HOUSEHOLD HAZARDOUS WASTE MANAGEMENT PRACTICES AMONG PASTORAL COMMUNITY OF MANDERA COUNTY, KENYA

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Q141/CE/23179/2012

THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF PUBLIC HEALTH (MONITORING AND EVALUATION) IN THE SCHOOL OF PUBLIC HEALTH OF KENYATTA UNIVERSITY.

OCTOBER 2018
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DEDICATION

To my father Abdirahman Sheikh who decided to educate me despite living a nomadic lifestyle in the remote villages of northern Kenya.
ACKNOWLEDGEMENT

I sincerely thank my supervisors, Dr. Joan Njagi and Dr. Jackim Nyamari for the support and guidance they have given me from the inception to the completion of this study. Many thanks go to the residents of Mandera, the local leaders, the ministry of health staff and all those stakeholders who willingly gave me the information required to make my study a success.

Many thanks also go to my wives LuL and ZamZam for the support they accorded me during this long process, not forgetting my friend Titus who stood with me throughout the process. I finally thank the Almighty Allah for the strength, courage and wisdom he gave me throughout the study period. I also acknowledge Kenyatta University management for the opportunity to study in the institution.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>i</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>ABBREVIATIONS AND ACRONYMS</td>
<td>x</td>
</tr>
<tr>
<td>DEFINITION OF OPERATIONAL TERMS</td>
<td>xii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>xiii</td>
</tr>
<tr>
<td><strong>CHAPTER ONE: INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1. Background to the Study</td>
<td>1</td>
</tr>
<tr>
<td>1.2. Problem Statement</td>
<td>3</td>
</tr>
<tr>
<td>1.3. Justification of Study</td>
<td>5</td>
</tr>
<tr>
<td>1.4. Research questions</td>
<td>5</td>
</tr>
<tr>
<td>1.5 Objectives of Study</td>
<td>6</td>
</tr>
<tr>
<td>1.5.1 General Objective</td>
<td>6</td>
</tr>
<tr>
<td>1.5.2 Specific objectives</td>
<td>6</td>
</tr>
<tr>
<td>1.6 Significance of study</td>
<td>6</td>
</tr>
<tr>
<td>1.7 Limitation and Delimitations</td>
<td>7</td>
</tr>
<tr>
<td>1.8 Conceptual Framework</td>
<td>7</td>
</tr>
<tr>
<td><strong>CHAPTER TWO: LITERATURE REVIEW</strong></td>
<td>10</td>
</tr>
<tr>
<td>2.1. Introduction</td>
<td>10</td>
</tr>
<tr>
<td>2.2 Overview of Household Hazardous waste</td>
<td>10</td>
</tr>
<tr>
<td>2.3 Types of hazardous waste generated by households</td>
<td>11</td>
</tr>
<tr>
<td>2.4 Risk Factors of Household Hazardous Waste</td>
<td>12</td>
</tr>
<tr>
<td>2.5 Knowledge on Household Hazardous Waste</td>
<td>13</td>
</tr>
<tr>
<td>2.6 Household Hazardous Waste Management Practices</td>
<td>13</td>
</tr>
<tr>
<td>2.6.1 Importance of managing Household Hazardous Waste</td>
<td>13</td>
</tr>
</tbody>
</table>
2.6.2 Types of Household Hazardous Wastes collections .......................... 14
2.6.3 Household Hazardous Waste storage and Segregation .................... 15
2.6.4 Household Hazardous Waste disposal methods ............................. 16
2.7 Summary of Literature Review .................................................... 16

CHAPTER THREE: MATERIALS AND METHODS ................................. 18
3.1 Introduction .................................................................................. 18
3.2 Study design ............................................................................... 18
3.3 Variables ..................................................................................... 19
   3.3.1 Independent Variables .......................................................... 19
   3.3.2 Dependent variables ............................................................. 19
3.4 Location of Study .......................................................................... 19
3.5 Inclusion Criteria .......................................................................... 20
3.6 Exclusion Criteria ......................................................................... 20
3.7 Study Population .......................................................................... 20
3.8 Sampling Technique ..................................................................... 21
3.9 Sample Size Determination ........................................................... 22
3.10 Construction of Research Instruments .......................................... 23
3.11 Pre-Testing ................................................................................ 23
   3.11.1 Validity ............................................................................... 24
   3.11.2 Reliability ........................................................................... 24
3.12 Data Management and Analysis .................................................... 25
   3.12.1 Data Management ............................................................... 25
   3.12.2 Data Analysis .................................................................... 25
3.13 Logistical and Ethical consideration .............................................. 25

CHAPTER FOUR: RESULTS ................................................................. 27
4.1 Introduction .................................................................................. 27
4.2 Socio Demographic Data of the Research participants ...................... 27
   4.2.1 Number of Household members .......................................... 28
4.2.2 Movement from One location to another .................................................. 29
4.2.3 Size of the Land for the Pastoral Households.......................................... 29
4.3 Types of Hazardous Waste Generated by Pastoral Households .................. 30
  4.3.1 Sources of Household Hazardous Waste............................................. 31
  4.3.2 Generation of Household Hazardous Waste......................................... 31
  4.3.3 Generating same type of HHW in Different Seasons............................. 32
  4.3.4 Seasons that households generate more household hazardous waste ....... 33
  4.3.5 Most common household Hazardous waste in the Seasons ..................... 34
  4.3.6 Buying of household hazardous goods............................................... 34
4.4 Occurrence of Accidents Related to Household Hazardous Waste ............... 35
  4.4.1 Victims of Household Hazardous Waste Related Accidents .................. 35
  4.4.2 Age of the Household Member Who were Involved in Accidental Mishap ... 36
  4.4.3 Type of Household Hazardous Waste/s that Caused the Reported Accident.. 36
  4.4.4 Health Problems that Occurred Due to the Accidental Occurrences, Place of
        Treatment and Outcome of the Incidents ......................................... 37
4.5 Level of knowledge on Household Hazardous Waste ................................ 38
  4.5.1 Knowledge Scores ........................................................................... 39
  4.5.2 Identification of Household Hazardous Wastes ................................... 39
  4.5.3 Source of Information on Household Hazardous Waste ......................... 40
  4.5.4 Level of Knowledge on Household Hazardous Waste ............................ 40
  4.5.5 Knowledge on Management of Household Hazardous Waste Practices..... 41
4.6 Household Hazardous Waste Management Practices at Household Level ...... 43
  4.6.1 Segregation of Household Hazardous Waste ....................................... 43
  4.6.2 Categories of Household Hazardous Waste Segregated ......................... 44
  4.6.3 Level of Education and Segregation of Household Hazardous Waste ...... 44
  4.6.4 Movement from One Place to Another and Storage of household hazardous
        waste ............................................................................................... 45
  4.6.5 Storage of Household Hazardous Waste before Disposal ..................... 46
  4.6.6 Size of the land and Storage of household hazardous waste before disposal... 47
  4.6.7 Read the Label/ Instructions on the Household Hazardous Goods ......... 47
  4.6.8 Level of education and Reading of Labels ......................................... 48
  4.6.9 Reasons for not Reading the Labels on the Household Hazardous Goods ... 48
  4.6.10 Management of used cosmetic products and laundry products ....... 49
4.6.11 Management of Unused Drugs (Human and Animal) ........................................ 49
4.6.12 Management of Pesticides, Insecticides, Fungicides and Other Farm Chemicals ................................................................. 50
4.6.13 Management of Old Batteries and Used Electronic Items .......................... 50
4.6.14 Management of containers of used oils, paraffin, petrol and empty aerosol cans .................................................................................. 51
4.6.15 Managing Unused Adhesives and Glues ..................................................... 51
4.6.16 Managing Used Needles and Syringes for Animal Treatment ................. 51
4.6.17 Challenges Facing the Management of Household Hazardous Waste ....... 52

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 53

5.1 Introduction ........................................................................................................ 53
5.2 Summary ............................................................................................................ 53
  5.2.1 Type of Hazardous Waste Generated by Pastoral Households ............ 53
  5.2.2 Occurrence of Accidents Related to Household Hazardous Waste ........ 54
  5.2.3 Level of Knowledge on Household Hazardous Waste .......................... 55
  5.2.4 Household Hazardous Waste Management Practices at Household Level ...... 58
5.3 Conclusions ....................................................................................................... 61
5.4 Recommendations For Practice ....................................................................... 62
5.5 Areas for Further Studies .................................................................................. 64

REFERENCES ......................................................................................................... 66

APPENDICES ........................................................................................................ 70
Appendix I: Consent on the Participation ............................................................... 70
Appendix II: Household Heads Questionnaire ..................................................... 72
Appendix III: Key Informant Interview Guide ..................................................... 80
Appendix IV: Map of Kenya Showing Mandera County ..................................... 81
Appendix V: Approval of Research Proposal ....................................................... 82
Appendix VI: Research Authorization Letter ....................................................... 83
Appendix VII: Kenyatta University Ethic Review Committee Approval ............ 84
Appendix VIII: NACOSTI Approval ................................................................. 85
Appendix IX: Mandera County MOH Research Authorization .......................... 86
LIST OF TABLES

Table 3.1: Target Population ........................................................................................................ 21
Table 3.2: Sampling frame .......................................................................................................... 23
Table 4.1: Socio Demographic Data of the Research participants ................................................. 28
Table 4.2: Number of Household members ................................................................................ 29
Table 4.3: Movement from One location to another ..................................................................... 29
Table 4.4: Size of the land ............................................................................................................ 30
Table 4.5: Types of HHW Generated .......................................................................................... 32
Table 4.6: Different seasons and types of HHW Generated .......................................................... 33
Table 4.7: Seasons households generate different type household hazardous waste ............... 34
Table 4.8: Most common household Hazardous waste according to Season ............................ 34
Table 4.9: Buying of Household Hazardous Goods ..................................................................... 35
Table 4.10: Age of the Household Members who were Involved in accidental mishap .. 36
Table 4.11: Type of Household Hazardous Waste/S that Caused the Reported Accident
.................................................................................................................................................. 37
Table 4.12: Health Problems that Occurred Due to the Accident, Place of Treatment and
Outcome of the Accidents .............................................................................................................. 38
Table 4.13: Knowledge Scores .................................................................................................... 39
Table 4.14: Source of Information on Household Hazardous Waste .......................................... 40
Table 4.15: Level of Knowledge on Household Hazardous Waste ............................................ 41
Table 4.16: Knowledge on Management of Household Hazardous Waste practices .......... 43
Table 4.17: Categories of Household Hazardous Waste segregated ........................................... 44
Table 4.18: Level of Education and Segregation of Household Hazardous Waste ............... 45
Table 4.19: Movement from One Place to Another and Storage of household hazardous
waste ................................................................................................................................................. 46
Table 4.20: Size of the land and Storage of household hazardous waste before disposal .......... 47
Table 4.21: Level of education and Reading of Labels ................................................................ 48
LIST OF FIGURES

Figure 1. 1: Conceptual Framework ........................................................................................................ 9
# Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS:</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<tr>
<td>ASAL:</td>
<td>Arid and Semi Arid Lands</td>
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<tr>
<td>AVMA:</td>
<td>American Veterinary Medical Association</td>
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<td>DEA:</td>
<td>Drug Enforcement Administration</td>
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<tr>
<td>DEP:</td>
<td>Department of Environmental Protection</td>
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<td>EPA:</td>
<td>Environmental Protection Authority</td>
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<td>EPR:</td>
<td>Extended Product/Producer Responsibility</td>
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<td>FSD:</td>
<td>Foundation for sustainable Development</td>
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<td>HHC:</td>
<td>Household Hazardous Chemicals</td>
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<td>HHP:</td>
<td>Household Hazardous Products</td>
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<td>HHW:</td>
<td>Household Hazardous Waste</td>
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<td>HHWM:</td>
<td>Household Hazardous waste Management</td>
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<td>HSW:</td>
<td>Household Solid Waste</td>
</tr>
<tr>
<td>ISSWM:</td>
<td>Integrated Sustainable Solid Waste Management.</td>
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<tr>
<td>JICA:</td>
<td>Japan International Cooperation</td>
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<tr>
<td>NCCK:</td>
<td>National Council of Churches of Kenya</td>
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<tr>
<td>NEMA:</td>
<td>National Environment Management Authority</td>
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<tr>
<td>NGO:</td>
<td>Non Governmental Organisation</td>
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<tr>
<td>OTC:</td>
<td>Over The Counter</td>
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<tr>
<td>POM:</td>
<td>Prescription Only Medicine</td>
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<tr>
<td>RAs:</td>
<td>Residential Associations</td>
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<td>TSD:</td>
<td>Treatment, Storage and Disposal.</td>
</tr>
</tbody>
</table>
US: United States
WASH: Water, Sanitation and Hygiene
WEEE: Waste Electric and Electronic Equipment
WHO: World Health Organization
DEFINITION OF OPERATIONAL TERMS

**Attitude:** This is a predisposition or a tendency to respond positively or negatively towards certain ideas, persons or situations like household hazardous waste.

**Household Hazardous waste:** household waste which can be characterized as; being ignitable, reactive, corrosive or toxic and requires special handling and disposal procedures to avoid risk to health and/or environmental effects such as pesticides.

**Household heads:** This is one of the members of the household recognized as the head of the unit by the other members of the household unit or by himself (or herself) if living alone.

**Household:** A group of related persons, who live together in the same dwelling unit and regularly take their food from the same pot and live in the same house.

**Knowledge:** These are facts, information, and skills acquired through experience or education; the theoretical or practical understanding of household hazardous waste management.

**Nomad:** This is a community member who has no fixed habitation and hence regularly moves from one place to another in search of pasture and water for their animals.

**Pastoral households:** This is a group of related individuals whose way of life is based on rearing goats, camels, sheep and cattle, and is typically nomadic.

**Pastoralists:** Are people who derive more than 50 per cent of their income from livestock and livestock Products.
ABSTRACT

Household hazardous waste possess physical, chemical or biological characteristics, which requires special handling and disposal procedures to avoid risk to health and/or environmental effects. The pastoral population of Mandera county has been treated in health facilities with complains of poisoning or reaction resulting from hazardous substances. Health effects of exposure to household hazardous waste could also take time to manifest in people who are exposed to it, such as development of cancers and effects on unborn babies. The pastoral population is unaware of the potential hazards caused by the many household hazardous waste in their homes therefore the options of safe disposal and storage are unexplored. The main objective of this study was to establish household hazardous waste management practices among pastoral community of Mandera County, Kenya. The specific objectives were; to identify the type of household hazardous waste generated and their disposal methods; to determine the occurrence of accidents related to household hazardous waste and to determine the level of knowledge on household hazardous waste management among household heads in the pastoral community. The study employed a descriptive cross sectional design. The sample size for this study was 415 household heads and 17 key informants from Mandera East Sub-County. The study used a multistage sampling technique that comprised of three steps: simple random sampling, systematic simple random sampling and purposive sampling. Data was collected by use of both qualitative and quantitative methods. Questionnaires, focus group discussions and key informant interviews tools were used to collect data. A pre test was conducted to assess the validity and reliability of the research instruments. Clean coded data was entered into SPSS version 20, frequencies and percentages were used for descriptive statistics while Chi square was used for inferential analysis. Quantitative data was presented in frequencies and percentages. The study found that almost half (48%) of the household heads in Mandera County had moderate knowledge on household hazardous waste while (32%) had good knowledge which had been obtained from radio and health workers. The study also found that almost all of the households at (99.5%) in Mandera County were generating used batteries and electronic items; unused drugs and pharmaceuticals for either human or animal use; remains of pesticides, herbicides, fungicides and acaricides; and used needles and syringes from animal treatment. The study found out that open dumping and incineration were the most common methods of waste disposal by all the study research participants. Further, to this, 8.3 per cent of the households in Mandera County had members who were victims of household hazardous waste related accidents. Most of these household members affected were aged between 0 and 5 years. The study established that there was a significant association between the level of education of research participants and segregation of household hazardous waste (p<0.05), the study also found that movement of households influences storage of HHW. Finally the size of land occupied by households had a significant association with the storage of HHW. This study recommends that the county government, national government and NGOs should initiate training and awareness creation programmes aimed at increasing knowledge on household hazardous waste in the pastoral population.
CHAPTER ONE: INTRODUCTION

1.1. Background to the Study

Household hazardous waste (HHW) refers to household waste which poses chemical characteristics such as ignitability, reactivity, corrosivity and toxicity. HHW can cause physical injury to the waste handlers and household members if improperly managed. HHW can also cause chemical poisoning to human and animals. In addition, household hazardous waste can cause serious environmental and health problems when improperly stored or disposed of (Lohri et al., 2012).

Numerous domestic products once used, or at the end of their useful life are converted to dangerous waste due to their composition and require special management, treatment and disposal to prevent environmental disturbances, water pollution and harmful human effect (Driedger, 2001). Household hazardous waste (HHW) presents a serious health threat to the many homes who store it, waste handlers and scavengers who roam the landfills because they release contaminants such as mercury and volatile organic compounds to the environment causing long term effects to human beings and the environment (Elston, 2010).

Lack of obligation by households to segregate HHW from the general household waste makes it very difficult to plan for its management (Desa et al., 2012). Poor understanding of the general public on what constitutes household hazardous waste products is one of the main causes linked to the lack of treatment, poor storage and disposal (TSD) practices in homesteads (Mbeng et al., 2012). Many developing countries do not have a national household hazardous waste system, or even a national strategic
plan for the development of one, while household hazardous waste has become increasingly important problem and needs an attention from governments, NGOs, CBOs and the academic circles (Taboada-Gonzalez et al., 2010).

In Europe, the European Commission (2013) reported that household products play a major role in the generation of household hazardous waste, which are problematic in their management and disposal routes. These wastes include florescent lamps, arsenic treated wood, paints and pesticides. However, Inglezakis and Moustakas (2015) indicate that household hazardous waste generated in households was not clearly defined in legislation. Therefore, there lack an obligation to segregate household hazardous waste from the general household waste. In Indonesia, Fikria et al. (2015) indicate that various household activities produce household hazardous waste, which cause danger to human health and the environment.

In Nigeria, Abimbola et al. (2012) indicates that key components in ensuring proper HHW management include identification of type of wastes generated, encouraging waste reuse and recycling and intensification of public education. Adu-Boahen et al. (2014) argue most of the households in Ghana generate solid household hazardous waste like plastics, batteries and electronic waste, which were mainly disposed off by burning. They also found that awareness and education on household hazardous waste was a key factor in the appropriate management of household hazardous waste.

In Kenya, Omambia and Ogonya (2017) indicate that the most common household waste in Eldoret included wood, glass, scrap metal, textiles, kitchen waste, disposable nappies and scrap metal. However, the community members had low knowledge on different
disposing methods and segregation. In rural Mandera every household has some hazardous waste comprising of pharmaceutical waste, animal drugs, batteries, torches containing lead, pesticides (acaricides), electronics and non-biodegradable waste such as polythene papers which have the potential for posing risk to life, health, property or the environment if improperly consumed, stored, or disposed of (District Public Health Office, 2013).

1.2. Problem Statement

African countries are facing health effects caused by HHW. As these countries are increasingly integrated into the global economy, local markets and homes are often flooded with dangerous imported goods as well as industrial wastes (Malandrakis, 2008). The health effects of exposure to hazardous waste may progress slowly and end up in chronic conditions. The common health problems include; Skin conditions, respiratory infections, central nervous disorders, blood infections, congenital disorders and many forms of cancers (Fleisted & Christensen, 2007).

Data is difficult to obtain on the rates of people exposure to toxins in any country; it is especially difficult to obtain in Africa, where meager health resources are focused on prevention and treatment of infectious diseases (Driedger, 2001). The pastoral populations in Mandera indicate that their health complains directly relate to household hazardous waste consumption, such as ingestion of acaricides applied on animals to kill or repel ectoparasites either through milk or accidental ingestion through contaminated hands and containers (District Public Health Office, 2013). According to MOH (2013), four rural health facilities (Neboi, Khalalio, Shafshafey and BurAbor) reported 33 cases of poisoning among the children less than five years of age and 21 adult poisoning. The
same facilities in Mandera east reported 10 cases of poisoning in children under five years and 2 cases of poisoning in adults from the months of January to December in 2014 (MOH, 2014). Even though programs to increase household hazardous waste knowledge among pastoral communities have been implemented, monitoring evaluation was not conducted to assess the effectiveness of the programmes. To address the issue of household hazardous waste poisoning, empirical evidence is needed to develop policies and strategies.

Veterinary drugs and human drugs and other pharmaceuticals could be in small amounts but they are an important component of every household’s stream in the pastoral population where self-medication is highly practiced (Driedger, 2001). Unused pharmaceuticals pose significant health problems when improperly stored or disposed. Reports have indicated that both children and adults have been poisoned after ingesting improperly disposed pharmaceuticals and other poisons after use in Mandera county rural population (MOH, 2014).

Studies have been conducted on household hazardous waste management both globally and locally (Chandrappa & Das, 2012; Driedger, 2001; Flisted & Christensen, 2007; Malandrakis, 2008). Most of these studies were conducted in developed countries to improve on methods of HHW management and related policies. In Africa pilot studies on HHW were conducted in Cameron and Zambia but mainly focused in urban areas. In Kenya, studies done on household waste have only focused mainly on general household solid waste and so far no study was done on HHW among the pastoral population. This study sought to address knowledge gap in household hazardous waste in Kenya and specifically the pastoral population of northern Kenya.
1.3. Justification of Study

This study provides information on the level of knowledge on HHWM practices among the pastoral communities that can be used to formulate policies and to develop training programs on household hazardous waste management. This study determined the type of hazardous wastes that are generated by the pastoral households in Mandera East as little literature is available about it. This was an opportunity to come up with practical HHW management strategies of managing the various HHW generated by the pastoralist population. The study also documented the occurrence of hazardous substance related accidents and injuries in the pastoral population of Mandera East Sub County. Even though there are policies focusing on waste in Kenya, the enforcement of these policies in relation to HHW has been poor, this document can contribute to the enforcement legislation on HHW in Mandera County government.

1.4. Research questions

i. What are the types of household hazardous wastes generated by pastoral households in Mandera County?

ii. What are the patterns of accidents that occur at pastoral homes that are related to hazardous substance?

iii. What is the level of knowledge on HHW among the pastoral community in Mandera County?

iv. What are the HHW management strategies amongst the pastoralist in Mandera County?
1.5 Objectives of Study

1.5.1 General Objective

To determine household hazardous waste management practices among pastoral community of Mandera County, Kenya.

1.5.2 Specific objectives

i. To identify the types of household hazardous waste generated by households in the pastoral community of Mandera County;

ii. To determine the occurrence of accidents related to household hazardous waste among the members of households of the pastoral community in Mandera County;

iii. To determine the level of knowledge on household hazardous waste (HHW) management among the pastoral community of Mandera County;

iv. To identify household hazardous waste management practices at household level in the pastoral community of Mandera County;

1.6 Significance of study

This study aimed to identify HHW management practices by the pastoral population in Mandera County. There is little data available on the types of HHW that are generated by pastoral community and related accidents and injuries resulting from it, therefore the study provides useful data that would help in the planning and management of HHW in pastoral areas. As part of recommendation, strategies of managing household hazardous waste have also been documented for adoption by pastoral communities and other stakeholders such as the County Government, NEMA, WHO and development partners. The findings of this study have also identified the channels that can be used to educate the
Mandera county pastoral community distinguish between household waste that are hazardous and the ones that are nonhazardous and adopt the principles of sound waste management hierarchy of reducing, reusing, recycling and safe disposal of these household wastes.

1.7 Limitation and Delimitations

Limitation

The study faced various constraints in the process of data collection. Since most of the community members in Mandera County are nomadic pastoralists, it was hard to reach out to them. However, the researcher visited the community members in their nomadic settlements, which are set up in form of villages holding up to 10 households. There was also a challenge of moving from one village to another during the data collection process. However, the research hired a vehicle to use during the period of data collection.

Delimitation

This study was delimited to the five wards of Mandera East Sub County, which included Arabia, Libehiya, Khalalio, Neboi and Township wards. The target population of this study was 25,923 pastoral household heads in the five wards in Mandera East Sub County.

1.8 Conceptual Framework

Household hazardous waste occurs as a result of numerous products that have been used or have reached the end of their useful life at the households and are converted to dangerous waste. This waste due to its composition requires special management, which
is based on the principle of prevention, reduction, recycling, recovery and finally disposal (Gu et al., 2014).

Any discussion on waste management will involve the use of various specialized frameworks. The frameworks are the cornerstones of general waste management implementation and guide policy development on waste management. The objectives of such a framework would focus on the four major waste related program areas: minimizing wastes; maximizing environmentally sound waste reuse and recycling, promoting environmentally sound waste disposal and treatment (Yasuda & Tanaka, 2006).

Waste management hierarchy is nationally and internationally accepted guide for prioritizing waste management practices with the objective of achieving an optimal environmental and health outcome. The hierarchy sets out the preferred order of waste management practices from the most preferred to the least preferred methods. Waste generation at the household level can be minimized, reused and or recycled, which are the most preferred methods. Incineration, open burning, open dumping and land filling are the least preferred methods in the hierarchy (Yasuda & Tanaka, 2006).
Independent Variables

- Social demographic factors
- Types of HHW waste Generated by HH
- Level of Knowledge on HHW

Dependent Variable

Management of HHW
- Reduce
- Reuse
- Recycle
- Incineration
- Land fill
- Open dumping

Figure 1.1: Conceptual Framework

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction
This chapter presents a review of literature on Household Hazardous Waste management practices among pastoral community. The chapter comprises of an overview of household hazardous waste, types of Household Hazardous Waste generated by households, risk factors of Household Hazardous Waste, knowledge levels on HHW, and different management practices of Household Hazardous waste and summary of the literature reviewed.

2.2 Overview of Household Hazardous waste
Household Hazardous Waste (HHW) consists of highly heterogeneous waste from households and the waste composition depends on factors such as living standards, geographical location, cultural, individual habits, type of housing and season (Vidanaarachchi et al., 2006). These household items that have been used, or have reached the end of their useful life are converted into dangerous wastes, which due to their composition need proper management, treatment and disposal (Bandunee et al., 2015). Used household materials that contain corrosive, toxic, ignitable or reactive ingredients are considered to be household hazardous waste (Ojeda-Benítez et al., 2013). These materials are contained in such products as household cleaners, detergents, furniture polish, pesticides, pharmaceuticals, paints, thinners, solvents, and items used in the care and service of motor vehicles. When inappropriately managed, products of this kind become “Household Hazardous Waste” (HHW). This type of waste can cause all
sorts of environmental disturbances, with ensuing detriment to human health (Lohri et al., 2012).

Some of the wastes produced by households are of a similar type to those produced by large industries. Household hazardous wastes make up only a small percentage of household waste, but they are a serious problem (Fleisted & Christensen, 2007). According to Driedger (2001), the four major properties of hazardous waste include corrosive, explosive/reactive, flammable and toxic. Corrosive waste has a chemical action that can burn and destroy living tissues or other materials that come in contact with the hazardous waste. Explosive/reactive waste can detonate or explode through exposure to heat, sudden shock, pressure, or incompatible chemicals. Flammable waste can be easily set on fire and Toxic waste is capable of causing injury or death through ingestion, inhalation, or absorption through the skin.

2.3 Types of hazardous waste generated by households

According to Slack et al. (2005), household hazardous waste fall into one of the following eight categories: automotive products, household cleaners, paints and solvents, poisons, medications and pharmaceutical products, sharps, e-waste and miscellaneous items. Household hazardous waste can further be subdivided into two broad categories (Slack et al., 2005). These are low toxicity materials and high toxicity materials. The low toxicity materials have relatively less toxicity or other hazardous characteristics such as water-based paint, automotive batteries, LPG cylinders and fluorescent tubes and lamps. The high toxicity category consists of a wide variety of materials that may have significant toxicity or other hazardous characteristics mainly pesticides, garden chemicals, acids, alkali, aerosols, fuels and many other products (Slack et al., 2005).
However, these findings were conducted in the United Kingdom which is a developed economy hence the results of the study cannot be generalized to Mandera County in Kenya as it is a developing economy. The most common household hazardous waste in Kenya includes batteries, accuracies, pesticides and other animal health products.

2.4 Risk Factors of Household Hazardous Waste

All household hazardous wastes such as oils, batteries, pesticides and medicines contain hazardous products. The best way to determine if household waste contains hazardous components is to read the labels on the products. Labels that read “danger”, “warning”, “caution”, “toxic”, “corrosive”, “flammable”, or “poison”. These words tell us that the products we are purchasing are capable of causing severe burns, illness, blindness, fatal harm, or even death if not used, stored, or disposed of properly. When precaution is not observed by households, the leftovers of these products can be dangerous to the health of individuals or the community members (Malandrakis, 2008).

Improper handling or disposal of products containing hazardous ingredients can result in serious accidents to people and animals by either drinking, eating, touching, or breathing household hazardous wastes. Some household hazardous waste and products emit toxic fumes that may produce acute reactions such as headaches, fatigue, burning eyes, runny noses, and skin rashes (Driedger, 2001).

The health risks associated with HHW in children are typically greater than that of adults. With their smaller bodies and endless curiosity, children are much more likely to come into contact with HHW at the home that have been stored or disposed of improperly, and to suffer ill effects from that contact (Wagner et al., 2013). Refuse workers and landfill
workers can be injured by chemical splashes or poisonous fumes caused by mixed or concentrated household hazardous wastes. Firefighters can also be injured by these household hazardous wastes when responding to a fire. However, all these studies were conducted in different countries with different types of hazards and the challenges posed by the hazards. The results cannot be generalized to Kenya as it is a developing country with different household hazards.

2.5 Knowledge on Household Hazardous Waste

Residents are often unaware of the potential hazards caused by many HHW in their homes. Recognition of hazardous products and wastes is paramount to encouraging the safe and proper disposal of moderate risks waste. In addition to this, the public is often unaware of their options for reducing, recycling and disposal of their HHW. To improve the reduction, storage and disposal of HHW, an education program targeting residents, community groups and school children is necessary, also information centers such as libraries and community gathering places can be established. There is not sufficient knowledge among the service providers and other relevant institutions to provide protection for human and the environment against chemical and other hazardous waste which are abundant and one of the major environmental challenges today (Ojeda-Benítez et al., 2013). Due to differences in legal frameworks and macroeconomic factors, the findings of studies conducted in other countries cannot be generalized to Kenya.

2.6 Household Hazardous Waste Management Practices

2.6.1 Importance of managing Household Hazardous Waste

There are cogent reasons why attention needs to be given to HHW in any national public health program that advocates for disease prevention due to the following reasons
Exposure to Household Hazardous Waste (HHW)/household hazardous products (HHPs) is a readily controllable health risk; it is by far easier to control the poisoning of young women with mercury in soap or dry cell batteries in young children than to find a local cure for AIDS. Moreover, any toxic substances in HHW/HHPs tend to exacerbate the severity of the endemic communicable diseases and vice versa. For instance, both lead poisoning and malaria affect the immune system, which can lead to synergism when two diseases co-occur (Senzige, 2014). Lastly, reduction and recycling of HHW conserves resources and energy that would be expended in the production of more products (Taboada-Gonzalez et al., 2010). The management of HHW incorporates a chain of processes from temporary storage, segregation, collection, transportation, reuse/recycle, resource recovery, treatment and final disposal (Senzige, 2014).

2.6.2 Types of Household Hazardous Wastes collections

One-day collections per month, is a type of waste collection where householders bring their household hazardous waste to a designated location on a specified date. The wastes received in this type of program are either recycled or sent to a hazardous waste treatment or disposal facility. According to Gu et al. (2014), one-day collection events can be organized for remote communities by regional facilities in their areas of service. Permanent collection facilities is another type of HHW collection, it is designed to store hazardous household wastes for short periods of time (Anyamani, 2014).

Door –To-Door Collections is also a type of HHW collection where trained staffs pick up materials in a retrofitted truck and sorted, packaged, and stored at a main facility until
enough waste is collected to warrant disposing it. Door-to-door type of collection is a very expensive service and typically is provided in conjunction with other collection events (Mbeng et al., 2012). In some communities curb side collection program is practiced where yellow boxes are set out at the curb for pickup of hazardous household wastes (Taboada-Gonzalez et al., 2010). Mobile collections which are also referred to as satellite or roving is practiced in some areas as a type of HHW collection. Mobile sites stay in one location for a specific period and then move the whole operation to the next site in within the service area. At the end of the collection period at the site, the waste is placed on a truck and transported back to the main facility; or if the truck is not full, it moves on to the next site (Massawe et al., 2014).

2.6.3 Household Hazardous Waste storage and Segregation

HHW handling and separation involves the activities associated with management of wastes until they are placed in storage containers. Handling also encompasses the movement of loaded containers to the point of collection. Separation of HHW from household waste is an important step in the handling and storage of HHW. According to Slack et al. (2005), the rules for storing hazardous products include following the directions for storage on the label; protecting the original label; storing household hazardous chemicals in the original container; keeping containers dry to prevent corrosion; storing products in a well-ventilated area; storing products away from any flammable materials or sources; and storing products away from children and pets. Generally high, locked shelves work best (Massawe et al., 2014).
2.6.4 Household Hazardous Waste disposal methods

Quantities of HHW remain unaccounted for in the domestic waste stream. Legislative pressure to deal with certain HHW appropriately like, (Waste Electrical and Electronic Equipment, Batteries and accumulators) has brought into view the issue of HHW management (Anyamani, 2014). Correct disposal methods of HHW vary from one product to another, sewer disposal of one product may dilute it sufficiently to render it harmless, while another product thrown down the drain may adversely affect wastewater treatment facilities. Ideally, labeling each product with appropriate disposal methods would assist in solving this dilemma. Unfortunately, laws which require detailed methods of chemical products may not apply to all consumer products. However the approved methods of HHW disposal are; reuse, triple-rinse container, recycle, Save for collection, flush down drain, put in trash, Fuel blending, chemical treatment , incineration and hazardous waste landfill (Malandrakis, 2008).

2.7 Summary of Literature Review

This chapter has reviewed relevant literature on the type of household hazardous waste generated by households. The literature review indicated that household hazardous waste fall into one of the following eight categories: automotive products, household cleaners, paints and solvents, poisons, medications and pharmaceutical products, sharps, e-waste and miscellaneous items. The risk factors of household hazardous waste include causing severe burns, illness, blindness, fetal harm, or even death if not used, stored, or disposed of properly. In addition, the literature above shows that knowledge levels of household hazardous waste was varying from one region to another and from one community to
another. Further, the literature shows that household hazardous waste management practices include reduction, reuse, recycle, incineration, landfill and open dumping.
CHAPTER THREE: MATERIALS AND METHODS

3.1 Introduction

This chapter outlines the procedures and methodology that was used to achieve the objectives of this study. The chapter comprises of study design, variables, location of the study, sampling technique and sample size, pre-testing of data collection tools, data collection techniques, logical and ethical consideration and data analysis.

3.2 Study design

This study employed a descriptive cross sectional design that involved the use of both qualitative and quantitative research. This study design was adopted because it analyzes data collected from a representative subset, at a specific point in time. In addition, it allows the combination of both qualitative and quantitative data. This study design aimed at describing the various hazardous household waste management practices by pastoralist households in Mandera County. Additionally, the type of HHW generated and their disposal methods, the occurrence of accidents related to household hazardous waste and the effect of the level of knowledge on household hazardous waste (HHW) management among household heads in the pastoral community were determined. This research design was used by Udofia et al. (2017) in a cross sectional study of household disposal practices and reported harm in Southern Ghana. The research design was also used by Amouei et al. (2014) in an investigation of household hazardous wastes production in the Amirkola Township in Iran.
3.3 Variables

3.3.1 Independent Variables
Independent variables included the types of household hazardous waste generated; socio demographic factors and level of knowledge on household hazardous waste (HHW) management.

3.3.2 Dependent variables
The dependent variable in this study was household hazardous waste management practices.

3.4 Location of Study
This study covered Mandera East Sub County, which covers 2,793.10 square kilo meters. Mandera East Sub County is one of the six sub Counties of Mandera County located in the North Eastern region of Kenya. The general population of the study area is 184,639 people (KNBS, 2010). The sub county consists of five wards namely; Arabia, Libehia, Khalalio, Neboi, and Township. The main socio economic activities in study area include; informal employment, seasonal farming, small scale trading and pastoralism. The pastoral community lives mainly in the five wards of Mandera east. Their main socioeconomic activity is pastoralism. Mandera is dominated by ethnic Somalis, whose clans comprise of Gurreh, Degodia, Murule and Corner tribes (KNBS, 2010). The climate in Mandera East is characterized as Arid; temperatures tend to be hot throughout the year. The day to day temperatures fall above 35 degrees during the day and above 20 degrees at night.
3.5 Inclusion Criteria
The study included all household heads (both male and female), or a household member above 18 years of age in their absence, which had lived a pastoral lifestyle for more than 6 months in Mandera East Sub County and consented to be involved in the study. The household members had to be above 18 years in age because for below 18 years the researcher would be required to obtain parental consent. In addition, the duration of living a pastoral life among the respondents is important to fully recognize the waste generation in the pastoral communities and hence 6 months is adequate time gain this information. The household heads were selected in this study as the researcher believes they are responsible of managing their households, which includes managing household waste.

3.6 Exclusion Criteria
The study excluded households whose heads or an adult member was not available during data collection, and any respondent who refused to give consent during data collection. The study also excluded household heads and adult members who were found insane or sick.

3.7 Study Population
The study population was pastoral households in Mandera East Sub-County. The key research participants were heads of households. The household heads were male or female who were responsible for the household during the data collection. According to KNBS (2010), there are 25,923 households and 184,639 persons in Mandera East Sub-County, which means there are about 25,923 household heads in the five wards of Mandera East sub-county. The five wards include Arabia, Libehiya, Khalalio, Neboi and
Township. The target population of this study was therefore 25,923 pastoral household heads. The study also included stake holders in waste management, working in the study area as key informants. The key informants have adequate information on HHW because of their role in government departments dealing with sanitation. These were 7 officers in the Public Health Department, 1 staff of National Environmental Management Authority (NEMA), 5 heads of wards, 1 staff of Water, Sanitation and Hygiene program (WASH) and 2 staff from Mandera East Sub-county health facilities. The key informants were therefore 17.

Table 3.1: Target Population

<table>
<thead>
<tr>
<th>Wards</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabia ward</td>
<td>2,921</td>
</tr>
<tr>
<td>Libehiya ward</td>
<td>7,568</td>
</tr>
<tr>
<td>Khalalio ward</td>
<td>2,854</td>
</tr>
<tr>
<td>Neboi ward</td>
<td>8,477</td>
</tr>
<tr>
<td>Township ward</td>
<td>4,103</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25,923</strong></td>
</tr>
</tbody>
</table>

Source: KNBS (2010)

3.8 Sampling Technique

This study made use of multistage sampling method. The first stage involved using simple random sampling, the second stage involved using systematic simple random sampling and the third stage involved using purposive sampling. This study used simple random sampling to select two wards from the five wards; these were Libehiya and Khalalio wards from the five wards of Mandera East Sub-County. This was done by the use of table of random numbers. Simple random sampling was further used to select two villages from each of the two wards earlier obtained; Harar and Farey villages were randomly picked for Libehiya ward while Matasafara and Bur Abor villages were
randomly picked for Khalalio ward. To identify the households whose heads were to be interviewed, the research assistants located the center of the village and tossed a pen to obtain the direction of movement. From where the pen pointed the closest household was visited to interview the household head and then systematic simple random sampling was used to interview every second household head until the desired sample size was achieved. Purposive sampling was used to select key informants from relevant government ministries and other stakeholders who directly deal with sanitation activities.

3.9 Sample Size Determination
The sample size was determined using Fisher et al. (2003) formula. This formula was used to obtain a representative sample of the target population. The target population is estimated at 25,923 pastoral households.

\[ n = Z^2 \frac{pq}{d^2} \]

Where,

- \( n \) = the desired sample size (if the target population is > 10,000).
- \( Z \) = is the standard normal deviation = 1.96 which corresponds to 95 per cent confidence interval.
- \( p \) = is the proportion in the target population estimated to have the characteristics being studied. The pastoral population is estimated at 57 per cent of the total population in Mandera County (Kratli & Swift, 2014).
- \( q = 1-0.57 = 0.43 \).
- \( d \) = the level of statistical significance set = 0.05

\[ n = 1.96^2 \times (0.57) \times (0.43)/0.05^2 = 377 \text{ household heads} \]

10 per cent of the sample size was added to cater for possible attrition or non-response. This therefore increased the sample size to 415 household heads.
The sampling frame of this study comprised of all the households of the 4 villages in the 2 wards of Khalalio and Libehiya in Mandera East Sub-County.

Table 3.2: Sampling frame

<table>
<thead>
<tr>
<th>Sub locations</th>
<th>Population</th>
<th>Households</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harar</td>
<td>1534</td>
<td>213</td>
<td>75</td>
</tr>
<tr>
<td>Farey</td>
<td>2885</td>
<td>465</td>
<td>164</td>
</tr>
<tr>
<td>Matasafara</td>
<td>829</td>
<td>118</td>
<td>42</td>
</tr>
<tr>
<td>Burabor</td>
<td>3078</td>
<td>382</td>
<td>134</td>
</tr>
<tr>
<td>Total</td>
<td>3907</td>
<td>500</td>
<td>415</td>
</tr>
</tbody>
</table>

Source: KNBS (2010)

3.10 Construction of Research Instruments

Primary data was collected by use of researcher-administered questionnaires; the questionnaires included structured and unstructured questions. Primary data was also collected by use of key informant interview guide. Semi-structured and structured questionnaires (see Appendix II) were administered to obtain information from the household heads. Key informant interview guide (see Appendix III) was also used to generate information from 17 key informants.

3.11 Pre-Testing

Pre-testing was carried out before the questionnaires were administered to the participants, to certify that the questions were relevant, make sense and clearly understandable. In this study, pretesting involved 38 household heads (10% of the sample size) and was carried out in Hareri Hosle Location (about 50 km from Mandera town) which has similar characteristics to the study area.
3.11.1 Validity

To enhance validity in this study, the instruments to be used were developed carefully to ensure the data generated addressed the objectives of the study. In addition, the validity of the research instruments was improved by seeking the opinions of experts in the field of study, particularly the supervisors to promote accuracy and meaningfulness of inferences. Obtaining an adequate sample size was also used to obtain the validity of the study. Pre-testing of the instruments before they were adapted for use was conducted to determine their suitability and changing any unclear and ambiguous question.

3.11.2 Reliability

Reliability is important to ensure the instruments yield the same results and reduce random errors in the study. Reliability was achieved by developing good quality questionnaire and constructed according to the specific objectives, correct coding of questioner, training of enumerators before data collection and constructing questionnaire that doesn’t waste the time of the interviewees. The questionnaire's reliability was statistically measured by measuring the internal consistency. In turn, internal consistency was measured by use of Cronbach’s Alpha. The alpha value ranges between 0 and 1 with reliability increasing consistently with increase in value (Cooper & Schindler, 2006). This study used coefficient values> 0.7 is normally accepted rule of thumb that designates acceptable reliability.
3.12 Data Management and Analysis

3.12.1 Data Management

Data Management began with instruments checking, which involved eliminating questionnaires that were not fully filled and which had inconsistent responses. This was then followed by data editing, which sought to correct illegible, incomplete, inconsistent and ambiguous answers. The quantitative data was coded, where a codebook for different variables was prepared on the basis of the numbering structure of the questionnaires. The data entry was done carefully. Data was also cleaned and reviewed for consistencies.

3.12.2 Data Analysis

The research instruments in this study generated both qualitative and quantitative data. Qualitative data was obtained from the open ended questions in the questionnaire and from key informant interviews. Thematic content analysis was used to analyze qualitative data gathered and related literature and presented into the thematic areas of study. On the other hand, quantitative raw data was coded and entered into Statistical Package for Social Scientists (SPSS version 21) for analysis. Descriptive statistics mainly frequencies and percentages were used to summarize the quantitative data. The analyzed data was presented in frequency distribution tables. In addition to this, inferential statistics (chi-square) was used to identify the association between the dependent and independent variables.

3.13 Logistical and Ethical consideration

Research approval and authorization to conduct the study was sought from Kenyatta University graduate school and Kenyatta University Ethics Review Committee (see
Appendix VI & VII) respectively. A research permit to carry out the study was also obtained from the National Council for Science, Technology and Innovation (see Appendix VIII). In addition, authorization to carry out this study was sought from the Ministry of Health (see Appendix XI) of Mandera County government. Informed consent was sought from the study participants before data collection (see Appendix I). Anonymity was highly maintained throughout the study by not recording names of participants. Research participants did not receive any incentives to participate in the study and no participant was forced to answer questions they did not wish to answer.
CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents results of the study with respect to the objectives. The general objective of the study was to explore household hazardous waste management practices among pastoral community of Mandera County. The results were presented in table and figures.

The sample size of the study was 377 household heads. In addition, 10 per cent of the sample size was added to carter for possible attrition or non-response. This was therefore increased to 415 household heads. Out of this, 412 responses were obtained, which gives a response rate of more than 99.27 per cent. Three of the questionnaires were not fully filled and had inconsistent responses and hence could not be used in the study. Key informants in the study included public health officers, health facility in charge, National Environmental Management Authority (NEMA) staff, chiefs/ward administrators and NGO staff dealing with WASH.

4.2 Socio Demographic Data of the Research participants

Table 4.1 presents data on the socio-demographic characteristic of the research participants. The results indicate that 52.4 per cent of the participants were male while 47.6 per cent were female. Most of the research participants 37.9 per cent were aged between 26 and 40 years, 34 per cent were aged between 41 and 54 years, 15.5 per cent indicated that they were over 64 years in age and 15.5 per cent indicated that they were aged between 18 and 25 years. Additionally, most (83%) of the research participants had
no formal education at all, 13.1 per cent had primary education, while 3.4 per cent had had secondary education and 0.5 per cent had tertiary level of education.

Different species of animals have a bearing on the generation of different types of household hazardous wastes related to animal care. Different species of animals determines the form of treatment and also relates to seasons. Table 4.1 presents data on species of animals kept by Household Heads. From the table, it is observed that 20.4 per cent of the households had camels, 42.2 per cent indicated that they had cattle, 68 per cent had goats and 18 per cent were rearing camel, cattle and goats (all species).

**Table 4.1: Socio Demographic Data of the Research participants**

<table>
<thead>
<tr>
<th>Socio Demographic characteristics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>216</td>
<td>52.4</td>
</tr>
<tr>
<td>Female</td>
<td>196</td>
<td>47.6</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 to 25 years</td>
<td>64</td>
<td>15.5</td>
</tr>
<tr>
<td>26 to 40 years</td>
<td>156</td>
<td>37.9</td>
</tr>
<tr>
<td>41 to 65 years</td>
<td>140</td>
<td>34.0</td>
</tr>
<tr>
<td>Over 65 years</td>
<td>52</td>
<td>12.6</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Level of education completed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>342</td>
<td>83.0</td>
</tr>
<tr>
<td>Primary Level</td>
<td>54</td>
<td>13.1</td>
</tr>
<tr>
<td>Secondary level</td>
<td>14</td>
<td>3.4</td>
</tr>
<tr>
<td>Tertiary level</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
<tr>
<td>Camel</td>
<td>84</td>
<td>20.4</td>
</tr>
<tr>
<td>Cattle</td>
<td>174</td>
<td>42.2</td>
</tr>
<tr>
<td>Goats</td>
<td>280</td>
<td>68.0</td>
</tr>
<tr>
<td>All species</td>
<td>74</td>
<td>18.0</td>
</tr>
</tbody>
</table>

**4.2.1 Number of Household members**

The study sought to know the number of people who live in households because it has a direct impact on the quantity of HHW generated. According to the findings, 34.5 per cent
of the research participants had between 6 and 8 people living in their households, 31.6 per cent had more than 8 people, 23.8 per cent had between 3 and 5 people and 10.2 per cent had less than 3 people. This implies that most of the pastoral households in Mandera County had between 6 and 8 members.

<table>
<thead>
<tr>
<th>Number of Household members</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 3 members</td>
<td>42</td>
<td>10.2</td>
</tr>
<tr>
<td>3 to 5 members</td>
<td>98</td>
<td>23.8</td>
</tr>
<tr>
<td>6 to 8 members</td>
<td>142</td>
<td>34.5</td>
</tr>
<tr>
<td>More than 8 members</td>
<td>130</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>412</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

### 4.2.2 Movement from One location to another

Table 4.3 presents data on movement of households from one location to another. Results indicate that 34.5 per cent of the households moved from one location to another in search of pasture more than three times a year, 29.1 per cent moved twice a year, 19.4 per cent did not move, 8.7 per cent moved three times a year and 8.3 per cent moved once a year.

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 3 times a year</td>
<td>34.5</td>
<td>142</td>
</tr>
<tr>
<td>Three times a year</td>
<td>8.7</td>
<td>36</td>
</tr>
<tr>
<td>Twice a year</td>
<td>29.1</td>
<td>120</td>
</tr>
<tr>
<td>Once a year</td>
<td>8.3</td>
<td>34</td>
</tr>
<tr>
<td>We don’t move</td>
<td>19.4</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td><strong>412</strong></td>
</tr>
</tbody>
</table>

### 4.2.3 Size of the Land for the Pastoral Households

Table 4.4 presents data on the size of land for the pastoral households. According to the findings, 65.2 per cent of the households were using community land and did not have
land of their own, 10.6 per cent had one acre, 8.6 per cent had 2 acres and 7.1 per cent
had 3 acres. This shows that most of the pastoral households in Mandera County do not
own land of their own and hence they use community land. This explains the reasons why
most of the research participants indicated that they did not own land and pastoralists can
move around the year from one location to another in search of pasture.

Table 4.4: Size of the land

<table>
<thead>
<tr>
<th>Size of Land</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than half an acre</td>
<td>14</td>
<td>3.5</td>
</tr>
<tr>
<td>One acre</td>
<td>44</td>
<td>10.6</td>
</tr>
<tr>
<td>2 acres</td>
<td>35</td>
<td>8.6</td>
</tr>
<tr>
<td>3 acres</td>
<td>29</td>
<td>7.1</td>
</tr>
<tr>
<td>4 acres</td>
<td>16</td>
<td>4.0</td>
</tr>
<tr>
<td>5 acres</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>More than 5 acres</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Have no land</td>
<td>269</td>
<td>65.2</td>
</tr>
<tr>
<td>Total</td>
<td><strong>412</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

4.3 Types of Hazardous Waste Generated by Pastoral Households

In this study, the first objective was to identify the type of household hazardous waste
generated by households in the pastoral community of Mandera County. This research
objective was achieved by putting forward to the participants’ eight questions asking
them if they generated the categories of HHW in the options provided by the interviewer.

The categorized Household Hazardous waste into eight broad categories which
comprised of drugs and pharmaceuticals, sharps, pesticides, used electronics, automotive
products such as oils, adhesives, paints and solvents and disinfectants. A household could
produce all or some of these HHW depending on their economic activity, season and type
of domestic animal they rare.
4.3.1 Sources of Household Hazardous Waste

The community in Mandera County is mainly pastoralists and hence keep livestock including camels, goats, sheep and cattle. The rearing of livestock involves use of drugs for treating the animals when they get sick. This leads to generation of drugs, plastic containers, syringes and needles. Drugs, syringes and needles used in the treatment of animals have toxic properties when incinerated. In addition, the daily activities of the nomadic community involves the use of electronics such as torches containing lead, batteries and flammables such as paraffin because they are not connected to electricity. The pastoral communities generate poisons such as acaracides and pesticides as they are used to treat and prevent parasitic infections in their livestock. These types of waste are corrosive and toxic and hence can lead to the death. Detergents, glues and adhesives are equally produced in households are also common HHW. Generally these wastes are, reactive, ignitable or toxic and require special handling form storage, segregation and disposal.

4.3.2 Generation of Household Hazardous Waste

The household hazardous wastes were categorized into 8 broad categories: unused drugs and pharmaceuticals; used needles and syringes; remains of pesticides, herbicides, fungicides and acaracides; used batteries and electronic items; automotive products; remains of glues and adhesives; paints and solvents; and disinfectants, laundry products and used cosmetics.

According to the findings, 99.5 per cent of the research participants indicated that their households were generating used batteries and electronic items (mobile phones and
radio), 96.1 per cent indicated that they were generating left over of used drugs and pharmaceuticals, 86.4 per cent indicated that they were generating remains of pesticides, herbicides, fungicides and accaricides and 83 per cent indicated that they were generating used needles and syringes for animal treatment.

In addition, 7.3 per cent of the research participants indicated that their households were generating automotive products such as oils, paraffin and petrol. Also, 1.5 per cent indicated that their households were generating remains of glues and adhesives and 1.0 per cent indicated that their households were generating disinfectants, laundry products and used cosmetics. However, none of the research participants indicated that their households were generating paints and solvents wastes. Other hazardous household wastes generated include polythene papers.

Table 4.5: Types of HHW Generated

<table>
<thead>
<tr>
<th>Types of HHW Generated</th>
<th>Percent</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused drugs and pharmaceuticals for either human or animal use</td>
<td></td>
<td>96.1</td>
<td>3.9</td>
<td>100</td>
</tr>
<tr>
<td>Used needles and syringes for animal and human treatment?</td>
<td></td>
<td>83</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>Remains of pesticides, herbicides, fungicides and accaricides</td>
<td></td>
<td>86.4</td>
<td>13.6</td>
<td>100</td>
</tr>
<tr>
<td>Used batteries (all size and type) and electronic items (mobile phones, radio, and television)</td>
<td></td>
<td>99.5</td>
<td>0.5</td>
<td>100</td>
</tr>
<tr>
<td>Automotive products such as oils, paraffin and petrol</td>
<td></td>
<td>7.3</td>
<td>92.7</td>
<td>100</td>
</tr>
<tr>
<td>Remains of glues and adhesives</td>
<td></td>
<td>1.5</td>
<td>98.5</td>
<td>100</td>
</tr>
<tr>
<td>Paints and solvents</td>
<td></td>
<td>0</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Disinfectants, laundry products and used cosmetics</td>
<td></td>
<td>1</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>

4.3.3 Generating same type of HHW in Different Seasons

In different seasons animals get different types of diseases that require the use of different types of drugs for treatment. There could also be variations in the use of pesticides and other hazardous waste depending on the season. According to the findings, 75.7 per cent
of the pastoral households generate different types of household hazardous waste in different seasons of the year while 24.3 per cent generated the same types of household hazardous waste in different seasons of the year. This implies that most pastoral households in Mandera County generate different types of household hazardous waste in different seasons of the year.

Table 4.6: Different seasons and types of HHW Generated

<table>
<thead>
<tr>
<th>Generating different types of household hazardous waste in different seasons</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generated the same types of household hazardous waste in different seasons</td>
<td>100</td>
<td>24.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>412</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.3.4 Seasons that households generate more household hazardous waste

Since most of the households were generating different types of household hazardous waste in different seasons of the year, it was important to determine which household hazardous wastes were generated in each season in the seasonal calendar of the pastoral community. From the findings, 38.8 per cent of the research participants indicated that they have seasonal variations in their waste stream during the windy season (June and July), 28.2 per cent indicated during the dry season (January, February, March, August, September and October), 24.3 per cent indicated they had no seasonal variations in their waste stream and 8.7 per cent indicated during the wet season (April, May, November and December). This shows that most of the households were generating different types of hazardous waste in their waste stream during the windy and dry season (January, February, March, June, July, August, September and October). This is because livestock gets sick mostly during the windy and the dry seasons.
Table 4.7: Seasons households generate different type household hazardous waste

<table>
<thead>
<tr>
<th>Types of waste</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry season</td>
<td>116</td>
<td>28.2</td>
</tr>
<tr>
<td>Windy season</td>
<td>160</td>
<td>38.8</td>
</tr>
<tr>
<td>Wet seasons</td>
<td>36</td>
<td>8.7</td>
</tr>
<tr>
<td>No seasonal wastes</td>
<td>100</td>
<td>24.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>412</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

4.3.5 Most common household Hazardous waste in the Seasons

Different household hazardous wastes are generated in different seasons of the year and hence it was important to understand the most common household Hazardous waste in each season to plan for its management. From the findings, 38.1 per cent of the research participants indicated that animal drugs were the most common household hazardous waste followed by accaricides and pesticides (35.3%) and needles and syringes (26.6%). This implies that animal drugs were the most common household hazardous waste followed by accaricides and pesticides and needles and syringes mostly during the windy season.

Table 4.8: Most common household Hazardous waste according to Season

<table>
<thead>
<tr>
<th>Types of waste</th>
<th>Season</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal drugs</td>
<td>Rainy season</td>
<td>119</td>
<td>38.1</td>
</tr>
<tr>
<td>Accaricides and pesticides</td>
<td>rainy season</td>
<td>110</td>
<td>35.3</td>
</tr>
<tr>
<td>Needles and syringes</td>
<td>Dry, windy and wet seasons</td>
<td>83</td>
<td>26.6</td>
</tr>
</tbody>
</table>

4.3.6 Buying of household hazardous goods

The research participants were also requested to indicate where they buy the household hazardous goods from. To identify the places where household hazardous goods are bought which later covert to hazardous waste is important in their management. Many
outlets may not be able to advice the customers who purchase the goods on its storage and disposal.

The results were as presented in Table 4.9. From the findings, 43.7 per cent of the research participants indicated that they bought household hazardous goods from retail shops, 25.2 per cent indicated from hawkers, 16.5 per cent indicated from open air market, 14.1 per cent indicated from chemists and 0.5 per cent indicated supermarkets.

| Table 4.9: Buying of Household Hazardous Goods |
|-------------------------------|------------------|------------------|
| Frequency                  |                  |
| Retail Shop                | 180              | 43.7             |
| Supermarket                | 2                | .5               |
| Open air market            | 68               | 16.5             |
| Chemists                   | 58               | 14.1             |
| Hawkers                    | 104              | 25.2             |
| Total                      | 412              | 100.0            |

4.4 Occurrence of Accidents Related to Household Hazardous Waste

The second objective was to determine the occurrence of accidents related to household hazardous waste among the members of households of the pastoral community in Mandera County.

4.4.1 Victims of Household Hazardous Waste Related Accidents

Accidents and injuries resulting from poorly managed HHW is common among human and pets in households both in developing and the developed world. Some accidents could be fatal to children and even adults if not treated properly and timely (Senzige, 2014).

The research participants were asked to indicate whether any of their household members had been a victim of household hazardous waste related accidents. From the findings,
91.7 per cent of the study research participants indicated that none of their household members has been a victim of household hazardous waste related accidents. However, 8.3 per cent indicated that their household members had been a victim of household hazardous waste related accidents. This implies that most of the household members in Mandera County had not been victims of household hazardous waste related accidents.

### 4.4.2 Age of the Household Member Who were Involved in Accidental Mishap

Accidents and injuries from HHW are common in children who get exposed to them because they are curious about things but severally adults have also been exposed due to their occupation or their unplanned handling. From the research participants who indicated that their household members had been a victim of household hazardous waste related accidents, the study also sought to determine their age. From the findings, 64.7 per cent of the research participants indicated that the household members who got the accident were aged between 0 and 5 years, 29.4 per cent indicated that they were 18 years and above in age and 5.9 per cent indicated that they were aged between 6 and 11 years.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>22</td>
<td>64.7</td>
</tr>
<tr>
<td>6-11 years</td>
<td>2</td>
<td>5.9</td>
</tr>
<tr>
<td>18 years and above</td>
<td>10</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

### 4.4.3 Type of Household Hazardous Waste/s that Caused the Reported Accident

The research participants, who indicated that their household members had been a victim of household hazardous waste related accidents, were asked to indicate the type of household hazardous waste/s that caused the reported accident. As indicated in Table 4.11, 58.8 per cent of the research participants indicated that the household hazards
accidents were caused by acaricides/pesticides, 29.4 per cent indicated that they were caused by paraffin while 11.8 per cent indicated that they were caused by animal/human drugs.

Table 4. 11: Type of Household Hazardous Waste/S that Caused the Reported Accident

<table>
<thead>
<tr>
<th>Type of HHW</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acaricides/pesticides</td>
<td>20</td>
<td>58.8</td>
</tr>
<tr>
<td>Animal/human drugs</td>
<td>4</td>
<td>11.8</td>
</tr>
<tr>
<td>Paraffin</td>
<td>10</td>
<td>29.4</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.4.4 Health Problems that Occurred Due to the Accidental Occurrences, Place of Treatment and Outcome of the Incidents

The research participants were also asked to indicate the health problems that occurred due to the accidental incidents as informed by the healthcare worker. According to the findings, 35.3 per cent of the research participants indicated that unconsciousness was one of the health problems that occurred due to the accidents. This was followed by diarrhea and vomiting (29.4%), eye irritation (17.6%), respiratory infection (11.8%) and skin infection (5.9%). The key informants, who included healthcare workers such as clinical officers and nurses, indicated that the most commonly reported accidental occurrences due to household hazardous waste at the pastoral households included injury related to sharp objects such as needles, food poisoning, drug poisoning, cuts, fire outbreak as well as skin diseases and respiratory illness from pesticides.

The research participants were asked to indicate where the family members were treated after the accident due to household hazardous waste. From the findings, 41.2 per cent of the household heads indicated that the family members were treated by other family
members after the accident due to household hazardous waste, 35.3 per cent indicate that they were treated in a hospital and 23.5 per cent indicated that they were treated by traditional healers.

The research participants were further asked to indicate what the outcome of the accident was. The results were as presented in Table 4.12. From the findings, 94.1 per cent of the household heads indicated that the victims of the household hazardous waste accident survived while 5.9 per cent indicated that they died.

Table 4.12: Health Problems that Occurred Due to the Accident, Place of Treatment and Outcome of the Accidents

<table>
<thead>
<tr>
<th>Health problems resulting from HHW accidents</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea and vomiting</td>
<td>10</td>
<td>29.4</td>
</tr>
<tr>
<td>Skin infection</td>
<td>2</td>
<td>5.9</td>
</tr>
<tr>
<td>Eye irritation</td>
<td>6</td>
<td>17.6</td>
</tr>
<tr>
<td>Respiratory infection</td>
<td>4</td>
<td>11.8</td>
</tr>
<tr>
<td>Unconsciousness</td>
<td>12</td>
<td>35.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place of treatment</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>12</td>
<td>35.3</td>
</tr>
<tr>
<td>Traditional healer</td>
<td>8</td>
<td>23.5</td>
</tr>
<tr>
<td>Treated by family members</td>
<td>14</td>
<td>41.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survived</td>
<td>32</td>
<td>94.1</td>
</tr>
<tr>
<td>Died</td>
<td>2</td>
<td>5.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

4.5 Level of knowledge on Household Hazardous Waste

The knowledge of the pastoralists on household hazardous waste influences their ability to manage different types of household hazardous wastes. Therefore, the third objective of the study was to determine the level of knowledge on household hazardous waste (HHW) management among pastoral community of Mandera County.
4.5.1 Knowledge Scores

The knowledge scores of the research participants on household hazardous waste management practices were measured by the number of questions they got correct responses where 0 to 3 scores were considered to be little knowledge, 4 to 7 scores was considered moderate knowledge, 8 to 11 was considered to be good knowledge and 12 to 13 scores was considered to be excellent knowledge. The knowledge scores were obtained from Hebbal et al. (2011). From the findings, 48.1 per cent of the research participants obtained between 4 and 7 scores, 32.7 per cent obtained 8 to 11 scores and 18.4 per cent obtained below 3 scores and 0.7 per cent obtained between 12 and 13 scores. This shows that most of the research participants had moderate awareness on household hazardous waste management.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3</td>
<td>18.4</td>
</tr>
<tr>
<td>4 to 7</td>
<td>48.1</td>
</tr>
<tr>
<td>8 to 11</td>
<td>32.7</td>
</tr>
<tr>
<td>12 to 13</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.5.2 Identification of Household Hazardous Wastes

The recognition of the existence of HHW in pastoral households is important as the sound management starts from knowing that this type of waste requires special handling. According to the findings, 92.8 per cent of the research participants indicated that they can identify household hazardous waste while 7.2 per cent stated that they cannot correctly identify household hazardous waste. This implies that most of the pastoral household heads in Mandera County can correctly identify household hazardous waste.
However, most of the household heads understood what household hazardous waste is, after the research assistants explained to them. This is because there is no specific term for household hazard waste in vernacular languages in Mandera County and considering that most of the household heads had no formal education.

4.5.3 Source of Information on Household Hazardous Waste

From the research participants who had heard about household hazardous waste, the study also sought to establish the source of information to identify household hazardous waste from general household waste. From the findings, 42.7 per cent of the research participants who had heard about household hazardous waste reported that the source of information was radio, 38.8 per cent indicated health workers, 6.3 per cent indicated neighbor and 4.8 per cent indicated veterinary officers. This implies that most of the household heads that had heard about household hazardous waste had obtained from radio and health workers.

Table 4.14: Source of Information on Household Hazardous Waste

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health workers</td>
<td>160</td>
<td>38.8</td>
</tr>
<tr>
<td>Radio</td>
<td>176</td>
<td>42.7</td>
</tr>
<tr>
<td>Neighbor</td>
<td>26</td>
<td>6.3</td>
</tr>
<tr>
<td>Veterinary officers</td>
<td>20</td>
<td>4.8</td>
</tr>
<tr>
<td>No information</td>
<td>30</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>412</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

4.5.4 Level of Knowledge on Household Hazardous Waste

Knowledge on the various types of household hazardous waste management methods influences their utilization in disposing various types of household hazardous waste. Actually the management of household hazardous waste starts from its recognition in order to segregate them from the other waste stream. The research participants were
given the options for the various methods of HHW management methods and a
dichotomous scale was used to measure the awareness on management methods.

From the findings, 85 per cent of the research participants indicated that they had
awareness on open dumping, 58.3 per cent had awareness on incineration/burning, 15.3
per cent had awareness on reuse, 2.7 per cent had awareness on land fill/burying, 1.3 per
cent had awareness on reducing usage and the same percent had awareness on recycling.
This implies that most of the household heads had knowledge on open dumping and
incineration. Knowledge on other methods of household hazardous waste management
practices like reuse, land fill/burying, reducing usage and recycling was found to be
uncommon among most of the household heads.

The key informants also indicated that household hazardous waste disposal methods that
are practiced by the pastoral community of Mandera East Sub County include burning in
an open area, compost pit, crude damping and opening damping.

<table>
<thead>
<tr>
<th>Table 4. 15: Level of Knowledge on Household Hazardous Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td><strong>Yes</strong></td>
</tr>
<tr>
<td>Reduce usage</td>
</tr>
<tr>
<td>Reuse</td>
</tr>
<tr>
<td>Recycle</td>
</tr>
<tr>
<td>Incineration</td>
</tr>
<tr>
<td>Land fill/Burying</td>
</tr>
<tr>
<td>Open dumping</td>
</tr>
</tbody>
</table>

4.5.5 Knowledge on Management of Household Hazardous Waste Practices

Most of the research participants (81%) stated that unused adhesives and glues should be
disposed by burying. This is the correct way of managing unused adhesives and glues. In
addition, according to 91.3 per cent of the research participants, remains of pesticides,
insecticides, fungicides and other farm chemicals should be disposed by burying/landfill. This is was the correct way of managing remains of pesticides, insecticides, fungicides and other farm chemicals.

According to the findings, 97.6 per cent of the research participants reported that empty oil and flammable containers should be reused, which was wrong. Further, 86.8 per cent of the research participants indicated that needles and syringes to treat animals should be reused, which is a wrong method of managing used needles and syringes. Also, 86.4 per cent of the research participants indicated that unused drugs (human and animal) should be disposed by burning. However, drugs are made of chemicals and hence burning them may lead to environmental pollution and hence this is wrong method of management.

In addition, 40.8 per cent indicated that aerosol/ compressed cans should not be incinerated. Burning of aerosol/ compressed cans may lead to explosions and hence it is a wrong way of managing aerosol/ compressed cans. Further, 29.6 per cent of the research participants reported that old batteries (all types) and used electronic items (phones, radio, and torches) should not be disposed by burning. However, this is a wrong way of managing used electronic items (phones, radio, and torches).
Table 4.16: Knowledge on Management of Household Hazardous Waste practices

<table>
<thead>
<tr>
<th>knowledge</th>
<th>Frequency (n=412)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remains of Pesticides, insecticides, fungicides and other farm chemicals should be disposed by burying/landfill</td>
<td>376</td>
<td>91.3</td>
</tr>
<tr>
<td>Unused drugs (human and animal) should be disposed by burning</td>
<td>356</td>
<td>86.4</td>
</tr>
<tr>
<td>Old Batteries (all types) and used electronic items (phones, radio, television) should be disposed by burning</td>
<td>122</td>
<td>29.6</td>
</tr>
<tr>
<td>Unused adhesives and glues should be disposed by landfill/burying</td>
<td>332</td>
<td>81.0</td>
</tr>
<tr>
<td>Needles and syringes to treat animals should be reused</td>
<td>356</td>
<td>86.8</td>
</tr>
<tr>
<td>Empty oil and flammable containers should be reused</td>
<td>400</td>
<td>97.6</td>
</tr>
<tr>
<td>Aerosol/ compressed cans should be incinerated</td>
<td>168</td>
<td>40.8</td>
</tr>
</tbody>
</table>

4.6 Household Hazardous Waste Management Practices at Household Level

The fourth objective of the study was to identify household hazardous waste management practices at household level in the pastoral community of Mandera County. This objective was achieved by identifying the storage, segregation and disposal methods used in managing the various types of household hazardous waste generated in pastoral community of Mandera County. It is important to identify the HHW management practices at household level in the pastoral community in this study in order to measure whether they have a good practice or bad practice and to give recommendations on improvement on HHW management at the HH level.

4.6.1 Segregation of Household Hazardous Waste

The research participants were asked to indicate whether they segregate their household hazardous waste from the general household waste before disposal. According to the findings, 87.8 per cent of the pastoral research participants indicated that they do not segregate their household hazardous waste from the general household waste before storage and disposal while 12.2 per cent indicated that they did.
4.6.2 Categories of Household Hazardous Waste Segregated

From the research participants who indicated that they segregate their household hazardous waste from the general household waste before disposal, the study also sought to establish the categories of household hazardous waste they segregate from the general hazardous waste. According to the findings, 88 per cent indicated that they segregate used needles and syringes, 84 per cent indicated that they segregate unused/ expired animal and human drugs and the same percent indicated that they segregate poisons, insecticides, fungicides and pesticides. In addition, 16 per cent of the research participants indicated that they segregate adhesives and glues, 12 per cent indicated that they segregate containers of used oils, paraffin, petrol and empty aerosol cans while 8 per cent indicated that they segregate batteries (all types) and used electronic items (phones and radio, torches).

Table 4.17: Categories of Household Hazardous Waste segregated

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency Segregate</th>
<th>Frequency Do not Segregate</th>
<th>Percent Segregate</th>
<th>Percent Do not Segregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused/ expired animal and human drugs</td>
<td>42</td>
<td>8</td>
<td>84.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Poisons, insecticides, fungicides and pesticides</td>
<td>42</td>
<td>8</td>
<td>84.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Batteries (all types) and used electronic items (phones, radio, torches)</td>
<td>4</td>
<td>46</td>
<td>8.0</td>
<td>92.0</td>
</tr>
<tr>
<td>Containers of used oils, paraffin, petrol and empty aerosol cans</td>
<td>6</td>
<td>44</td>
<td>12.0</td>
<td>88.0</td>
</tr>
<tr>
<td>Adhesives and glues</td>
<td>8</td>
<td>42</td>
<td>16.0</td>
<td>84.0</td>
</tr>
<tr>
<td>Used needles and syringes</td>
<td>44</td>
<td>6</td>
<td>88.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

4.6.3 Level of Education and Segregation of Household Hazardous Waste

The level of education and knowledge may affect segregation of Household Hazardous Waste among pastoral communities. Primary education and no formal education were
classified as “low or no education” while secondary education, college education and university education were classified as “educated”. Many household hazardous goods have labels that direct the users on how to store and dispose them. This can only be read by literate persons and may disadvantage many pastoral household heads as most of them have no formal education. In addition, household heads who have never heard of segregation, may not advocate for its use in the households. From the findings, there is a significant association between level of education and segregation of household hazardous waste from the general household waste before disposal ($\chi^2 = 98.515$, df =1, p <0.05).

**Table 4. 18: Level of Education and Segregation of Household Hazardous Waste**

<table>
<thead>
<tr>
<th>Level of education completed</th>
<th>Segregate your household hazardous waste</th>
<th>Total</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Low or no education</td>
<td>36</td>
<td>360</td>
<td>396</td>
</tr>
<tr>
<td>Percent</td>
<td>9.09</td>
<td>90.91</td>
<td>100</td>
</tr>
<tr>
<td>Educated</td>
<td>14</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Percent</td>
<td>87.5</td>
<td>12.5</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>362</td>
<td>412</td>
</tr>
<tr>
<td>Percent</td>
<td>12.2</td>
<td>87.8</td>
<td>100</td>
</tr>
</tbody>
</table>

**4.6.4 Movement from One Place to Another and Storage of household hazardous waste**

Pastoralists who move from one location to another and the frequency of movement may affect the storage of household hazardous waste as they may not move with it. Movement of households will also affect on the choice of the disposal methods such as incineration and open dumping. From the findings, there is a significant association between movement from one place to another and storage of household hazardous waste ($\chi^2 = 44.233$, df =1, p <0.05). The households that were not moving were more likely to store household hazardous waste before disposal than households that were moving. The
likelihood of storage of household hazardous waste decreased with increase in the number of movements.

**Table 4. 19: Movement from One Place to Another and Storage of household hazardous waste**

<table>
<thead>
<tr>
<th>Movement from One Place to Another</th>
<th>Storage of household hazardous waste before disposal</th>
<th>Total</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>No movement</td>
<td>Count</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Movement</td>
<td>Count</td>
<td>20</td>
<td>312</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>6.13</td>
<td>93.87</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>40</td>
<td>372</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>9.71</td>
<td>90.29</td>
</tr>
</tbody>
</table>

**4.6.5 Storage of Household Hazardous Waste before Disposal**

Storage of household hazardous waste is very important in its management. Hazardous waste must be stored in an appropriate manner to avoid contamination or poisoning effect on animals and human. The duration of storage depends on the form of the waste generated.

The research participants were requested to indicate whether they store their household hazardous waste before disposal. From the findings, 87.9 per cent of the research participants indicated that they do not store their household hazardous waste before disposal while 12.1 per cent indicated that they store their household hazardous waste before disposal. This implies that most of the household heads do not store their household hazardous waste before disposal.
4.6.6 Size of the land and Storage of household hazardous waste before disposal

The size of the land owned by a household may affect the storage and management of household hazardous waste before disposal as this requires space. From the findings, there is a significant association between size of the land owned by households and storage of household hazardous waste ($\chi^2 = 78.888$, df =1, $p <0.05$). The households that had smaller pieces of land were more likely to store household hazardous waste before disposal than households that larger pieces of land. The likelihood of storage of household hazardous waste decreased with increase the size of the land.

**Table 4.20: Size of the land and Storage of household hazardous waste before disposal**

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Storage of household hazardous waste before disposal</th>
<th>Total</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Own a piece of land</td>
<td>Count</td>
<td>34</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Community land</td>
<td>Count</td>
<td>21</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>55</td>
<td>357</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>13</td>
<td>87</td>
</tr>
</tbody>
</table>

4.6.7 Read the Label/ Instructions on the Household Hazardous Goods

The ability of the household heads and members to read labels and instructions may influence how they manage household hazardous waste. Many of the household hazardous goods either show images or have instruction on how best to handle and dispose them. The ability and willingness to observe or read them will aid the user on how to dispose them safely. From the findings, 83.4 per cent indicated that they do not read the label/ instructions on the household hazardous goods they buy while 11.6 per
cent indicated that they read the label/ instructions on the household hazardous goods they buy. This implies that most of the households do not read the label/ instructions on the household hazardous goods they buy.

### 4.6.8 Level of education and Reading of Labels

The level of education of the household heads may affect their ability to read through labels. According to the findings, there is a significant association between level of education and reading of labels/ instructions on the household hazardous goods ($\chi^2 = 184.276$, df =1, $p <0.05$). The results also indicated that the pastoral household heads with tertiary education read labels/instructions on the household hazardous goods, followed by those who had secondary education, primary education and only a few (2.4%) of those who had no formal education were reading the labels/instructions.

#### Table 4.21: Level of education and Reading of Labels

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Reading label/ instructions on the household hazardous goods</th>
<th>Total</th>
<th>Chi square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>396</td>
</tr>
<tr>
<td>Low or no education</td>
<td>Count</td>
<td>34</td>
<td>362</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>8.6</td>
<td>91.4</td>
</tr>
<tr>
<td>Educated</td>
<td>Count</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>87.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>48</td>
<td>364</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>11.7</td>
<td>88.3</td>
</tr>
</tbody>
</table>

### 4.6.9 Reasons for not Reading the Labels on the Household Hazardous Goods

It was also important to understand the main reasons for not reading instructions and labels in Household Hazardous Goods. This is because the labels/instructions contain information on the disposal methods and storage of Household Hazardous Goods.
Therefore, from the household heads who indicated that they do not read the label/instructions on the household hazardous goods they buy, the study also sought to establish reasons for not reading the labels on the household hazardous goods they buy. According to the findings, 81.1 per cent of the research participants indicated that they do not know how to read, 12.8 per cent indicated that they have never seen any label, 5.6 per cent indicated that many goods do not have labels while 0.6 per cent indicated that they don’t care to look at the labels.

4.6.10 Management of used cosmetic products and laundry products

The research participants were requested to indicate how they manage used cosmetic products and laundry products in their household. From the findings, 75 per cent of the research participants reported that they managed used cosmetic products and laundry products in their households through open dumping, and 25 per cent indicated through reduction of usage. This implies that most of the households were managing used cosmetic products and laundry products in their household through open dumping.

4.6.11 Management of Unused Drugs (Human and Animal)

Most of the households in Mandera County are pastoralists and hence it was important to understand how they dispose unused drugs for human and animals. According to the findings, 51.7 per cent of the research participants indicated that they manage unused drugs (human and animal) in their households through open dumping, 39.8 per cent indicated through incineration/burning and 8.5 per cent indicated through burying. This findings show that the method used mostly to manage unused drugs (human and animal) in their households was open dumping.
4.6.12 Management of Pesticides, Insecticides, Fungicides and Other Farm Chemicals

Being pastoralists, most households in Mandera County use pesticides, insecticides, fungicides and other farm chemicals and hence it was important to understand how they dispose them. Therefore, the research participants were asked to indicate how they manage remains of pesticides, insecticides, fungicides and other farm chemicals in their households. According to the findings, 47.9 per cent of the research participants indicated that they used land fill/burying to manage remains of pesticides, insecticides, fungicides and other farm chemicals in their household, 37.9 per cent indicated that they used open dumping, 13.6 per cent indicated that they used incineration/ burning and 0.7 per cent indicated that they used reduction of usage. Anyamani (2014) indicates that remains of pesticides, insecticides, fungicides and other farm chemicals should be kept in double polythene bags awaiting collection in the household hazardous waste collection program.

4.6.13 Management of Old Batteries and Used Electronic Items

Pastoralists often use torches to look after their livestock at night and during the day they use electronic gadgets like radio for music and news. Therefore, it is important to understand how they manage old batteries (all types) in their households. According to the findings, 67.8 per cent of the research participants indicated that the management old Batteries (all types) in their households through reuse by crashing them to prepare local ink, 20 per cent indicated through open dumping, 7.8 per cent indicated through incineration/burning and 3.9 per cent indicated through burying.
4.6.14 Management of containers of used oils, paraffin, petrol and empty aerosol cans

Since most pastoralists move from one location to another, they use paraffin to light their lamps at night because of the inaccessibility to a power source. In addition, they use other aerosols, petrol and oil containers. These containers are either used to transport different products from their original content or carry their content which is highly hazardous. Therefore, the research participants were also requested to indicate how they manage containers of used oils, paraffin, petrol and empty aerosol cans in their household. According to the findings, 83.3 per cent of the research participants indicated that they were managing containers of used oils, paraffin, petrol and empty aerosol cans in their household through reuse, 9.1 per cent indicated through incineration/burning, 4 per cent indicated through land fill/burying and 3.5 per cent indicated through open dumping.

4.6.15 Managing Unused Adhesives and Glues

Adhesives and Glues are common in most pastoral households in Mandera County and hence it is important to understand how they are managed. Therefore, the research participants were asked to indicate how they manage unused adhesives and glues in their households. From the findings, all the research participants (100%) indicated that they manage unused adhesives and glues in their households through open dumping.

4.6.16 Managing Used Needles and Syringes for Animal Treatment

During animal treatment pastoralists often use Needles and Syringes and hence it is important to understand how they manage them after use. Thus, the research participants were asked to indicate which method they use to manage used needles and syringes for
animal treatment in their households. According to the findings, 67 per cent of the research participants indicated that they manage used needles and syringes for animal treatment in their household through reuse, 31 per cent indicated burying, 1.5 per cent indicated open dumping and 0.5 per cent indicated reduction of usage.

4.6.17 Challenges Facing the Management of Household Hazardous Waste

The key informants were asked to indicate the main challenges facing the management of household hazardous waste among pastoral community of Mandera East Sub County. They indicated that these challenges include lack of knowledge about the danger of household hazardous waste, lack of knowledge on ways of disposal, absence of storage facilities to prompt collection of the wastes, lack of general awareness on HHW, inappropriate disposing methods and poor infrastructure for transport of hazardous waste.
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction
This chapter presents the summary of the data findings, conclusion drawn from the findings highlighted and recommendation made there-to. The conclusions and recommendations drawn were focused on addressing the objective of the study which was to explore household hazardous waste management practices among pastoral community of Mandera County, Kenya.

5.2 Summary
5.2.1 Type of Hazardous Waste Generated by Pastoral Households
The study found that most of the households in Mandera County were generating used batteries (all size and type) and electronic items (phones, radio and torches); unused drugs and pharmaceuticals for either human or animal use; remains of pesticides, herbicides, fungicides and accaricides; and used needles and syringes for animal treatment. These findings support the findings of District Public Health Office (2013) which reported that in rural Mandera every household has some hazardous waste comprising of pharmaceutical, animal drugs, batteries, torches containing lead, pesticides (accaracides), electronics and non-biodegradable waste such as polythene papers which have the potential for posing risk to life, health, property or the environment if improperly consumed, stored, or disposed.

The study also found that animal drugs were the most common household hazardous waste followed by accaracides, pesticides, needles and syringes mostly during the windy season. According to MOH (2014), accaracides and pesticides such as fungicides,
herbicides, insecticides, and rodenticides are the common poisons used in homes. The study found that most of the household heads bought household hazardous goods from retail shops and hawkers.

5.2.2 Occurrence of Accidents Related to Household Hazardous Waste

Improper handling or disposal of products containing hazardous ingredients can result in serious accidents to people and animals by either drinking, eating, touching, or breathing in of household hazardous wastes. The study found that 8.3 per cent of the households in Mandera County had members who were victims of household hazardous waste related accidents. These findings support MOH (2013) report that the pastoral populations in Mandera East have severally reported health complains directly related to household hazardous waste consumption, such as ingestion of acaricides applied on animals to kill or repel ectoparasites either through milk or accidental ingestion through hands and containers.

In addition to this, most of the household members who got the accident were aged between 0 and 5 years. These findings support MOH (2013) report that health facilities in Mandera East reported 10 poisoning in children under five years and 2 cases of poisoning in adults from the months of January to December in 2014. This is also supported by Ojeda-Benítez et al. (2013) argument that health risks associated with HHW in children are typically greater than that of adults. With their smaller bodies and endless curiosity, children are much more likely to come into contact with HHW in the home that have been stored or disposed of improperly, and to suffer the ill effects from that contact.
The study revealed that most of the household hazards accidents were caused by acaricides/pesticides followed by paraffin and animal/human drugs. These findings agree with District Public Health (2013) report that acaricides/pesticides are the most common household hazard wastes in Mandera East Sub County.

The study revealed that unconsciousness was one of the health problems that occurred due to the accident, followed by diarrhea and vomiting, eye irritation, respiratory infection, skin infection, injury related to sharp objects such as needles, food poisoning, drug poisoning, cuts, fire outbreak as well as skin diseases and respiratory illness from pesticides. These findings agree with Senzige (2014) argument that the most common household hazardous waste related health problems among pastoralists include poisoning injuries and skin infection.

5.2.3 Level of Knowledge on Household Hazardous Waste

The study established that most of the household heads in Mandera County had some knowledge on household hazardous waste. However, most of the household heads could identify household hazardous waste they generated but polythene paper was regarded as a hazardous waste due to the deaths it caused when ingested by animals, while used dry cell batteries which are very hazardous were not identified as hazardous waste among the pastoral household heads. These findings agree with Ojeda-Benítez *et al.* (2013) findings that pastoralists are often unaware of the potential hazards caused by many HHW in their homes.

According to Yasuda and Tanaka (2006), poor understanding from the general public on what constitutes household hazardous waste is one of the main causes linked to the lack
of treatment, poor storage and disposal (TSD) practices in homesteads. The study found that the household heads had mainly obtained information on household hazard wastes from radio and health workers. The study also found that most of the household heads had knowledge on open dumping and incineration. Knowledge on other methods of household hazardous waste management practices like reuse, land fill/burying, reducing usage and recycling was found to be lacking among most of the household heads. The study also identified that dry cell batteries were being reused inappropriate way by crushing them and making ink for *Quran* teaching but the pastoral population do not know the dangers associated with it. These findings agree with Slack *et al.* (2005) argument that the public is often unaware of their options for reducing, recycling and disposal of their HHW.

The study established that most of the household heads in Mandera County had moderate knowledge on households’ hazardous waste management. These findings agree with Wagner *et al.* (2013) argument that residents are often unaware of the potential hazards caused by many HHW in their homes. Recognition of hazardous products and wastes is paramount to encouraging the safe and proper disposal of moderate risks waste. The study found that the households’ heads had knowledge on the management of unused adhesives and glues and remains of pesticides, insecticides, fungicides and other farm chemicals. The household heads also indicated that remains of pesticides, insecticides, fungicides and other farm chemicals should be disposed by burying.

The household heads indicated that unused adhesives and glues should be disposed by burying. This is contrary to Slack *et al.* (2005) recommendation that incineration at high temperatures is the best disposal management method for adhesives, sealers, and
flammable materials. The study established that the household heads had no knowledge on the management of empty oil and flammable containers. They indicated that empty oil and flammable containers should be reused, which was incorrect. Oil and flammable containers can be easily set on fire and hence should be triple rinsed before disposal as recommended by Massawe et al. (2014). Further, household heads indicated that needles and syringes to treat animals should be reused, which is an incorrect method of managing used needles and syringes. According to Ojeda-Benítez et al. (2013), reusing needles and syringes may lead to re-infections and hence should be fully encapsulated and placed in puncture proof containers at the home awaiting collection.

The household heads indicated that unused drugs (human and animal) should be disposed by burning. However, drugs are made of chemicals and hence burning them may lead to environmental pollution by the release of dioxins and furans which have adverse health effects and is therefore an incorrect method of managing drugs and pharmaceuticals. In addition, the household heads indicated that aerosol/compressed cans should not be incinerated. Burning of aerosol/compressed cans may lead to explosions and hence it is a wrong way of managing aerosol/compressed cans. Further, the household heads reported that old batteries (all types) and used electronic items (phones, radio and torches) should be disposed by reusing or incineration. The pastoral population is reusing used batteries for making local ink called qhat in quran schools where children leak the ink made of the batteries exposing them to heavy metals and also apply the crushed powder on open wounds for the acids to wash the bacteria, which means that heavy metals have direct access to the blood of animals and human. However, this is a wrong way of managing used dry cell batteries and other electronic waste. E-waste should be collected for
segregation, removal of hazardous material and recycling is the recommended method of managing electronic waste.

**5.2.4 Household Hazardous Waste Management Practices at Household Level**

The study found that households in Mandera County do not segregate their household hazardous waste from the general household waste stream before disposal. For the households who were segregating their household hazardous waste were mostly segregating unused/ expired animal and human drugs and the same percent indicated that they segregate poisons, insecticides and fungicides. A few (one fifth) were segregating containers of used oils, paraffin, petrol and empty aerosol cans; and batteries (all types) and used electronic items (phones and radio). According to Ojeda-Benítez *et al.* (2013), lack of obligation by households to segregate HHW from the general household waste makes it very difficult to plan for its management.

The study also revealed that most of the households do not read the label/ instructions on the household hazardous goods they buy. Them who were not reading the label/ instructions indicated that the main reasons were that they do not know how to read, have never seen any label and many goods do not have labels. These findings are contrary to Hammet *et al.* (2002) argument that some of the rules for managing household hazardous Products are following the directions for storage on the label and protecting the original label to guide the treatment in the event of poisoning.

The study revealed that the method used mostly to manage unused drugs (human and animal) in their households was open dumping. According to Anyamani (2014), most often unused or expired medications are either flushed down the toilet or thrown in the
garbage where they pose a threat to the environment. If flushed, pharmaceuticals may pass through treatment facilities and end up in surface and groundwater. If land filled, they have the potential to leach from the landfill into groundwater. Alternately, without a safe and effective method for disposal, prescription drugs may be left indefinitely in medicine cabinets where they pose a threat of potential prescription drug misuse or abuse. When disposed of in the trash, children or illicit drug users might get access to them. According to Mbeng et al. (2012), livestock farmers should be advised to consult a local veterinary clinic, waste collection company if there are expired and unwanted medications are on the farm for opportunities to safely dispose of these products.

The study revealed that most of the households in Mandera County were managing old batteries (all types) in their households through reuse. These findings agree with Massawe et al. (2014), that e-waste provides a source of valuable income through recycling and reuse. In some African countries such as Ghana and Nigeria it provides economic opportunities through the development of community based collection, recovery and recycling. However, low-price non-rechargeable standard batteries often have short lifetimes and contain heavy metals such as lead and/or cadmium. Dead dry cell batteries are often given to children for the so-called *kila* game, which involves trying to smash the cells on another stationary battery (Mbeng et al., 2012). The black power in the cell (cadmium and nickel salts) are scattered in the play area where the children can become exposed. There are cases reported of children dying, going into a coma, or being made sick by swallowing the black powder in dry cell batteries in Zambia. Some adults have reported where they had crushed the batteries and used the black powder as shoe polish, hair dye, or on black boards. In Mandera the black powder
in the dry cell batteries are smashed by children to prepare ink for learning *Quran*, where they leak the wet ink in case they want to make a correction exposing them to heavy metal poisoning (Massawe *et al.*, 2014). Actually children go round the households collecting the used batteries to reuse them for the preparation of this ink. In addition to this, the powder in some cases is applied on chronic wounds to wash away bacteria and other germs causing direct skin absorption of these heavy metals.

The study found that most households in Mandera County were managing containers of used oils, paraffin, petrol and empty aerosol cans in their household through reuse. Many of the automotive products are flammable and should not be disposed in to the drains, sewer, nor in the garbage containers. Used automotive oils are used as form of pesticides and applied on the traditional houses to repel termites in Mandera County. Oil poured onto the ground or down the storm sewers may eventually find its way into surface water such as rivers, streams or even ground water and contaminate drinking water and harm living organisms. According to Massawe *et al.* (2014), triple-rinse container is the prescribed treatment method for empty oils, paraffin, petrol and empty aerosol containers. To triple-rinse, the container is filled 1/4 full with water (or the solvent recommended on the product label), close it tightly, and shake or invert so the rinse reaches all inside surfaces. This is repeated two or more times.

The study found that households manage used needles and syringes for animal treatment in their household through incineration/burning. These findings are contrary to Ojeda-Benítez *et al.* (2013) argument that needles and syringes should be disposed using save for collection method. Save for collection indicates those products that should be saved for a household hazardous waste collection. This is supported by Malandrakis (2008),
who recommended that all used sharps are fully encapsulated placed in puncture proof containers at the home. Household Health care waste should be taken to drop off collection sites or mailed back through postal services which have worked well in rural communities in the United States.

The study revealed that in most households in Mandera County it was the duty of the mothers to manage household hazardous waste. However, in some households fathers and other members of the family were playing the role. These findings agree with Tiwari (2001) findings that women rather than men handle household hazardous waste. Female participation was mostly involved in recycling, composting and burying.

5.3 Conclusions

The study concludes that most of the households in Mandera County were generating used batteries (all size and type) and electronic items; unused drugs and pharmaceuticals for either human or animal use; remains of pesticides, herbicides, fungicides and acaricides; and used needles and syringes for animal treatment. Different types of household hazardous waste were generated in different seasons of the year. As compared to the dry and wet seasons, the composition of the waste stream had more used animal drugs, acaricides, pesticides, needles and syringes during the windy season.

The study also concludes that most of the household heads in Mandera County had moderate knowledge on household hazardous waste, which had been obtained from radio and health workers. The study revealed that most of the household heads had knowledge on open dumping and incineration as hazardous waste disposal method, but knowledge on other methods of household hazardous waste management practices like reuse, land
fill/burying, reducing usage and recycling was found to be lacking among most of the household heads.

The study concludes that 10 per cent of the households in Mandera County had members who were victims of household hazardous waste related accidents. In addition, most of the household members who got the accident were aged between 0 and 5 years. Most of the household hazards accidents were caused by accaricides/pesticides followed by paraffin and animal/human drugs. The study established that most of the household hazardous wastes related accidents occurred in their households after more than two years.

The study concludes that most households in Mandera County do not segregate their household hazardous waste from the general household waste before storage and disposal. The study revealed that most of the households do not read the label/instructions on the household hazardous goods they buy. The study found that open dumping and incineration were the most common methods of dealing with household hazardous waste among households in Mandera County.

5.4 Recommendations For Practice

1. The study found that generation of HHW was dependent on seasons as Households were generating different types of hazardous waste during different seasons of the year based on the type of animals they keep. This study therefore recommends that the remains of pesticides, herbicides, fungicides and accaricides should be stored well and their remains disposed in the same season of the year, mobile collections and one
day collection should be conducted before the end of the season to remove this hazardous waste from the households.

2. The study found that in most cases the victims of household hazardous waste did not go to the hospital for treatment. This study recommends that the Ministry of Health of Mandera County Government should increase awareness on the importance of reporting to healthcare facilities for treatment in the event household hazardous waste accidents occur and possibly carrying the hazardous waste that caused the poisoning to the health facility for correct case management.

3. Lack of knowledge on household hazardous waste affects the management of household hazardous waste. The study found that most of household heads had no formal education and hence they had little knowledge on the identification and the correct household hazardous waste management methods. This study recommends that the county and national government should come up with trainings and awareness creation programmes aimed to increase knowledge on household hazardous waste management. The training programmes can be offered in public barazas and through mass media such as radio. In addition, the study recommends that training programmes should be accompanied by monitoring and evaluation to assess the knowledge of the pastoral communities before training, during training and after training. This will play a major role in ensuring that programmes are adjusted after mid-term evaluation to fit the knowledge needs of the community.

4. The study found that most of the household heads knew of burning and open dumping only. Different hazardous waste should be disposed in different ways (reduce, reuse,
recycle, incineration, land fill and open dumping) and hence community members should be trained on these management methods.

5. The study also found that there were no collection centers for hazardous wastes such as needles and syringes as well as e-waste. The study recommends that the county government in collaboration with national government should establish mobile collections methods which are appropriate for household hazardous waste that needs special handling for destruction or recycling in the pastoral zones. This will help to reduce the accumulation and the risk of hazardous wastes such as needles, syringes and e-waste which can be harmful to human health. In addition, the study recommends that monitoring and evaluation of the mobile collections should be conducted to assess their effectiveness.

6. The study established that children of pastoral community of Mandera do reuse old batteries by crashing and using the black powder as ink which is often leaked in the cause of learning, public education on the importance of using the harmless traditional materials (wild gum and charcoal) as ink should be revived. The dangers of using old batteries as ink should be emphasized.

5.5 Areas for Further Studies

1. This study was limited to Mandera East Sub-county and hence its findings cannot be generalized to other Counties in Kenya. This is because different communities generate different types of household hazardous waste. This study therefore suggests comparative studies on hazardous household waste management practices among different communities in Kenya.
2. The study also suggests further studies on the effect of knowledge, attitude and practices on Household hazardous waste in Kenya.

3. In addition, the study suggests further studies on household hazardous waste management practices in urban areas in Kenya.

4. Also, further studies should be conducted on the role of monitoring and evaluation in the implementation of household hazardous waste management training programmes.
REFERENCES


APPENDICES

Appendix I: Consent on the Participation

HOUSEHOLD HAZARDOUS WASTE MANAGEMENT PRACTICES AMONG PASTORAL COMMUNITY OF MANDERA COUNTY, KENYA

The Purpose
I am Abukar Abdi Sheikh, a postgraduate student in the School of Public Health of Kenyatta University pursuing a degree of master of public health-monitoring and evaluation in the school of public health of Kenyatta University. The main objective is to explore hazardous household waste management practices among pastoral community of Mandera County, Kenya. The study also seeks to determine the level of knowledge on household hazardous waste (HHW) management among pastoral community; identify the type of household hazardous waste generated by households in the pastoral community; identify household hazardous waste management practices at household level in the pastoral community and determine the pattern of occurrence of accidents related to household hazardous waste among the members of households of the pastoral community in Mandera County.

Procedures
Participation in this study will require I ask you some questions on household hazardous waste management practices. Information will be written down in a same sheet of paper. You may ask questions related to the study at any time. You may refuse to respond to any questions and you may stop participating at any time without consequences to you.

Discomforts and risks
There will be minimum risk to you for participating in this study. However, some questions you will be asked will be of a sensitive nature and may make you uncomfortable. If this happens you may refuse to answer if you so choose. You may also stop the interview at any time. The interview shall take approximately 30 minutes of your time.

Benefits
There may be no direct benefits or compensation to you as an individual but the information generated will be used by the administrators and other stakeholders to come
up with strategies to improve household hazardous waste management practices in the pastoral community.

**Voluntary Participation and Withdrawal**

Your participation is entirely voluntary and should you change your mind you are free to opt out at any time. You may skip questions or stop participating at any time without any penalty.

**Confidentiality**

I will not identify you and no information that will make it possible for anyone to identify you will be required in this study. The information provided will only be used for academic purposes and will not be given to any organization or individual for any other use. All information will be kept under key and lock and the electronic information will be under a password.

**Contact information**

Any queries regarding this study may be directed to me, Abukar Abdi Sheikh cell phone number 0722101360.

Having been informed about the study and having read the above and understood all that it entails, do willingly give consent to participate in the study.

Participant signature…………………… Date………………………………………………

Researcher’s signature…………………… Date……………………………………………
Appendix II: Household Heads Questionnaire

This is an academic study assessing household hazardous waste management practices among pastoral community of Mandera County, Kenya. The information herein requested is for use to meet academic requirements and as such shall be treated with utmost confidentiality. No full or part of the information shall be disclosed to the government, any authority or potential competitors, and hence any form of victimization shall not be leveled to the informant for whichever kind of information.

**Demographic Information**

1. Gender
   - Male [   ]
   - Female [   ]

2. Age Bracket
   - 18 to 25 years [   ]
   - 26 to 40 years [   ]
   - 41 to 65 years [   ]
   - Over 65 years [   ]

3. Level of education completed
   - No formal education [   ]
   - Primary Level [   ]
   - Secondary level [   ]
   - College level [   ]
   - University level [   ]

4. How many people live in your household?
   - Less than 3 [   ]
   - 3 to 5 [   ]
   - 6 to 8 [   ]
   - More than 8 [   ]

5. How often do you move from one location to another in search of pasture?
   - We don’t move [   ]
   - Once in a year [   ]
   - Twice in a year [   ]
   - Three times a year [   ]
   - More than three times a year [   ]
6. What is the size of your land?

   Less than half an acre [ ] One acre [ ]
   2 acres [ ] 3 acres [ ]
   4 acres [ ] 5 acres [ ]
   More than 5 acres [ ] others (Specify)…………………

7. What species of animals do you keep?

   Camel [ ] Cattle [ ]
   Goats [ ] All species [ ]

Level of Awareness on household hazardous waste Management practices

Operational Definition of household hazardous waste: refers to household waste which requires special handling and disposal procedures to avoid risk to health and/or environmental effects.

1. Have you ever heard of household hazardous waste? Yes [ ] No [ ]

2. If Yes, What was your source of information to identify household hazardous waste from general household waste?

   Health workers [ ] Radio [ ] Television [ ]
   Neighbor [ ] others (specify)…………………………
3. Which of the following household hazardous waste management practices do you know?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce usage</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Reuse</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Recycle</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Incineration</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Land fill</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Open Dumping</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

4. Do you agree with the following statements on the management of household hazardous waste?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remains of Pesticides, insecticides, fungicides and other farm chemicals should be disposed by burying/landfill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unused drugs (human and animal) should be disposed by burning?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Old Batteries (all types) and used electronic items (phones, radio, television) should be disposed by burning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unused adhesives and glues should be disposed by landfill/burying.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needles and syringes to treat animals should be reused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empty oil and flammables containers should be reused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerosol/ compressed cans should be incinerated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Type of Household Hazardous waste Generated by pastoral Households

1. Does your household generate unused drugs and pharmaceuticals for either human or animal use?
   Yes [ ] No [ ]

2. Does your household generate used needles and syringes for animal and human treatment?
   Yes [ ] No [ ]

3. Does your household generate remains of poisons, pesticides, herbicides, fungicides and acaricides?
   Yes [ ] No [ ]

4. Does your household generate used batteries (all size and type) and electronic items (phones, radio, and television)?
   Yes [ ] No [ ]

5. Does your household generate remains of glues and adhesives?
   Yes [ ] No [ ]

6. Does your household generate automotive products such as oils, antifreeze, gasoline and brake fluids?
   Yes [ ] No [ ]

7. Does your household generate paints and solvents?
   Yes [ ] No [ ]

8. Does your household generate disinfectants, laundry products and used cosmetics?
   Yes [ ] No [ ]

9. Does your household generate the same type of household hazardous waste in different Seasons of the year?
   Yes [ ] No [ ]

10. If No, which seasons does your household generate different types of household hazardous waste?
    Dry season [ ] Windy season [ ]
    Wet seasons [ ]

11. Which household Hazardous waste is common in the season? ……………….
12. Where do you buy the household hazardous goods from?

- Retail Shop [ ]
- Supermarket [ ]
- Open air market [ ]
- Chemists [ ]
- Others [ ]

**Household Hazardous Waste Management Practices at Household Level**

1. Do you segregate your household hazardous waste from the general household waste before storage and disposal?

   Yes [ ]
   No [ ]

2. If yes, which categories of household hazardous waste do you segregate from the general household waste?

<table>
<thead>
<tr>
<th>Category</th>
<th>Segregate</th>
<th>Do not Segregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unused/ expired animal and human drugs</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Poisons, insecticides, fungicides and pest control chemicals</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Batteries (all types) and used electronic items (phones, radio, television)</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Containers of used oils, paraffin, petrol, empty aerosol cans and other automotive products</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Adhesives and glues</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Used needles and syringes</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

3. Do you store your household hazardous waste before disposal?

   Yes [ ]
   No [ ]

4. Have you ever read the label/instructions on the household hazardous goods you buy?

   Yes [ ]
   No [ ]

5. If no, why haven’t you read the labels on the household hazardous goods you buy?

   Don’t know how to read [ ]
   Never seen any label [ ]
   May goods don’t have label [ ]
   Don’t care to look at it [ ]
6. What do you do with the household hazardous goods in your home after they are used?
   Reuse as much as possible [ ] Reduce its use [ ]
   Recycle [ ] Incineration [ ]
   Land filling/ burying [ ] Open dumping [ ]

7. How do you manage used cosmetic, laundry and cosmetic products in your household?
   Reduce usage [ ] Pour down the drain [ ]
   Land fill/Burying [ ] Open dumping [ ]
   Reuse [ ] Recycle

8. How do you manage unused drugs (human and animal) in your household?
   Reduce usage [ ] Incineration/ Burning [ ]
   Land fill/Burying [ ] Open dumping [ ]
   Reuse [ ] Recycle

9. How do you manage remains of poisons, pesticides, insecticides, fungicides and other farm chemicals in your household?
   Reduce usage [ ] Reuse [ ] Open Dumping [ ]
   Incineration/ Burning [ ] Land fill/Burying [ ] Recycle [ ]

10. How do you manage old Batteries (all types) and used electronic items (phones, radio, television) in your household?
    Reduce usage [ ] Recycle [ ] Open Dumping [ ]
    Incineration/ Burning [ ] Land fill/Burying [ ] Reuse [ ]

11. How do you manage containers of used oils, paraffin, petrol and empty aerosol cans in your household?
    Reduce usage [ ] Reuse [ ] Open Dumping [ ]
    Incineration/ Burning [ ] Land fill/Burying [ ]

12. How do you manage unused adhesives and glues in your household?
    Reduce usage [ ] Reuse [ ] Open Dumping [ ]
Incineration/ Burning  [  ]  Land fill/Burying  [  ]

13. Which method do you use to manage used needles and syringes in your household?
Reduce usage  [  ]  Reuse  [  ]  Open Dumping  [  ]
Incineration/ Burning  [  ]  Land fill/Burying  [  ]

14. Whose duty is it to manage household hazardous waste in your home?
Father  [  ]  mother  [  ]  children  [  ]  others (specify)………………

Occurrence of accidents related to household hazardous waste

1. Have any of your household members been a victim of household hazardous waste related accidents?
   Yes  [  ]  No  [  ]

2. If yes, what was the age of the household member who got the accident?
   0-5 years  [  ]  6-11 years  [  ]  12-17 years  [  ]  18 years and above [  ]

3. If yes, how often do household hazardous wastes related accidents occur in your household?
   Every month  [  ]  Every 3 months  [  ]
   Every six months  [  ]  Every nine months  [  ]
   Once an year  [  ]  Every two years  [  ]
   After more than two years  [  ]

4. Which type of household hazardous waste/s caused the reported accident?
   ……………………………………………………………………………………………………………

5. What are the health problems that occurred due to the accident?
   Diarrhea and vomiting  [  ]  Skin infection  [  ]
   Burns  [  ]  Eye irritation  [  ]
   Respiratory infection  [  ]  Unconsciousness  [  ]

6. Where was the family member treated after the accident due to Household hazardous waste?
   Hospital  [  ]  Traditional healer  [  ]
Treated by family members [ ] others (specify)…………..

7. What was the outcome of the accident?
   Survived [ ] Disabled [ ] Died [ ]
Appendix III: Key Informant Interview Guide

For public health officers, health facility in charges, national environmental management authority staff, chiefs/ ward administrators and NGO staff dealing with WASH

1. What is household hazardous waste?
2. Which the most common hazardous waste among the pastoral community of Mandera East Sub County
3. Which household hazardous waste disposal methods that are practiced by the pastoral community of Mandera East Sub County use?
4. Who in your opinion who should manage household hazardous waste?
5. What facilities or services are provided in the pastoral areas for the management of household hazardous waste?
6. Which is the most appropriate method you recommend for the pastoral households to manage their household hazardous waste?
7. Which are the most commonly reported accidents related to household hazardous waste that occurs at the pastoral households?
8. What are the main challenges facing the management of household hazardous waste among pastoral community of Mandera East Sub County?
9. Is there a policy that has been developed to guide the implementation of household hazardous waste management in Mandera County?
10. Is the county government in your opinion doing enough to manage household hazardous waste?
Appendix IV: Map of Kenya Showing Mandera County

Map of Mandera East Sub County showing the wards
Appendix V: Approval of Research Proposal

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

FROM: Dean, Graduate School
TO: Abukar Abdi Sheikh
C/o Community Health
Dept

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

REF: Q141/CE/23179/2012

This is to inform you that Graduate School Board, at its meeting of 9th December, 2015 approved your Research Proposal for the M.P.H Degree entitled, “Household Hazardous Waste Management Practices among Pastoral Community of Mandera County, Kenya”.

You may now proceed with your Data Collection, subject to clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University’s Website under Graduate School webpage downloads.

Thank you.

[Signature]

DAVID MJOROGE
FOR: DEAN, GRADUATE SCHOOL

- 8 JAN 2016

c.c. Chairman, Department of Community Health

Supervisors:

1. Dr. Jackim Nyamari
   Environmental Health Department
   Kenyatta University

2. Dr. Joan N. Njagi
   Environmental Health
   Kenyatta University

DNN/ruw
Appendix VI: Research Authorization Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

Internal Memo

Our Ref: Q141/CE/23179/2012


The Director, General
National Commission for Science and Technology,
P.O. Box 30040,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION ABUKAR ABDI SHEIKH — REG. NO. Q141/CE/23179/2012

I write to introduce Mr. Abukar Abdi Sheikh who is a Postgraduate Student of this University. He is registered for M.P.H degree programme in the Department of Community Health.

Mr. Abukar intends to conduct research for a M.P.H proposal entitled, “Household Hazardous Waste Management Practices among Pastoral Community of Mandera County, Kenya.”

Any assistance given will be highly appreciated.

Yours faithfully,

MRS. LUCY N. MBA ABDU
FOR: DEAN, GRADUATE SCHOOL

LNM/rwm
Appendix VII: Kenyatta University Ethic Review Committee Approval

KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Email: chairman_kuerc@ku.ac.ke
       secretary.kuerc@ku.ac.ke
       erkkn2008@gmail.com
Website: www.ku.ac.ke

P. O. Box 43844 - 00100 Nairobi
Tel: 8710901/12
Fax: 8711242/8711575

Our Ref: KU/R/COMM/51/731
Date: 23rd May, 2016

Abukar Abdi Sheikh,
Kenyatta University,
P.O Box 43844,
Nairobi

Dear Abdi,

APPLICATION NUMBER PKU/499/1595 – “HOUSEHOLD HAZARDOUS WASTE MANAGEMENT PRACTICES AMONG PASTORAL COMMUNITY OF MANDERA COUNTY, KENYA.”

1. IDENTIFICATION OF PROTOCOL,
The application before the committee is with a research topic, “Household hazardous waste management practices among pastoral community of Mandera County, Kenya” received on 29th April, 2016 and discussed on 17th May, 2016.

2. APPLICANT
Abukar Abdi Sheikh, Department of Community Health

3. SITE
Mandera County, Kenya

4. DECISION
The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.5) and the Kenyatta University Ethics Review Committee Guidelines, and is of the view that against the following elements of review,

(i) Scientific design and conduct of study,
(ii) Recruitment of research participant,
(iii) Care and protection of research participants,
(iv) Protection of research participant’s confidentiality,
(v) Informed consent process,
(vi) Community considerations.

AND APPROVED and that the research may proceed ON CONDITION that you incorporate its advise below.
Appendix VIII: NACOSTI Approval

**THIS IS TO CERTIFY THAT:**

**MR. ABUKAR ABDI SHEIKH**

of KENYATTU UNIVERSITY, 43844-1001

nairobi, has been permitted to conduct research in Mandera County

on the topic: **HOUSEHOLD HAZARDOUS WASTE MANAGEMENT PRACTICES AMONG PASTORAL COMMUNITY OF MANDERA COUNTY, KENYA**

for the period ending: 18th August, 2017

**Date of Issue: 18th August, 2016**

**Fee Received: Ksh 1000**

**Permit No.: NACOSTIIP/16/10299/13248**

**Applicant’s Signature**

**Director General**

National Commission for Science, Technology and Innovation

**Signature**
Appendix IX: Mandera County MOH Research Authorization

MANDERA COUNTY GOVERNMENT

MINISTRY OF HEALTH SERVICES

Box 13 – 70300, Mandera.
23rd August 2016

TO WHOM IT MAY CONCERN

RESEARCH AUTHORIZATION ABUKAR ABDI SHEIKH REG. NO. Q141/CE/23179/2012

I would like to introduce the bearer of this letter who is a postgraduate student at Kenyatta University. He is registered for MPH Program (Monitoring and Evaluation) in the Department of Community Health and intends to collect data for his Thesis topic: Household Hazardous Waste Management Practices Among Pastoral Community of Mandera County, Kenya.

The ministry of health has reviewed his documents and granted him the permission to conduct his study in Mandera East Sub County.

Please accord him the necessary support.

[Signature]

Ibrahim Sheikh Hussein
For; Director of Health Services
Mandera