendations. This has been implemented in a number of countries, such as India (Patil and Pokhrel, 2004). Recommendations and guidelines from WHO and the UN are of utmost benefit for the development of actual healthcare waste management in hospitals, this includes appropriate waste management plans and pharmaceutical waste management (White et al., 2006).

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 (MoH, 2007). The main aim of this plan was to come up with an instrument that could give health managers direction in planning, implementing and monitoring of 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 of waste disposal sites and control of hazardous waste (NEMA, 2006). However, the practice of all legal requirements concerning pharmaceutical waste management is not 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. 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 out that the level of awareness in the management of pharmaceutical waste among medical staff members in Kenyatta National and Referral hospital was at 60 percent. The promotion of proper handling and disposal of pharmaceutical waste is an important activity for medical facilities. Segregation of pharmaceutical wastes immediately after administration of medications is an essential daily practice in hospitals (WHO, 2015). Nowadays, many developing and undeveloped countries increased healthcare waste segregation to ensure safe practices for disposing and managing of hazardous waste, such as infectious, pathological and pharmaceutical wastes.

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Antibiotics are medicines used for the treatment of infections and diseases caused by bacteria. According to a study carried among households on pharmaceutical waste disposal antibiotics were found to be the most disposed 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 an irritant or mutagenic anticancer drugs and the possible link between endocrine-disrupting compounds and failing fertility of the aquatic life (Mekonnen and Fentie, 2014). Pharmaceutical waste disposal is a global challenge not only at the household level but also at the medical facilities. This study hence aimed at analysing disposal practices of pharmaceutical wastes among medical facilities and their contribution to environmental pollution in Nakuru town.

Theoritical Framework

Various theories have been recognised as applicable to pro-evironmental behaviour (Nisbet & Gick, 2008; Pronello & Gaborieau, 2018). One of the theories is the protection motivation theory. The theory was first written by Rogers in 1975. It sought to explain ways in which fear-appeals results to change in behaviour. That an individual's decision to undertake activities that prevents exposure to risks is driven by determination to protect themselves from threats. The decision is made based on the results of the threat appraisal and coping appraisal (Rogers, 1986). Threat appraisal is determined by how an individual perceives the seriousnes of a threat (severity), the probability of being exposed to the threat (susceptibility) and benefits of maladaptive response (failure to engage in protective behaviour) (Prentice-Dunn & Rogers, 1986, Norman et al., 2015). For example, when susceptibility and severity are low and maladaptive response is high, the general threat appraisal is low. On the other hand, cognitive appraisal is determined by individual's ability to accomplish the protective behaviour (self-efficacy), the efficacy of adaptive response in preventing a threat (response efficacy) and response costs that are expenses associated with adopting a protective behaviour (Norman et al., 2015). Therefore, if self-efficacy and response efficacy are low and response costs are high, coping appraisal will be generally low. The threat and coping appraisal processes determines an individual's decision to engage in protective behaviour. Where the threat and coping appraisal are perceived to be high, the intention to implement protective increases (Norman et al., 2015).

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The protective motivation theory has its application in various areas including sustainable waste management systems (Janmaimool, 2017). The world health organization has laid down procedures on medical waste handling including pharmaceutical waste. Medical waste is hazardous and therefore needs to be properly disposed to protect the environment and people's health. Adherence to the disposal guidelines of the waste (including pharmaceutical waste) is a protective behaviour that should be implemented by all workers in a medical facility. However, their intention to engage in the protective behaviour is determined by their threat and coping appraisal. If their threat and coping appraisal in generally high, then their intention to engage in protective behaviour (adherence to WHO guidelines on pharmaceutical waste disposal) will increase. The threat and coping appraisal can be increased in cases where it is low through training and reminders on the importance of adapting and engaging in protective behaviour.

Conceptual Framework

The independent variables include handling procedures, disposal practices of pharmaceutical waste and traces of selected antibiotics (Metronidazole, Benzyl penicillin and Ceftriaxone) in incinerator ash. These variables determine the presence of pharmaceutical pollutants which cause environmental pollution. The dependent variable for this study is presence of pharmaceutical waste in the environment. Disposal practices such as dumping of the pharmaceutical waste in open dumpsites can contaminate sediments in the area. It can also pollute surface water when they are washed away by runoff into rivers and lakes. Disposal practice such as incineration is recommended for most of the pharmaceutical waste; however, the process may result in more toxic compounds from chemicals especially if the incineration process is not effective. The resulting ash can, therefore, cause environmental pollution if it is disposed of carelessly.

On the other hand, handling procedures of pharmaceutical wastes can influence their disposal and their presence in the environment. For example, pharmaceutical wastes that may be more hazardous to a person may be disposed of more carefully compared to that which is perceived to be less hazardous. This will subsequently influence the amount that may be found in the environment. They may also interact with intervening variables such as the legal policies and regulation and demographic factors such as location of the medical facility, size of the medical facility, amount of pharmaceuticals stocked, number of patients within the medical facilities.

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The availability of legal policies and regulations put in place for disposal of pharmaceutical waste will determine handling procedures and disposal practice of the waste. If they are well implemented medical facilities are likely to dispose the pharmaceutical waste in a safe and proper manner hence there will be less environmental pollution from the disposal of pharmaceutical waste.

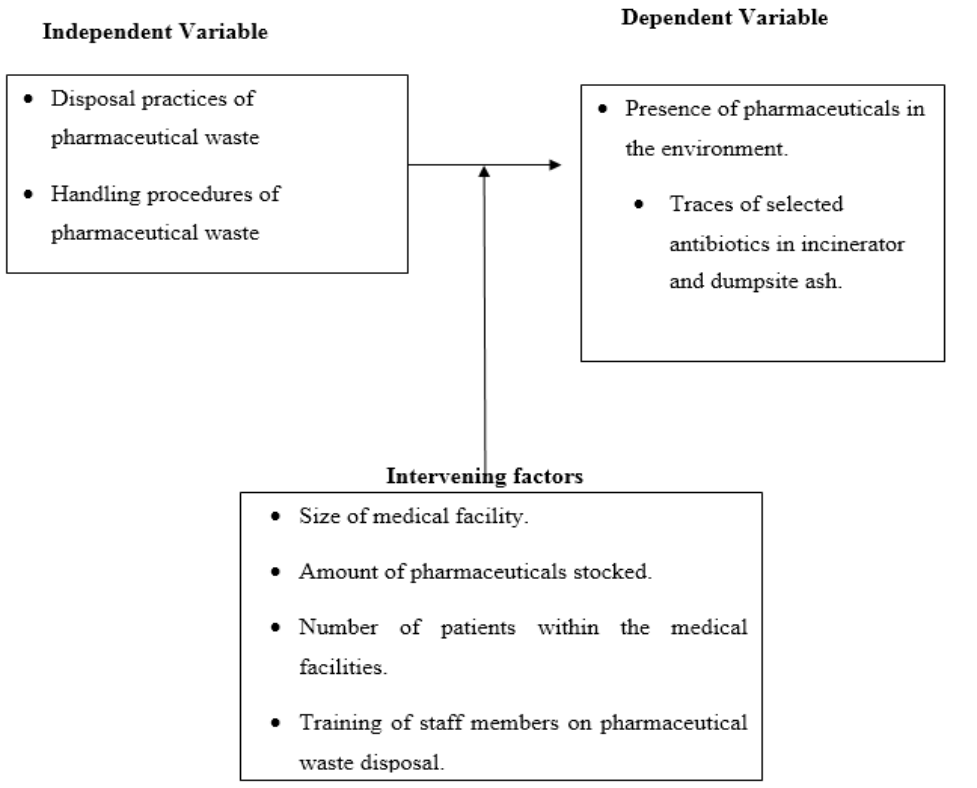

Fig. 1: Conceptual framework of the study

Methods

Description of Study Area

Nakuru Town is in Nakuru County which is located 160 km northwest of Nairobi on latitude -0.2833 and longitude 36.0667. It is the fourth largest urban Centre in Kenya after Nairobi, Mombasa, and Kisumu. It is situated at an altitude of 1859m above sea level and is within the region of the Great Rift Valley. Gioto dumpsite is located in London ward, Nakuru Town West Sub-County, Nakuru County along Nakuru-Sigor road. Nakuru was once dubbed the cleanest town

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in East Africa, but this has changed due to rapid urbanization coupled with high population growth. The pressures on the environment from the anthropogenic activities in the town have increased due to pollution within the town.

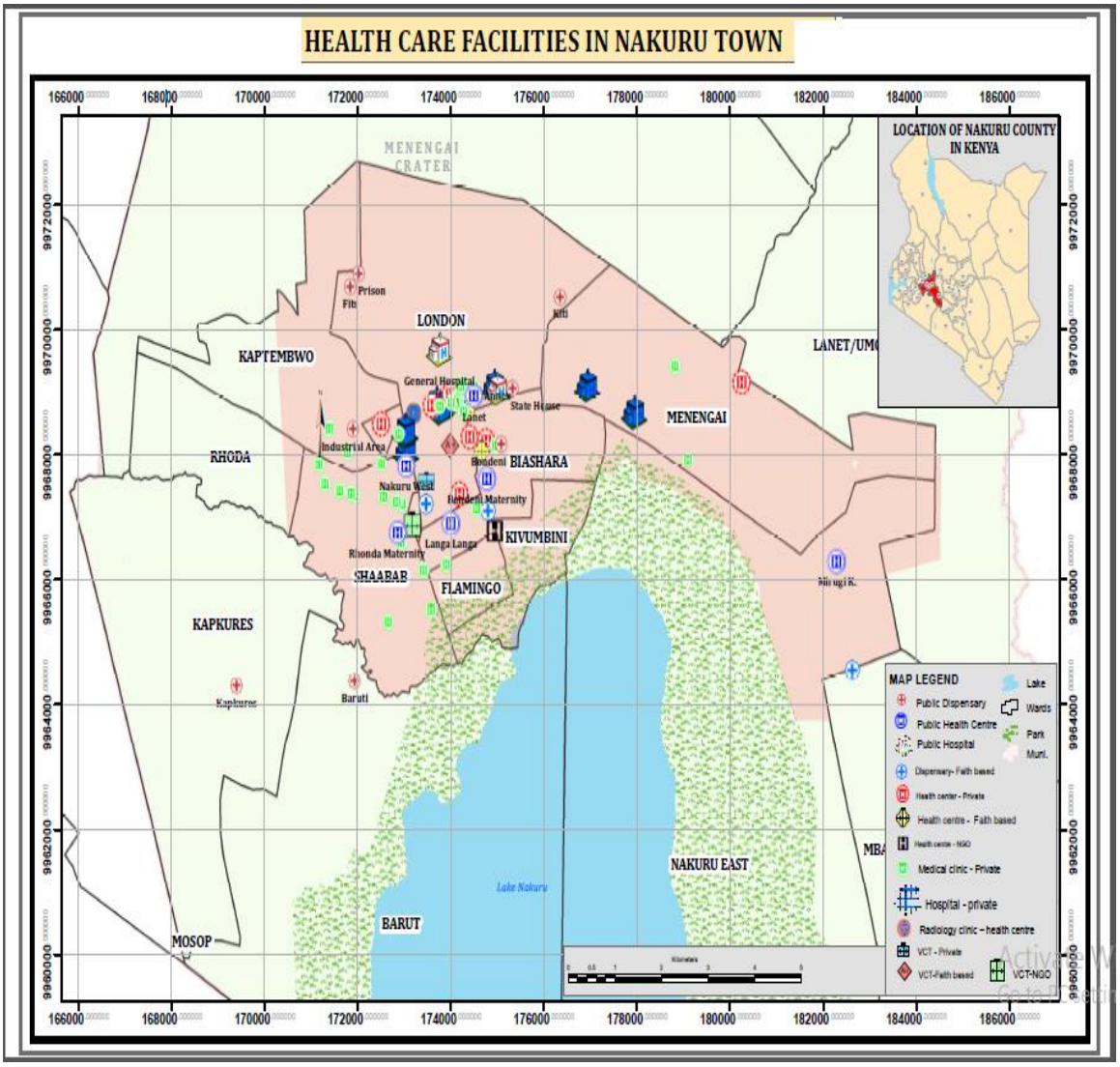

Fig. 2: Map of Healthcare facilities in Nakuru Town (Source: Map modified from Nakuru County Integrated Development Plan 2013 – 2017)

Data Analysis

Descriptive statistics was used to assess disposal methods of pharmaceutical waste among medical facilities in Nakuru town. The raw data obtained was sorted and coded. The open-ended questions

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were manually analysed by grouping responses into similar themes and tallying them. Frequencies were determined using excel spreadsheet. The closed-ended response was appropriately labelled and entered into the statistical package for social science software (SPSS). The data obtained was further presented in form of tables, bar graphs, and percentages.

Results and Discussions

Disposal Practices of Unwanted Pharmaceuticals

In this study the pharmaceuticals were being disposed using different methods which were further classified into two disposal types.

Disposal Type

The social survey indicated that approximately 70% of the disposal is done in the facility (on - site). On the other hand, those facilities that practice disposal outside the facility (off-site) was 16%.

Commonly Disposed Antibiotics

The findings of the commonly disposed antibiotics are given in the figure below.

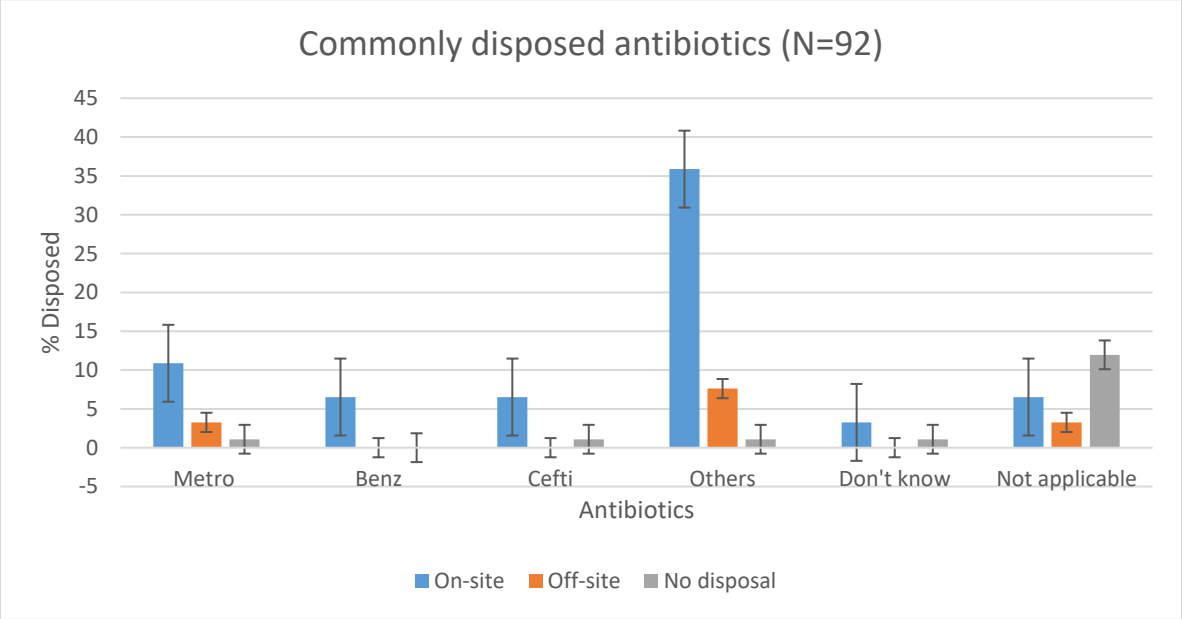

Fig. 2: Commonly Disposed Anti-biotics

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Other antibiotics are highly disposed in the on -site with 36%, 11% of metronidazole are disposed on site both Benzyl penicillin with 7% and ceftriaxone with7%. In the offsite disposal other antibiotics are disposed with 8% and only metronidazole was found to be disposed offsite with 3%. The results are contrary to the study done by (Momanyi et al., 2019) since ceftriaxone had the highest proportion of use followed by Benzyl penicillin and metronidazole is the least.

Methods of disposal

In the study the pharmaceuticals were being disposed using various methods which included both proper methods of disposal and improper methods of disposal.

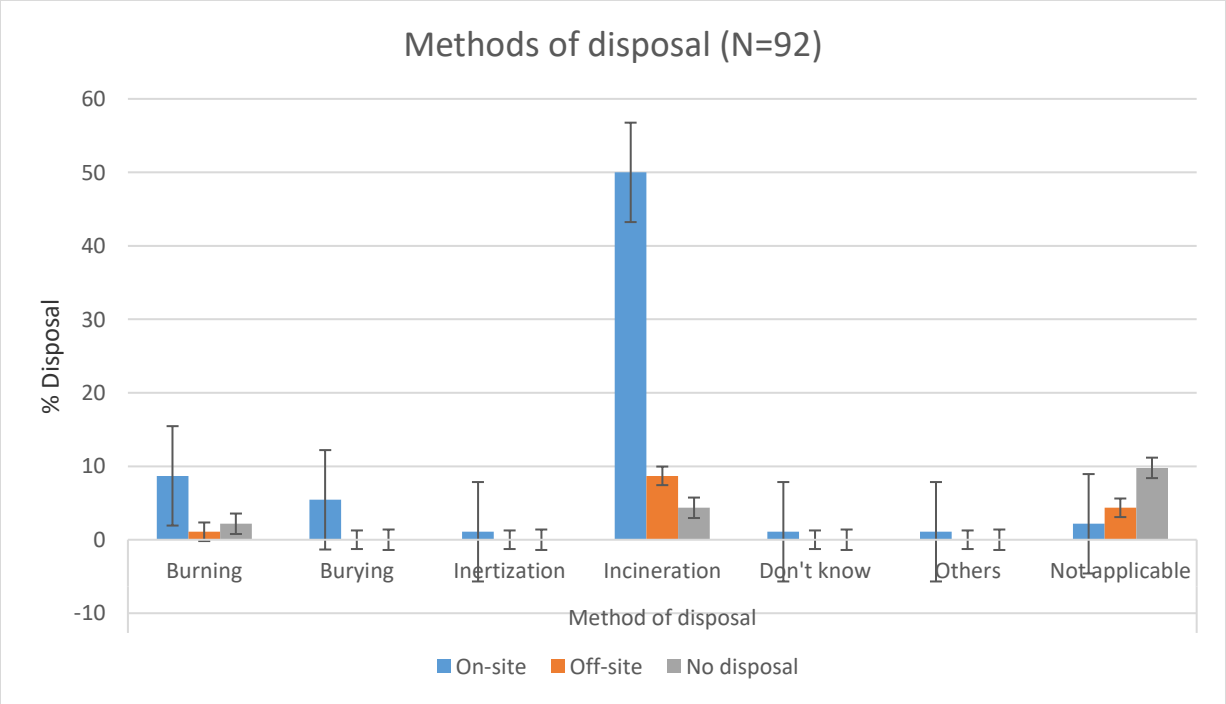

Fig. 3: Commonly Used methods of Disposal of pharmaceuticals

From the figure 3, above it is indicated that 50 percent of the respondents practice incineration as a method of disposal in their facility 8 percent said that they practice incineration but it is done outside their facility, other methods used for disposal were burning 9 percent followed by burying 5 percent. The study findings are contrary to the study (Sharon et al., 2010) that found out that there are three major methods of disposal that are commonly used for pharmaceutical disposal this includes flushing, burning and dumping.

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In this study we found out that most facilities in the study area practice incineration which is the most recommended method of pharmaceutical disposal that is suggested by most health and monitoring organizations including United Nations and World Health Organization (Smith et al., 2008). Incineration is the best method that destroys pharmaceutical and is friendly to the environment (WHO, 1999).

Conclusion

From the results on methods of disposal though majority practice incineration with 50 percent still we have some facilities that practice improper methods of disposal such us burning with 9 percent followed by burying 5 percent. These improper methods of disposal may contribute to availability of pharmaceuticals in drinking water which can further contribute to development of antibiotic resistance also can have possible link between endocrine disrupting compounds and failing fertility of the aquatic life.

Acknowledgement

Successful completion of this work was due to the support given from the Department of Environmental Science, Laikipia University which gave me the opportunity to pursue the course and facilities to study and carry out research. I appreciate the support given by my supervisors Dr. Veronicah N. Kimani, Prof. Wilkister N. Moturi and Dr Silvanus Shisia. I also acknowledge the assistance received from medical facility respondents who spared their time during my interaction with them. All the financial and moral support from my husband Dr. Kerama, my sons Jordan and Cayden and my dad Jeremiah. The support from the following institutions and companies is also appreciated; the Rift valley provincial Hospital, Pharmacy and Poisons Board, Valley Hospital, Evans Hospital, Mercy Mission, Langalanga Hospital, and Northern hills pharmacy. Above all, my gratitude goes to the Almighty God for his guidance and protection during the entire research period.

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