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Disposal of Unused Medicines in a Rural Ghanaian Household and its Effect on the Environment

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Abstract

In order to ensure that medicines are readily available, affordable and accessible, the supply chain management of medicines has faced many challenges in the advent of improper medicines disposal practices, where toxins are released into the environment [1,26]. In this study, to determine the medicines disposal practices of the people of Akuse, the environmental impact of the practices and the environmentally acceptable method of medicines disposal, it was gathered that many methods are used to dispose of unused medicines by the people of Akuse. These include burning, burying in the ground, donating to family and friends, flushing down the toilet or sink, and adding to household trash. The most typical method is adding to household trash. The various environmental effects of the practices identified were seen to be harmful, such as pollution of water bodies (making water unsafe for use), aquatic life loss, soil nutritional value loss and accidental poisoning of children, mentally disabled persons and pets. The medicine take-back program - Disposal of Unused / Unwanted Medicines Program (D.U.M.P), currently practised at Cocoa Clinic (Accra-Ghana), is the environmentally acceptable means for proper medicines disposal.

Keywords: *Disposal, Unused Medicines, Supply Chain Management, Environmental Impact*

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1.0 INTRODUCTION

Medicines are chemical substances used for clinical diagnosis and treatment of ailments. All medicines have potential risks as well as benefits. Their clinical advantages include improving an individual's health and quality of life. The risks of medicines are the potential side effects of the medicine. This is said to be the chance that something unwanted or unexpected would happen when a medicine is used [2,25]. Medicines may be manufactured in varied dosage forms, such as capsules, tablets, suppositories, pessaries, syrups, suspensions, solutions, injections, creams, gels, caplets and others [3,27].

Medication compliance and adherence largely depend on the patient and his or her preparedness to comply with the instructions given. Depending on the dosage frequency, a patient may deliberately skip some doses. If this repeats in the individuals who assess care at a health facility, there is the ripple effect of some medicines being left behind and, therefore,

unused medicines accumulate [4,28]. Such unused medicines, therefore, need to be appropriately discarded without resulting in any harm to the environment. Humans are an integral part of the environment. It has been said that there are inseparable connections between human health and the quality of the environment [5,29]. This study researched the disposal method of unused medicines and its impact on the environment in a typical Ghanaian household like in Akuse. The study also assessed the environmentally friendly alternatives available to ensure that all parties within the supply chain properly dispose of unused medicines.

2.0 MATERIALS AND METHOD

The World Health Organization estimates that more than half of all medicines are prescribed, dispensed, or sold inappropriately and that half of all patients fail to take their medications correctly [6]—Therefore, overusing, underusing, or misusing medicines results in waste and potentially improper disposal methods.

Often, older or chronically ill Americans have many unused medicines in their medicine cabinets. After the death of a parent or loved one, surviving family members are left with large amounts of unused medicines [7]

2.1 Source of Unused Medicines in the Home

In many Ghanaian homes, unused or unwanted medicines are kept for later use or donated to a family member or friend [8]. Even though this is the usual practice in most homes, several factors contribute to the many unused or unwanted medicines in the households. The reasons medicines pile up in homes include:

- Access to Health Care: The increased access to health care under the National Health Insurance Scheme (N. H. I. S) is the primary reason for the stockpile of medicines at home. This is because increased access to health care implies that patients can easily access medicines to manage or treat their health conditions. In effect, as long as the supply of medicines is assured at every visit to the health centre, one can afford to give excuses for not finishing the recommended dosage regimen.

- The Practice of Poly–Pharmacy: Poly–pharmacy (or overprescribing) is when too many medications are prescribed for a particular disease condition. In most cases, not all the medicines prescribed are needed to manage or treat the disease or condition diagnosed. Poly-pharmacy happens to be a consequence of increasing volumes of prescription writing. In the United States, nearly forty per cent (40%) received an average of 4.3 medicines per person from 2017 to March 2020 [9].

- Direct – To – Consumer Advertising: Direct-to-consumer advertising also contributes to the pile of medicines found in homes. This is a significant cause of inappropriate self–medication. Many innocent Ghanaians fall prey to such direct-to-consumer advertisements of medicines from drug peddlers on buses, market places among others.

- Changes to Prescriptions: Changes to patients' medications without finishing with a previous one also result in some medicines being left unused. The inability to effectively arrange for the return of previous medicines leads to unused or unwanted medicines piled up in the home.
- Patient Non–Compliance;

Patient non-compliance is a key cause of unused medicines in homes. People generally tend to stop taking medicines when they feel better.

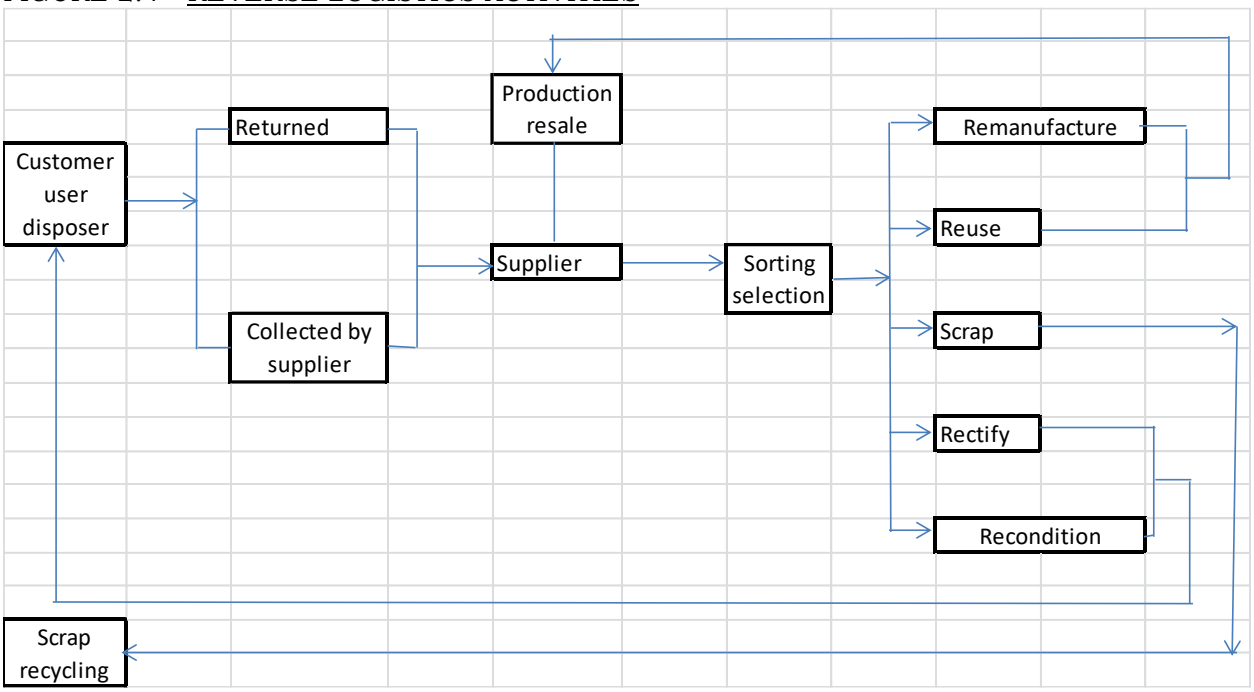
2.2 Reverse Logistics

Reverse logistics is the process of planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from

the point of consumption to the point of origin to recapture value or proper disposal [10]. In reverse logistics, there are two principal drivers in its activities. They are:

- The importance of the environmental aspects of waste disposal and
- Recognition of the potential returns that can be obtained from the reuse of products or parts or the recycling of materials [11]

FIGURE 2.4 - REVERSE LOGISTICS ACTIVITIES



Source: Kenneth Lysons and Brian Farrington, 7th Edition, page 91.

The Reverse Logistics activities in Figure 4 show that reverse logistics activities mainly include collecting returnable items, inspecting and separating them, and applying a range of disposition options. These disposition options include repair, reconditioning, upgrading, remanufacturing, de-manufacturing (reclamation of functional parts), and recycling [10,11].

2.3 Disposal of Pharmaceuticals and The Environmental Impact

In February 2007, the United States Food and Drug Administration (US F.D.A) and the White House Office of National Drug Control Policy (O.N.D.C.P) released federal guidelines for adequately disposing of prescription drugs. According to the Department of Environmental Conservation (D.E.C), a nationwide study done in 1999 and 2000 by the United States Geological Survey (U.S.G.S) found some levels of drugs such as antibiotics, hormones, contraceptives and steroids in 80% of the rivers and streams tested [12].

The three most commonly used disposal practices for household unused medicines are

1. Flushing down the toilet,
2. Washing down the sink, or
3. Discarding as household trash [13]

It is imperative to dispose of pharmaceuticals properly because negative consequences could result from improper disposal [14]. Improper disposal can result in:

- ✓ Contaminated or polluted water supplies. This could result in water bodies not being safe for consumption.
- ✓ Diversion and resale of expired or inactive medicines. By that, the disease conditions of patients could aggravate into fatal forms.
- ✓ Improperly incinerated products could release toxic pollutants into the air. This could eventually result in many respiratory tract infections like Bronchitis.

- ✓ Loss of the nutritional content of the soil, thereby making the soil lose its fertility and the ability to support good crop yield [14]

2.4 Medicine Take - Back Program

Medicine take-back programs are the only secure and environmentally sound ways to dispose of leftover or unused medicines. This ongoing drop-off medicines program is highly practised in many developed countries like the United States of America. According to the U.S. Drug Enforcement Administration's Report 2020, it is usually done at a pharmacy or a law enforcement office. The program uses secure equipment and well-structured procedures to prevent theft or diversion [15]. In Ghana, the Cocoa Clinic (the medical wing of the Ghana Cocoa Board Company) introduced a concept known as the Disposal of Unused / Unwanted Medicines Program (D.U.M.P) in the clinic in 2009. The program sought to encourage the clients to freely return all unused medicines to the designated points at the Clinic's Pharmacy. 'DUMP' is a Medicines Take Back Program practised in Ghana [16].

3.0 METHODOLOGY

3.1 Research Design

The case study method was chosen for this study. Quantitative and qualitative data collection techniques were used based on the research questions and the specific objectives. The questionnaire helped determine the populace's opinion on medicine disposal methods and their environmental effects. A focused group interview with the members involved in medicines handling and counselling, policy-making and health workers was also conducted to identify current laws and policies on medicines disposal, the effect of improper disposal on the environment and alternatives available. The study site was Akuse, located at the Lower Manya Krobo Municipal Assembly of the Eastern Region of Ghana [17]. Lower Manya has a total population of 121,478 (56,662 males and 64,816 females), comprising urban and rural settlers [18]. The population of Akuse is about 26,788 [18]. The town was a prominent centre of commerce serving the Yilo and Manya Krobo Municipality and some parts of Volta and Greater Accra Regions in the early nineteen nighties. The town folks are mainly farmers and fishermen [19]. Akuse Government Hospital is the oldest hospital in the district. It was built in 1911 by the Germans [20].

The study's inclusion criteria were residents who were at least 18 years old, resided in Akuse for not less than 6 months, and consented to be part of the study. The sample size was calculated by adopting a 95% confidence level and 5% margin of error at a response distribution of 50% for the population (n = 26,788). The estimated sample size was 379 [21]. A purposive sampling technique was used to determine where households in Akuse were visited.

3.2 Questionnaire Design

A standardised questionnaire from a previous study [22]. It was slightly amended and used as a data collection instrument. A panel of experts tested the questionnaire for face cogency and altered it with their suggestions to warrant respondents' comprehension. Questionnaires used in this study were in four major sections. The first section sought respondents' bio-data (gender, age, occupational status, marital status and educational background). In contrast, the second section sought information about the availability of unused medicines in the households; the third section was about the assessment of the disposal practices, and the fourth looked at the environmental impact of the disposal practices. There were focused group interviews with the Deputy Director of Pharmaceutical Services - Eastern Region, Pharmacists, Medical Doctors, Medical Representatives and the Assemblyman of Akuse. In all, the self-conducted focused group interviews covered 27 subject experts.

3.3 Data Analysis Methods

The administration and retrieval of all questionnaires from respondents and the focused group interviews were done from 7th September 2021 to 27th January 2022. The questionnaires were administered by three trained field assistants who explained the questions in the local language to participants who could not read or write in English. Data collected were coded, stored and analysed using the Statistical Package for the Social Sciences (SPSS) Version 18 Software. Respondents consented by signing or thumb-printing against their decision as indicated on the questionnaire.

4.0 RESULTS AND DISCUSSIONS

4.1 Respondents Bio-Data

Questions about occupation, gender, marital status, age, and educational status were sought to ascertain the backgrounds of the individual respondents.

From Table 4.1, 60% of the respondents were farmers and fishermen. This explains the main occupation of the people of Akuse. This could be attributed to the vast farmlands and the Volta River, which share a boundary with Akuse. More than half of the respondents (62%) were females. Looking at the marital status of the respondents, 31% were married, and 15% were single. More of the natives had had no formal education, while 8% had had tertiary education, and 72% were aged between 21 and 40 years.

Table 4.1 - Respondents Bio - Data

CHARACTERISTIC	PARAMETER	RESPONDENTS (n=379)	PERCENTAGE (%)
Occupation	Farmers	140	37%
	Teachers	76	20%
	Fishermen	87	23%
	Trade	45	12%
	Others	31	8%
Gender	Male	144	38%
	Female	235	62%
Marital Status	Married	197	52%
	Single	95	25%
	Widowed	38	10%
	Divorced	49	13%
Age (Years)	Below 20	45	12%
	21-30	152	40%
	31-40	121	32%
	Above 40	61	16%
Educational Status	None	68	18%

	Non-formal education	121	32%
		102	27 %
	Middle school/JSS	57	15 %
	Secondary	31	8 %
	Tertiary	0	0 %
	others		

Source: Researcher's fieldwork, January 2022

4.2 Assessing the Availability of Unused Medicines in the Home

Respondents were asked some questions to assess the availability of unused medicines in the household, and their responses are discussed below.

4.2.1 Source of Medicine Acquisition

Respondents were asked - 'Where do you usually take or buy your medicines from?'

From Table 4.2 below, 45% of the respondents obtained their medicines from the hospital pharmacy and 13% from drug peddlers.

Table 4.2 - Respondents Source of Acquisition of Medicines

Acquisition Source	Frequency	Percentage (%)
Hospital Pharmacy	171	45 %
Community Pharmacy	83	22 %
Family and Friends	76	20 %
Drug Peddlers	49	13 %

Source: Researcher's fieldwork, January 2022

4.2.2 Completion of Medicines Prescribed

Respondents were asked whether they could complete the dosage recommended by their prescribers; 90% answered 'NO'.

Table 4.3 Respondents Ability to Complete Medicine Dosage Recommended

Response	Frequency	Percentage (%)
Yes	38	10 %
No	341	90 %

Source: Researcher's fieldwork, January 2022

4.2.3 Reasons for the Inability to Complete Prescribed Medicines

Figure 4.1 illustrates respondents' inability to complete the prescribed medicines.

Figure 4.1 - Respondents do Not complete Reasons Medicines Dosage Recommended

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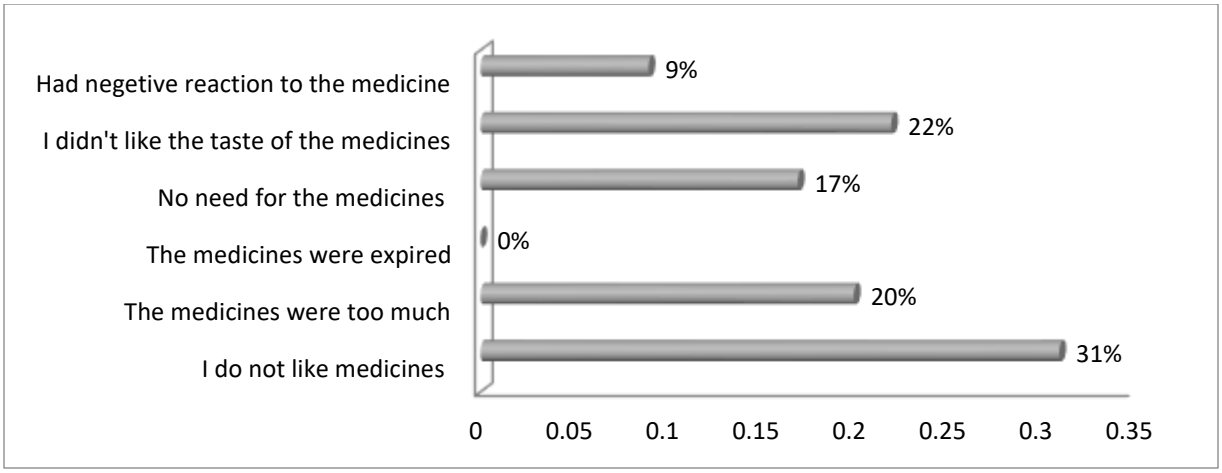

Source: Researcher's fieldwork, January 2022

4.2.4 Importance of Completing Prescribed Dosage

All three hundred and seventy-nine (379) respondents, making up one hundred per cent (100%), answered 'YES' when asked this question: "Do you think it is important to complete the dosage as recommended?". This indicates that though there are reasons they are unable to complete the dosage of the medicine recommended, they know it is important to adhere to the instructions given to them by the pharmacist as regards the directives for taking the recommended medicines.

4.3 Assessing the Disposal Methods Used

Respondents were asked questions to assess the disposal methods of medicines practised by the people of Akuse.

4.3.1 Place of Storage of Medicines

In response to the question, 'In which part of the house would you usually store your medicines? ';63% - living room, 35% and 2% bedroom and kitchen respectively.

Table 4.4 - Respondents Storage Of Medicines

Place of Storage	Frequency	Percentage (%)
Kitchen	8	2%
Bedroom	133	35%
Living Room	238	63%
Bathroom	0	0%
Storeroom	0	0%

Source: Researcher's fieldwork, January 2022

4.3.2 Accessibility of Storage Place of Medicines to Children

To ascertain the risk of exposing children in the house to the medicines stored, the question, "Do you think the storage place for your medicines is accessible to children in the house?" was asked. The responses recorded were very close.

Table 4.5 - Risk of Children's Access to Stored Medicines in the House

Response	**Frequency**	**Percentage (%)**
Yes	208	55 %
No	171	45 %

Source: Researcher's fieldwork, January 2022

4.3.3 Disposal Methods Practiced

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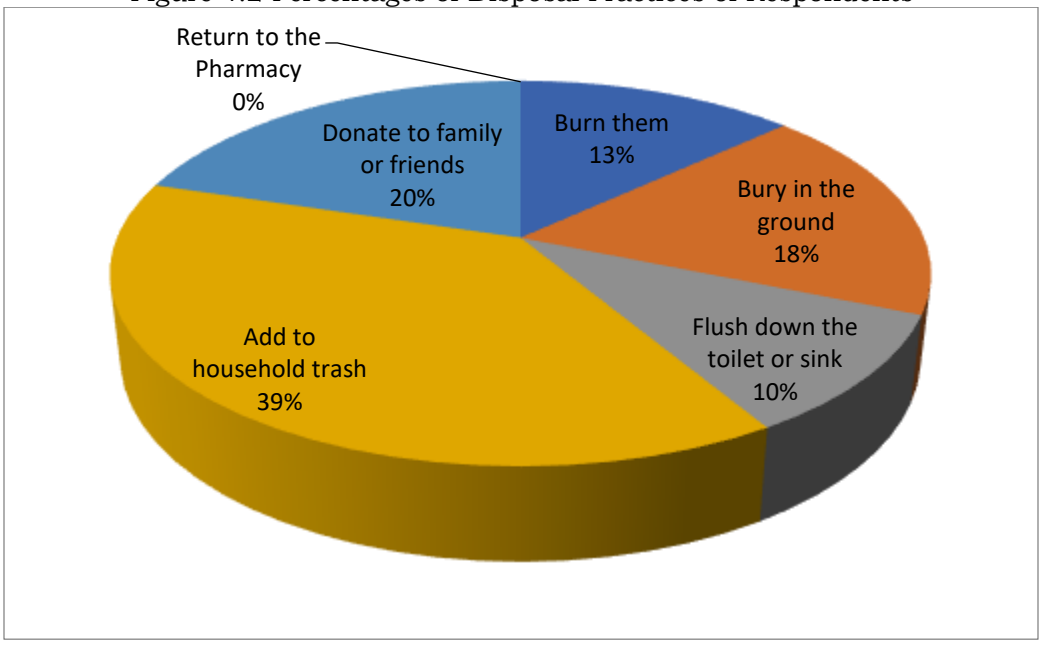
Figure 4.2 shows the response to the question, 'How do you dispose of your unused medicines?' to achieve the research objective of identifying the methods of disposal used.

Figure 4.2 Percentages of Disposal Practices of Respondents



Source: Researcher's fieldwork, January 2022

Figure 4.2 shows that none of the respondents returned their unused medicines to the pharmacy where they received them.

4.3.4 Reasons for the Choice of Disposal Methods Practiced

It was found that 52% of people used a particular disposal practice because it was either more convenient (52%) or cheaper (48%).

Table 4.7 Reasons for the Disposal Method Adopted

Reason	Frequency	Percentage (%)
I do not have any other alternative	0	0 %
Convenience to respondent	197	52 %
It is easy and inexpensive	182	48 %

Source: Researcher's fieldwork, January 2022

4.4 Assessing the Environmental Impact of the Disposal Methods

In order to determine the environmental impact of the disposal practices adopted, the following questions were asked of the respondents in the questionnaire.

4.4.1 Environmental Impact of the Practice.

When asked, "Do you know the environmental impact of the method you use?" none of the respondents had any idea of their actions' environmental impact.

Table 4.8 Respondents Idea of Environmental Impact of the Disposal Method Used

Response	Frequency	Percentage (%)
Yes	0	0 %
No	379	100 %

Source: Researcher's fieldwork, January 2022

4.4.2 The Need for Proper Disposal to Protect the Environment

All the respondents answered 'YES' (from Table 4.9 below) when asked: 'Do you think that unused medicines need to be disposed of properly to protect the environment?'

Table 4.9 – Respondents Feedback on the Need for Proper Disposal to Protect the Environment

Response	Frequency	Percentage (%)
Yes	379	100 %
No	0	0 %

Source: Researcher's fieldwork, January 2022

4.5 Focus Group Interviews

From the focused group interviews, the members provided an in-depth understanding and insight into the issues arising from the research findings. They discussed that medicines must be stored properly at home to prevent accidents. Again, patients must understand all the instructions or counselling about a particular medication and adhere to those instructions. By so doing, they could enjoy the full benefit of the medicines recommended. In Ghana, there are laws and policies regarding the disposal of medicines. One such law, according to the Pharmacists, was explicitly stated in the Ghana National Drug Policy section 6.3.7.1; "The FDA shall ensure in collaboration with other agencies where appropriate, that *suitable measures* are instituted for the regular identification, collection and safe disposal of expired drugs and drug waste" [23]. However, the policies are not specific on the methods ideal enough to protect the environment. The GNDP, 2004 section 63.7.1, only mentions that *suitable measures* should be used to dispose of waste drugs. By so doing, people are left to decide which method they find suitable enough to dispose of their unused medicines. According to the Public Procurement Act 2004, a health institution needs to form a board of survey that will decide on the appropriate method to adopt to dispose of items in the facility [24]. However, the board's action needs to be adequately documented, and the district, regional, or national level should be informed appropriately. The medical representatives confirmed that unused or wasted medicines were often returned to the pharmaceutical companies for proper disposal, particularly in large quantities.

They concluded that returning unused or unwanted medicines to the community or hospital pharmacy where they were obtained for proper disposal is a sure way to protect the environment.

4.6 Environmentally Acceptable Means of Medicines Disposal

It is said that the most environmentally sound means of disposing of leftover medicines is through the 'Medicine Take Back Program' [15]. Disposal of Unused / Unwanted Medicines Program (D. U. M. P), practised at Cocoa Clinic (Accra – Ghana), is a type of 'Medicine Take Back Program' practised in Ghana and is similar to what is practised in the United States of America and New Zealand [5,15] The practice is such that unused medicines are dropped into the 'DUMP' branded boxes at the pharmacy over some time. Contacts are established with regulatory bodies like the Food and Drugs Authority, the Environmental Protection Agency, and some pharmaceutical companies to facilitate the safe disposal of returned unused medicines to protect the environment.

5.0 CONCLUSION

This study was set to determine the people of Akuse's medicine disposal practices, consider the environmental impact of the practices identified, and identify environmentally acceptable disposal methods for unused medicines. The current study has established that there are many

means by which the rural folks in Akuse dispose of their unused medicines, but the dominant one among them is adding them to their household trash. Though the respondents had no idea of the effect of their disposal practices on the environment, it was found that their methods could result in the pollution of water bodies, making water unsafe for use, aquatic life lost, soil nutritional value loss and accidental poisoning of children, mentally disabled persons and pets. The D. U. M. P, a type of "Medicines Take Back Program" practised at Cocoa Clinic, Accra, is a safe and environmentally friendly means of disposing of medicines. Extending the practice to all healthcare facilities in Ghana would help protect our environment from the indiscriminate disposal of medicines that negatively impact it [5].

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