THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE
DEPARTMENT OF PUBLIC HEALTH

EPIDEMIOLOGY OF CHEMICAL POISONING: A CASE OF THE UNIVERSITY TEACHING HOSPITAL AND LEVY MWANAWASA GENERAL HOSPITAL, LUSAKA (JANUARY TO DECEMBER 2012)

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'Submitted in partial fulfilment of the requirements towards the awarding of Master of Science Degree in Epidemiology'

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Declaration

I hereby do declare that the work presented in this report is for the award of Master of Science degree in Epidemiology and has not been presented wholly or in part for any other degree nor is it being submitted for any other course.

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Date: …………………. Signature: ……………................

Mr Y. Siulapwa

Statement

I Jessy Ruth Z'gambo hereby attest that this report is entirely as a result of independent investigations. The various sources of information to which I am indebted are clearly indicated in the document and in the references.

__________________ __________________

Candidate's Signature Date

Approval

The University of Zambia approves this dissertation of Jessy Z'gambo as fulfilling part of the requirements for the award of the Master of Science Degree in Epidemiology

Signatures

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Dedication

I dedicate my work to my loving parents, Idah M'tawale Z'gambo and Joseph Z'gambo. Their guidance and discipline has made me the woman I am today. I know that they heartily celebrate with me in all my achievements this far.

To the Almighty God, JEHOVAH! My protector, provider and source of strength, who continues to show me that with him nothing is impossible. To him be all the glory.

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"Uushitasha patunono, napafingipene takatashe" Bemba saying.

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Acronyms and Abbreviations

AEO	Africa Environment Outlook
AHO	Africa Health Observatory
CAS	Chemical Abstract Service
CI	Confidence Interval
DALYs	Disability Adjusted Life Years
DEC	Drug Enforcement Commission
ERES	Excellence in Research Ethics and Science
FNDP	Fifth National Development Plan
GDP	Gross Domestic Product
HIV	Human Immunodeficiency Virus
IRB	Institutional Research Board
LMGH	Levy Mwanawasa General Hospital
MoH	Ministry of Health
OECD	Organisation for Economic Cooperation and Development
OPD	Out-Patient Department
OR	Odds Ratio
SD	Standard Deviation
TB	Tuberculosis
TESS	Toxic Exposure Surveillance System
USA	United States of America
UTH	University Teaching Hospital
WHO	World Health Organisation
ZDHS	Zambia Demographic and Health Survey
ZEMA	Zambia Environmental Management Agency

Abstract

Introduction

Chemical poisoning has been identified as a significant global public health problem resulting in over 350, 000 deaths due to unintentional poisoning. Each year nearly a million people die as a result of suicide, and chemicals account for a significant number of these deaths. Although data on the occurrence of poisoning on a global scale may seem to be well established, updated data from developing countries like Zambia is largely unexplored.

Methods

Data on poisoning was retrospectively collected from two referral hospitals in Lusaka from 1st January to 31st December, 2012. A pretested data collection form was used to collect demographic and epidemiologic data surrounding cases including toxic agents used, route of exposure to toxic agent, circumstance (deliberate/accidental) and outcome (recovery/death) of poisoning. All analysis was done using STATA version 13.

Results

A total of 1, 031 poisoning cases were reviewed resulting in a prevalence of 1.1 per 100 admissions. Of the cases reviewed men (n=592, 57%) dominated females (n=439, 43%). Deliberate poisoning was common among those aged between 20-30 years (n=231, 52%) while accidental poisoning (n=292, 64%) characterised most of the cases aged between 0-12 years (P-value <0.001). There were a total of 27 deaths representing a 2.6 per 100 case mortality rate. Pesticides (n=187, 18%), alcohol (n=158, 15%) and pharmaceuticals (n=123, 12%) were associated with a larger proportion of poisoning cases. The majority (n=682, 66%) of cases reported were from peri urban residences of Lusaka District.

Conclusion

The prevalence of chemical poisoning established in this study was lower than that found in the African region while the mortality was higher than that observed elsewhere. Common toxic agents involved in poisoning were pesticides, alcohol and pharmaceuticals, these also had higher case fatality rates. The significant predictors of deliberate/accidental poisoning were age, route of exposure and toxic agent used while those of recovery/death were sex, age and toxic agent used (more so for pesticides).

CHAPTER I

Background

Chemicals have become important and indispensible to modern life, contributing substantially to human development and activities. Chemicals have become integrated in people's daily activities to the point that humans are oblivious of their presence. It is recognized currently that more than 62 million chemical substances are commercially available (Chemical Abstracts Service, 2014) and approximately 60 000 to 70 000 chemical substances are in regular use. These chemicals are present in a varying range of forms, products and applications either naturally occurring or synthesized by humans. It has been established that between 200 and 1000 chemicals are produced in excess of one tone annually (World Health Organisation, 2009).

In almost all economic sectors globally, chemicals have become integral to the development agenda driving many economic activities (United Nations Environment Programme, 2013). In agriculture, chemicals (herbicides, insecticides, and fertilizers) are used extensively to increase yields of agricultural crops. Chemicals are widely used in various manufacturing processes at various stages, either as key ingredients or main products of various consumer goods. Almost all industrial processes make use of chemicals for different purposes, the mining industry for instance uses tonnes of chemicals in the extraction and processing of minerals, construction industries rely heavily on the use of chemicals in the building and repair of various construction projects. Chemicals are used in various forms and applications in the health sector for prevention and treatment of diseases. At a domestic level, chemicals are part of various household chores including cleaning and cooking. They are used in various personal care products for hygiene and many other purposes (Ibid).

Trends in Chemical Use

Currently, global trends point toward an increasing chemical intensification of the economy (Chemical Abstracts Service, 2014, United Nations Environment Programme, 2013). In 2001, the Organisation for Economic Cooperation and Development (OECD) issued projections that by 2020, developing countries would be home to 31% of global chemical production, and 33% of global chemical consumption. In Africa, as the economy grows and the Gross Domestic Product (GDP) per capita increases, the consumption of chemicals in agriculture, industry, health as well as in domestic sectors is projected to grow (Organisation for

Economic Co-operation and Development (OECD), 2001). According to the Fifth National Development Plan (2006-2010), trends in Zambia have shown economic growth in various sectors over the last decade (Ministry of Finance and National Planning, 2006). This economic growth may be linked to increased demand and use for chemicals in all these sectors. The growing use of chemicals in Zambia as well as the rest of the world is likely to increase people's exposure to chemicals in their workplace and homes.

Chemical Exposure

Humans are exposed to chemicals on a daily basis by various means but mainly through interactions with air, soil, food, and water. Exposure to chemicals occurs in homes, workplaces and many other settings. In certain instances, exposure to chemicals may occur early in human life during the foetal stage if the mother is exposed to hazardous chemicals. The most common routes of exposure to chemicals are mainly inhalation (i.e. chemical gases, dust, fumes or other aerosol forms); ingestion (i.e. either directly or through contaminated food); absorption (i.e. when chemicals come into contact with the skin or eyes) and by injection. Exposure to chemicals in most cases is unintentional except for cases of suicide or homicide. Other exposures identified include; recreational mishap, natural catastrophe, chemical warfare, criminal acts and acts of terrorism (World Health Organisation, 2009). This stresses the fact that although chemicals have become very useful to modern life, they also pose a hazard to human health and the environment.

According to the World Health Organisation (2009), more than 25% of the global burden of disease is linked to environmental factors including exposures to, and inappropriate use of toxic chemicals. Some of these chemicals humans are exposed to have the potential to accumulate in the body and affect the integrity of human health (Manda and Mohamed-Katerene, 2006). In addition, the WHO established that increased chemical use will increase the risk of exposure through chemical production accidents and pollution through industrial waste discharge. Increased exposure is likely to result in increased morbidity and mortality due to chemical poisoning. This will place a new burden on chemical management systems, and place new challenges on governments to effectively regulate and develop appropriate monitoring and evaluation systems. The increased exposure to chemicals and related illnesses will equally place new demands on the already fragile health sector, especially in developing countries like Zambia. In addition, mismanagement of chemicals places a significant burden on national economies (United Nations Environment Programme, 2013) in controlling and averting ecological and health damage.

Chemical Control

If not used and managed properly, chemicals have the potential to wipe out the entire human race as would be the case in a situation where chemicals are used as warfare agents or for other criminal acts. The World Health Organisation noted that health hazards and deaths due to chemicals can be reduced by limiting the availability of, and access to, highly toxic chemicals such as pesticides. For this reason and many others, governments globally and international bodies have put in place various measures to regulate chemicals throughout the entire life cycle from production, transport, import and export, storage, use and disposal (United Nations Environment Programme, 2013). Various national and international chemicals related instruments and multilateral agreements have been put in place to provide voluntary and legally binding frameworks for promoting the sound management of chemicals. For instance the Strategic Approach to International Chemicals Management (SAICM) was specially designed to strengthen sound chemicals management across relevant economic sectors. SAICM addresses all the phases and elements of chemical safety taking into consideration a range of environmental and public health concerns throughout the life cycle of chemicals (Strategic Approach to International Chemicals Management, 2014).

Many national governments have created legal structures and competent authorities for managing chemicals in their different forms as commodities, constituents of products, environmental pollutants, occupational and public health hazards and wastes (United Nations Environment Programme, 2013). In this regard, Zambia has legal instrument under well-established institutions responsible for the control and management of chemicals some of which are outlined in Table 1 in the appendix.

Burden of Chemical Poisoning

Chemical poisoning has been identified as a significant global public health problem. According to the World Health Organisation, over 350,000 people died worldwide from unintentional poisoning in 2004 resulting in the loss of over 7.4 million years of healthy life (disability adjusted life years, DALYs). Furthermore, nearly a million people die each year as a result of suicide, and chemicals account for a significant number of these deaths (World Health Organisation, 2008). For instance, it is estimated that deliberate ingestion of pesticides causes 370,000 deaths each year (World Health Organisation, 2014). Of these deaths, 91% occurred in low and middle income countries (World Health Organisation, 2008).

In 2004 it was reported that 530 chemical poisoning cases per 100,000 populations are reported with 8.5 deaths per 100,000 population of the United States of America (USA) (Institute of Medicine, 2004). A recent report by the American association of Poison Control Centres' National Poison Data System (NPDS) showed that since 2000, cases with more serious outcomes have increased by 4.6 % from 108, 148 cases in 2000 to 170, 956 cases in 2012. In addition, cases with less serious outcomes have consistently decreased since 2008 by 3.7% (Mowry et al., 2013).

On an African perspective, Malangu (2009) stated that acute poisoning has been identified as a significant cause of both morbidity and mortality, and the hospital prevalence of poisoning has been known to vary up to 17%. In Botswana, poisoning by various agents contributes to 7% of morbidity and ranks third among injuries leading to hospitalisation (Malangu, 2008b).

Studies have revealed that the toxic agents associated with the morbidity and mortality vary from place to place and over time (Eddleston, 2000, Hawton and Fagg, 1992). This variability has been attributed to the availability and use of various chemicals and other poisoning agents in different regions; changes in lifestyles, beliefs and traditions of people cannot be left out in considering reason of variations in distribution of toxic agents.

A survey conducted by Tagwireyi et al (2002) in 8 referral hospitals in Zimbabwe revealed that pesticides and pharmaceuticals were the most common toxic agents responsible for hospital admissions. In another study conducted in Hong Kong, sleeping pills and analgesics were the most commonly used poisons (Chan et al., 2005). Sedative hypnotic drugs, opioids and pesticides were common agents in Tehran-Iran (Shadnia et al., 2007). In Francistown and Gaborone, Botswana; household chemicals and pharmaceuticals were the predominant cause of acute poisoning (Malangu, 2008b). In Kampala-Uganda, most of the poisoning cases were due to agrochemicals and household chemicals respectively (Malangu, 2008a). Medications and pesticides were in descending order the common agents used in Fujian-China (Chan et al., 2005). In Riyadh-Saudi Arabia, drugs and household chemicals were most prevalent among the cases (Al-Barraq and Farahat, 2011).

The Need for Information on Poisoning

Though a lot is known and documented on acute chemical poisoning on a global perspective, very little is known on the epidemiology of acute chemical poisoning in Zambia. Similarly, a number of studies show that in most countries especially in developing countries, the epidemiology of acute chemical poisoning is less established. Studies in Hong Kong (Chan et al., 2005) and Botswana (Malangu, 2008b) are such examples. At the heart of this lack of up to date data on acute chemical poisoning is the lack of published data in internationally recognised data bases (Ibid), as well as the lack of national surveillance system and the non-mandatory notification of acute poisoning cases (Chan et al., 2005).

Furthermore, although there are good data bases in developed countries concerning poisoning such as the Toxic Exposure Surveillance System (TESS); for most of the low income countries like Zambia, there are no formal and well established Poison Control Centres to collect such data. Hence information on this very important public health issue remains insufficient. The WHO (1986) identified that a large number of acute poisoning cases can be prevented or lessened through a thorough understanding of circumstances, substances and populations at risk coupled with other considerations which may provide pathways to sound policies targeted at poisoning prevention (Joint WHO/IPCS/CEC Meeting et al., 1986).

In view of this premise, the need for a more up-to-date review of the pattern of poisoning in Zambia is imperative. This will help to provide insight into the most common causes of poisoning and create opportunities for identification of areas where health education or other interventions can be applied.

CHAPTER II

Research Focus

This section details the problem under study and the purpose for undertaking the research. It also includes the research question and objectives that guided the study as well as the conceptual framework.

2.1 Statement of the Problem

Studies have shown that poisoning is a common reason for visits to emergency departments and for hospitalisation worldwide and is responsible for more than one million illnesses annually (Murray and Lopez, 1996). Although data on the prevalence of poisoning on a global scale may seem to be well established, updated data from developing countries is largely unexplored (World Health Organisation, 2009).

In Zambia, most of the current data on poisoning are limited to case reports or series; the prevalence and epidemiological profile of chemical poisoning is yet to be established. The paucity of updated data on poisoning in Zambia makes the understanding of the extent and complexity of the problem with regard to circumstances leading to poisoning as well as the populations at risk very challenging. Unavailability of such vital information cripples the prospect of putting up preventive and control intervention measures for this public health problem. Failure to prevent and control any public health issue creates negative consequences on the already pressured health service delivery system of Zambia.

Epidemiological knowledge of the patterns and characteristics of poisoning is useful in the design of interventions directed at the reduction of morbidity and mortality due to this scourge, hence the study.

2.2 Purpose Statement

The purpose of this study was to establish the epidemiology and characteristics of chemical poisoning cases as reported at the University Teaching Hospital (UTH) and Levy Mwanawasa Hospital, in view of creating an up to date profile of chemical poisoning. The two hospitals are referral hospitals, UTH being one of the largest hospitals in the country. It was expected that the hospitals would provide information from a wider population base.

The study was envisioned to provide information on the prevalence of chemical poisoning at the two hospitals under review, the common chemicals involved in poisoning as well as the case fatality rates for the various chemical agents. It was also expected to provide further information needed in the understanding of relationships between the outcomes (i.e. recovery, injury or death), type of chemicals involved, sex, age, occupation and circumstances of poisoning (i.e. intentional or unintentional).

It was envisaged that information gathered from this study would be vital in identifying risk situations, risk populations and notorious chemicals which are the main targets of any intervention plan to prevent and control morbidity and mortality caused by acute poisoning. In addition the information may be useful in setting up a surveillance system which could help in providing timely information on poisoning whenever it is required. The study was anticipated to stimulate further research on this important public health problem.

2.3 Research Question

What is the epidemiology of chemical poisoning in Lusaka, Zambia?

2.4 Objectives

General Objective

The general objective of the study was to describe the distribution and determinants of chemical poisoning at the University Teaching Hospital (UTH) and Levy Mwanawasa General Hospital in Lusaka from January to December, 2012.

Specific Objectives

1. To identify the common chemical agents involved in poisoning.

2. To establish the burden of chemical poisoning as reported at the University Teaching Hospital and Levy Mwanawasa General Hospital.

3. To establish the mortality rate of chemical poisoning and the case fatality rates of the various chemical agents involved in poisoning.

4. To assess the determinants/predictors of outcome (death/recovery) and circumstance (deliberate/accidental) leading to acute chemical poisoning.

2.5 Conceptual Framework

To answer the research question and address the specific objectives, the conceptual framework was developed based on the proximate determinants framework. The framework used in this study was an adaptation of the works of Boerma and Weir used in the study of the distribution and determinants of human immunodeficiency virus (HIV) infection in populations (Boerma and Weir, 2005). This version was adapted from the framework widely used by demographers in the study of fertility and child survival (Bongaarts, 1978, Davis and Blake, 1956). The model gives an outline of the relationships and interactions of sets of distal and proximate determinants which influence exposure to chemical agents leading to various health outcomes. The details of how various factors interact at different levels to influence acute chemical poisoning are illustrated in Figure 1.

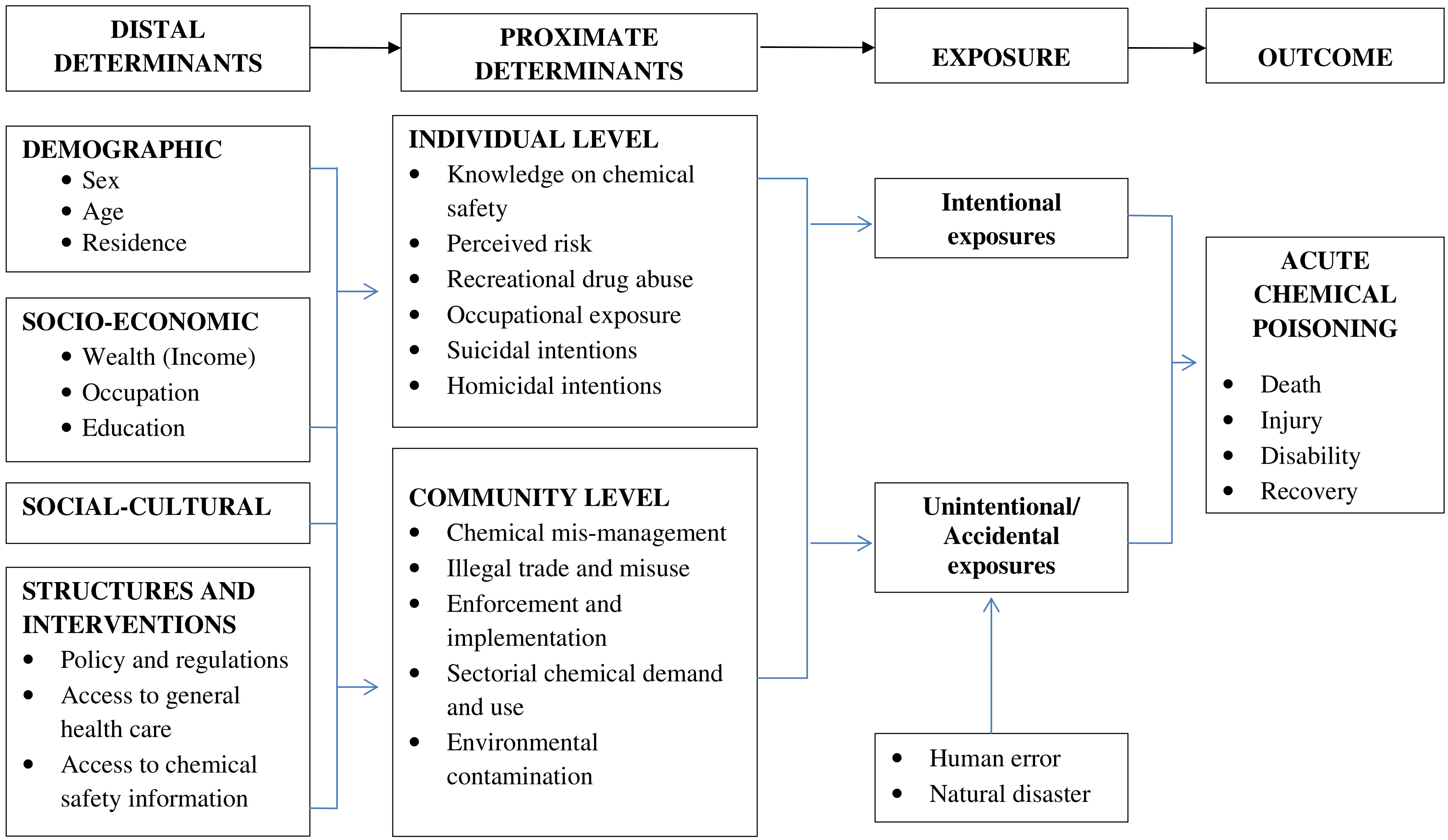


Figure 1: Conceptual Framework

CHAPTER III

Methodology

The study was undertaken using quantitative retrospective methods that made use of a formal, objective and systematic process in the collection of data to establish an up to date epidemiological profile of chemical poisoning as reported at the University Teaching Hospital (UTH) and Levy Mwanawasa General Hospital (LMGH) for a period of one year (i.e.1st January to 31st December 2012). The researcher analysed patterns of chemical poisoning in relation to sex, age, residence, types of poisons/chemical agents involved, route of exposure to poison, circumstance leading to poisoning (i.e. deliberate/accidental) and outcome (i.e. recovery, injury or death) of poisoning, (see Table 2 of study variables in the appendix).

3.1 Study Setting

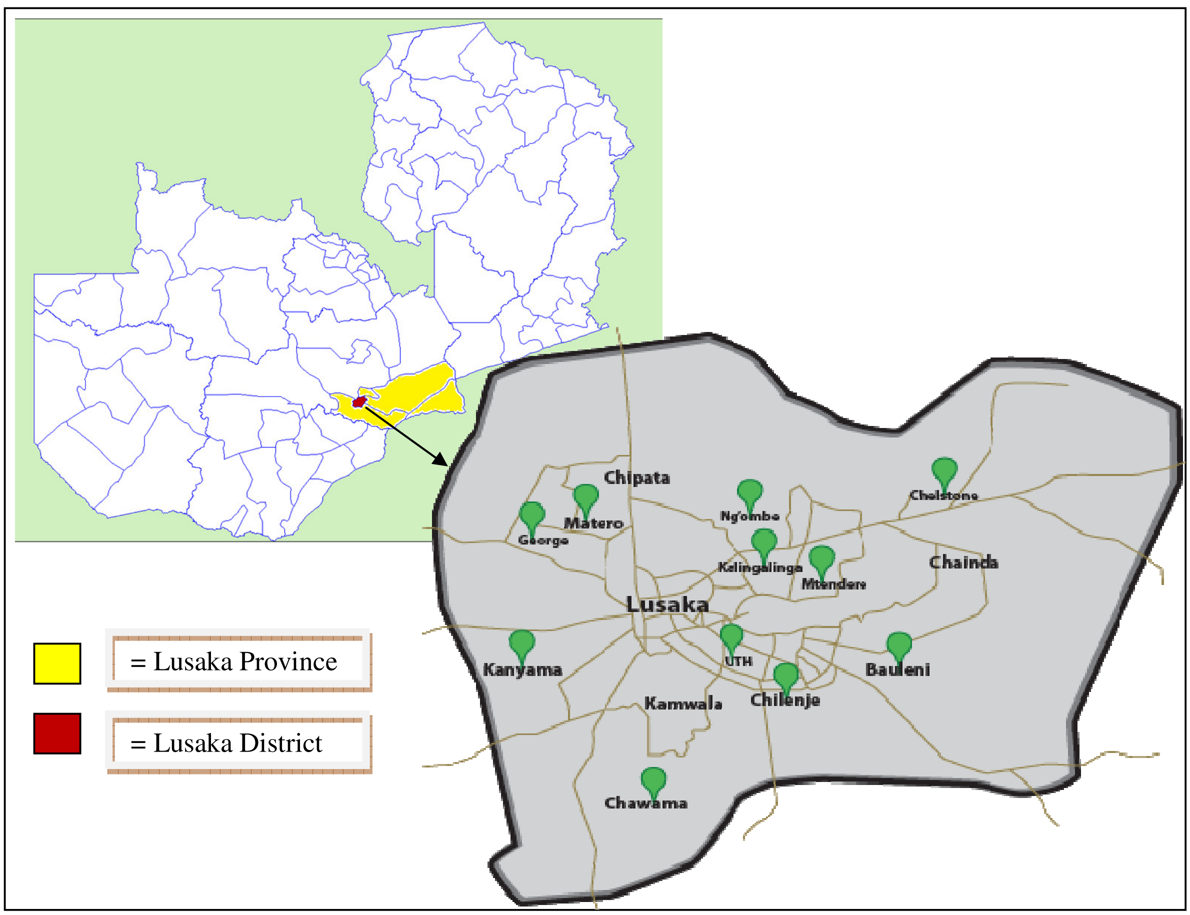


Figure 2: Map of Zambia with an extract of Lusaka District. (Source; African Centre of Excellence for Women with Cervical Cancer, 2014 [Internet] and Wiki maps, 2014 [internet])

The study was conducted in Lusaka District of Zambia at the University Teaching Hospital (UTH) and Levy Mwanawasa General Hospital (LMGH). The two hospitals are referral hospitals receiving cases from hospitals and health centres from both within and outside Lusaka District. Therefore, it was anticipated that sufficient number of cases would be gathered for analysis during the short study period. The University Teaching Hospital was founded in 1974 and has remained the biggest hospital in Zambia with more than 1600 beds. It is located approximately 4km east of Lusaka city centre. Located on the Great East Road, Levy Mwanawasa General Hospital is a relatively new hospital in Lusaka officially opened in August 2010. With only 150 beds at inception, the hospital had cared for over 25, 000 people within the first year of it opening (Muvi TV Online, 2014, The Post Online, 2014)

For UTH, the study more specifically focused on Filter Clinic where adult cases are first attended to, and the Admission Wards (both female and male) where cases requiring further treatment and assessment are admitted. In addition to the filter clinic, the Paediatric Outpatient Department (OPD) and Paediatric Admission Wards were considered to make available the children population. The Department of Casualty at LMGH provided both the children and adult population as it is the first point of contact between the hospital and the patients coming in with poisoning and other conditions requiring emergency attention.

3.2 Study Design

This was an analytical cross sectional study. The design was chosen to retrospectively collect data for the purpose of generating information on the epidemiology of acute chemical poisoning as recorded at UTH and LMGH in Lusaka for a one year period. A cross-sectional study design was selected as it provides estimates of features in a study population at one point in time (Kirkwood and Sterne, 2003). It was anticipated that the study would benefit greatly from these attributes in achieving the goal to describe the distribution and determinants of acute poisoning. In addition, a cross sectional design describes both the exposure and outcome at the same time; this was valuable to the study in describing the various possible causes (i.e. exposure to various toxic agents) and possible outcomes (i.e. death or recovery) in relation to age, sex, residence, outcomes and risk situations of acute chemical poisoning, all at the same time.

According to this study, chemical poisoning was poisoning as a result of injection, inhalation, ingestion, or absorption of a naturally or artificially produced chemical in gaseous, liquid or solid state resulting in the interference of normal biological function or death. According to Mosby's medical dictionary (2009), acute toxicity/poisoning is the harmful effect of a toxic agent that manifests itself in seconds, minutes, hours or days after entering the patient. According to this study, acute cases of poisoning were considered as those with a diagnosis of poisoning as a result exposure to a chemical(s) within 24-96 hours resulting in biological harm. Classification of residential areas followed the guidelines used by the Lusaka City Council which classify urban areas as planned settlements with legal status, some of which are also classified as high cost residential areas. Peri urban areas are those classified as unplanned settlements. These were not originally planned for by the local authorities; however, some were later upgraded and gained a legal status that is renewable after 30 years. Rural areas are areas in the outskirts of Lusaka most of which are along the major roads of Zambia and others are on traditionally owned or acquired land (Mulima, 2010).

Study Population

The study population included all acute chemical poisoning cases recorded in the hospital registers and patient files at UTH and LMGH for the period under review. The population included all cases of chemical poisoning for both children and adults as recorded in the registers. Only acute intoxications were considered for the study, any complications as a result of long term exposure to chemicals were not considered. The study excluded all non-chemical poisoning cases with an exception of food poisoning for which it was difficult to disaggregate between foods contaminated with chemical or bacterial agents.

3.3 Data Collection

Sampling Method and Sample Size

Total sampling was used in the selection of participants for the study. The sample included all individuals with a diagnosis of chemical and food poisoning as recorded in the hospital registers and patient files for a period of one year (i.e. 1st January to 31st December, 2012). Selecting all cases was expected to award the data for the study internal validity as no case satisfying the selection criteria was left out of the study.

Data Collection Techniques and Tools

Record review technique was used in data collection. Hospital Out-Patient and Death Registers as well as Patient Case Files were reviewed to retrospectively collect data on chemical poisoning. A predesigned and pretested data collection form was used as a tool to record and collect demographic and epidemiologic data surrounding the cases. The data collection form was diligently designed to ensure that all the relevant information entered in the records was captured to help achieve the study objectives. A Pilot study was carried out at UTH on records for the months of October and November 2010. The use of the same setting as that for the study had no adverse effect on the study as records used were not included in the study period that was reviewed. The pilot was performed to determine the effectiveness and credibility of the data collection tools and methods in achieving the objectives of the study. The pilot was beneficial in improving the quality of the data collection process based on experiences from pre-testing.

The first point of data collection was the out-patient registers. This is where information on all cases attended to in the various hospital departments is entered. For more information on the individual poisoning cases identified, serial numbers from out-patient registers were used to locate the patient files. The patient files contained detailed information surrounding the poisoning case including the circumstances leading to poisoning, chemical agent used, the treatment as well as the outcome (i.e. injury, recovery or death). Just to make sure that no cases were missed out, death registers were reviewed to identify all deaths as a result of poisoning.

Data collection was done by the researcher with the help of two research assistants. The research assistants were medical students in fifth and sixth year. Both had had previous experience in research and data collection from their own research and from other studies. In addition to experience, the research assistants were given adequate information on the goals of the study and their responsibilities to ensure that they understood their role in the study. Further, their competence was assessed during the pilot study.

To ensure quality assurance, the data collected by the research assistants using the data collection forms was checked by the principal investigator for accuracy, consistency and completeness on a daily basis after collection. It was then entered in Epi Data version 3.0 and later exported to STATA version 13 for processing and analysis.

3.4 Data Management and Analysis

Analysis and description of all variables at baseline was done as they were presented and presented (coded) in the data collection forms. In subsequent analyses, the unknowns for each of the study variables were dropped. Age was collected as a continuous variable and categorised into four groups at analysis (with an exception of logistic regression analysis in which age was analysed as a continuous variable). Literature showed that patterns of poisoning differ for persons in various age groups, hence the reason for categorising to represent different population groups. For this study, 0-12 years was used to represent the children population, 13-19 years was used to represent the teenage population, 20-30 years was used to represent the young adults and over 30 years was used to represent the elderly of the population. Two categories were created for outcome of poisoning which included death and recovery, cases with injuries were combined with those who had recovered. Inhalation, absorption and injection were combined to make one category. Therefore the variable route of poisoning had two categories i.e. ingestion and all other routes combined. Also, residence was regrouped to two categories i.e. urban and peri urban combined with rural. Toxic agents involved were also regrouped into five categories depending on the characteristics of the agents and as seen logical by the researchers. The categories included: Plant, animal and food poisoning; alcohol; medications and narcotics; pesticides; as well as domestic and industrial chemicals. The regrouping was done to make the dependent variables binary and to reduce disparities in categories of the variables as some categories had very few cases in them thereby creating a challenge at analysis.

The specific toxic agents used were individually counted and presented in tabular form with counts and percentages. For poisoning cases that involved more than one toxic agent, each agent was counted in the specific category to which it belonged. Baseline characteristics of the poisoning cases were described according to the data collection site and presented as counts and frequencies for each of the study variables.

Descriptive statistics were used to describe the study variables. The study also made use of quantitative analysis of the data collected on acute chemical poisoning. Graphs and tables were used in the presentation of the results for the study. Bivariate analysis was used to make complete and accurate comparisons of relationships of the study variables. Chi Square test was used to examine the associations of the variables of the study with a cut-off point of

$p \leq 0.05$ for significance. To this effect, the circumstance of poisoning (i.e. deliberate or accidental) and outcome of poisoning (i.e. recovery of death) were used as dependent variables and cross tabulated with all other study variables.

Logistic regression models were fit to explore the relationship between the odds of circumstance of poisoning with all other variables in the study; and the odds of outcome of poisoning with all other variables in the study. For the purpose of this part of the analysis, it was hypothesised that the dependent variables (i.e. circumstance and outcome of poisoning) were associated with the independent variables of the study. The null hypothesis was that there is no association between the dependent and independent variable. Logistic regression was also used to explore the predictors/determinants of outcome (i.e. survival or recovery) and circumstance of poisoning (i.e. intentional/unintentional). For this purpose, the predictors included all variables of the study.

Logistic regression was carried out using logistic regression for reporting odds in STATA version 13. Backward stepwise regression modelling was used in this study. All variables from the bivariate analysis were included in the models, some of those that were not significant were dropped from the study and those that resulted in multi collinearity were also dropped. The R squares for each of the models were considered in selecting the model that fit the data best.

In addition, seasonal variations were also considered in the analysis using the month case recorded in the data. However, only seasonal variations in number of cases due to selected toxic agents involved were explored in this study and presented in a histogram.

3.5 Ethical Considerations

The study involved accessing hospital registers and patient files which may be considered as an invasion of the patient's privacy. Hence, in an effort to uphold the respect of persons principle of ethics, permission was sought from the hospital administration and the patients were only identified by serial numbers as recorded in the hospital registers and all the information was kept confidential.

In order to ensure distributive justice in the study, all the patients diagnosed with acute chemical poisoning during the study period were included in the sample; this was also used as a strategy to avoid any bias in the selection of the cases. There were no direct benefits to the participants of this study; however, the study was beneficial in generating up to date information on acute chemical poisoning which is useful in informing policy addressed at reducing exposure to chemicals as well as morbidity and mortality.

In addition, permission to conduct the study was sought from Excellence in Research Ethics and Science (ERES), the Institutional Research Board (IRB).

3.6 Plans for Utilisation and Dissemination of Results

The researcher planned to make available summary copies of the final report to the relevant stakeholders who have the authority to act on the recommendations given in the study. These stakeholders included the University Teaching Hospital (UTH) and Levy Mwanawasa General Hospital (LMGH) Administration being the host institution, as well as the Zambia Environmental Management Agency (ZEMA) and the Ministry of Health (MoH) who are the policy makers. In addition, a copy of the final report will be submitted to the University of Zambia Libraries for academic referencing. The study will be submitted to a local or international journal for publication. It is envisaged that the findings of the study will help inform policy on intervention measures to address morbidity and mortality due to acute chemical poisoning. In addition the study findings will help highlight the epidemiological profile of acute chemical poisoning which may be useful for academic purpose a well as in planning for a National Toxicological Surveillance System.

CHAPTER IV

Results

The baseline characteristics of study participant from all data collection sites have been outlined in Table 3. Details of the results of the data analysis have been presented in subsequent sections of this chapter.

Table 3: Baseline characteristics of poisoning cases from out-patient registers in Department of Casualty of Levy Mwanawasa General Hospital (LMGH); Filter Clinic and Department of Paediatrics of University Teaching Hospital (UTH) from January to December 2012

	Frequencies [n (%)]			
	LMGH	**University Teaching Hospital**		
Patient Characteristics	**Casualty Department (n=334)**	**Filter Clinic (n=424)**	**Paediatrics Department (n=273)**	**Overall (n=1031)**
Sex				
Male	174 (52.10)	269 (63.44)	149 (54.58)	592 (57.42)
Female	160 (47.90)	155 (36.56)	124 (45.42)	439 (42.58)
Age				
0 to 12 years	71 (21.26)	0	235 (86.08)	306 (29.68)
13 to 19 years	63 (18.86)	71 (16.75)	29 (10.62)	163 (15.81)
20 to 30 years	124 (37.13)	204 (48.11)	3 (1.10)	331 (32.10)
Over 30 years	60 (17.96)	113 (26.65)	0	173 (16.78)
Unknown	16 (4.79)	36 (8.49)	6 (2.2)	58 (5.63)
Mean age (SD)	25 (20.62)	33 (21.88)	7 (14.62)	24 (22.48)
Residence				
Urban	117 (35.03)	100 (23.58)	55 (20.15)	272 (26.38)
Peri Urban	187 (55.99)	302 (71.23)	193 (70.70)	682 (66.15)
Rural	27 (8.08)	17 (4.01)	18 (6.56)	62 (6.01)
Unspecified	3(0.90)	5 (1.18)	7 (2.56)	15 (1.4)
Circumstance of poisoning				
Accidental	150 (44.91)	72 (16.98)	241 (88.28)	463 (44.91)
Deliberate	143 (42.81)	305 (71.93)	28 (10.26)	479 (46.17)
Unspecified	41 (12.28)	47 (11.08)	4 (1.47)	92 (8.92)
Outcome of poisoning				
Recovery	328 (98.20)	400 (94.34)	272 (99.63)	1000 (96.99)
Injury	0	3 (0.71)	1 (0.37)	4 (6.39)
Death	6 (1.80)	21 (4.95)	0	27 (2.62)

Route of poisoning				
Ingestion	268 (80.24)	412 (97.17)	271 (99.27)	951 (92.24)
Inhalation	4 (1.20)	10 (2.36)	0	14 (1.36)
Absorption (Dermal)	0	0	1 (0.37)	1 (0.10)
Injection	57 (17.07)	0	1 (0.37)	58 (5.63)
Unspecified	5 (1.50)	2 (0.47)	0	7 (0.68)
Toxic agent involved				
Household chemicals	14 (4.19)	15 (3.54)	15 (5.49)	44 (4.27)
Alcohol	27 (8.08)	124 (29.25)	7 (2.56)	158 (15.32)
Pharmaceutical	43 (12.87)	58 (13.68)	22 (8.06)	123 (11.93)
Animal/insect bites	59 (17.66)	0	1 (0.37)	60 (5.82)
Agro chemicals	33 (9.88)	114 (26.89)	40 (14.65)	187 (18.14)
Food Poisoning	38 (11.38)	42 (9.91)	35 (12.82)	115 (11.15)
Narcotics	0	3 (0.17)	0	3 (0.29)
Traditional medicine	1 (0.30)	5 (1.18)	1 (0.37)	7 (0.68)
Plants	3 (0.90)	1 (0.24)	15 (5.49)	19 (1.84)
Unspecified agents	91 (27.25)	25 (5.90)	57 (20.88)	178 (16.78)
Others agents	25 (7.49)	37 (8.73)	80 (29.30)	142 (13.77)

Note:

- Marital status not included because the variable was found to be missing for most cases.
- Pharmaceuticals were predominantly oral but difficult to disaggregate.
- Based on medical definition, the maximum age limit for Paediatric Department is 14 years, however, cases with age older than 14 were found in the records and were recorded as such.
- Accidental or deliberate cases were as recorded in the files or based on the researchers judgement of the details provided in case files.
- Unspecified agents were those whose identity could not be established during data collection.
- Other agents were those that were not included in the data collection form whose identity was indicated in hospital records.

Participation and Prevalence

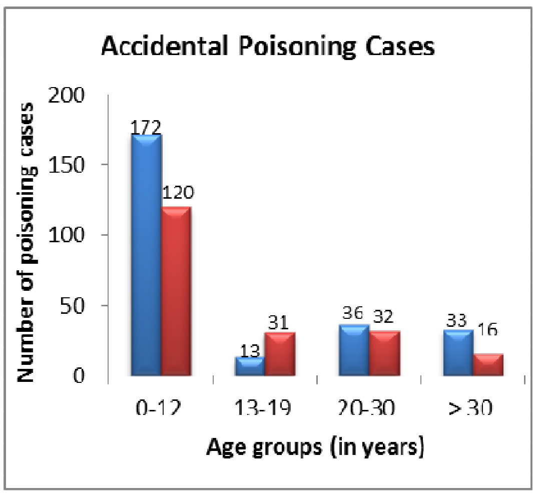
There were a total of 1, 031 poisoning cases with complete data in the three data collection sites during the one year study period. This was out of a total of 93, 570 patients attended to in the three data collection sites resulting in a prevalence of 1.1 per 100 hospital admissions. Majority of the cases were recorded in Filter Clinic (n=424, 41%) of the University Teaching Hospital and Department of Casualty (n=334, 32%), at Levy Mwanawasa General Hospital. The Department of Paediatrics (n=273, 27%) of the University Teaching Hospital had the lowest number of cases (See table 3).

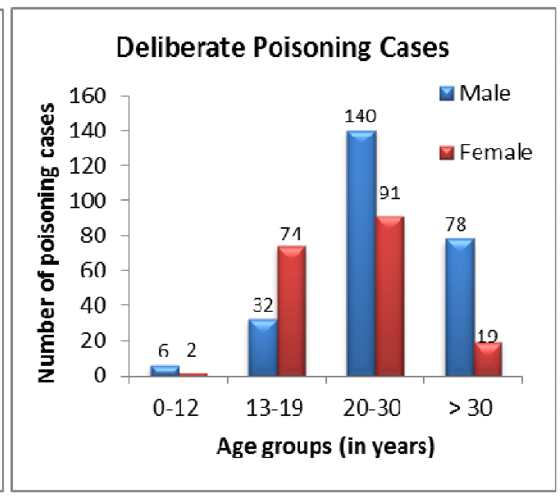
Socio-Demographic Distribution

The social demographic factors considered in the study included sex, age and residence, details of their distribution were as described below.

Sex

Male dominance was observed in all data collection sites. Overall, males accounted for 57% (n=592) of the cases and females accounted for 43% (n=439). Also, there were more male cases observed in all age groups for both accidental and deliberate poisoning with an exception of the 13-19 years age category in which females accounted for the highest number of cases (n=105, 70%), Of these female cases in this age category, majority were due to deliberate poisoning (n=74, 70%), (See figure 3).





Median age = 5years (IQR: 2-21) *Median age = 25years (IQR: 20-31)*

Figure 3: Distribution of Circumstance of Poisoning by Sex and Age

Age

Overall mean age of the cases reviewed was 24 (SD 22.5), with a range of 0 to 76 years. Most of the poisoning cases (n=331, 32%) were aged between 20-30 years and 0-12 years (n=306, 30%). Poisoning among those aged between 20-30 years was mostly deliberate (n=231, 69%) with male cases as high as 61% (n=140) while accidental poisoning characterised most of the cases aged between 0-12 years (n=292, 95%) also with a majority of male cases (n=172, 59%) (See figure 3).

Residence

Specific locations of the residences varied for each of the data collection sites. In Filter Clinic of UTH, Chilenje was the urban residential area with highest poisoning cases (n=25, 25%). Matero, Chawama and Kanyama contributed similar proportions of cases in peri urban residences (n=33, 11%; n=32, 11% and n=30, 10% respectively). While Ngwerere was the rural residential area with most poisoning cases (n=7, 71%) (See table 13 in the appendix). In the Department of Paediatrics of UTH, Chilenje (n=11, 20%), Matero (n=23, 12%) and Mungule (n=6, 33%) were residences with the highest number of cases from urban, peri urban and rural areas respectively. (See table 14 in the appendix). In the Department of Casualty of LMGH, most cases in urban residential areas were from Chelstone (n=15, 13%) while Mtendere (n=57, 31%) and Ngombe (n=55, 29.4%) contributed similar proportions of cases from peri urban residential areas. Majority of the cases in rural residential areas were from Kasisi (n=16, 59%) (See table 15 in the appendix).

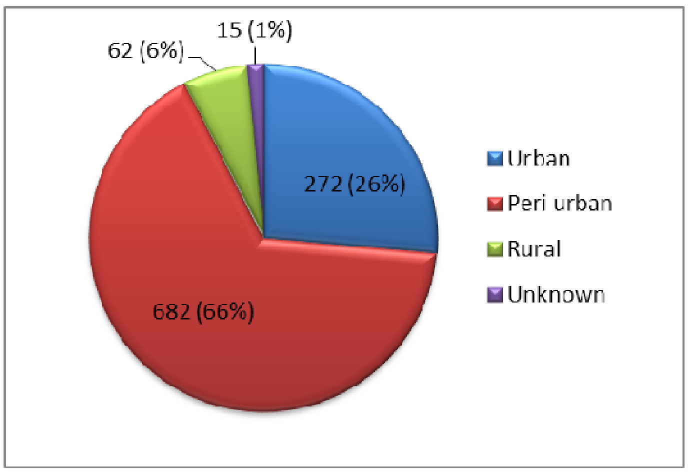


Figure 4: Distribution of Poisoning Cases by Residence

Figure 4 shows that overall, a large proportion of the cases (n=682, 66%) reviewed were from peri urban residences of Lusaka District. Rural residences contributed the lowest number of poisoning cases (n=62, 6%).

Mortality and Socio-Demographic Distribution

Of all the cases reviewed 27 resulted in an outcome of death giving a mortality rate of 2.6 per 100 cases. Injuries recorded in 4 of the cases were predominantly oesophageal injuries as a result of damage by corrosive chemicals ingested. It was interesting to note that there more deaths in men in comparison to women with an exception of the teenage category were a lone case resulting into death was female. Overall, deaths in men were as high as 78% (n=21) while only 22% (n=6) of the deaths were observed in females. Similar proportions of deaths (n=9, 33%) were observed in both the 20-30 and over 30 years age categories. Most of these deaths were due to deliberate poisoning (n=20, 74%), of which 78% (n=21) were a result of ingesting toxic agents. The age and circumstance leading to poisoning could not be established in 30% (n=8) and 26% (n=7) respectively. Of those who died, 67% (n=18) where from peri urban areas, and 26% (n=7) from urban areas.

Distribution of Toxic Agents and their Case Fatality Rates

Figure 5 shows the distribution of toxic agents that were involved in poisoning in the cases reviewed. Details of various toxic agent categories and case fatalities of specific agents are given in subsequent sections.

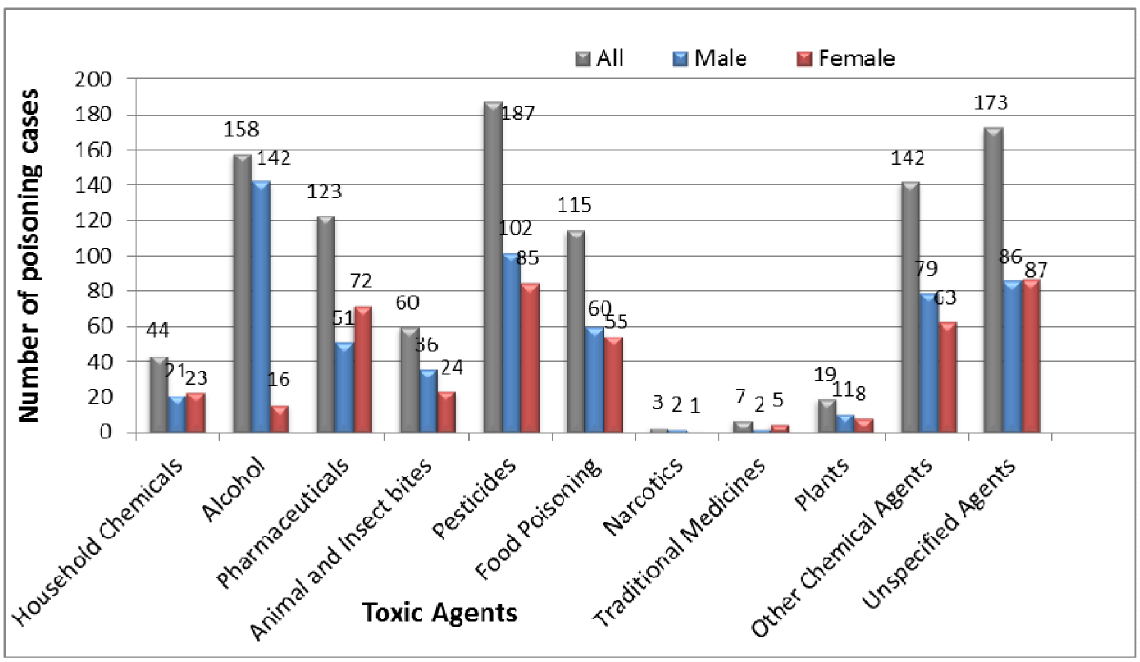


Figure 5: Distribution of Toxic Agents

a) Pesticides

Pesticides were associated with a larger proportion of poisoning cases (n=187, 18%) (See table 3 and figure 5), they were also associated with a high number of the deaths (n=13, 48%) giving a 7% case fatality rate. In descending order, the pesticides identified included unspecified organophosphates (n=97, 52%), insecticides (n=76, 41%) and rodenticides (n=14, 7%) (See table 4). Overall, poisoning by pesticides was common in men (n=102, 55%). However, this observation was not consistent with the teenage girls (n=22, 69%) who showed higher cases of pesticide poisoning than teenage boys (n=10, 31%).

b) Alcohol

Alcohol intoxication was associated with 15% (n=158) (See table 2) of the poisoning cases and 15% (n=4) of all the deaths, resulting in a 3% case fatality rate. Alcohol poisoning showed a high prevalence in men (n=142, 90%) compared to women (n=16, 10%). This observation was consistent in all age categories, the highest numbers being in the 20-30 years (n=78, 49%) and over 30 years (n=48, 30%) age categories. Interestingly there were cases of alcohol intoxication in the 0-12 and 13-19 age category, contributing 4% (n=6) and 9% (n=14) to the total alcohol intoxication cases respectively.

c) Pharmaceutical and Narcotic drugs

Pharmaceutics also accounted for an important number of poisoning cases (n=123, 12%). Death as a result of pharmaceuticals was observed in 11% (n=3) of the cases giving a case fatality of 2%. Analgesics (n=56, 44%) and antibiotics (n=20, 16%) were the most common drugs in this category. Poisoning by pharmaceuticals was more prevalent among the teenage (n=24, 80%) and adult females (n=36, 71%). Narcotics were responsible for few poisoning cases (n=3, 0.3%). However with a lone fatality they had the highest case fatality rate (33% case fatality).

d) Domestic and Industrial Chemicals

Disinfectants (n=19, 43%) and cleaning agents (n=15, 34%) were the most common toxic agent among the household chemicals (n=44, 4%). There were no deaths associated to household chemicals. Disinfectants were mainly chlorine which is used in the purification of water in most households while detergent was the most common cleaning agent used.

Agents that could not be included in any of the categories identified prior to data collection were identified as other agents and they accounted for 14% of the poisoning cases (n=142). Kerosene (n=69, 49%) was the most common agent in this category and carbon monoxide n=26, 18%). Acids (n=23, 16%) also accounted for a large proportion of poisonings in this category.

e) Food Poisoning, Plant Toxins and Animal Envenomation

It was difficult to disaggregate food poisoning cases due to chemical or bacterial contamination hence all food poisoning cases were recorded (n=115, 11%). Animal and insect bites were the cause of poisoning for 6% (n=60) of the total number of cases. These bites were predominantly snake bites (n=53, 88%) most of which were recorded in the casualty department (n=59, 18%). Less than 5% of the poisoning cases were as a result of traditional medicines and plants. Traditional medications were all herbal medications associated with less than 1% (n=7) of the poisoning cases.

f) Unspecified Toxic Agents

The toxic agent involved in poisoning could not be identified in a significant proportion of the case (n=178, 17%). This would be an indication of the state and efficiency of diagnostic facilities in the data collection sites. Males and females contributed similar proportions of cases for which the cause of poisoning could not be established.

Routes of Exposure and Related Toxic Agents

The most common route of exposure for the chemical agents was ingestion (n=951, 92%). By virtue of the attack mechanism, snake bites were associated with exposure by injection (n=58, 6%) of the snake venom through the bite. Other routes of exposure to chemicals where through inhalation, which was associated with carbon monoxide poisoning (n=10, 7%) and pesticides (n=2, 1%). There was only one case recorded with dermal absorption to an unknown toxic agent. The route of exposure could not be established for 7 (1%) of the cases.

Table 4: Specification of Toxic Agents and their Related Number of Poisoning Cases Recorded in all Data Collection Sites• • Toxic Agent • Frequency
• Toxic Agent
• Frequency
Toxic Agent
• Frequency
Frequency
n (%)• Toxic Agent• Frequency
Toxic Agent• Frequency
Frequency
n (%)• • Pesticides (n= 187) • Household Chemicals (n=44)• • • Unspecified Organophosphates• 97
(51.87)• Disinfectants• 1
9
(43.18)• • Insecticide• 76
(40.64)• Cleaning agents• 15
(34.09)• • Rodenticides•
• Pesticides (n= 187) • Household Chemicals (n=44)• • • Unspecified Organophosphates• 97
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Cleaning agents• 15
(34.09)• • Rodenticides•
15
(34.09)• • Rodenticides•
• Rodenticides• 14
(7.49)• Personal care
products• 8
(18.18)• • • • Food
additives• 2
(4.55)• • • • • • • **Alcoh
ol (n=158)**• 158
(15.32)• **Food Poisoning
(n=115)**• 115
(11.15)• • • • • • • **Phar
maceutics*
(n=128**)**• • **Narcotic
drugs (n=3)**
• • • Analgesics• 56
(43.75)

• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional**
Medicines• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1

(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
Rodenticides• 14
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Fluid• 1
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(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
8 (18.18)• • • • Food
additives• 2
(4.55)• • • • • • • **Alcoh**
ol (n=158)• 158
(15.32)• **Food Poisoning**
(n=115)• 115
(11.15)• • • • • • • **Phar**
maceutics*
(n=128****)**• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)

• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional**
Medicines• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1

(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• • • Food additives• 2
(4.55)• • • • • • • **Alcoh
ol (n=158)**• 158
(15.32)• **Food Poisoning
(n=115)**• 115
(11.15)• • • • • • • **Phar
maceutics*
(n=128**)• • Narcotic
drugs (n=3)**
• • • Analgesics• 56
(43.75)
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(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
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drugs• 18
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Medicines**• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
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(n=19)**• • • Antimalarial
drugs• 6
(4.69)• Unspecified
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drugs• 4 (3.13)• Elephant
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(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
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(0.78)• **Other agents**

(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect
bites**
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
• • Food additives• 2
(4.55)• • • • • • • **Alcoh
ol (n=158)**• 158
(15.32)• **Food Poisoning
(n=115)**• 115
(11.15)• • • • • • • **Phar
maceutics*
(n=128**)**• • **Narcotic
drugs (n=3)**
• • • Analgesics• 56
(43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18

(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family planning pills• 1
(0.78)• **Other agents (n=142)** • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites (n=60)**• Construction chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel

• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• Food additives• 2 (4.55)• • • • • • • **Alcohol (n=158)**• 158 (15.32)• **Food Poisoning (n=115)**• 115 (11.15)• • • • • • • **Pharmaceutics* (n=128**)**• • **Narcotic drugs (n=3)**
• • • Analgesics• 56 (43.75)
• Amphetamines• 2 (66.67)• • Antibiotics• 20 (15.63)• Glue• 1 (33.33)• • Unspecified drugs• 18 (14.63)• • • • Antipsychotics• 7 (5.47)• **Traditional Medicines**• 7 (0.68)• • Nutrition supplements• 6 (4.69)• • • • Anticonvulsants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6 (4.69)• Unspecified plants• 14 (93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5 (26.32)• • Antihistamines • 2 (1.56)• • • • Family planning pills• 1 (0.78)• **Other agents (n=142)** • • • Antihypertensive drugs• 1 (0.78)• Kerosene • 69 (48.59)• • Anti TB Drugs• 1 (0.78)• Carbon

monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites**
(n=60)• Construction chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
Food additives• 2
(4.55)• • • • • • • **Alcohol (n=158)**• 158
(15.32)• **Food Poisoning (n=115)**• 115
(11.15)• • • • • • • **Pharmaceutics* (n=128**)**• • **Narcotic drugs (n=3)**
• • • Analgesics• 56
(43.75)
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(66.67)• • Antibiotics• 20
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(14.63)• • • • Antipsychotics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition

supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
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• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
2
(4.55)• • • • • • • **Alcoh**

ol (n=158)• 158
(15.32)• **Food Poisoning**
(n=115)• 115
(11.15)• • • • • • • **Phar**
maceutics*
(n=128[**]**)**• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)
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Medicines• 7
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(n=142) • • • Antihyperte
nsive drugs• 1
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bites

(n=60)• Construction
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drugs (n=3)

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(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
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Pharmaceuticals were predominantly oral
• • • • **Alcohol**
(n=158)• 158
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maceutics*
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• • • Analgesics• 56
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(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
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• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
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• • • **Alcohol**
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(15.32)• **Food Poisoning**
(n=115)• 115
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maceutics*
(n=128[**]**)**• • **Narcotic**
drugs (n=3)
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drugs• 18

(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines
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(0.78)• **Other agents (n=142)** • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
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(16.2)• • **Animal/Insect bites**
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(88.33)• Spirit of salt
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(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel

• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• • **Alcohol (n=158)**• 158 (15.32)• **Food Poisoning (n=115)**• 115 (11.15)• • • • • • • **Phar maceutics* (n=128**[**]**)**• • **Narcotic drugs (n=3)**
• • • Analgesics• 56 (43.75)
• Amphetamines• 2 (66.67)• • Antibiotics• 20 (15.63)• Glue• 1 (33.33)• • Unspecified drugs• 18 (14.63)• • • • Antipsycho tics• 7 (5.47)• **Traditional Medicines**• 7 (0.68)• • Nutrition supplements• 6 (4.69)• • • • Anticonvuls ants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6 (4.69)• Unspecified plants• 14 (93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5 (26.32)• • Antihistamines
• 2 (1.56)• • • • Family planning pills• 1 (0.78)• **Other agents (n=142)** • • • Antihyperte nsive drugs• 1 (0.78)• Kerosene • 69 (48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide

• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites**
(n=60)• Construction chemicals• 11
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• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • * Pharmaceuticals were predominantly oral
• **Alcohol (n=158)**• 158
(15.32)• **Food Poisoning (n=115)**• 115
(11.15)• • • • • • • **Pharmaceutics* (n=128**)**• • **Narcotic drugs (n=3)**
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(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvulsants• 6 (4.69)• **Plants**

(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
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Pharmaceuticals were
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(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family planning pills• 1
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Pharmaceuticals were predominantly oral
158 (15.32)• **Food Poisoning (n=115)**• 115
(11.15)• • • • • • • **Pharmaceutics* (n=128**)**• • **Narcotic drugs (n=3)**
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tics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1

(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
Food Poisoning
(n=115)• 115
(11.15)• • • • • • • **Phar**
maceutics*
(n=128****)**• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho
tics• 7

(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvuls ants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines • 2 (1.56)• • • • Family planning pills• 1
(0.78)• **Other agents (n=142)** • • • Antihyperte nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites**
(n=60)• Construction chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were

predominantly oral
115
(11.15)• • • • • • • **Phar maceutics***
(n=128)**• • **Narcotic drugs (n=3)**
• • • Analgesics• 56
(43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified drugs• 18
(14.63)• • • • Antipsycho tics• 7
(5.47)• **Traditional Medicines•** 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvuls ants• 6 (4.69)• **Plants (n=19)•** • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
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(0.78)• **Other agents (n=142)** • • • Antihyperte nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites**
(n=60)• Construction

chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• • • • • • **Pharmaceutics* (n=128**)**• • **Narcotic drugs (n=3)**
• • • Analgesics• 56
(43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
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drugs• 18
(14.63)• • • • Antipsychotics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvulsants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
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planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• • • • • **Pharmaceutics***
(n=128[**])• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)
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drugs• 18
(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional**
Medicines• 7

(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
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planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
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(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
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(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
• • • • **Pharmaceutics***

(n=128)**● • **Narcotic drugs (n=3)**
● ● • Analgesics● 56 (43.75)
● Amphetamines● 2 (66.67)● • Antibiotics● 20 (15.63)● Glue● 1 (33.33)● • Unspecified drugs● 18 (14.63)● ● ● • Antipsychotics● 7 (5.47)● **Traditional Medicines**● 7 (0.68)● • Nutrition supplements● 6 (4.69)● ● ● • Anticonvulsants● 6 (4.69)● **Plants (n=19)**● ● • Antimalarial drugs● 6 (4.69)● Unspecified plants● 14 (93.68)● • Anti-retroviral drugs● 4 (3.13)● Elephant plant● 5 (26.32)● • Antihistamines ● 2 (1.56)● ● ● • Family planning pills● 1 (0.78)● **Other agents (n=142)** ● ● • Antihypertensive drugs● 1 (0.78)● Kerosene ● 69 (48.59)● • Anti TB Drugs● 1 (0.78)● Carbon monoxide
● 26 (18.31)● ● ● • Acids
● 23 (16.2)● • **Animal/Insect bites**
(n=60)● Construction chemicals● 11 (7.75)● • Snake● 53 (88.33)● Spirit of salt
● 6 (4.25)● • Bee● 4

(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• • • **Pharmaceutics***
(n=128[**])• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional**
Medicines• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1

(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect
bites**
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
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(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were
predominantly oral
• • **Pharmaceutics***
(n=128[**]**)**• • **Narcotic
drugs (n=3)**
• • • Analgesics• 56
(43.75)
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tics• 7
(5.47)• **Traditional
Medicines**• 7
(0.68)• • Nutrition
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ants• 6 (4.69)• **Plants**

(n=19)• • • Antimalarial
drugs• 6
(4.69)• Unspecified
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planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
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Drugs• 1 (0.78)• Carbon
monoxide
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bites
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Pharmaceuticals were
predominantly oral
• **Pharmaceutics***
(n=128[**]**)**• • **Narcotic**
drugs (n=3)
• • • Analgesics• 56
(43.75)

• Amphetamines• 2
(66.67)• • Antibiotics• 20
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drugs• 18
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tics• 7
(5.47)• **Traditional Medicines**• 7
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nsive drugs• 1
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(16.2)• • **Animal/Insect bites (n=60)**• Construction
chemicals• 11
(7.75)• • Snake• 53
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(0.7)• • Scorpion• 1

(1.67)● Car radiant
cooler● 1
(0.7)● ● ● ● Brake
Fluid● 1
(0.7)● ● ● ● Silica gel
● 1 (0.7)● ● *
Pharmaceuticals were predominantly oral
Pharmaceutics*
(n=128[**]**)**● ● **Narcotic drugs (n=3)**
● ● ● Analgesics● 56
(43.75)
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(5.47)● **Traditional Medicines**● 7
(0.68)● ● Nutrition
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ants● 6 (4.69)● **Plants (n=19)**● ● ● Antimalarial
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nsive drugs● 1
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• 26 (18.31)• • • • Acids
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56 (43.75)
• Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho
tics• 7
(5.47)• **Traditional**
Medicines• 7
(0.68)• • Nutrition
supplements• 6
(4.69)• • • • Anticonvuls
ants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial

drugs• 6
(4.69)• Unspecified
plants• 14
(93.68)• • Anti-retroviral
drugs• 4 (3.13)• Elephant
plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family
planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihyperte
nsive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB
Drugs• 1 (0.78)• Carbon
monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect**
bites
(n=60)• Construction
chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
Amphetamines• 2
(66.67)• • Antibiotics• 20
(15.63)• Glue• 1
(33.33)• • Unspecified
drugs• 18
(14.63)• • • • Antipsycho

tics• 7
(5.47)• **Traditional Medicines**• 7
(0.68)• • Nutrition supplements• 6
(4.69)• • • • Anticonvulsants• 6 (4.69)• **Plants (n=19)**• • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family planning pills• 1
(0.78)• **Other agents (n=142)** • • • Antihypertensive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
• 23
(16.2)• • **Animal/Insect bites**
(n=60)• Construction chemicals• 11
(7.75)• • Snake• 53
(88.33)• Spirit of salt
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• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *

Pharmaceuticals were predominantly oral
2
(66.67)• • Antibiotics• 20
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(0.7)• • Scorpion• 1
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cooler• 1

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(7.75)• • Snake• 53
(88.33)• Spirit of salt
• 6 (4.25)• • Bee• 4
(6.67)• Formalin
• 3 (2.11)• • Wasp• 2
(3.33)• Diesel• 1
(0.7)• • Scorpion• 1
(1.67)• Car radiant cooler• 1
(0.7)• • • • Brake Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• Nutrition supplements• 6
(4.69)• • • • Anticonvulsants• 6 (4.69)• **Plants**
(n=19)• • • Antimalarial drugs• 6
(4.69)• Unspecified plants• 14
(93.68)• • Anti-retroviral drugs• 4 (3.13)• Elephant plant• 5
(26.32)• • Antihistamines
• 2 (1.56)• • • • Family planning pills• 1
(0.78)• **Other agents**
(n=142) • • • Antihypertensive drugs• 1
(0.78)• Kerosene • 69
(48.59)• • Anti TB Drugs• 1 (0.78)• Carbon monoxide
• 26 (18.31)• • • • Acids
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(16.2)• • **Animal/Insect**

bites
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Pharmaceuticals were
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(4.69)• • • • Anticonvuls
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Pharmaceuticals were predominantly oral
2 (1.56)• • • • Family planning pills• 1
(0.78)• **Other agents (n=142)** • • • Antihypertensive drugs• 1
(0.78)• Kerosene • 69
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(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
• Scorpion• 1 (1.67)• Car radiant cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
Scorpion• 1 (1.67)• Car
radiant cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
Pharmaceuticals were predominantly oral
1 (1.67)• Car radiant
cooler• 1
(0.7)• • • • Brake
Fluid• 1
(0.7)• • • • Silica gel
• 1 (0.7)• • *
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Pharmaceuticals were predominantly oral
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Pharmaceuticals were predominantly oral
1 (0.7)• • *
Pharmaceuticals were predominantly oral

* Pharmaceuticals were predominantly oral
** Individual drugs counted separately for cases with multiple drug over-doses.

Associations of Characteristics of Poisoning Cases

With an exception of sex (p-value = 0.409), age, route of poisoning, residence, outcome of poisoning and toxic agent involved showed strong associations with the circumstance of poisoning (p-value <0.001). The cross tabulations showed that accidental poisoning was more common among the 0-12 year old category accounting for over 60% (n=292) of the cases while more than 50% (n=231) of the deliberate poisoning cases were among the 20-30 years age category. Ingestion was the main mode of exposure for both accidental (n=392, 85%) and deliberate (n=475, 100%) poisoning. The results also showed that none of those who were accidentally poisoned had died. The plant, animal and food poisoning category had the highest number of accidental poisoning cases (n=171, 43%) while alcohol showed the highest number of deliberate poisoning cases (n=137, 33%). Table 5 gives details of the cross tabulations between circumstance of poisoning as dependent variable with all other variables in the study.

The outcome of poisoning showed high associations with age, circumstance of poisoning and toxic agent involved (p values <0.001) while weaker associations were observed with route of poisoning and sex (p values 0.004 and 0.03 respectively). Residence on the other had showed statistically insignificant association with the outcome of poisoning (p value 0.986). Fatalities were highest in males (n=21, 78%) compared to females (n=6, 22%). The age groups 20-30 and over 30 years contributed the same number of cases (n=9, 47%) to the total fatality. Over 75% (n=21) of the deaths were as a result of exposure to toxic agents by ingestion with only 22% (n=6) due to exposure by inhalation, injection or absorption. Close to 60% of the deaths were due to poisoning with pesticides. Table 6 gives details of the cross tabulations between outcome of poisoning as dependent variable with all other variables in the study.

Table 5: Associations of Circumstance of Poisoning with Other Patient Characteristics (N=809*)

Patient Characteristics	Circumstance of Poisoning [Number (%)]		
	Accidental	**Deliberate**	**(P-Value)****
Sex			
Male	61 (56.37)	281 (59.03)	0.409
Female	202 (43.63)	1 5 (40.97)	
Age			
0 to 12 years	292 (64.46)	8 (1.81)	<0.001
13 to 19 years	44 (9.71)	106 (23.98)	
20 to 30 years	8 (15.01)	23 (52.26)	
Over 30 years	49 (10.82)	97 (21.95)	
Route of Poisoning			
Ingestion	392 (84.67)	475 (99.79)	<0.001
All other routes combined***	71 (15.33)	1 (0.21)	
Residence			
Urban	142 (31.14)	103 (21.87)	0.001
Peri urban; Rural	314 (68.86)	368 (78.13)	
Outcome of poisoning			
Recovered	463 (100)	456 (95.80)	<0.001
Died	0	20 (4.20)	
Toxic agent involved			
Alcohol	10 (2.53)	137 (33.09)	
Pharmaceutics and narcotics	27 (6.84)	93 (22.46)	<0.001
Pesticides	61 (15.44)	120 (23.99)	
Domestic and industrial	126 (31.90)	55 (13.29)	
Plant, animal and food poisoning	171 (43.29)	9 (2.17)	

*Total number of cases after excluding unknowns
**P-values were derived from chi square
***Comprised of inhalation, injection and dermal routes

Table 6: Associations of Outcome of Poisoning with other Patient Characteristics (N=858*)

Patient Characteristics	Outcome of Poisoning [Number (%)]		
	Recovery	Death	P-Value**
Sex			
Male	571 (56.87)	21 (77.78)	0.03
Female	433 (43.13)	6 (22.22)	
Age			
0 to 12 years	306 (32.08)	0	<0.001
13 to 19 years	162 (16. 8)	1 (5.26)	
20 to 30 years	322 (33.75)	9 (47.37)	
Over 30 years	16 (17.19)	9 (47.37)	
Route of Poisoning			
Ingestion	930 (92.63)	21 (77.78)	0.004
All other routes combined***	74 (7.37)	6 (22.22)	
Residence			
Urban	265 (26.77)	7 (26.92)	0.986
Peri urban; Rural	725 (73.23)	19 (73.08)	
Circumstance of poisoning			
Accidental	463 (50.38)	0	<0.001
Deliberate	456 (49.62)	20 (100)	
Toxic agent involved			
Alcohol	154 (18.42)	4 (18.18)	
Pharmaceutics and narcotics	122 (14.59)	4 (18.18)	<0.001
Pesticides	174 (20.81)	13 (59.09)	
Domestic and industrial	185 (22.13)	1 (4.55)	
Plant, animal and food poisoning	201 (24.04)	0	

*Total number of cases after excluding unknowns
**P-values were derived from chi square
***Comprised of inhalation, injection and dermal routes

Bivariate and Multivariate Logistic Regression Analysis

Details of the logistic regression analysis were as outlined in subsequent subsections.

Determinants of Circumstance of Poisoning (i.e. Accidental/Deliberate)

At bivariate logistic regression analysis, it was observed that circumstance of poisoning was positively associated with age, residence, route of poisoning and toxic agent (p value ≤ 0.001). However, after adjusting for other variables in the model, residence showed insignificant association with circumstance of poisoning while the other variables maintained significance. An increase in chances of deliberate poisoning was observed for every year increase in age of the cases (OR=1.10, 95% CI 1.08-1.12). This meant that the older the age of the poisoning patient the higher the chances that poisoning was due to intentional circumstances. In addition, compared to all other routes of poisoning i.e. injection, inhalation and dermal route, the circumstance of poisoning was almost 100% more likely to be deliberate if the route of poisoning was ingestion (OR=0.00, 95% CI: 0.00-0.01). With regard to toxic agents, alcohol (OR=12.57, 95% CI: 5.63-28.05) was associated with the highest odds of deliberate poisoning compared to all other agents. The order of toxic agents in the prediction of deliberate poisoning was consistent before and after adjusting for the effect of other variables in the model. Table 7 gives details of the predictors of deliberate poisoning.

Determinants of Outcome of Poisoning (i.e. Death/Recovery)

Bivariate logistic regression analysis showed that only sex, age, route and pesticides were significantly associated with recovery. At multivariate analysis the route of poisoning ceased to be significant while the other variables remained significant. This gave an indication that the significant predictors of recovery/death were sex, age and toxic agent (more so for pesticides). The chances of recovery were more than 4 times higher in females compared to males (95% CI: 1.29-16.50). While a reduction in the probability of recovery by 0.98 (95% CI: 0.96-0.99) for every year increase in the age of the cases was observed. The chances of recovery were lowest if the toxic agent used was pesticides (OR=0.08, 95% CI: 0.01-0.66). Table 8 gives details of the predictors of recovery.

Table 7: Determinants of Deliberate Poisoning for Cases Admitted at the University Teaching Hospital and Levy Mwanawasa General Hospital

Predictors	cOR (95% CI)	P value	aOR (95% CI)	P-Value
Sex				
Male	1.00		1.00	
Female	0.90 (0.69 - 1.16)	0.409	1.42 (0.92 - 2.20)	0.112
Age	1.07 (1.05 - 1.08)	<0.001	1.10 (1.08 - 1.12)	<0.001
Residence				
Urban	1.00		1.00	
Peri urban and rural	1.62 (1.20 - 2.17)	0.001	1.23 (0.74 - 2.04)	0.435
Route of Poisoning				
Ingestion	1.00		1.00	
All other routes	0.01 (0.00- 0.08)	<0.001	0.00 (0.00 – 0.01)	<0.001
Toxic Agent				
Domestic; Industrial Chemicals	1.00		1.00	
Alcohol	31.39 (15.34 - 64.22)	<0.001	12.57 (5.63 – 28.05)	<0.001
Pharmaceutics; Narcotics	7.89 (4.63 - 13.44)	<0.001	5.67 (3.05 – 10.52)	<0.001
Pesticides	4.51 (2.90 - 7.01)	<0.001	2.52 (1.48 – 4.29)	0.001
Plant; animal; food poisoning	0.12 (0.06 - 0.25)	<0.001	0.05 (0.02 – 0.15)	<0.001

Note: - Outcome of Poisoning was dropped as it predicted success perfectly.
- cOR: Crude Odds Ratio
- aOR: Adjusted Odds Ratio
- Age was analysed as a continuous variable in the model, categorising age introduced collinearity and loss of power.

Table 8: Determinants of Recovery for Cases Admitted at the University Teaching Hospital and Levy Mwanawasa General Hospital

Predictors	cOR (CI)	P value	aOR (CI)	P value
Sex				
Male	1.00		1.00	
Female	2.65 (1.06 - 6.63)	0.037	4.62 (1.29 – 16.50)	0.018
Age	0.97 (0.96 - 0.98)	<0.001	0.98 (0.96 - 0.99)	0.001
Residence				
Urban	1.00		1.00	
Peri urban and rural	1.01 (0.42 - 2.43)	0.986	1.12 (0.39 – 3.23)	0.837
Route of Poisoning				
Ingestion	1.00		1.00	
All other routes	0.28 (0.11 – 0.71)	0.008	0.43 (0.04 – 4.64)	0.487
Toxic Agents				
Domestic; Industrial Chemicals	1.00		1.00	
Alcohol	0.21 (0.02 - 1.88)	0.162	0.34 (0.03 - 3.45)	0.360
Pharmaceutics; Narcotics	0.16 (0.02 - 1.49)	0.109	0.17 (0.02 - 1.65)	0.126
Pesticides	0.07 (0.01- 0.56)	0.012	0.08 (0.01 - 0.66)	0.019

Note: - Plant; Animal and Food poisoning category was dropped as it predicted success perfectly.
- Circumstance of Poisoning was omitted as it predicted success perfectly.
- Age was analysed as a continuous variable in the model, categorising age introduced collinearity and loss of power.
- cOR: Crude Odds Ratio
- aOR: Adjusted Odds Ratio

Seasonal Variations of Poisoning Cases

The analysis revealed that overall, highest number of cases were recorded in the months of September (n=104, 10%), October (n=108, 11%), November (104, 10%) and December (n=99, 10%). The lowest number of cases were recorded in July (n=56, 5%) and April (n=65, 6%). Snake bites were highest in the month of November. Figure 6 below shows the distribution of the top three identified toxic agents. Interestingly, pesticides had persistently higher number of cases from August through to December which is a predominantly farming period for both the rain fed and irrigated crops. Pharmaceuticals and alcohol poisoning cases varied throughout the year. It was difficult to establish any seasonal variations in poisoning cases, perhaps a consideration of annual trends could have provided more insight.

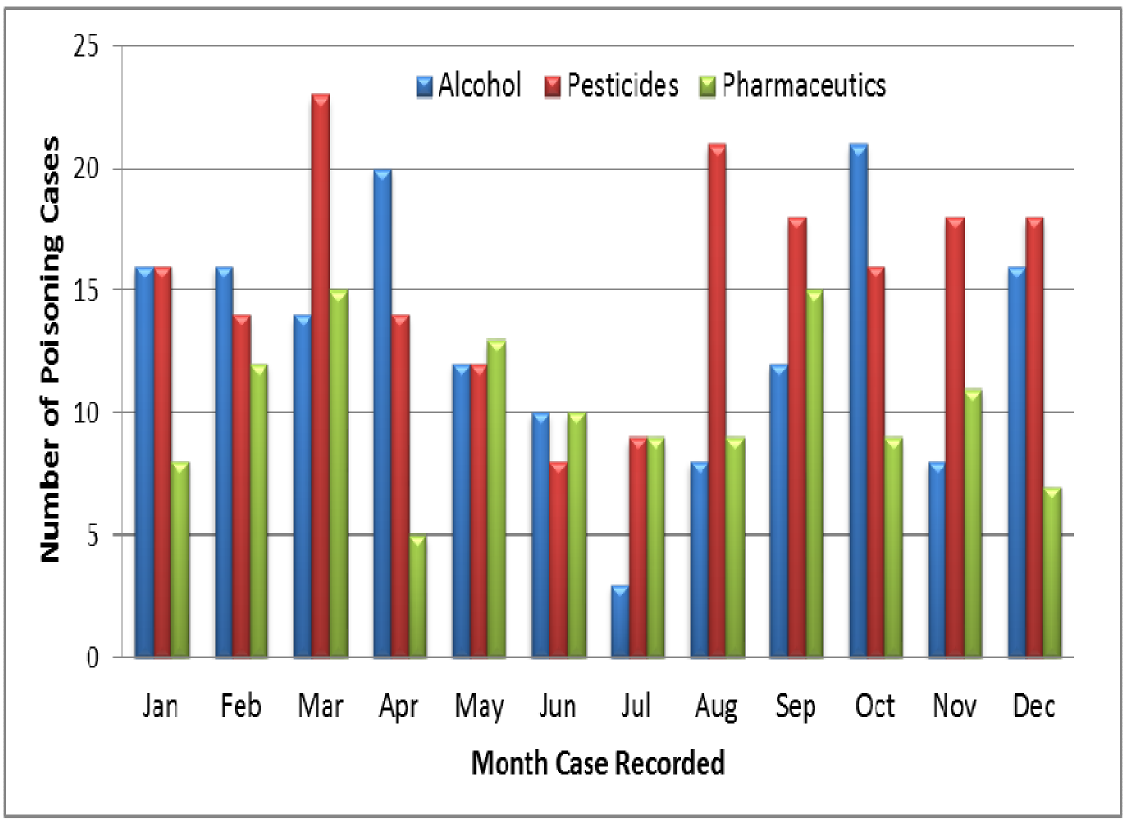

Figure 6: Monthly Distribution of Poisoning Cases

Case Reporting from the Data Collection Sites

Differences in the number of cases recorded were observed between those recorded by the Health Information Office and those recorded in the study from data reviewed in the hospital registers for Filter Clinic and Department of Casualty. Poisoning cases were not tallied in the Department of Paediatrics at the time of data collection. There was an over reporting for all the months recorded for Filter Clinic, while the opposite was true from records in casualty department. It was observed that venomous animal bites were not recorded or tallied as poisoning cases but rather bites. This might explain the discrepancy observed in the Department of Casualty but not in Filter Clinic even after taking into consideration cases with incomplete data. The differences between the numbers recorded in health information records and those established in the study including the average number of cases are presented in Table 9.

Table 9: Comparison of reported poisoning cases according to the health information records with those established in the study

Facility	Month case reported	Reported cases	Established cases	Difference	Average	Total OPD*
University Teaching Hospital (UTH) (Filter clinic)	**Jan**	80	37	+43	59	3748
	Feb	82	41	+41	62	3555
	Mar	105	41	+64	73	3584
	Apr	83	38	+45	61	3333
	May	62	29	+33	46	3237
	Jun	75	22	+53	49	3103
	Jul	67	20	+47	44	3608
	Aug	102	27	+75	65	4028
	Sep	126	46	+80	86	3700
	Oct	104	52	+52	78	4091
	Nov	117	29	+88	73	4248
	Dec	93	42	+51	68	3319
	Total	**1096**	**424**		**760**	**43554**
Levy Mwanawasa General Hospital (LMGH)	**Jan**	21	20	+1	21	1028
	Feb	23	23	0	23	1061
	Mar	32	29	+3	31	1157
	Apr	38	11	+27	25	1129
	May	21	30	-11	26	1209
	Jun	17	25	-8	21	1235
	Jul	29	17	+12	23	1311
	Aug	12	21	-9	17	1293
	Sep	14	32	-18	23	1264
	Oct	32	36	-4	34	1151
	Nov	35	52	-17	44	1256
	Dec	11	38	-27	25	1249
	Total	**235**	**334**		**285**	**14343**
University Teaching Hospital (UTH) (Paediatrics)	**Jan**	-	22	-	22	2981
	Feb	-	18	-	18	3049
	Mar	-	24	-	24	4085
	Apr	-	16	-	16	2605
	May	-	22	-	22	2381
	Jun	-	26	-	26	2484
	Jul	-	19	-	19	2549
	Aug	-	28	-	28	2641
	Sep	-	26	-	26	2981
	Oct	-	30	-	30	3668
	Nov	-	23	-	23	3427
	Dec	-	19	-	19	2822
	Total	-	**273**	-	**273**	**35673**
TOTAL		**1331**	**1031**		**1318**	**93570**

Note: * Outpatient Department

- Poisoning cases are not tallied in the Department of Paediatrics
- Established cases were those collected during the study, those reported in the table are those with complete data
- Reported cases were those recorded in the health information records/reports

CHAPTER V

Discussion

The study sought to describe the distribution and determinants of chemical poisoning, the specific toxic agents involved and their respective case fatalities at the University Teaching Hospital (UTH) and Levy Mwanawasa General Hospital in Lusaka, Zambia. To achieve this, hospital registers and patient files from 1st January to 31st December 2012 were reviewed for all poisoning cases recorded as such, in Filter Clinic and Department of Paediatrics at the University Teaching Hospital and the Department of Casualty at Levy Mwanawasa General Hospital. This chapter attempts to discuss and interpret the implications of the results of the study.

Distribution of Acute Chemical Poisoning and Social Demographic Factors

A total of 1, 031 poisoning cases were reviewed in the study giving a prevalence of 1.1 per 100 hospital admissions. The prevalence of poisoning in Africa has been known to range up to 17% (Malangu and Ogunbanjo, 2009), hence the prevalence found in this study lies in the lower end of the range. Majority of the cases reviewed were male in the age category of 20-30 years. Literature has shown variations in age and sex distribution of poisoning cases in different geographic regions (Eddleston, 2000) and time periods (Hawton and Fagg, 1992). To this effect, some scholars have observed male dominance in poisoning cases (Malangu, 2008a, Shadnia et al., 2007) while others observed a reverse pattern of female dominance in poisoning cases (Chan et al., 2005, Malangu and Ogunbanjo, 2009, Tagwireyi et al., 2002). These variations have been attributed to the influence of socioeconomic, cultural and behavioural factors in the general population. Shadnia et al. (2007) attributed the higher poisoning incidences in males in the 21-30 years age category to higher exposures to occupational hazards and stress or strain. This may lend support to the findings in this study especially that 20-30 years age category is representative of the youthful labour-force of Zambia.

The study revealed that females in the teenage category reported higher cases of deliberate poisoning than their male counterparts. This finding is consistent with reports by other authors (Eddleston et al., 2005, Hawton and Fagg, 1992, Zakharov et al., 2013). Adolescents are well placed in a crucial developmental phase in which emerging physical, cognitive and personality characteristics transform the individual from a child into a young adult (Fortune and Hawton, 2007). Failure to cope with emotional and physical changes at this stage makes the adolescents more vulnerable to self-harm. Furthermore, earlier physical and mental maturation of girls as well as gender differences in emotional and behavioural problems places the girls at an even higher risk of suicide attempts (Kaess at al., 2011 in Zakhanov et al., 2012). Clarke (1988) also noted that backgrounds such as broken homes, parental psychiatric disturbance and past history of child abuse in young people influences their involvement in self-poisoning. Similar to reports in literature, most of the patient files of the cases in this study revealed that quarrels with parents or guardians or boyfriend or girlfriend preceded suicide attempts (Clarke, 1988).

It was not surprising that accidental poisoning was most common among children in the age group 0-12 years, as already established by other authors (Malangu and Ogunbanjo, 2009, Tagwireyi et al., 2002). Meredith (1999) in Jepsen et al. (2005) noted that accidental poisoning can occur at any age but is most common in children with peak age around 2 years (Jepsen and Ryan, 2005). Poisoning in this age group has been attributed to the hand to mouth behaviour of the inquisitive children as they explore the world around them, coupled with the lack of knowledge of consequences (Eddleston, 2000). Similar to other findings, the study also showed that there were more poisoning cases in boys than girls in this age category (Jepsen and Ryan, 2005). This observation has been attributed to differences in socialisation between the boys and girls. In addition, Purushothaman (1975) pointed out that boys tend to have greater resourcefulness in play and exploring their environment and they tend to remain in the crawling phase longer than the girls leaving them in danger of poisonous substances stored within their reach.

With regard to residential areas, the peri urban areas dominated most of the cases reviewed. Residential areas in urban Lusaka are also classified as high, medium and low cost housing areas based on the infrastructure and social services available. Studies and surveys have shown distinct differences in socioeconomic characteristics in these classes such as level of education, income and employment status (Mweembaa and Webb, 2008). A gradient in number of cases was observed in these areas of which the majority resided in low cost, densely populated residential areas suggesting an influence of social economic status and living conditions on chemical poisoning.

Mortality and Socio-Demographic Distribution

A mortality rate of 2.6 per 100 cases was observed in this study similar to the findings by Malangu (2008b). This was considerably high as other studies have found mortality rates as low as 1.3% (Chan et al., 2005, Malangu, 2008a, Shadnia et al., 2007). As already established in literature, the study revealed that there were more deaths in male cases than females. Tagwireyi et al. (2002) attributed this pattern to the fact that men usually choose more violent and successful means of self-harm than women. In addition, adults with suicidal intentions are more likely to deliberately take high amounts of toxic agents to result in death than the young ones would. This also explains why no deaths were recorded in the 0-12 years age category.

Distribution of toxic agents and their case fatalities

a)Pesticides

In this study, Pesticides were the most prevalent toxic agents used in poisoning and they also recorded the highest number of deaths for the cases reviewed. Causes of acute pesticide poisoning vary between developing and developed countries as observed by Thundiyil et al. (2008). Higher incidences are expected in developing countries where there is insufficient regulation, lack of surveillance systems, less enforcement, lack of training, inadequate access to information systems, poorly maintained or non-existent personal protective equipment and larger agriculturally based populations (Thundiyil et al., 2008). A survey of household gardening in Lusaka indicated that gardening activities in Lusaka have increased since the 1980s with an exception of highly populated areas with no space for gardening (Drescher, 1997). Increase in gardening in Lusaka though beneficial as source of food and income for households has sadly made possible agrochemicals, most of which are stored in homes and are easily accessible for people. High toxicity of pesticides makes them more fatal than other agents recorded in the study. This also makes them a suicide agent of choice for men for whom it has been established use more aggressive means of self-harm (Tagwireyi et al., 2002). The observation that majority of the pesticides could not be specified/identified highlights the need for improvement of diagnostic facilities in the hospitals under review.

b) Alcohol

The study revealed that second to pesticides, alcohol intoxication was common in a large proportion of the poisoning cases. It also contributed an important number of deaths among the cases reviewed. Of these cases, the majority were males in 20-30 and over 30 years age categories. This finding lends support to reports by the World Health Organisation (2014) which noted that approximately 25% of the global deaths in the age group 20-39 years are alcohol attributable. According to the Zambia Demographic and Health Survey (2002), an estimated 76% of men and 23% of women consumed alcohol (Africa Health Observatory 2014). In addition, cases of alcohol intoxication were observed among the minors suggesting a need for urgent control measures to prevent persons below the age of 18 from accessing alcohol and alcohol related adverse effects.

c)Pharmaceuticals and Narcotics

Pharmaceuticals also accounted for an important number of poisoning cases with only 3 fatalities tied to them, analgesics and antibiotics being the most prevalent among all cases in this category. It was observed in the study that pharmaceuticals were the toxic agent of choice for both the teenage and adult females. Females are known to be more vulnerable to attempt suicide by means that are less violent (Fathelrahman et al., 2008). This explains why most of the cases were due to overdose of analgesics which are relatively less toxic. Misuse of antibiotics and many other drugs such as antimalarial and TB drugs observed in this study calls for great concern as it poses a threat to public health due to development of drug resistance.

Though there were few cases with narcotic poisoning recorded in this study, this observation is of particular importance. The study being hospital based means that only the serious cases were captured, implying that the figures captured in this study are more likely to be an underestimation of the real extent of the problem. According to the Drug Enforcement Commission (DEC, 2011-2012), Zambia has in recent years become a consumer of hard drugs evidenced by the increasing number of drug dependent persons attended to by the Commission (Drug Enforcement Commission, 2011-2012). This increase in the rates of drug abuse observed pose a threat to public health in the near future.

d)Domestic and Industrial Chemicals

Most cases in this category were recorded in children, the most common agents being kerosene, carbon monoxide, and chlorine. Kerosene is used as a source of energy for most households in Lusaka. It is often used in combination with solid fuels such as charcoal and wood for heating and cooking purposes. It followed therefore, that the number of poisonings due to carbon monoxide intoxication were equally high in this category. This is because carbon monoxide is a by-product of incomplete combustion of biomass. Children recorded more cases of poisoning with kerosene and carbon monoxide. This finding is in support of Eddleston (2000) who noted that kerosene and paraffin oils are often kept in unsafe non-child-proof containers resulting in accidental ingestion of the chemicals by children.

e)Food Poisoning, Plant Toxins and Animal Envenomation

A good number of food poisoning cases were reviewed in the study. It was difficult to segregate poisoning due to chemicals unless where this was indicated in the case files. Food poisoning cases were common in all age group, suggesting a need for improvements in food hygiene and other public health measures such as hand washing.

Of those who were implicated with plant poisoning, the majority were children who were reported to have eaten leaves of elephant ear plant (i.e. Colocasia plant). Ingestion or exposure to potentially poisonous plants in toddlers has been reported as a common phenomenon in paediatric departments (Jepsen and Ryan, 2005).

The number of snake envenomation cases recorded in this study was similar to those recorded in studies within the region such as Zimbabwe, Uganda and South Africa where more than 10% were affected (Malangu, 2008a, Tagwireyi et al., 2002). As noted by the World health Organisation, snake bites are given less attention as a public health issue in Zambia and many other tropical and subtropical countries (World Health Organisation, 2010).

More than 90% of all the poisoning cases reviewed were exposed through ingestion, all other routes contributed less than 10% of the poisoning cases. These findings were similar to a study conducted in Saudi Arabia where 92% of the studied cases were exposed to toxic agents through oral route while derma, inhalation and injection contributed less than 7% to the poisoning cases.

Predictors of Chemical Poisoning

The significant predictors of deliberate/accidental poisoning were found to be age, route of poisoning and type of toxic agent. On the other hand, significant predictors of recovery/death were sex, age and toxic agent, specifically pesticides. In this study, chances of deliberate poisoning were higher as the age of the cases increased, a large proportion of accidental poisoning cases were in children. The sex and age of victims have been known to influence the distribution of acute poisoning cases in a given population. Findings in this study were similar to those in a study by Malangu (2009), in which children under the age of 10 years accounted for up to 80% of all victims of poisoning, most of which were unintentional.

It was shown in the study that females had higher chances of survival than males as has been established in literature (Tagwireyi et al., 2002). In addition literature has established that mortality is usually high in patients who are victims of suicide. However, other toxicological factors such as potency of toxic agent and amount exposed to also need to be put into consideration with regards to survival of the victims. Other factors surrounding circumstances leading to poisoning could not be established, therefore, findings in this study should be interpreted with caution.

Several limitations were encountered in the study during data collection, analysis and interpretation. The use of secondary data in the study limited control over the quality of data that was collected. Files were found to be missing during data collection for most of the cases, and for those that were available certain information such as marital status and occupation were not available even when there is provision for them in the registers. Furthermore, data on variables such as level of education and social economic status was not explored as they are not captured in the hospital records. Pages in some of the registers were missing hence some of the cases were probably lost at data collection. In addition the study was limited to a one year study period thereby limiting annual trend analysis of poisoning cases. However, effort was made to explore seasonal trends of poisoning.

At analysis, poisoning cases that involved more than one agent could not be segregated and accounted for separately. However, the individual poisoning agents were accounted for in their respective categories. Interpretation of the results was limited as a result of missing variables that could not be collected during the study. Furthermore, this being a hospital based study, the results may not be representative of the general population. Health seeking behaviour in the general population might have had an influence on the cases reviewed as the majority of cases could have been those who felt the need to go to the hospital after a poisoning incidence. It is likely that persons with severe cases of poisoning may seek professional help in hospitals or clinics than mild or less severe cases. Admittedly, results may be an underestimation of the real problem in the population as not all cases reach the hospitals. The data provided is still valuable in characterising acute chemical poisoning in Lusaka.

Conclusion and Recommendations

The study has made an effort to make a description of acute chemical poisoning as recorded in the two main referral hospitals in Lusaka. It can be concluded that the prevalence established in this study was lower than that found in the African region while the mortality was higher than that observed elsewhere. Common toxic agents involved in poisoning were pesticides, alcohol and pharmaceuticals; these also had the high case fatalities. The significant predictors of deliberate/accidental poisoning were age, route of exposure and toxic agent involved while those of recovery/death were sex age and toxic agents (more so for pesticides).

The study has revealed that alcohol poisoning cases were common in males in the youthful and economically active age category. This finding suggests a need for health education in the general public on the dangers of alcohol abuse to prevent alcohol related intoxications and death. Also, regulations aimed at restricting sale of alcohol should be enforced to prevent access and alcohol intoxication among minors as highlighted by the study. Another group at risk identified in the study were children whose access to toxic agents is in homes. Health education on chemical safety to mothers and care givers is important to prevent exposures in this group. Also, the study points out the need for strengthening enforcement of regulations pertaining to the control of pharmaceuticals, pesticides and petroleum products to prevent unnecessary access and exposure in the general population. Also vigilance in use of narcotics in the country is of uttermost importance to prevent mortality and morbidity due to abuse. Snake bites contributed an important number of poisoning cases; therefore, we suggest that public health messages should incorporate information on prevention of snake bites especially during the rainy season when most of the cases were recorded.

The poor state of information entered in registers and their physical state observed during data collection calls for an urgent need to improve recording and storage of information in hospitals. A good number of patient files could not be located, pages were missing from registers and certain vital information as easy as marital status, level of education or occupation was not entered, even when provision has been made for their reporting. Hospital registers and files hold immense information vital for planning and research purposes and should therefore be given adequate attention and care during collection and storage. Proposals have been made to digitalise data collection and storage in hospitals; we suggest that the process be considered with urgency amongst other challenges being addressed in the health sector. Also, most chemical agents in the study could not be identified/specified suggesting a need for improvement in diagnostic facilities in hospitals which would improve reporting as well as care/management for the patients.

Further prospective studies are required to explore the influence of socioeconomic factors such as type of occupation, marital status, level of income and education on chemical poisoning. Also, we suggest an investigation of psychological factors surrounding chemical poisoning in Zambia owing to the fact that mental health has not been fully explored or given much priority in the health sector.

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Appendices

Table 1: Legal Instruments and Institutions Addressing Chemicals in Zambia

Legal Instrument and Responsible Institution		**Objective of Legislation**	**Chemical Category Covered**
Ministry of Health and Ministry of Local Government	Public Health Act Cap 295	• Disease prevention and suppression • Regulation of all matters of Public Health concern	Therapeutic drugs, food additives, cosmetics
	Food and Drugs Act Cap 303	• Protection of the public against health hazards and fraud in the sale and use of food, drugs, cosmetics and medical devices.	
Pharmaceutical Regulatory Authority	Pharmaceutical Act No. 14 of 2004	• Provides for the registration and regulation of pharmacies and for the registration and regulation of medicines intended for human use and for animal use; • Provides for the regulation and control of medicines, herbal medicines and allied substances; and to • Regulate and control of the manufacture, importation, exportation, possession, storage, distribution, supply, promotion, sale and use of medicines, herbal medicines and allied substances.	Poisons cosmetics and therapeutic drugs
Zambia Environmental Management Agency (ZEMA)	Environmental Management Act No.12 of 2011	• Prevention and control of pollution and environmental degradation • Provides for public participation in environmental decision making and access to environmental information (including chemicals information)	Industrial chemicals
	Pesticides and Toxic Substances Regulation (SI No. 20 of 1994)	• Regulates the manufacture, improvement or processing, importation, exportation, transportation, storage, distribution, packaging, labelling, handling and disposal of pesticides and toxic chemicals.	Pesticides and toxic chemicals.
	The Waste Management (Licensing of Transporters of Wastes and Waste Disposal Sites) Regulations (SI No.71 of 1993)	• Regulates the handling, transportation and disposal of domestic and hazardous waste	Construction and demolition waste Hazardous waste

	The Water Pollution Control (Effluent and Waste Water) Regulations (SI No. 72 of 1993)	• Regulates the discharge of effluent into aquatic environment	Sewage and effluent
Ministry of Agriculture and Livestock	Agriculture (Fertilizers and Feed) Act Cap 226	• Regulates and controls the manufacture, processing, importation and sale of agricultural fertilisers and farm feed; • And also provides for minimum standards of effectiveness and purity of such fertilisers and feed.	Fertilisers
Energy Regulatory Board	Energy Regulation Act Cap 436	• Provides for the licensing of undertakings for the production of energy or the production or handling of certain fuels	Petroleum, petroleum products, coal and its derivatives
	Petroleum Act Cap 435	• Regulates the importation, conveyance and storage of petroleum and other flammable oils and liquids.	
Ministry of Labour	Factories Act Cap 441	• Provides for the regulation of the conditions of employment in factories and other places as regards the safety, health and welfare of persons employed therein; to provide for the safety, examination and inspection of certain plant and machinery.	Industrial chemicals
	Occupational Health and Safety Act 2010	• provides for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; • provides for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; • provides for the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work.	

Table 2: Study Variables

	Variable	Variable coding	Indicator	Measure of Interest
	Dependent variables			
1.	Circumstance of poisoning	0 1	Accidental/Unintentional Deliberate/Intentional	Number, percentage (%)
2.	Outcome of poisoning	0 1	Recovery/injured Death	Number, percentage (%)
	Independent variables			
1.	Sex	0 1	Male Female	Number, Percentage (%)
2.	Age	0 1 2 3	0 to 12 years 13 to 19 years 20 to 30 years Over 30 years	Mean, median and range
3.	Residence*	0 1 2	Urban Peri urban Rural	Number, percentage (%)
4.	Route of poisoning*	1 2 3 4	Ingestion Inhalation Absorption Injection	Number, percentage (%)
5.	Toxic agents involved*	1 2 3 4 5 6 7 8 9 10	Household chemicals Alcohol Pharmaceutical Animal/insect bites Agro chemicals Food Drug of abuse Traditional medicine Plants Unknown toxic agents	Number, percentage (%)

* Variables were re-categorised at analysis stage.

Table 10: Specification of toxic agents and their related number of poisoning cases recorded in Filter Clinic at the University Teaching Hospital (UTH) n=424

Toxic Agent	Frequency n (%)
Household chemicals (n=15)	
Cleaning agents	7 (46.7)
Disinfectants	4 (26.7)
Personal care products	4 (26.7)
Pharmaceutical (n=63#)	
Analgesics	34 (54.0)
Antibiotics	12 (19.0)
Unspecified	7 (11.1)
Antimalarial	3 (4.8)
Antipsychotics	2 (3.2)
Anticonvulsants	2 (3.2)
Anti TB Drugs	1 (1.6)
Nutrition supplements	1 (1.6)
Antiretroviral drugs	1 (1.6)
Pesticides (n= 114)	
Unspecified Organophosphates	64 (56.1)
Insecticide	45 (39.5)
Rodenticides	5 (4.4)
Drugs of abuse (n=3)	
Glue	1 (33.3)
Amphetamines	2 (66.7)
Other agents (n=37)	
Acids	13 (35.1)
Carbon monoxide	7 (18.9)
Kerosene	6 (16.2)
Spirit of salt	4 (10.8)
Formalin	3 (8.1)
Brake Fluid	1 (2.7)
Cement	1 (2.7)
Tile Fixer	1 (2.7)
Paint Thinner	1 (2.7)

Drugs taken in combination with others, were accounted for individually.

Table 11: Specification of toxic agents and their related number of poisoning cases recorded in Department of Paediatrics at the University Teaching Hospital (UTH) (n=273)

Toxic Agent	Frequency n
Household chemicals (n=15)	
Disinfectants	6 (40)
Personal care products	4 (26.7)
Cleaning agents	3 (20)
Food additives	2 (13.3)
Pharmaceutical (n=22)	
Unspecified	5 (22.7)
Analgesics	4 (18.2)
Anticonvulsants	4 (18.2)
Antipsychotics	3 (13.6)
Nutrition supplements	2 (9.1)
Antibiotics	1 (4.5)
Anti-retroviral drugs	1 (4.5)
Antihypertensive drugs	1 (4.5)
Family planning pills	1 (4.5)
Pesticides (n= 40)	
Unspecified Organophosphates	23 (57.5)
Insecticide	10 (25)
Rodenticides	7 (17.5)
Plants (n=15)	
Unspecified plants	10 (66.7)
Elephant plant	5 (33.3)
Other agents (n=80)	
Kerosene hydrocarbon	57 (71.3)
Carbon monoxide	12 (15.0)
Acids	7 (8.8)
Cement	1 (1.3)
Phinus	1 (1.3)
Diesel	1 (1.3)
Car radiant cooler	1 (1.3)

Table 12: Specification of toxic agents and their related number of poisoning cases recorded in Department of Casualty at Levy Mwanawasa General Hospital n=334

Toxic Agent	Frequency n (%)
Household chemicals (n=14)	
Disinfectants	7 (50)
Cleaning agents	7 (50)
Pharmaceuticals (n=43)	
Analgesic	18 (41.9)
Antibiotics	7 (16.3)
Unspecified	6 (14.0)
Antimalarial	3 (7.0)
Nutrition supplements	3 (7.0)
Anti-Retroviral Drugs	2 (4.7)
Antipsychotics	2 (4.7)
Antihistamines	2 (4.7)
Animal/Insect bites (n=59)	
Snake	53 (89.8)
Bee	3 (5.1)
Wasp	2 (3.4)
Scorpion	1 (1.7)
Pesticides (=33)	
Insecticide	21 (63.6)
Unspecified Organophosphates	10 (30.3)
Rodenticide	2 (6.1)
Other (n=25)	
Carbon monoxide	7 (28.0)
Kerosene	6 (24.0)
Cement	3 (12.0)
Battery acid	3 (12.0)
Spirit of salt	2 (8.0)
Wall paint	2 (8.0)
Silica Gel	1 (4.0)
Phinus	1 (4.0)

Table 13: Specification of residential areas with their respective number of poisoning cases recorded in Filter Clinic at the University Teaching Hospital (UTH) n=424

Urban n=100 (23.6%)		**Peri Urban n=312 (73.6%)**		**Rural n=7 (1.6%)**	
Chilenje	25	Matero	33 (10.6)	Ngewrere	5 (71.4)
Libala	16	Chawama	32 (10.3)	Mbosha	1 (14.3)
Makeni	10	Kanyama	30 (9.6)	Shabasonje	1 (14.3)
Kabwata	8	Garden Comp.	18 (5.8)		
Lilayi	6	Chipata	19 (6.3)		
Kamwala	5	John Leng	18 (6.1)		
Chalala	5	Bauleni	17 (5.4)		
Arakan Barrack	3	Kalingalinga	12 (3.4)		
Lusaka West	3	Lilanda	12 (3.4)		
Mwembeshi	2	Mandevu	10 (3.2)		
St Bonaventure	1	Misisi	10 (3.2)		
Barastone	1	Zingalume	10 (3.2)		
Chainda	1	Chaisa	10 (3.2)		
Chudleigh	1	Chunga	10 (3.2)		
Emasdale	1	Mtendere	9 (2.8)		
David Kaunda	1	George Comp.	9 (2.8)		
Hellen Kaunda	1	Kabanana	9 (2.8)		
Ibex Hill	1	Chazanga	7 (2.2)		
Kalundu	1	John Howard	6 (1.9)		
Kabulonga	1	Chibolya	6 (1.9)		
New Kasama	1	Kaunda Square	5 (1.6)		
Nyumba Yanga	1	Ngombe	5 (1.6)		
State Lodge	1	Kuku	5 (1.6)		
Woodlands	1	Mazyopa	3 (0.9)		
Northmead	1	Linda Comp.	3 (0.9)		
Long Acres	1	Zanimone	2 (0.6)		
Roma	1	Desai	1 (0.3)		
		Jack Comp.	1 (0.3)		

Note: Unknown residence: n = 5 (1.2%)

Table 14: Specification of residential areas with their respective number of poisoning cases recorded in Department of Paediatrics at the University Teaching Hospital (UTH) n=273

Urban n=55 (20.1%)		**Peri Urban n=193 (70.7%)**		**Rural n=18 (6.6%)**	
Chilenje	11 (20)	Matero	23 (11.9)	Mungule	6 (33.3)
Kabwata	7 (12.7)	Garden	18 (9.3)	Nampundwe	5 (27.8)
Kamwala	5 (9.1)	Kanyama	16 (8.3)	Chilulu	3 (16.7)
Libala	4 (7.3)	Chawama	16 (8.3)	Kasisi	2 (11.1)
Makeni	3 (5.5)	Bauleni	13 (6.7)	Chipwema	1 (5.6)
Chalala	3 (5.5)	Lilanda	12 (6.2)	Kubweza	1 (5.6)
Chelstone	3 (5.5)	Chipata	11 (5.7)		
Woodlands	3 (5.5)	Mandevu	8 (4.1)		
Lusaka West	2 (3.6)	Kabanana	8 (4.1)		
Lusaka South	2 (3.6)	Chibolya	7 (3.6)		
Nyumba Yanga	2 (3.6)	Kuku	6 (3.1)		
Avondale	1 (1.8)	Marapodi	6 (3.1)		
Arakan	1 (1.8)	Chaisa	5 (2.6)		
Villa	1 (1.8)	Chazanga	5 (2.6)		
State Lodge	1 (1.8)	Georgecomp	5 (2.6)		
Emmasdale	1 (1.8)	6 Miles	3 (1.6)		
Olympia	1 (1.8)	Chunga	3 (1.6)		
Lilayi	1 (1.8)	Kalingalinga	3 (1.6)		
Ibex	1 (1.8)	Misisi	3 (1.6)		
Barastone	1 (1.8)	Mtendere	3 (1.6)		
Rhodes Park	1 (1.8)	Chilanga	3 (1.6)		
		10 Miles	2 (1.0)		
		Chingewre	2 (1.0)		
		Desai Comp	2 (1.0)		
		J.Howard	2 (1.0)		
		Jack Comp	2 (1.0)		
		Zanimone	2 (1.0)		
		Johnleng	1 (0.5)		
		Kamanga	1 (0.5)		
		Zingalume	1 (0.5)		
		Jambo	1 (0.5)		

Note: Unknown residence: n = 7 (2.6%)

Table 15: Specification of residential areas with their respective number of poisoning cases recorded in the Department of Casualty at Levy Mwanawasa General Hospital (n=334)

Urban n=117 (35%)		**Peri urban n=187 (56%)**		**Rural n=27 (8.1%)**	
Chelstone	15 (12.8)	Mtendere	57 (30.5)	Kasisi	16 (59.3)
Kaunda Square	12 (10.3)	Ngombe	55 (29.4)	Chongwe	6 (22.2)
Chainda	11 (9.4)	Kalingalinga	21 (11.2)	Chalimbana	3 (11.1)
Waterfalls	11 (9.4)	Garden	18 (9.6)	Kabangwe	1 (3.7)
Avodale	10 (8.5)	Kamanga	11 (5.9)	Chikula	1 (3.7)
Chainama	8 (6.8)	Chunga	4 (2.1)		
Chambavalley	6 (5.1)	Hellen Kaunda	4 (2.1)		
Meanwood	6 (5.1)	Kabanana	4 (2.1)		
Phi	5 (4.3)	Kalikiliki	3 (1.6)		
Ibex	5 (4.3)	Kanyama	2 (1.1)		
Lusaka West	4 (3.4)	Matero	2 (1.1)		
Ban Motel	3 (2.6)	Ngwerere	2 (1.1)		
NRDC	3 (2.6)	Zingalume	1 (0.5)		
Silverest	3 (2.6)	Mandevu	1 (0.5)		
Jesmondine	2 (1.7)	Chaisa	1 (0.5)		
Kabulonga	2 (1.7)	Chipata	1 (0.5)		
Chudleigh	1 (0.9)				
Chilenje	1 (0.9)				
Foxdale	1 (0.9)				
Makeni	1 (0.9)				
Kalundu	1 (0.9)				
Minestone	1 (0.9)				
Munali	1 (0.9)				
Marshlands	1 (0.9)				
Northmead	1 (0.9)				
Olympia	1 (0.9)				
Rhodes Park	1 (0.9)				

Note: Unknown residence: n=3 (0.9%)

Table 16: Budget for the Study

S/N	Item Description	Quantity	Estimation of Duration in Days	Unit Cost (ZMK)	Total Cost (ZMK)
	Stationary				
1.	Note book	5	-	5	25
2.	A4 Bond paper	6 rims	-	30	180
3.	Pens	20	-	1	20
4.	Ti-pex	4	-	10	40
5.	Stapler	4	-	20	80
6.	Filing clips	5	-	1	5
7.	File	3	-	10	45
8.	Staples	2 boxes	-	10	20
	Sub total				**415**
	Services				
9.	Development and printing of data collection forms	-	-	5	1500
10.	Data collection (Transport and Lunch)	4	30	50	6000
11.	Printing, Photocopying and binding of reports	-	-	-	3000
	Sub total				**10 500**
12.	Contingence funds (10% of total)	**-**	**-**	**-**	1091.5
	GRAND TOTAL				**12 006.5**

Note: (Unit cost in Kwacha Rebased)

Table 17: Budget Summary

ITEM	COST (ZMK)
Stationary	415
Data Collection	6000
Other logistical costs	5591.5
GRAND TOTAL	12 006.5

Note: (Cost in Kwacha rebased)

DATA COLLECTION FORM

Case Serial Number: ____________ Date: ____________ Investigator: __________

Part 1

Please check (√) or fill in the appropriate box

1.	**Sex**	Male	
		Female	
2.	**Age**		
3.	**Marital status**		
4.	**Residence**		
5.	**Occupation**		
6.	**Month case recorded**		

Part 2

Please check (√) or fill in the appropriate box

7.	**Circumstance of Poisoning**	Accidental	
		Deliberate	
		Not known	
8.	**Outcome of Poisoning**	Recovery	
		Injury	
		Death	
9.	**Route of Poisoning**	Ingestion	
		Inhalation	
		Absorption/dermal	
		Injection	
10.	**Length of hospital stay**		

11.	**Toxic Agents Involved**	(√)	*Please Specify*
	Household chemicals		
	Alcohol		
	Pharmaceutical		
	Animal/insect bites		
	Agro chemicals		
	Food		
	Drug of abuse		
	Traditional medicine		
	Plants		
	Unknown toxic agents		
	Other		

ERES CONVERGE

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22nd July, 2013

Ref. No. 2013-June-011

The Principal Investigator
Ms. Jessy Z`gambo
C/o The University of Zambia - School of Medicine
School of Public Health
P.O. Box 50110,
LUSAKA.

Dear Ms. Z`gambo,

RE: Epidemiology of Acute Chemical Poisoning at the University Teaching Hospital and Levy Mwanawasa Hospital from January to December 2012.

Reference is made to your corrections dated 12th July, 2013. Noting that you addressed concerns raised the IRB resolved to approve this study and your participation as principal investigator for a period of one year.

Review Type	Ordinary	Approval No. **2013-June-011**
Approval and Expiry Date	Approval Date: 22nd July, 2013	Expiry Date: 21st July, 2014
Protocol Version and Date	Version-Nil,	21st July, 2014
Information Sheet, Consent Forms and Dates	Version-Nil	21st July, 2014
Consent form ID and Date	Version-Nil	21st July, 2014
Recruitment Materials	Nil	21st July, 2014
Other Study Documents	Data Collection Form.	21st July, 2014
Number of participants approved for study	-	21st July, 2014

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

Conditions of Approval

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.
- All unanticipated or Serious Adverse Events (SAEs) must be reported to the IRB within 5 days.
- All protocol modifications must be IRB approved prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.
- All protocol deviations must be reported to the IRB within 5 working days.
- All recruitment materials must be approved by the IRB prior to being used.
- Principal investigators are responsible for initiating Continuing Review proceedings. Documents must be received by the IRB at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Any documents received less than 30 days before expiry will be labelled "late submissions" and will incur a penalty.
- Every 6 (six) months a progress report form supplied by ERES IRB must be filled in and submitted to us.
- ERES Converge IRB does not "stamp" approval letters, consent forms or study documents unless requested for in writing. This is because the approval letter clearly indicates the documents approved by the IRB as well as other elements and conditions of approval.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of ERES Converge IRB, we would like to wish you all the success as you carry out your study.

Yours faithfully,
ERES CONVERGE IRB

Dr. E. Munalula-Nkandu
BSc (Hons), MSc, MA Bioethics, PgD R/Ethics, PhD
CHAIRPERSON

Telephone: 227745 - 8 /228385 - 8
Fax: 223435
Telegrames:
Telex: ZA 40436

In reply please quote
No ....

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

P.O. Box 30205
LUSAKA

17th June, 2013

C/O Department of Public Health
School of Medicine
University of Zambia
Lusaka

Dear Sir,

REQUEST FOR PERMISSION TO CARRY OUT A RESEARCH – JESSY ZGAMBO (512809039)

Refer to the above.

I write to acknowledge receipt of your letter dated 4th June, 2013 in which you requested to carry out a research.

Management has no objection to you doing your research at this institution.

You are further informed that this is so on condition that the institution bears no financial obligation to you during the period of this research and we are availed results prior to their dissemination

Yours faithfully,

Dr. C. Chiluba
Head Clinical Care
LEVY MWANAWASA GENERAL HOSPITAL

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
UNIVERSITY TEACHING HOSPITAL
28 JUN 2013
HOD'S OFFICE
PRIVATE BAG RW1X, LUSAKA

28/06/13
Please assist Jessie to collect information as requested.
V. Mulenga

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH
University Teaching Hospital

P/Bag Rw 1X
Lusaka - Zambia
Fax: +260 211 250305
e-mail: mduth@yahoo.com
Tel: +260 211 253947 (Switch Board)
+260 211 251451

OFFICE OF THE SENIOR MEDICAL SUPERINTENDENT

Our Ref: UTH/HCC/9/8
Your Ref:

12th June, 2013

Jessy Zgambo
Department of Public Health
School of Medicine
University of Zambia
LUSAKA

Dear Zgambo

RE: <u>REQUEST FOR CONDITIONAL PERMISSION TO CONDUCT RESEARCH AT UNINIVERSITY TEACHING HOSPITAL</u>

I write in response to your letter of 4th June 2013 regarding the above subject matter.

This serves to inform you that management has granted your request to conduct a research entitled "Epidemiology of chemical poisoning as reported at our institution" with the knowledge of the Head of Department Medicine, Paediatrics and Adult Medical Emergency Unit Incharge.

Yours sincerely,

Dr. L. Chikoya
Head Clinical Care
For/Senior Medical Superintendent
UNIVERSITY TEACHING HOSPITAL

CC: Senior Medical Superintendent
Head of Department – Medicine
In-charge - AMEU

LC/mnm