# INTENTIONAL ORGANOPHOSPHATE POISONING: A STUDY IN THREE HOSPITALS IN JOHANNESBURG

Babalwa Ndyebokazi Dunga

A research report submitted to the Faculty of Health Sciences,
University of the Witwatersrand, in partial fulfilment of the requirements for
the degree of Master of Medicine in the branch of Community Health
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## DECLARATION

I, Babalwa Ndyebokazi Dunga, declare that this research report is my own work. This report is being submitted for the degree of Master of Medicine in the branch of Community Health, to the University of Witwatersrand, Johannesburg. I declare that this report has not been submitted before for any degree or examination at this or any other university.

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September 2019

# DEDICATION

This research project is dedicated to my family. Thank you for your support, motivation, and encouragement.

**ABSTRACT**

**Background:** In 2016, suicide deaths were estimated to be 800 000, suicide rate of 10.5 per 100 000 population. Information collected between 1990 and 2007 reported that 30% of global suicides are due to pesticide poisoning, which happen mostly in the low and middle income countries. In 2012, the global suicide attempt was estimated to be 20 times higher than the suicide rates. Previous intentional self-harm has been shown that it is a predictor for death by suicide. The prevalence of intentional self-poisoning differs from country to country and it is a common method of suicide/suicide attempt in the African, East Asia and Western Pacific Regions.

**Aim:** To determine the socio-demographic and medical profiles of patients admitted with intentional organophosphate (pesticide) and non-organophosphate poisoning (non-pesticide) in the three study hospitals and identify factors that might influence their outcome (such as duration of hospital admission and case fatality rate).

**Methodology:** An analytical cross sectional study design was used for this study. Record review and face-to-face interviews were done to collect data from the three study sites (Chris Hani Baragwanath Academic Hospital, Leratong Hospital, and Sebokeng Hospital) in Gauteng between September in 2011 and December in 2013.
The study population consisted of all patients above 18 years of age who were identified by the admitting doctor as having intentionally ingested poison and then admitted to the medical ward, the intensive care unit (ICU) or/and the high care ward (HCW) during the study periods at the three study sites.
The study was initiated after obtaining permission from the University of the Witwatersrand Human Research Ethics Committee (WHREC), and Chris Hani Baragwanath Academic Hospital as the central and tertiary hospital.

**Results:** Six hundred and forty-eight participants were recruited into the study from three study sites. The study participants were young, median age was 26 years and the interquartile range (IQR) was from 18 to 63 years and the majority (61.6%) were females. Most (59%) of the study participants had ingested other substances and only forty-nine percent had ingested a pesticide. Age, sex, ethnicity, relationship status and being on medication were significantly associated with the type of poison taken for intentional self-poisoning on the multivariate

analysis. The median length of stay for the study population was three days and ethnicity, type of poison taken and having a medical condition were significant predictors of the length of stay. The case fatality rate was 2.6%. The group that had ingested a pesticide had a higher fatality rate than those that had ingested other substances.

**Conclusion:** The findings of this cross-sectional study conducted in three hospitals in the Gauteng Province demonstrated how access to means for intentional self-harm was a problem. It showed the population vulnerable to self-poisoning and that there is inadequate implementation of legislation and policies in South Africa for limiting access to pesticides. Addressing this problem would require a multifaceted, context specific approach. Health promotion activities should be implemented to reduce the prevalence of intentional self-poisoning.

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# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

## GLOSSARY OF TERMS

**Carbamate:** are derived from carbamic acid and widely used as insecticides, herbicides and fungicides. Carbamate insecticides inhibit acetylcholinesterase and thus evidence of exposure to such compounds can be obtained by measuring cholinesterase activity (1).

**Case fatality rate:** the proportion of cases of a specified condition that are fatal within a specified time (2).

$$\text{Case fatality rate usually expressed as a percentage} = \frac{\text{Number of deaths from a disease in a given period}}{\text{Number of diagnosed cases of that disease (in the same period)}} \times 100$$

**Hazard:** the inherent capability of a natural or human-made agent or process to adversely affect human life, health, property, or activity, with the potential to cause a disease, epidemic, accident, or disaster (2).

**Intentional self-poisoning**: is defined as intentional ingestion of more than the prescribed or advised amount of any drug, recreational drug, non-ingestible substance, or excess alcohol for self-harming purposes, regardless of evidence of intention to die of the poisoning (3).

**Notifiable medical conditions (Category 2)**: These are medical conditions that have to be notified through written or electronic notification to the Department of Health within seven (7) days of clinical or laboratory diagnosis by health care providers, private health laboratories or public health laboratories (4). E.g. Agricultural or stock remedy poisoning, hepatitis, lead poisoning, tuberculosis, etc.

**Organophosphate:** are a group of phosphorus containing pesticide chemicals intended to control insects insecticides and herbicides. Organophosphate herbicides interfere with

neurotransmission by inhibition of acetylcholinesterase and evidence of exposure can be obtained by measuring cholinesterase activity (1).

**Parasuicide:** non-fatal act of deliberate self-harm (5).

**Pesticides:** any substance, or mixture of substances of chemical or biological ingredients intended for repelling, destroying or controlling any pest, or regulating plant growth. Pesticide formulations consist of active ingredients and inert ingredients. (6)

**Self-harm**: a range of more specific self-harming behaviours including: self-poisoning (Overdose with or without suicidal intent) and self-injury (self-cutting, or hanging or self-burning or hanging self) (5).

**Suicidal behaviour:** refers to a range of behaviours that include thinking about suicide (or ideation), planning for suicide, attempting suicide and suicide itself (7).

**Suicide:** self-inflicted death (8).

**Suicide attempt:** is used to mean any non-fatal suicidal behaviour and refers to intentional self-inflicted poisoning, injury or self-harm which may or may not have a fatal intent or outcome (7).

**Surveillance:** systematic ongoing collection, collation, and analysis of data and the timely dissemination of information to those who need to know so that action can be taken (2).

# LIST OF ABBREVIATIONS

| | |
|---|---|
| CHBAH | Chris Hani Baragwanath Academic Hospital |
| CT | Cape Town |
| DoL | Department of Labour |
| DoH | Department of Health |
| EC | Eastern Cape |
| EL | East London |
| FAO | Food and Agricultural Organization |
| GP | Gauteng Province |
| HCW | High Care Ward |
| HIC | High Income Countries |
| HIV | Human Immunodeficiency Virus |
| ISP | Intentional Self-Poisoning |
| ICU | Intensive Care Unit |
| IQR | Inter Quartile range |
| KZN | KwaZulu Natal |
| LIC | Lower Income Countries |
| MIC | Middle Income Countries |
| Non-OP | Other poisonings |
| OP | Organophosphate poisoning |
| PAN | Pesticide Action Network |
| POP | Persistent Organic Pollutants |
| US | United States of America |
| SA | South Africa |
| UK | United Kingdom |
| WHO | World Health Organization |

# CHAPER ONE
# INTRODUCTION

This chapter provides the background and the context for this study. Furthermore, it introduces and explains the rationale and justification for the research.

## 1.1 BACKGROUND

In 2016, the World Health Organization (WHO) estimated that there were approximately 800 000 suicide deaths worldwide, a suicide rate of 10.5 per 100 000 population (9,10). More than 70% of identified suicides occur in low and middle-income countries. (9) South Africa's (SA) suicide rate was estimated to be 11.6 per 100 000 population. (10) The figure below illustrates the 2016 distribution of global suicide deaths by age and sex, this is notably more prevalent amongst men and in younger age group (10).

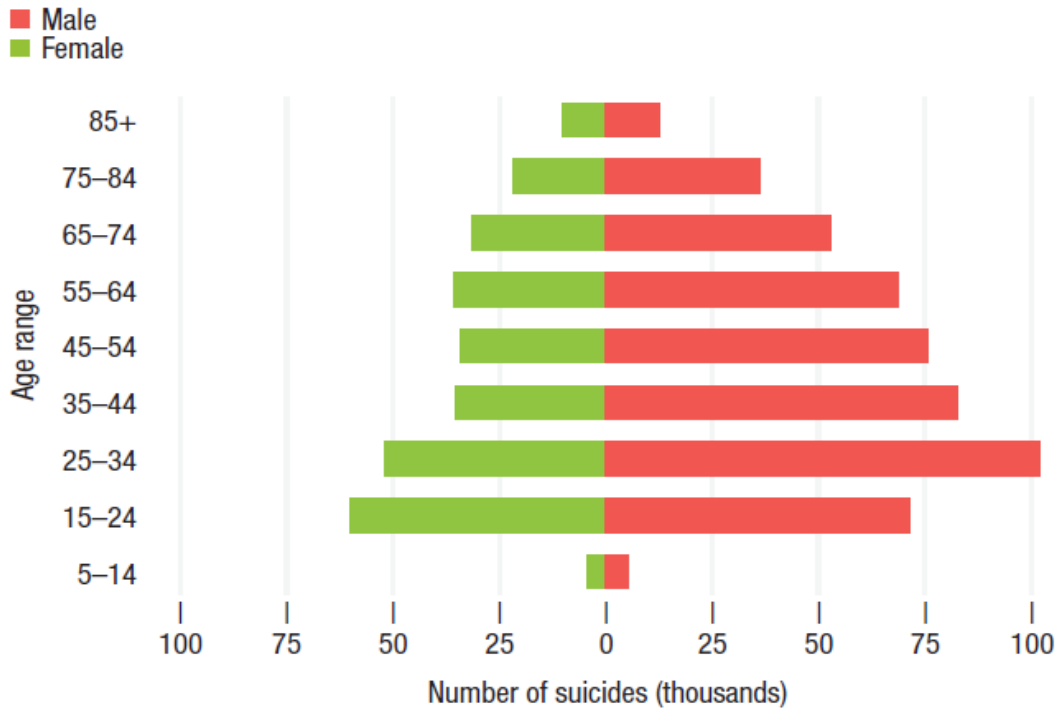


**Figure 1.1 Global suicide deaths by age and sex, 2016**

Procedures frequently used globally to commit suicide were pesticide poisoning, hanging and firearms. (9) Data collected on suicidal deaths between 2005 and 2011 showed that only 28%

of the identified suicides had information on methods used (mostly firearms, and hanging). Most of this information was from high-income countries. (7) In addition, a systematic review of data collected between 1990 and 2007 reported that 30% of global suicides are due to pesticide poisoning and occur in low and middle income countries. (11) More recent information estimate that 20% of suicides due to pesticide poisoning occur in low and middle-income countries especially in rural agricultural settings. (9)

Previous intentional self-harm is an important risk factor for death by suicide. In 2012, the global suicide attempt rates were estimated to be 20 times higher than the suicide rate. (7) Information on suicide attempts is not routinely collected and this information is based on research, medical records usually from hospitals, and surveys that are conducted. (7)

The methods commonly used for suicide attempts/suicide can be classified into violent and non-violent as listed in the diagram below. (12)

| | | |
|---|---|---|
| **Methods used for suicide attempt/ suicide** | **Violent** | Hanging, strangulationjumping from high places |
| | | Drowning and submersion |
| | | Guns and explosives |
| | | Crashing motor vehicle, lying in front of moving object |
| | | Sharp and blunt objects |
| | | Fire and steam |
| | **Non violent** | Poisoning: Solvents (includes pesticides), Medication drugs, Recreational drugs and alcohol |
| | | Gas and vapours |

**Figure 1.2 Methods used for suicide attempt/suicide**

This study focused on intentional self-poisoning as a method of self-harm.

### 1.1.1 Intentional Self-Poisoning: A Method of Suicide/Suicide Attempt

Self-poisoning is defined as the intentional ingestion of more than the prescribed amount of any drug, non-ingestible substances, overdoses of recreational drugs and severe alcohol intoxication, whether or not there is evidence that the act was intended to result in death (3).

Substances used for self-poisoning vary from country to country as well as from region to region. Pesticide self-poisoning has been noted to be particularly prevalent (11.3-48.3%) in South Asia, South East Asia, and China. (13) A systematic review of the global burden of fatal self-poisoning (2010-14) estimated that 3.5% (2100 pesticide suicides) of suicides in Africa were due to pesticide poisoning (13). However, this might be an under estimation of the problem. Previous publications have estimated the prevalence to be as high as 22, 9% and even this might not be accurate. (11)

In Zimbabwe, pesticides and pharmaceuticals were found to be the most frequently used agent amongst patients admitted intentional self-poisoning. (14) In South Africa (SA), substances used for self-poisoning differ from region to region. In Cape Town (CT) and KwaZulu Natal (KZN), medicines were the most common agents used followed by pesticides. A study done at two sites, Gauteng (GP) and KZN showed that household products were frequently used, followed by pharmaceuticals and lastly agrichemicals. (15–17) South African studies in 2009 reported that agricultural chemicals were the fourth most commonly used agent by para-suicidal patients, with organophosphates (OP) being the most frequently used chemical. (18,19)

Pesticide formulations consist of active and inert ingredients. The active ingredients include organophosphates, phenoxyherbicides, insect growth regulators and pyrethroids. Organophosphates are used for pest control both in the agricultural and domestic setting. In the domestic setting, they are used as active ingredients in shampoos to treat head lice, to kill ectoparasites on domestic animals and to control of household pests – for example, rats and cockroaches. Pesticides are of public health importance because of their potentially toxic effects on organisms (including humans) other than the ones they are intended for. (20)

The World Health Organization (WHO) classifies pesticides into four classes according to their hazard potential - extremely and highly hazardous, moderately hazardous, and slightly

hazardous and pesticides that are unlikely to cause any acute hazard. Since there was overwhelming evidence of the toxic effects of pesticides and acknowledgement of the benefits that the agricultural sector derives from pesticides, the international community developed an interest in managing the use of pesticides in the 1980s.

### 1.1.2 International Legislation for Regulating the Availability of Pesticides

A global Pesticide Action Network (PAN) was established in 1982 to address human and environmental health problems caused by the use of pesticides. The PAN urged the Food and Agricultural Organization (FAO) to create an international code of conduct on the distribution and use of pesticides and this was done in 1985. Governments were urged to have national pesticide legislation with effective implementation and monitoring strategies. (21) However, this is a challenge in developing countries. (22)

The code of practice on international trade in pesticide and pesticide use was revised in 2002, introducing three internationally binding code of conducts namely: The United Nations Basel Convention, Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention. (22)

- The Basel Convention regulates import and export of hazardous waste and its disposal (22).
- The Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals states that pesticides that have been banned, withdrawn or severely restricted in a defined number of countries, should only be exported to a country if the importing country's government has been informed of the reasons for the regulatory action. The receiving country has to give consent to the importation of the chemical or pesticide (21).
- The Stockholm Convention aims to eliminate the production and use of stockpiles and the presence of certain chemicals/pesticides in the environment that are defined as persistent organic pollutants (POPs) (21,22).

Furthermore, African countries developed the Bamako Convention to regulate the ban, import and movement of hazardous waste within Africa (22). There is no specific convention for organophosphate control or elimination. However, the global and African conventions

would require formulation of national and probably subnational legislative frameworks to control the availability of these substances.

## 1.2 STATEMENT OF THE PROBLEM

South Africa has legislation [The Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 36 of 1947)] and a policy (Pesticide Management Policy for South Africa) protecting South Africans from the risks posed by pesticides by limiting access to pesticides and enforcing the provision of information on hazardous health effects. (23,24) A study done in Cape Town (CT) in SA has shown that access to pesticides is not limited; pesticides are being sold in the informal sector regardless of the existence of this legislation. (25)

Pesticide poisoning is a category 2 notifiable medical condition in SA (4,26) however, it is under-reported (27,28) therefore, the magnitude of the problem caused by increased access to pesticides is not documented. Data collected between 2009 and the beginning of 2011 at Chris Hani Baragwanath Academic Hospital (CHBAH), in the south of Johannesburg and at Leratong Hospital in the West Rand, had shown an increase in the number of patients admitted with intentional organophosphate poisoning. The study also reported an increase in mortality from 3.8% in 2007 to 19.2% in 2010 (Personal communication, Professor Huddle). This increase in the admissions of patients with intentional organophosphate poisoning and the high mortality may reflect an increase in availability of organophosphates, the types of organophosphates available are more lethal and the possible need for policy changes and/or enforcement regarding the availability of pesticides.

## 1.3 JUSTIFICATION FOR THE STUDY

There is limited published literature available in Gauteng on pesticide poisoning and the passive surveillance system for pesticide poisoning grossly underestimates the prevalence of pesticide poisoning. The Head of the Internal Medicine of the University of the Witwatersrand noted that intentional self-poisoning might be a major public health problem and the majority of hospital admissions associated with intentional self-poisoning in public hospitals are related to ingestion of OP and their mortality was increasing significantly over

the years. The study was planned in that context in three health districts in the Gauteng Province, which refer patients to Chris Hani Baragwanath Academic Hospital, a central hospital. The findings of this study would assist in advocating for further improvement in policies on pesticide management and surveillance especially or improved implementation of the existing policy is required in South Africa. Furthermore, can assist in developing comprehensive suicide prevention interventions for SA.

## 1.4 PURPOSE OF THE STUDY

This exploratory study will assist in quantifying intentional self-poisoning especially organophosphate (pesticide) poisoning, the profiles and the outcome of these patients. In addition, the availability of pesticides and the type used for intentional self-poisoning will be assessed.

## 1.5 RESEARCH QUESTION

What are the profiles (socio-demographic and clinical) of patients admitted at the three hospitals in Gauteng with intentional self-poisoning (organophosphate and non-organophosphate poisoning) and which factors might influence the outcomes (such as duration of hospital admission and case fatality rate) during the study period?

## 1.6 AIMS AND OBJECTIVES

### 1.6.1 Aims

To determine the socio-demographic and medical profiles of patients admitted with intentional organophosphate and non-organophosphate self-poisoning in the three study hospitals and identify factors that might influence their outcome (such as duration of hospital admission and case fatality rate).

### 1.6.2 Specific Objectives

1. To describe the profiles of patients admitted to three hospitals in Gauteng with intentional organophosphate and non-organophosphate self-poisoning

   i) To describe the socio-demographic profile of patients admitted to the three hospitals in Gauteng for intentional organophosphate poisoning and intentional non-organophosphate poisoning

   ii) To describe the medical profile of patients admitted three hospitals and determine whether this influences the choice of substance used for intentional self-poisoning

   iii) To determine if these profiles mentioned in (i) and (ii) might influence the choice of substance used for intentional self-poisoning
2. To determine which substances were taken by patients admitted to the hospitals with intentional self-poisoning and describe the source of these substances
3. To determine if there is any difference between the OP cases versus non-OP cases in terms of (a) Profiles of patients; (b) Outcomes (such as duration of hospital admissions, case fatality rate)

# CHAPTER TWO
# REVIEW OF LITERATURE

This chapter provides a detailed review of pertinent literature on intentional self-poisoning. In addition to published literature, information from various unpublished sources was reviewed.

## 2.1 INTRODUCTION

The WHO World Mental Health Survey (2008), based on data collected between 2001 to 2007 estimated self-reported one year prevalence of suicide attempt to be 0.03 per 100 000 in high income countries (HIC) for both males and females, 0.03 for males and 0.06 for females in middle income countries (MIC) and 0.04 for males and females in low income countries (LIC) for persons 18 years and above (130 as cited in 29). A health provider perspective costing study done in Sri Lanka in 2006 (using 2004 data) reported that 48098 patients were admitted with self-poisoning and this cost the Ministry of Health US$ 866 304. (30) A more recent (2013) economic costing study done in the United States estimated non-fatal suicide attempts cost to be US$ 8,377 Billion. (31) Intentional self-poisoning places a significant burden on the health care system and communities and an investment on prevention must be made.

Effective suicide prevention programmes should be holistic and consider interventions at all three levels of prevention (primary, secondary and tertiary level). This would entail identifying the high risk individuals, their socio-demographic characteristics, method commonly used for the suicide attempt and management of these individuals. This study will contribute to existing knowledge on one of the most commonly used methods for suicide attempts (intentional self-poisoning) (17,32,33) .

## 2.2 FACTORS INFLUENCING SUICIDAL ATTEMPTS (SPECIFICALLY INTENTIONAL SELF-POISONING)

The figure below (Figure 2.1) shows the risk factors and protective factors for self-harm and they were adapted from the lancet article on self-harm and a systematic review by Fliege et al. (34,35).

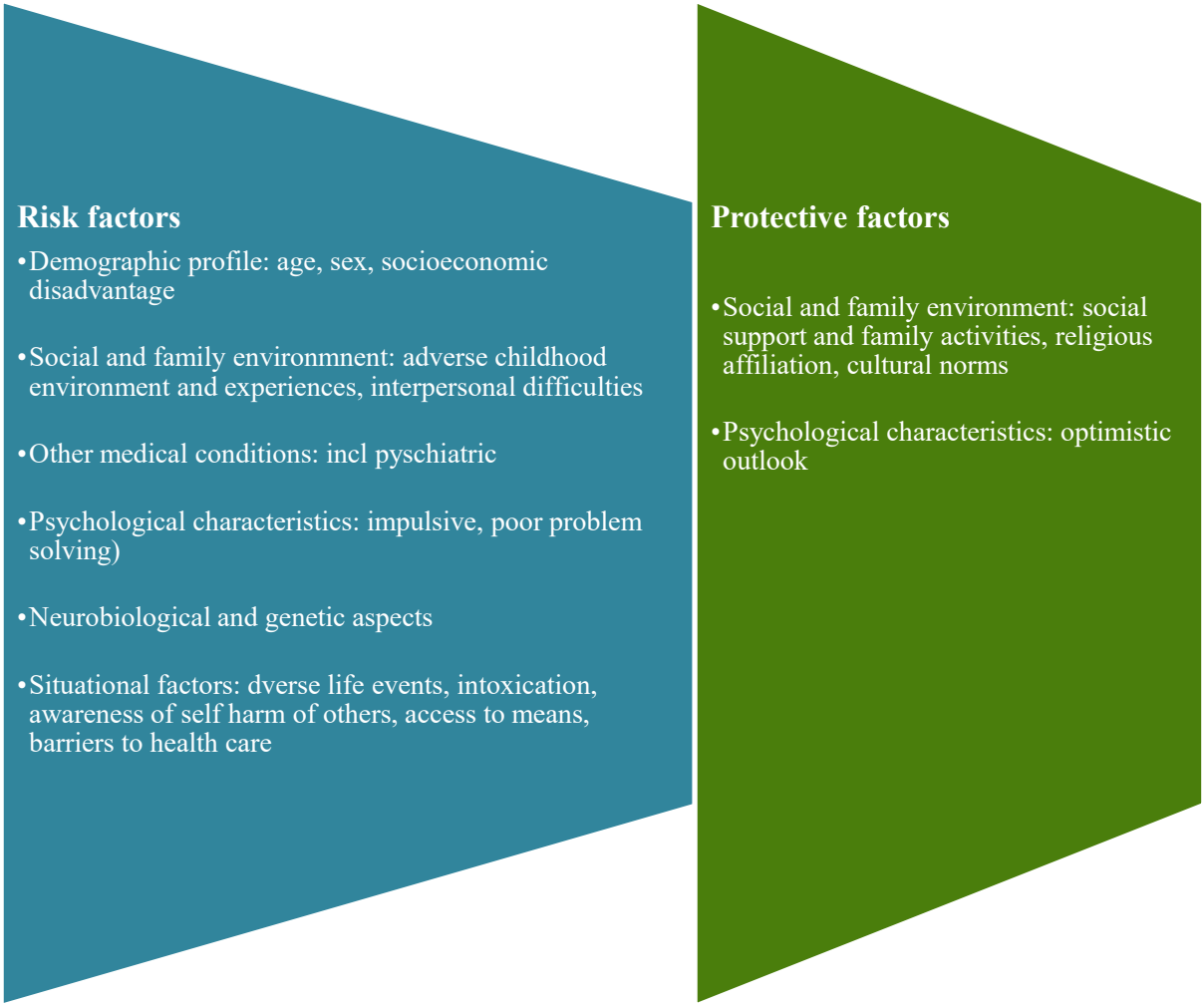


**Figure 2.1 Risk and protective factors for self-harm**

This study focused on sociodemographic and medical factors that might influence intentional self-poisoning as well as what substance is used for poisoning.

### 2.2.1 Demographic factors

#### i. Age

A systematic review conducted by Pires et al in 2014 reported that the majority of first episodes of intentional self-poisoning occurred between the ages of 15 to 40 years. (36) A multicentre study conducted by the WHO/EURO in the early 90s showed that the highest rates of drug overdoses were in the 15 to 24 year age group (33). Historically, in Sri Lanka, it was found that pesticides were more frequently used for intentional self-poisoning at the age of 20 years (37) whereas a more recent study found that females less than 30 years more commonly used medicines than organophosphate and carbamate for poisoning. (38) This change was probably due to changes in the availability of substances used for poisoning, after implementation of legislation controlling access to pesticides. However, the males in the same age group used mostly organophosphate and carbamate for poisoning than medicines. (38) A study done in Malaysia in 2008 found that participants between 31 to 60 years of age were more likely to take chemical poisons (include pesticides) than medicines and participants less than 30 years and above 60years were more likely to take medicines. (39)

In Cape Town (CT), South Africa, intentional self-poisoning occurred commonly in the younger age group, less than 35 years of age. (15)

#### ii. Sex

More females than males use self-poisoning for intentional self-harm. (39–43) However, in Sri Lanka, in 2003, Eddleston et al. reported more males than females had intentional self-poisoning. (37) Females were noted as being more likely to take chemical poisoning (pesticides) than medicines and males were more likely to take medicines than chemical poisoning in Malaysia. (39) Conversely, the study in Sri Lanka reported more males than females commonly ingesting pesticides than other substance. (37) This implies that there are sex differences in the choice of poison used for intentional self-harm amongst the different regions.

Whilst in South Africa (Cape Town, East London, KwaZulu Natal, and Gauteng), literature supported that more females than males presented to hospital with intentional self-poisoning. (15,18,19)

### iii. Socioeconomic factors

Low socio-economic status, which includes low incomes, low level of education and living in poverty have been identified as factors associated with self-harm. (44–46) A study done in a teaching hospital in the United Kingdom in 2004 reported that more than 50% of the participants that had self-poisoning were from areas that are highly deprived. (47) This was further supported in Sweden where they found that the risk of self-harm increased amongst participants that were accessing social welfare benefits. (48) Similarly, in 2008, a study that was done in Iran reported that 53% of participants that had attempted suicide were unemployed and 22% were students and only 25% were employed demonstrating the magnitude of the problem amongst economically disadvantaged people. (49) Inversely, in rural Sri Lanka in 2002, the incidence of self-poisoning was lower in areas with poor socio-economic conditions and unemployment was not associated with self-poisoning. (50) However, in the same study, a comparison was made between pesticide and non-pesticide poisoning and unemployment was associated with non-pesticide poisoning and working in the agricultural sector was associated with increased use of pesticides for intentional self-poisoning which supports the notion that access to means is an important factor in intentional harm. (50)

Fathelrahman et al. made a comparison between those that had used medicine/drug overdose for self-poisoning to those that used chemical poisons (include pesticides) and found that the participants that took a drug overdose were more likely to have socio-economic problems. (39)

A national household survey conducted in SA in 2002-4 reported a significant association between low/medium education levels and a risk of suicide attempt. (51) This was further supported by another study done in KwaZulu Natal in 2013. (17)
There was no identified literature that compared education levels between participants that intentionally ingested organophosphates and those that took pharmaceutical drugs or other poisons.

### iv. Relationship status

Studies have reported that being separated and divorced is associated with an increased likelihood of intentional self-harm (52). Najafi et al. reported that most of the participants with intentional self-poisoning were divorced, the rate of self-harm among them was two times higher than married couples (53). In addition, being unmarried was associated with an increased risk of intentional self-poisoning. (54) However, other literature reported that most participants were single/unmarried but this was not a predictor of intentional self-poisoning. (55–58) Similar findings have been reported in Africa, most of the participants that deliberately self-harm was single. (32) In KwaZulu Natal (SA), single participants were more likely to be admitted with parasuicide, attempted suicide and suicide than married participants (17).

## 2.2.2 Substance Use

A high rate of chronic alcohol intake amongst males with acetaminophen deliberate self-poisoning was reported in Malaysia between 2006 and 2008. (57) In 2012-13 in Sri Lanka, hazardous drinking was seen in 20% of male participants, alcohol use disorder in 8% of the male participants and alcohol ingestion prior to the act of self-poisoning in 24% of males. (59) In addition, a study done in Norway described that 37% of their study participants are using substances on a daily basis and they were more likely to have substance use related poisoning. (60)

In South Africa (KwaZulu Natal), it was reported that 55% of participants seen at the emergency department reported substance use at the time of deliberate self-harm. These substances were alcohol, cigarettes, dagga, wunga, cocaine, and heroin. (17)

Social desirability bias might influence the results of researchers when assessing lifestyle factors associated with self-poisoning. The reviewed literature has not looked at comparing behaviours between study participants that take an OP and those that take other substances to note any difference in behaviour.

### 2.2.3 Co-Existing Medical Conditions

Patients that intentionally self-harm have been found to have a co-existing mental disorder. (36,44,57,59,61) A multicentre study done in Europe found that mood disorders were more prevalent followed by neurotic, stress related and somatoform, then personality disorder, then substance induced psychiatric disorder and lastly schizophrenia or a delusional disorder. (44)

Amongst elderly patients, having a medical illness was found to have an increased risk of self-harm. (62) A household survey conducted in Gauteng (South Africa) in 2006-11 reported that households with a person suffering from a medical condition were more likely to report an episode of deliberate self-harm (63). Furthermore, patients that had a health problem were more likely to drug overdose than use chemical poisons. (39)

In Nigeria, a case control study investigating suicidality among Human Immunodeficiency Virus (HIV) positive individuals reported that 9% of the cases (have HIV) compared to 1% of the controls(no HIV) were significantly associated with suicidality. (64) In SA (Cape Town), 20% of participants with intentional self-poisoning had human immunodeficiency virus (HIV), 7% had a psychiatric illness, 6% were pregnant and 3% had a neurological disease. (15)

## 2.3 CHOICE OF POISON USED FOR INTENTIONAL SELF-POISONING

Access has been defined as having three main dimensions; availability, acceptability, and affordability. (65) The choice of poison used for intentional self-poisoning is dependent on the access to means. (66)

In Sri Lanka, the choice of poison used for intentional poisoning was identified as being dependent on availability. (66,67) This was further validated by studies done after there was a ban on highly hazardous pesticides, which resulted in a reduction of pesticide related suicide rates. (68)(50) In addition, in England, it was found that access to paracetamol and salicylate analgesics is easy and these substances were commonly used for self-poisoning. (69) The

Medicines Control Agency in the United Kingdom introduced legislation to limit the availability of paracetamol (limited paracetamol tablets sold) in 1998 and this led to a reduction in the number of liver transplants due to paracetamol toxicity, reduced paracetamol sales and reduction in hospital admissions due to paracetamol poisoning (70).

Intent and awareness of lethality of substance play a role in determining the choice of substance to use for intentional self-poisoning. A study was done in the UK and the US (United States of America) reported that 30% of their population would not have taken the substance if they had known that the substance would kill them. (71) In addition, the use of a particular substance for self-poisoning was influenced by its usage by friend or relative for self-harm. (67)

However, a comprehensive approach to reducing suicide rates is needed because other studies have shown that the population at risk look at other methods for suicide. (72,73)

## 2.4 OUTCOMES OF INTENTIONAL SELF-POISONING

Mortality and morbidity related to acute poisoning depend on a number of factors such as age, type of poison, dose consumed, level of available medical facilities, clinical status and the time interval between intake of poison and arrival at the hospital. (37,39,74–77) The epidemiological triad has been used to evaluate injuries (including intentional self-harm), develop prevention, and control strategies. (78) Figure 2.2 illustrates the interaction and interdependence of host, agent and environment in intentional self-harm and how they predict outcomes.

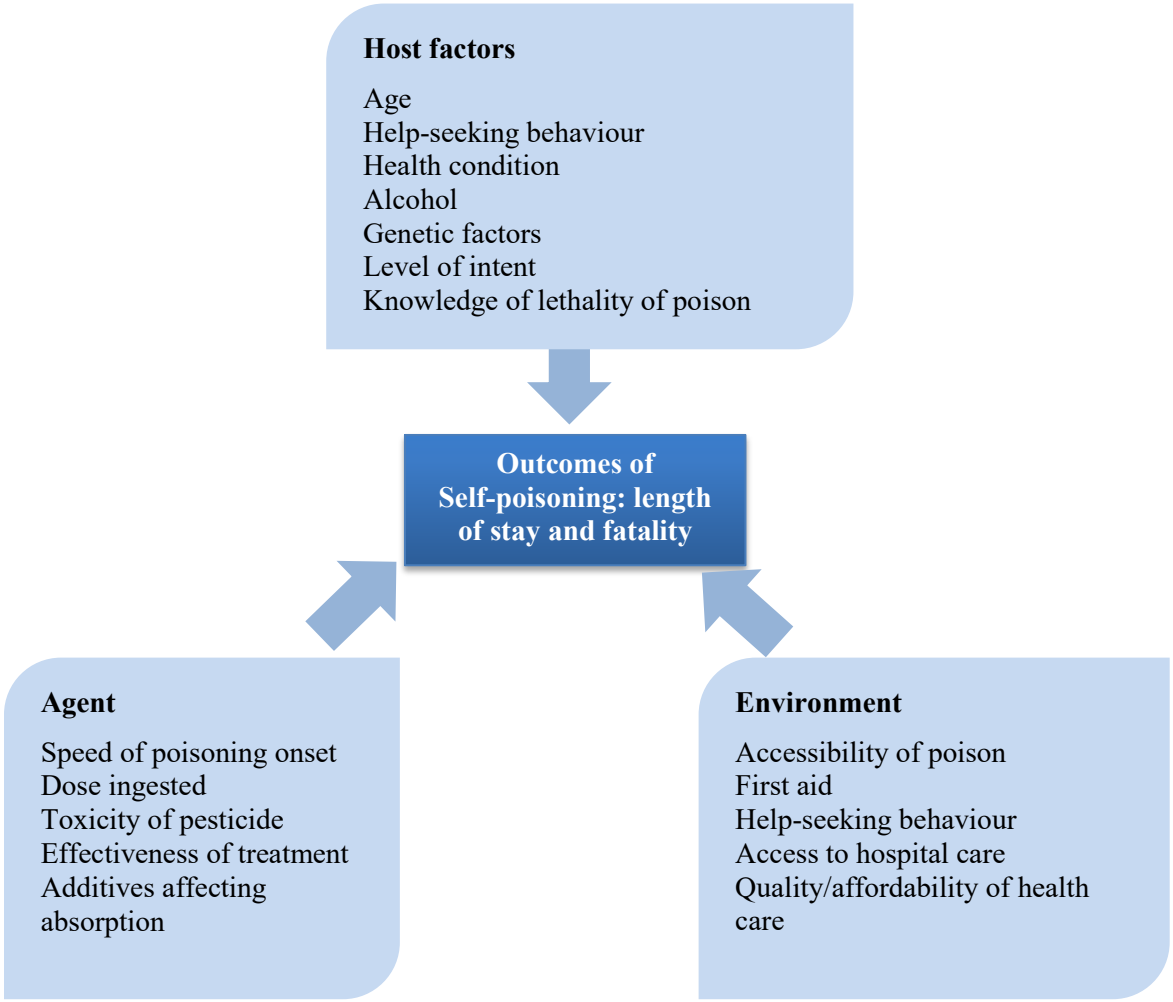


**Figure 2.2 Illustration of factors affecting the outcome of intentional self-poisoning**

An intentional medicine (paracetamol) related poisoning study in Malaysia, conducted between 2004 and 2008 found that hospital length of stay was predicted by the time taken to administer antidote after self –poisoning. (79) Older people with drug/medicine overdose have been shown to have a higher case fatality rate and stay longer in the hospital than younger people. (80)

In Iran in 2011-12, it was found that patients with a living place in cities experienced a shorter period of hospitalization and were associated with a lower rate of mortality (81). In addition, a review of poisoning deaths in China between 2006 and 2016 reported that rural areas had greater mortality than urban areas (82). This provides evidence that access and quality of care are key factors to consider when assessing fatality and length of stay in the hospital. Patients that had intentional chemical poisoning (incl. pesticides) had a shorter hospital length of stay than those who took a drug overdose. However, the drug overdose

patient was more likely to be admitted in the intensive care unit (ICU) and had a lower rate of death than the chemical poisoning. (39) Contrary to this, a retrospective study done in the ICU setting in East London (EL), in SA reported that mean duration of admission was higher amongst the participants that had taken cholinesterase inhibitors (usually pesticides) in comparison to those that took other agents for intentional self-poisoning. The mortality was higher amongst participants that had taken an unknown substance. (83) However, in Taiwan, the highest fatality rate was amongst pesticide poisoning than other substances. (84)

Between 2002 and 2004, in Sri Lanka, the fatality was associated with being male, level of consciousness at presentation, toxin blood concentration. (85) In addition, Peter et al demonstrated an association between the WHO pesticide classification and mortality (86). (Table 2.1)

**Table 2.1. The WHO classification of pesticides according to their hazard potential**

| Class | Description |
|---|---|
| Ia: | extremely hazardous (e.g. Aldicarb) |
| Ib | highly hazardous (e.g. Dichlorvos) |
| II | moderately hazardous (e.g. Chorpyrifos) |
| III | slightly hazardous, unlikely to cause any acute hazard (e.g. Amitraz) |

Source: (20)

Available evidence has demonstrated that Class 1 related mortality was higher than class II and Class III and the same picture was seen in ventilator needs. (86) Studies have demonstrated an association between the pesticide hazard classification and suicide related mortality.(77,86,87) In addition, factors such as the general health of the patient, their age and adequacy of clinical management contribute to the outcome of a patient with pesticide poisoning. (77,87)

There is limited data available on the factors that influence the use of OP versus non-OP for poisoning, most of the identified literature described self -poisoning as a whole and did not look at any differences that exist between populations that use OP for poisoning and those that use other substances. Furthermore, most of the identified literature does not focus on OP but pesticides as a whole or describes them acetylcholinesterase inhibitor.

# CHAPTER THREE
# RESEARCH METHODOLOGY

This chapter describes the methods used to conduct this study. The study design and setting, data collection and data analysis methods are described.

## 3.1 SCOPE OF THE STUDY

An analytical cross sectional study design was used for this study. Record review and face-to-face interviews were done to collect data from the three study sites in Gauteng in between September in 2011 and December in 2013.

## 3.2 STUDY SETTING

The study was conducted in three hospitals within the Gauteng province in South Africa. The map below shows the location of the different hospitals within the Gauteng Province.

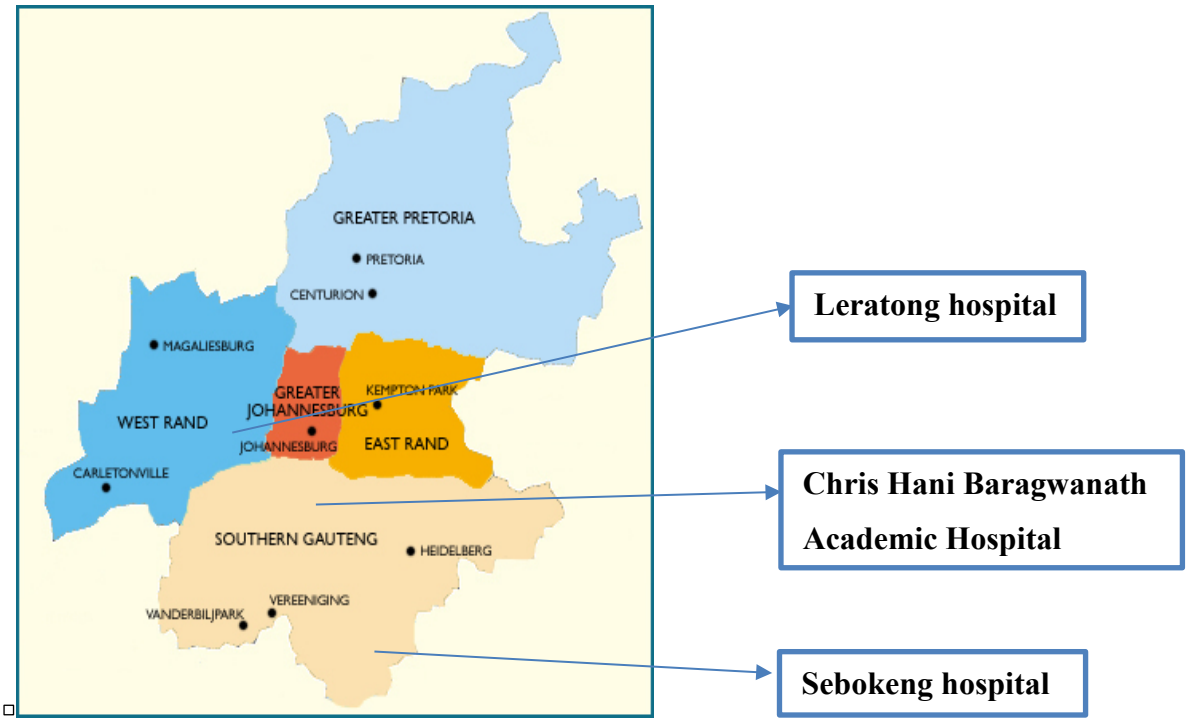


**Figure 3.1 A Map of the Gauteng Province**

- **Chris Hani Baragwanath Academic Hospital (CHBAH):** The CHBAH is a central, academic hospital, situated in the south of Johannesburg in Soweto and is the largest public hospital in Africa. The hospital provides tertiary services to the population of Soweto, surrounding townships and other provinces (approximately 3 million catchment population).
- **Sebokeng Hospital:** Sebokeng Hospital is a regional hospital situated in the Vaal area in the Sedibeng District. It provides general specialist services to the population of Sebokeng Township and the surrounding area (approximately 1.5 million-catchment population).
- **Leratong Hospital:** Leratong hospital is a large regional hospital situated in the West Rand District. It provides general specialist services to the community in the West Rand area (approximately 1.1 million-catchment population).

These three hospitals were selected for the study based on their geographic locations in the three districts in the Gauteng Province.

## 3.3 STUDY PERIOD

All the data were collected during the two-year study periods (September in 2011 and December in 2013). The data collection took place at different times, as there was significant delays in getting approval from each hospital.

- Chris Hani Baragwanath Academic Hospital: 01/09/2012 to 31/12/2012
- Leratong Hospital: 01/09/2013 to 31/12/2013
- Sebokeng Hospital: 01/01/2014- 30/04/2014

## 3.4 STUDY POPULATION

All patients above 18 years of age admitted to medical wards, high care wards and intensive care units (ICU) during the study period for intentionally ingestion of any poison, as identified by the medical specialist / admitting doctor were included in the study (figure 3.2 below demonstrates the process of identifying and recruiting study participants). These

patients are generally admitted in the medical wards in a public hospital, and kept in hospital until a full psychiatric assessment was done. Medical registrars and specialists took the initial history and identified the patients. The medical diagnoses of these patients in the admission books were parasuicide or the substance used (e.g. organophosphate or paracetamol poisoning).

Inclusion criteria: All patients above 18 years of age admitted to medical wards, high care wards and intensive care units (ICU) during the study period for intentionally ingestion of any poison, as identified by the medical specialist / admitting doctor in the three hospitals mentioned above

Exclusion criteria: Patients below 18 years of age, those that refused to participate in the study, those that were not admitted in the designated wards, those that were not recorded in the admission books and those that died in casualty were excluded from the study. Patients that have used other methods in their suicide attempts such as guns, knives and other physical means were also excluded from the study.

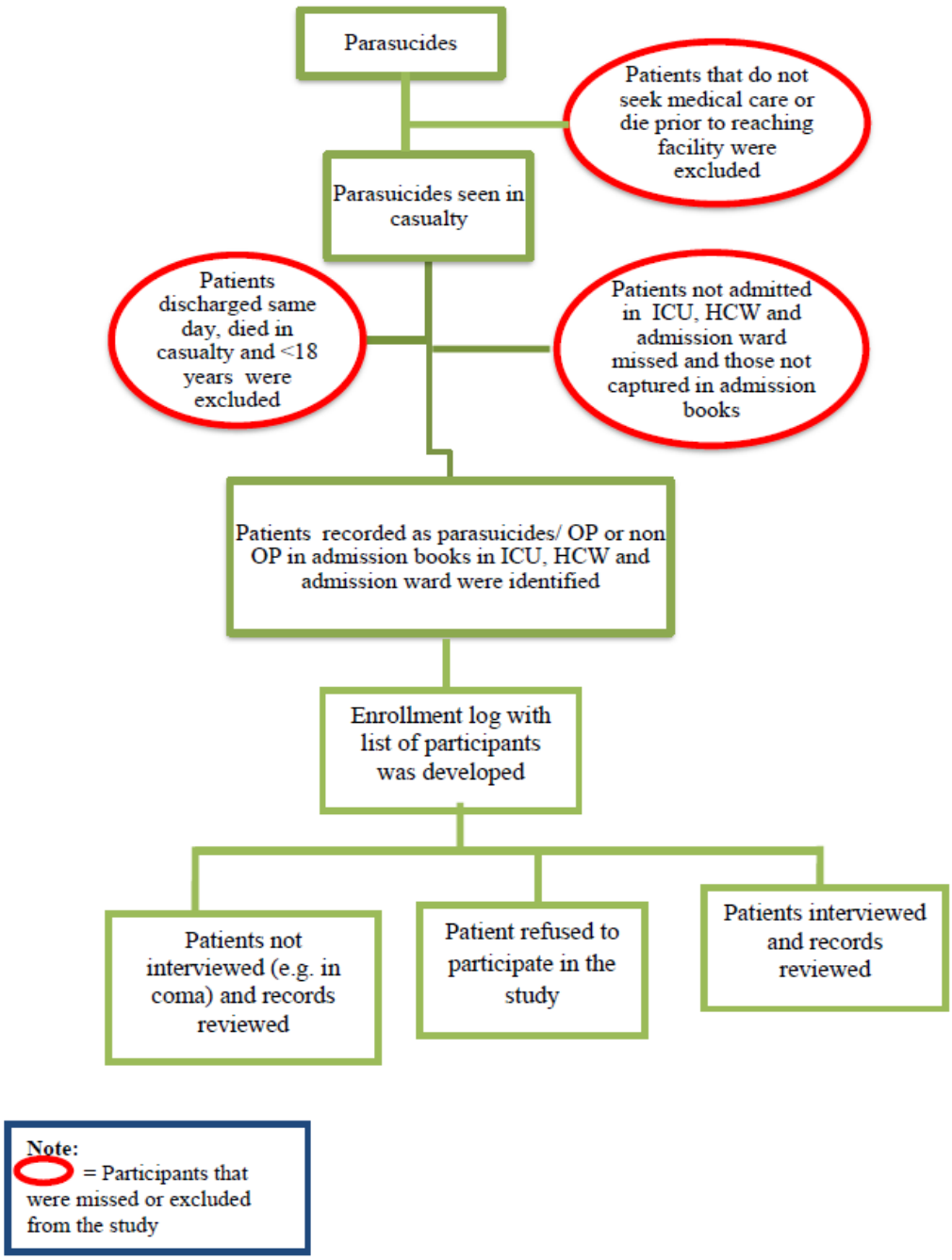


**Figure 3.2: Diagram showing the study population and the process of data collection**

## 3.5 DATA MANAGEMENT

### 3.5.1 Data Collection

Two research assistants were employed to assist with the data collection. The research assistants and the principal investigator identified patients admitted with intentional

poisoning in the admission books in the high care wards, intensive care units, and the medical wards. Once these patients were identified, they were visited in the wards. The interviewers had to check whether the patient was orientated to time, place and person prior to obtaining the informed consent. Thereafter, the patients were informed about the study and consent was obtained. The patients that gave consent were then interviewed. The data were collected during their hospital stay and discharge.

Data was collected using two methods:

- Face-to-face interviews with all those included in the study population
- Record reviews

(a) Face-to-face interviews

All patients/respondents were interviewed using a semi-structured questionnaire. Two research assistants were employed and trained on how to conduct face to face interviews and had to interview patients admitted with intentional poisoning at two hospitals (Sebokeng and Leratong Hospitals) of the three study sites. The research assistants were trained by the principal investigator to ensure that the questions in the questionnaire were understood and to minimize inter-observer variability. The principal investigator conducted the face to face interviews at the CHBAH.

A private room was used to conduct interviews to maintain privacy and confidentiality. The principal investigator and research assistants conducted face-to-face interviews using a semi-structured questionnaire with open ended and closed questions (Appendix C). The interviews were conducted during weekdays only. The research assistants and the principal investigator spent four months at their designated hospital conducting these interviews. The research assistants and the principal investigator were fluent in most of the local languages and interviews were conducted in mostly English or Zulu, depending on the study participants' preference. The face-to-face interviews took about 30 to 40 minutes.

(b) Record review

The principal investigator conducted the record reviews at the three study sites using the record review tool (Appendix D). The research assistants and the principal investigator kept a logbook of all patients identified with intentional poisoning or para-suicide using the admission books in the admission wards, ICUs and HCWs and their medical records were retrieved and the record reviews were conducted after the study participants were discharged.

Patients that were identified with intentional poisoning and were discharged prior to the face-to-face interviews were also recorded in the logbook and their records were included in the record review. Limited data were obtained from patients admitted with intentional poisoning in ICU or in a coma and died before the interview because of challenges in accessing these records in the facilities. These study participants were kept in the study population to look at certain demographic factors that were obtained from the admission books and association with the outcomes of interest (mortality and the duration of admission). Patients that were not interviewed and their records were missing were not excluded; certain information (sex, age, type of poison, total days of admission and outcome-dead or alive) that was on the admission books was utilized.

The table below shows the data collection tool used, the method of collecting the data for each of the study objectives.

**Table 3.2 Data source and collection tools**

| Objective | Source of Data | Data collection tool |
|---|---|---|
| 1. To describe the profiles of patients admitted to three hospitals in Gauteng with intentional organophosphate and non-organophosphate self-poisoning<br>i) To describe the socio-demographic profile of patients admitted to the three hospitals in Gauteng for intentional organophosphate poisoning and intentional non-organophosphate poisoning and determine whether there are any differences<br>ii) To describe the medical profile of patients admitted three hospitals and determine whether this influences the choice of substance used for intentional self-poisoning | In the hospital- the patient- face to face interview using a structured questionnaire<br>Record review using data collection tool | Appendix C<br><br>Appendix D |

| | | |
|---|---|---|
| 2. To determine which substances were taken by patients admitted to the hospitals with intentional self-poisoning and describe the source of these substances | In hospital-patient face to face interview using a structured questionnaire<br><br>The internet visits shops and vendors to obtain information about the organophosphate taken. | Appendix C-Poison exposure record section to help identify the substance and its source<br><br>Appendix E -Information sheet on pesticide/organophosphate for biohazard classification of pesticide |
| 3. To determine if there is any difference between the OP cases vs non-OP cases in terms of:<br>Profile of patients<br>Outcomes (Duration of hospital admission; Case fatality rate) | Record review using data collection tool | Appendix D |

### 3.5.2 Study Tools

Different tools were developed to ensure ethical conduct of the study and structured data collection process (Appendices):

- Appendix A: Information sheet for study participants
- Appendix B: Patient informed consent
- Appendix C: Patient questionnaire
- Appendix D: Record review tool
- Appendix E: Poison information sheet

The data collection tools were developed by reviewing the literature on factors associated with intentional poisoning and the choice of poison used and the outcome of patients with intentional self-poisoning.

- The face-to-face interview consisted of questions about socio-demographic factors, co-existing conditions, some behavioural issues and information about the poison ingested.
- The record review tool was designed to obtain information about their clinical features, the presence of co-morbid conditions and duration of admission and presumably the outcome.

A pretest of the data collection tools was conducted by the principal investigator at CHBAH prior to the commencement of the data collection process to ensure that the medical records and the information required is available. Patients who were admitted to CHBAH with

intentional poisoning were asked to participate in the pretest. Changes to the questionnaire were made based on the results of the pretest.

### 3.5.3 Study Variables

The variables for the study are listed in Table 3. 1.

**Table 3.1 List of Study variables**

| Variables | | Description | Type |
|---|---|---|---|
| **Objective 1:** To describe the profiles of patients admitted to three hospitals in Gauteng with intentional organophosphate and non-organophosphate self-poisoning<br>i) To describe the socio-demographic profile of patients admitted to the three hospitals in Gauteng for intentional organophosphate poisoning and intentional non-organophosphate poisoning<br>ii) To describe the medical profile of patients admitted three hospitals and determine whether this influences the choice of substance used for intentional self-poisoning | | | |
| Socio-demographic | Age | Age categories: 18-25years, 26-34 years,35- years and above 45 years | Categorical<br><br>Continuous |
| | Income | Monthly income categories: 0-R2000, R2000-R5000, R5000-R8000 and above R8000 annual {Daily income will be multiplied by the number of days the participant works in a month and weekly income will be multiplied by the number of weeks the participant works in a month} | categorical |
| | Sex | Male or Female | categorical |
| | Ethnicity | Black or White or Coloured or Indian | categorical |
| | Relationship status | Single / no partner or Never married / never living together or Living with partner /Married or Divorced<br>Or Widowed | categorical |
| | Education | Never been to school or Pre-primary school or Completed Primary school or Completed High school<br>Tertiary or Don't know | categorical |
| Clinical and substance use | Co-existing conditions | List medical conditions | categorical |
| | Medications | List medications | categorical |
| | Alcohol and recreational drugs | Yes or No | categorical |
| | | Four categories if the answer is yes: daily, weekly, monthly and less than monthly | categorical |
| | Tobacco | Yes or no | categorical |
| | | Smoking analysed in four categories: 1-10 per day, 11-20 per day, 21–30 per day and more than 30 per day and will calculate percentage per category, per group | categorical |
| **Objective 2:** To determine which substances were taken by patients admitted to the hospitals with intentional self-poisoning and describe the source of these substances | | | |
| Substance | Substance is taken | Organophosphate and non- organophosphate | categorical |

| | | | |
|---|---|---|---|
| | Substance taken is OP | Each organophosphate will be classified into class 1, 2, 3 or 4 Biohazard classification WHO classification (Class 1, 2, 3 and 4) (33) | categorical |
| Source | Source of substances | type of shop, already in the house, from a friend | categorical |
| Use | Use of substance | Pesticide, domestic chemical agents, medication, etc. | categorical |
| cost | Cost of substance | Prices will be put into categories | categorical |
| Labelling | Labeling of toxic effects on containers | Yes or no | categorical |
| Registr-ation | Registered for use in South Africa | Yes or no | categorical |
| **Objective 3**: To determine if there is any difference between the OP cases vs non-OP cases in terms of (a) Profile of patients (b) Outcomes (Duration of hospital admission; Case fatality rate) | | | |
| Outcome | Duration of hospital stay | Length of stay per patient, per group and per ward, ICU, HCW<br>Length of stay categorised using the mean or median into two groups | continuous<br><br>categorical |
| | Final outcome | Dead or Alive | categorical |

### 3.5.4 Data Capturing

All the data obtained from the interviews and record reviews were entered into Epi-info (Version 3.5.1) by two data capturers. The data capturers were trained by the principal investigator on how to capture data in Epi-info. Single data entry was done and the principal investigator randomly selected one hundred questionnaires and checked if the data entry was correct. The principal investigator compared the captured data to the information in the completed data tools. Data cleaning for all fields was conducted by looking at data ranges and outliers.

### 3.5.5 Data Analysis

The statistical analysis software used for analysis was Stata release 12.0 (StatCorp LP), for Microsoft Windows. (88). The data analysis involved both descriptive and analytical statistics:

The following descriptive statistical tests were used:

- Categorical variables (such as ethnicity): Proportions and percentages.
- Continuous variables with the normal distribution (such as the number of days): mean and standard deviation and range (minimum and maximum)
- Continuous variables without normal distribution: median and interquartile range and range (minimum and maximum).

All continuous variables were tested for the assumption of normality using histograms, normal quintile plots and standardised normal probability plots. Normally distributed continuous variables were summarized in terms of mean and standard deviation. Categorical variables were described using frequency tables.

The study participants were divided into two groups based on the substances that they ingested:

(a) Group 1. Those patients that ingested OP only; and

(b) Group 2. Those that did not take any OP

The study participants that had ingested an unknown substance were reclassified into one of the two groups based on their clinical features and the final diagnosis made by the specialist based on their clinical signs, symptoms and laboratory investigations.

The following analytical statistical tests were used:

- Categorical (such as ethnicity): Chi-square test.
- Continuous variables with the normal distribution (such as age): t-test and ANOVA
- Continuous variables without normal distribution: Mann Whitney's U test

The significance of the statistics was calculated at 95% confidence levels.

Chi square test was used to test for statistical differences in categorical variables in the socio-demographic profile, health outcomes and length of hospital stay of patients admitted with OP and non OP. The Kruskal Wallis equality of populations rank test was used for non-normal distributed data.

To identify factors (age, sex, co-morbid conditions, and medications, type of poison ingested, no. of days in hospital and alcohol and recreational drug use) associated with in-hospital outcome (dead or alive), a logistic regression model was used and a linear regression model

was used to identify factors associated with the duration of admission. The association was quantified using adjusted odds ratios and confidence intervals.

## 3.6 ETHICAL CONSIDERATIONS

The University of the Witwatersrand Human Research Ethics Committee (WHREC) approved to conduct of this study (see Appendix F). The hospital management teams granted permission for the conduct of the study in their respective hospitals.

Respect for Autonomy

Each participant was informed of the study and given an information sheet. The information sheets were written in English and these were verbally translated into the local languages by the principal investigator and the research assistants depending on the participant's preference. The consent forms were given to the study participants who agreed to the face-to-face interviews. The face-to-face interviews were conducted in a private room in the ward to maintain privacy. The study participants were made aware that they are free to withdraw from the study at any time, without giving a reason.

The researchers assured the anonymity of the participants by using study numbers on the questionnaire. The records with the study participants' names, patient folder number, were kept separate from the consent forms and questionnaire in a locked cabinet to ensure confidentiality and these (records with patient's identity details) were discarded after completion of the data collection. Access to data was limited to the principal investigator only.

Data capturers captured the data in laptops that were password protected and then the data was combined and kept in one desktop which was password protected and only the principal investigator has access to it.

Non-maleficence

No physical harm could arise from participating in the study. The research assistants were social workers and participants were informed that they would be available if any

psychological discomfort arises from the interviews. The study participants were given an opportunity to ask any questions or concerns about the study or participating in the study.

# CHAPTER FOUR
# RESULTS

This chapter outlines the main results of the study. Demographic characteristics of the study population are presented, followed by an exploration of associations between type of poison and duration of admission and fatality.

## 4.1 STUDY PARTICIPANTS

### 4.1.1 Distribution of Study Participants

Six hundred and forty-eight participants were recruited into the study from the three study sites (Chris Hani Baragwanath Academic Hospital, Leratong Hospital, and Sebokeng Hospital). Thirty nine percent were from CHBAH, 38% were from Leratong Hospital and 23% were from Sebokeng Hospital, illustrated in figure 4.1 below.

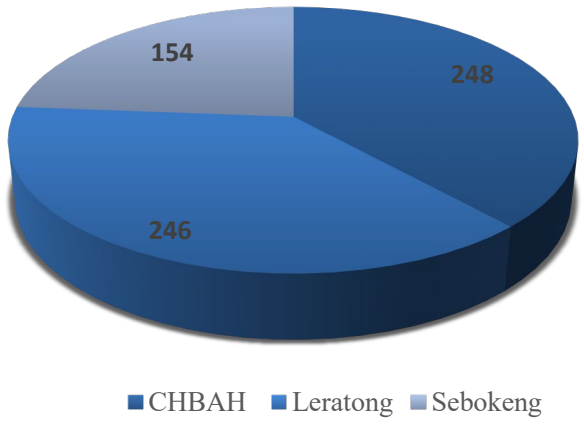


**Figure 4.1: Study participants recruited from the study sites**

The study participants from all the study sites were categorised according to the type of poison they had ingested. The ingested substance was not known in thirty three patients and based on clinical features and final diagnosis by discharging medical doctor documented in the available medical record, these were re-classified into either the OP and Non-OP group.

Fifty-nine percent (n=382) of the study participants had ingested non –OP and forty one percent (n=266) had ingested OP.

## 4.2 TYPE OF POISON TAKEN

Figure 4.2 below illustrates the proportion of study participants according to the type of poison they had ingested from each of the three study sites.

- 54% admitted at CHBAH had taken OP,
- 26% admitted at Leratong Hospital had taken OP and
- 45% admitted at Sebokeng Hospital had taken OP.

There was a statistically significant difference in the type of poison used for intentional harm across the three hospitals (Chi square test; p<0.001). The participants at Leratong Hospital were less likely to take OP poisoning compared to non-OP (P<0.0001; 95% CI 0.200-0.428).

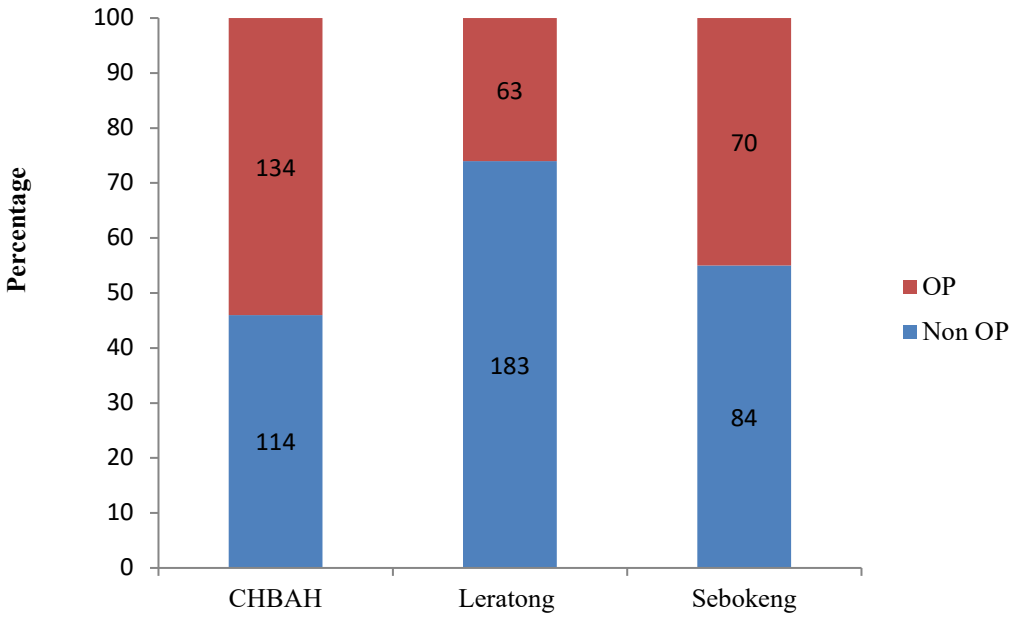


**Figure 4.2 Type of poison ingested**

Further analysis that was conducted compared those that ingested OP to those that ingested non-OP and the findings are presented in this report.

The study population changed depending on the analysis being conducted because of missing information, not all participants were interviewed, and this is illustrated in Figure 4.3.

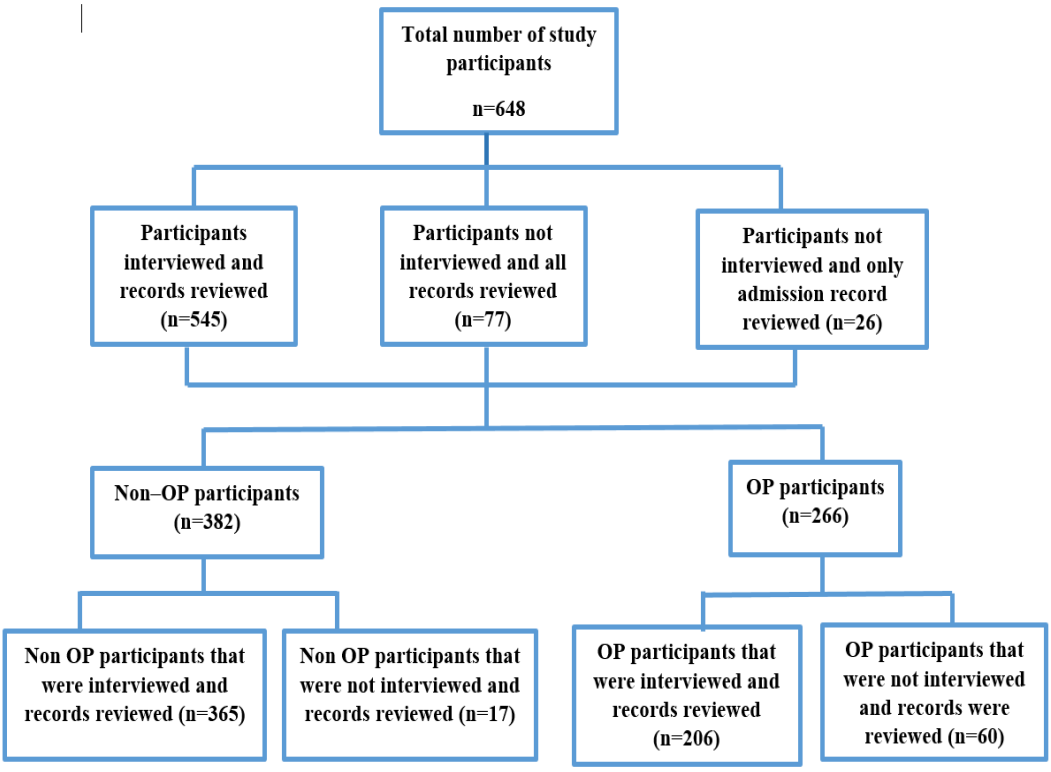


**Figure 4.3: Flow diagram showing study participants and the availability of information**

## 4.3 PROFILES OF STUDY PARTICIPANTS

### 4.3.1 Basic Socio-Demographic Characteristics

#### 4.3.1.1 Age

The age distribution was right skewed and platykurtic, illustrated in Figure 4.5. The median age of the study participants was 26 years and the interquartile range (IQR) was from 18 to 63 years. The ages of the study participants ranged from 18 to 70 years.

- The group that ingested an OP had a median age of 27 years (IQR: 18-63) and
- The group that took a Non-OP had a median age of 25 years (IQR: 18-57).

There was a statistically significant difference in age and the type of poison ingested (Kruskal-Wallis test, p=0.0008). For every unit increase in age, there are higher odds of participants taking OP for intentional self-poisoning (p=0.001; 95% CI 1.012-1.045).

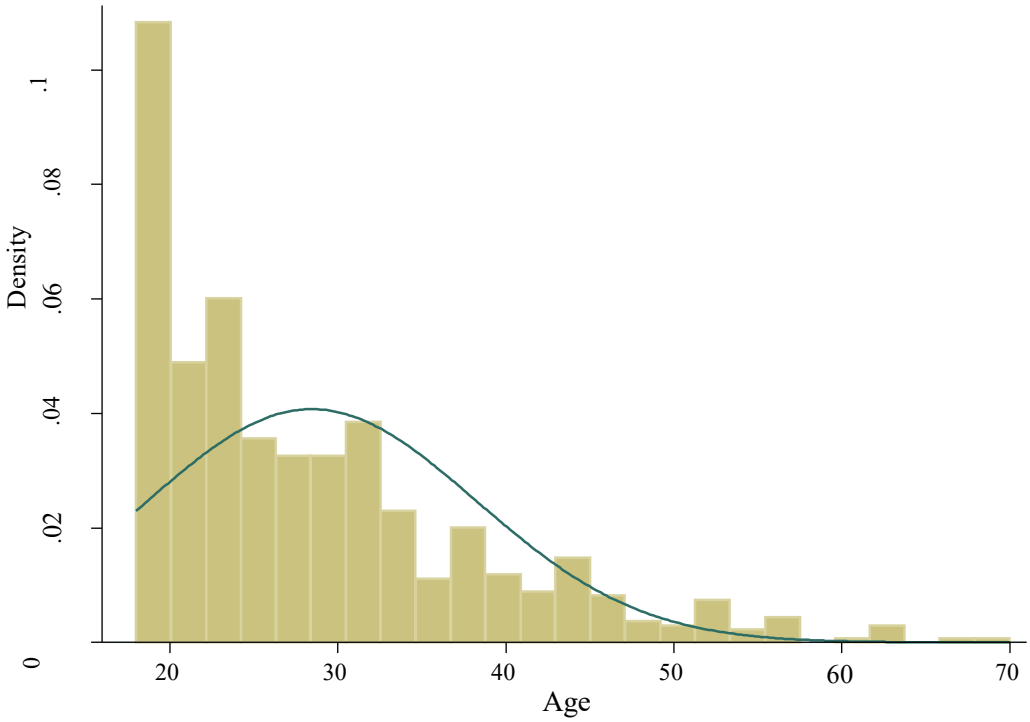


**Figure 4.4 Age distribution of the study population**

Age was categorised into the following strata: 18-25; 26-34; 35-45 and 46 years and above.

- A significant number (312, 48.15%) of the study participant were in the 18 to 25 years age category. Within this age category, fifty two percent (198) of the participant ingested non-OP.
- The participants within the 26 to 34 years category were 200 (30.9%) and the majority (118, 59%) of these participants had ingested non-OP.
- The participants within the 35 to 45 category were 90 (13.9%) and
- In the 46 to 70 years were 46 (7.1%) of the study population.

It was noted that the use of OP as the agent of choice for intentional poisoning increased with age. There was a statistically significant difference found in the age categories and the type of poison ingested (Chi square test; p =0.030). The 35-45 year age group were 1.7 times more likely to take OP than the 18-25 age group (OR=1.736; 95% CI 1.08-2.78). The 46-70 year age group were twice more likely to take OP than the 18-25age group (OR = 2.067; 95% CI 1.10-3.86).

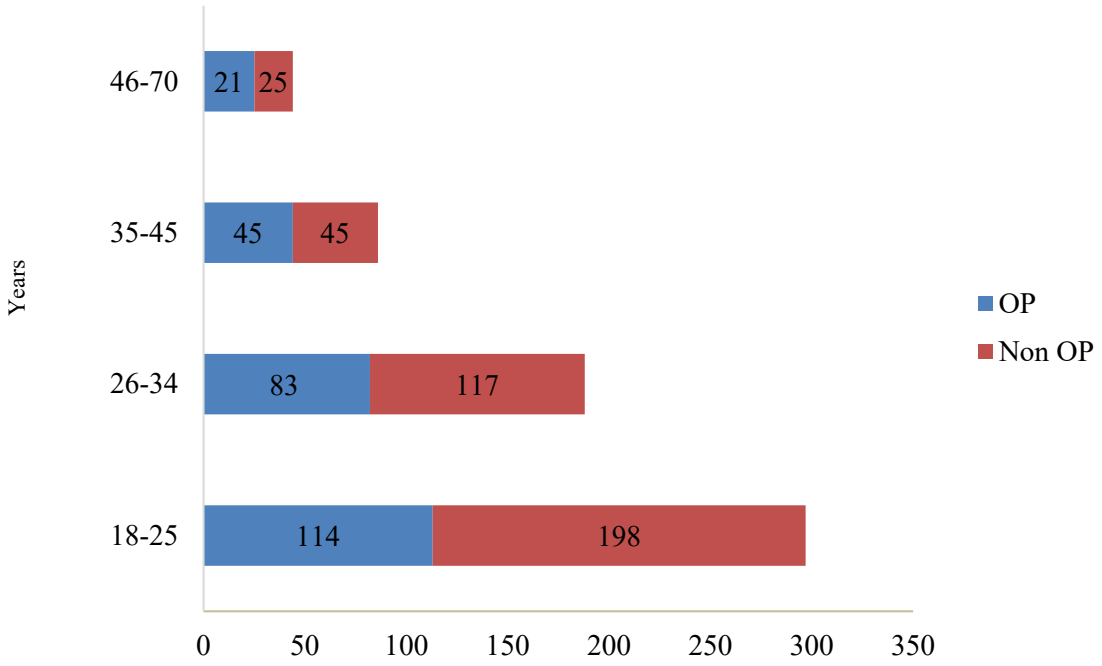


**Figure 4.5 Age categories and type of poison used for intentional poisoning**

Looking at the different age groups and the admitting hospitals, the 18 to 25 year old age group was still the predominant age group admitted for intentional self-poisoning across the three study sites as shown in Figure 4.6 below. There was no statistically significant difference found in the age categories and the admitting hospital, Chi square test, p=0,156.

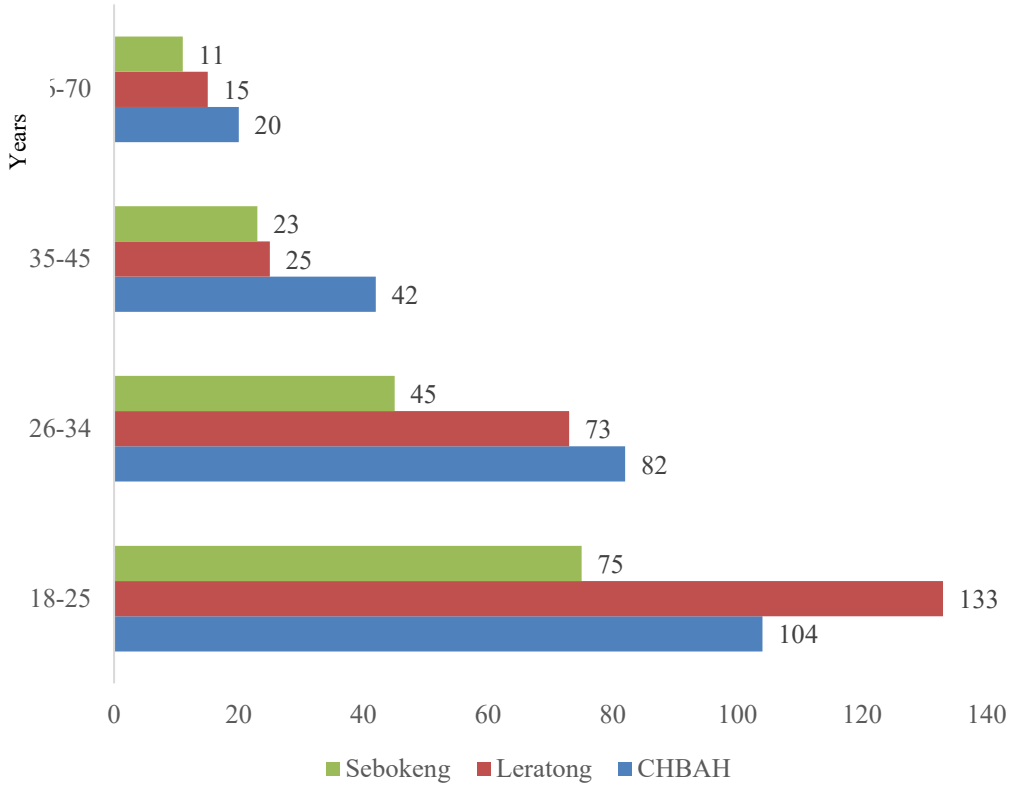


**Figure 4.6 Age categories of participants admitted at the three study sites**

#### 4.3.1.2 Ethnicity

The study population was predominantly black, 599 (92.4%) and all other ethnic group constituted 7.6% (49) There were 31 coloureds, 17 whites and 1 Indian in the other category. The majority (39/49; 80%) of the other ethnic groups used Non-OP for intentional poisoning which was similar to the blacks (343/599; 57%). There was a statically significant difference in ethnicity and the admitting hospital (Chi square test; p=0.042) There was also a statistically significant difference in ethnicity and the type of poison ingested (Chi square test; p =0.002). Black participants were approximately three times more likely to take OP than the other ethnic group (OR =2.91; 95% CI 1.42-5.94).

#### 4.3.1.3 Sex

The study population was comprised of 399 (61.6%) females and 249 (38.4%) males. Of the participants that took OP; 51.1% (136) were males and 48.9% (130) were females. Looking at the sex of participants admitted across the three-study site, females were the predominant sex admitted with intentional poisoning across the three hospitals. The majority of the participants that had ingested a Non-OP substance were female (70.42 %; 269) and males were only 29.58% (113). There was a statistically significant difference in sex and the type of poison ingested (Chi square test; $p<0.001$). Females were less likely to take OP than males (OR=0.401, 95% CI 0.289-0.556).

Further analysis was done to look at the gender distribution of participants according to the different age categories; this is represented in figure 4.8 below. Females were still the predominant sex in the different age categories except for the 46 to 70 year old age group, where females were more than males by merely 2%. Looking at the graph below it seems that there was an increasing trend of males intentional self-poisoning as their age increased and the inverse in females. An analysis of age as a continuous variable was done, the median age for male participants is 29years and IQR (18-56years) and for females, the median age is 24 and IQR (18-62years).

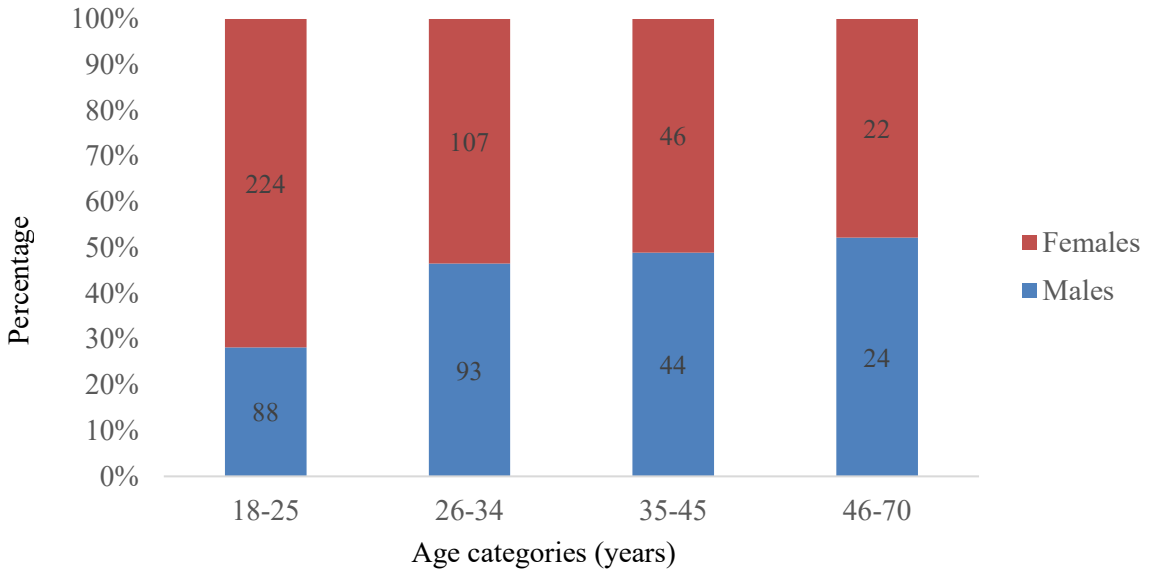


**Figure 4.7. The distribution of gender of the study participants by different age categories**

#### 4.3.1.4 Relationship Status

Information on relationship status was available on 553 study participants. Three categories (single/no partner; never married/never living together; married/living with a partner; divorced/widowed/separated) for the marital status were initially created. The available information on marital status showed that 281(50.81%) of the study population were single with no partner, 129(23.33%) were living with their partner or married, 18(3.25%) were divorced or separated or widowed and lastly 125(22.60%) have a partner and were not living together. This variable was re-categorised into two categories because of a very small sample of divorced, widowed, or separated group, namely:

- Those in a relationship (have a partner and not living together, married and those in a relationship and living together were combined): 46% (254/553)
- Those that were not in a relationship (single/no partner and widowed/ separated/divorced were combined): 54% (299/553).

There was a statistically significant difference between relationship status and the type of poison used for intentional poisoning (Chi square test; $p < 0.0001$), a similar observation was noted when looking at the three sites (Chi square test; $p<0.0001$). Those that were not in a relationship were less likely to take OP than those that were in a relationship (OR= 0.512, 95% CI 0.360-0.726).

#### 4.3.1.5 Education

Information on education was available for 553 study participants. Initially, there were seven categories in the level of education (Never been to school, less than primary school, completed primary school, completed secondary school, completed high school, tertiary and those that don't know). All (553) study participants knew their level of education, figure 4.8.

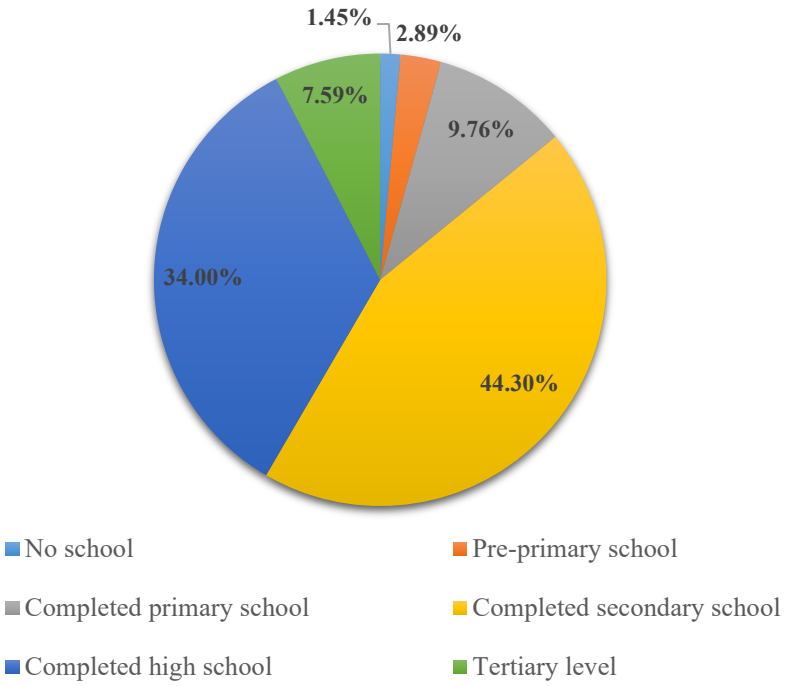


**Figure 4.8 Level of education of study participants**

There were very few participants in some of these categories so the level of education was re-categorised into three groups, namely:

- Not completed high school: this combined no school, pre-primary school, completed primary school and completed secondary school categories: 58%(323/553)
- Completed high school (this category was not changed): 34% (188/553)
- Tertiary level education (this category was not changed): 8%(42/553).

There was no statistically significant difference between the level of education and the type of poison used for intentional poisoning (Chi square test, p=0.251).

#### 4.3.1.6 Income

Information on income was available for 614 of the study participants. Most (469/614, 76%) of the study participants had no income and only 24%(145/614) had an income. The participants that had an income, the majority (74) were doing unskilled labour; figure 4.10 below demonstrates the other categories of income generation within this group.

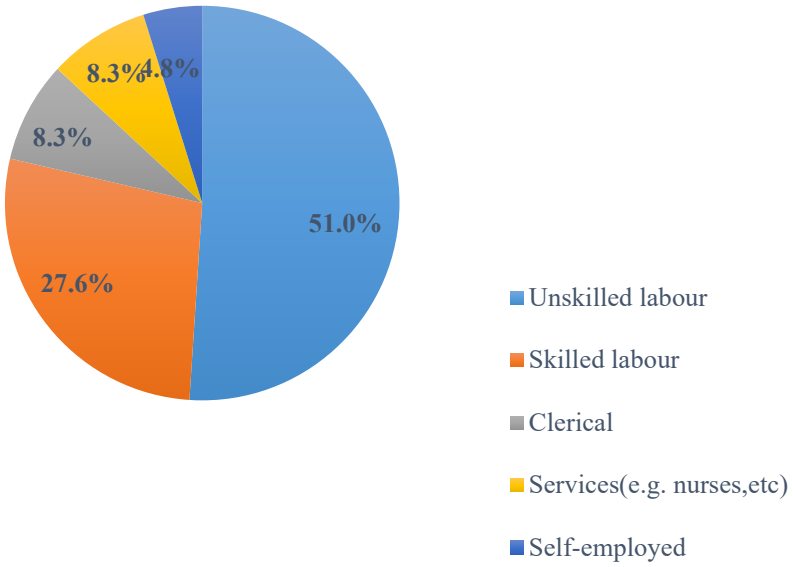


**Figure 4.9 Different income-generating groups within the study population**

The amount of income earned by the study participants ranged from R500 to R 19 000. There was no statistically significant association between having an income and the type of poison used for intentional poisoning (Chi square test, p=0.22).

### 4.3.2 Substance Use

Information on lifestyle factors of study participants was available for 572 participants. Table 4.1 shows the lifestyle risk factor profile of the study population stratified by the type of poison ingested.

**Table 4.1: Presence of lifestyle risk factors for intentional poisoning**

| Variables | | Total N= 648 | Non OP N = 382 | OP N=266 | P value |
|---|---|---|---|---|---|
| **Alcohol consumption** | No | 325 | 222 (58.12) | 103 (38.72) | *0.004 |
| | Yes | 247 | 140 (36.65) | 107 (40.23) | |
| | Missing | 76 | 20 (5.24) | 56 (21.05) | |
| **Smoking** | No | 424 | 269 (70.42) | 155 (58.27) | 0.90 |
| | Yes | 148 | 93 (24.34) | 55 (20.68) | |
| | Missing | 76 | 20 (5.24) | 56 (21.05) | |
| **Recreational drug use** | No | 546 | 348 (91.10) | 198 (74.44) | 0.31 |
| | Yes | 26 | 14(3.66) | 12 (4.51) | |
| | Missing | 76 | 20(5.24) | 56 (20.05) | |

*P-value significant at <0.05

Fifty-three percent (247/572) of the study participants consumed alcohol.

- Most (104, 42%) of these participants consumed alcohol on a monthly basis,
- 15% (37) consumed it less than once a month but less than weekly,
- 36% (89) consumed it weekly and
- 6% (14) consumed it on a daily basis and
- 1% (3) didn't know their frequency of alcohol consumption.

There was a statistically significant difference between consuming alcohol and the choice of poison used for intentional poisoning (Chi square test, p <0.004). The participants that consumed alcohol had 1.6 times higher odds of taking OP than the ones that did not consume alcohol (OR=1.64; 95% CI 1.168-2.322).

Twenty-six (148/572) percent of the study population smoked and 85% (124/148) smoked on a daily basis. There was no statistically significant difference between smoking and the type of poison used for intentional poisoning (Chi square test, p=0.895).

Approximately five percent (26/572) of the study participants reported recreational drug use. Most (14/26; 54%) of these participants reported using reported recreational drug use on a monthly basis. Similarly, there was no statistically significant difference between those that reported the use of any recreational drug and the poison used for intentional poisoning (Chi square test, p=0.31).

### 4.3.3 Presence of Co-Existing Medical Illness

The information on the presence of other medical illness was available on 613 participants. Twenty-eight percent (176/613) study participants had a co-existing medical condition. Figure 4.10 shows the prevalence of other medical conditions in the study population by the type of poison used for intentional poisoning. There was a statistically significant difference between those that had other medical and the type of poison ingested (Chi square test, p=0.033). The study participants that had other medical conditions had 0.6 times fewer odds of taking OP than those that did not have any medical condition (OR=0.671; 95% CI 0.464-0.970).

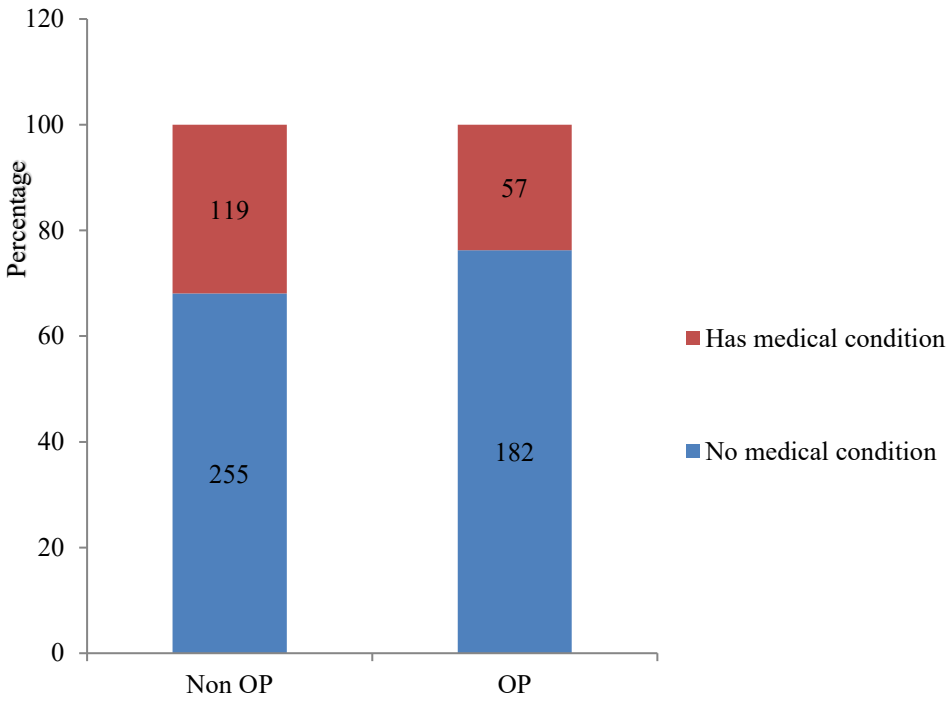


**Figure 4.10 Medical condition by type of poison used for intention harm**

Figure 4.11 demonstrates the different medical conditions prevalent in the study population.

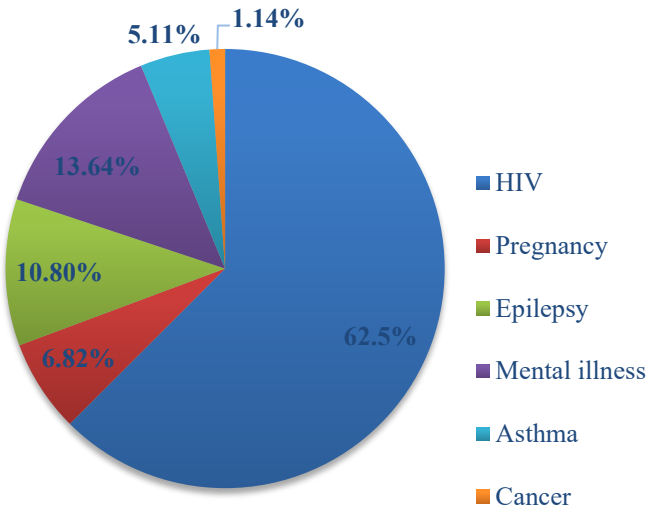


**Figure 4.11 Different medical conditions present in the study population**

Most, sixty-four percent (110/176) of these participants had the human immunodeficiency virus (HIV). Only seventy-one percent (117/164) of those that require treatment were on medication. There was a statistically significant difference between participants that were on medication and those that were not and the type of poison ingested (Chi square test, $p<0.0001$). Participants that were on medication had fewer odds of taking OP than those that were not on medication (OR=0.408; 95% CI 0.259-0.643)

### 4.3.4 Factors Influencing the Type of Poison Ingested

Table 4.2 represents the factors that were significantly associated with the type of poison chosen for intentional poisoning after conducting the bivariate analysis using the appropriate test ($p<0.1$). These factors were age, ethnicity, sex, marital status, alcohol use, medical condition and being on medication. All of these variables were included in the multivariate model investigating factors associated with the type of poison used for intentional poisoning.

The multivariate model revealed five independent factors that were significantly associated with the type of poison used for intentional self-poisoning. Age, sex, ethnicity, relationship status, being on any medication were all significantly associated with taking the type of poison taken for intentional harm ($p<0.05$).

- As the age of participant increased by one unit, the odds of taking OP was one times higher (OR=1.025; 95% CI 1.002-1.047).
- Females had less odds of taking OP compared to males (OR=0.494; 95% CI 0.328-0.742).
- Black participants had three times higher odds of taking OP compared to participants of other ethnic group (OR=2.927; 95% CI 1.245-6.881).
- Participants that were not in a relationship had less odds of taking OP than those that were in a relationship (OR= 0.548; 95% CI 0.374-0.804).
- Participants that were on medication for any illness had less odds of taking OP than those that were not on any medication.

A second model with age in categories was conducted; the model had similar findings as the previous model, however, age was no longer statistically significant.

A third logistic regression model that included the level of education was created and this variable was not important for the model (p=0.70). This showed that the first model without the level of education had the best overall fit.

The final model had a good fit (p=0.420) and the area under the ROC of 0.686 was good implying that this model could predict the type of poison used for intentional poisoning for the study population.

**Table 4.2 Multivariate analysis of patient factors identified to predict the type of poison chosen for poisoning.**

| Factors | | | Adjusted Odds ratio | 95% CI | P - value |
|---|---|---|---|---|---|
| **Socio-demographic** | Age | | 1.025 | 1.002-1.047 | 0.032* |
| | Sex | Male | 1 | | 0.001* |
| | | Female | 0.494 | 0.328-0.742 | |
| | Ethnicity | Other | 1 | | 0.014* |
| | | Black | 2.927 | 1.245-6.881 | |
| | Relationship status | In a relationship | 1 | | 0.002* |
| | | Not in a relationship | 0.549 | 0.375-0.804 | |
| **Lifestyle factors** | Alcohol use | No | 1 | | 0.232 |
| | | Yes | 1.279 | 0.854-1.917 | |
| **Medical factors** | Medical condition | No | 1 | | 0.808 |
| | | Yes | 1.079 | 0.585-1.988 | |
| | Use of medication | No | 1 | | 0.010* |
| | | Yes | 0.388 | 0.189-0.767 | |

∗ P-value significant at <0.05

## 4.4 POISON INFORMATION

As reported earlier, the study population had 382 (59%) participants that had taken non-OP and 266(41%) participants that had taken OP.

### 4.4.1 Different Substances Taken For Poisoning

Information on the number of different substances used for intentional harm was available for 636 study participants. The majority (460, 72%) of these study participants had taken one substance for intentional poisoning and the rest had taken more than one substance, this is illustrated in the diagram below (figure 4.12). There was a statistically significant difference in the type of poison used for intentional poisoning and the number of substances taken (Fischer's exact test, $p<0.001$). The participants that had taken OP had less odds of taking two or three and a greater number of substances compared to those that had taken non-OP, (2 substances-OR=0.426; 95% CI 0.153-0.118) (3 and more substances-OR=0.336; 95% CI 0.121-0.929)

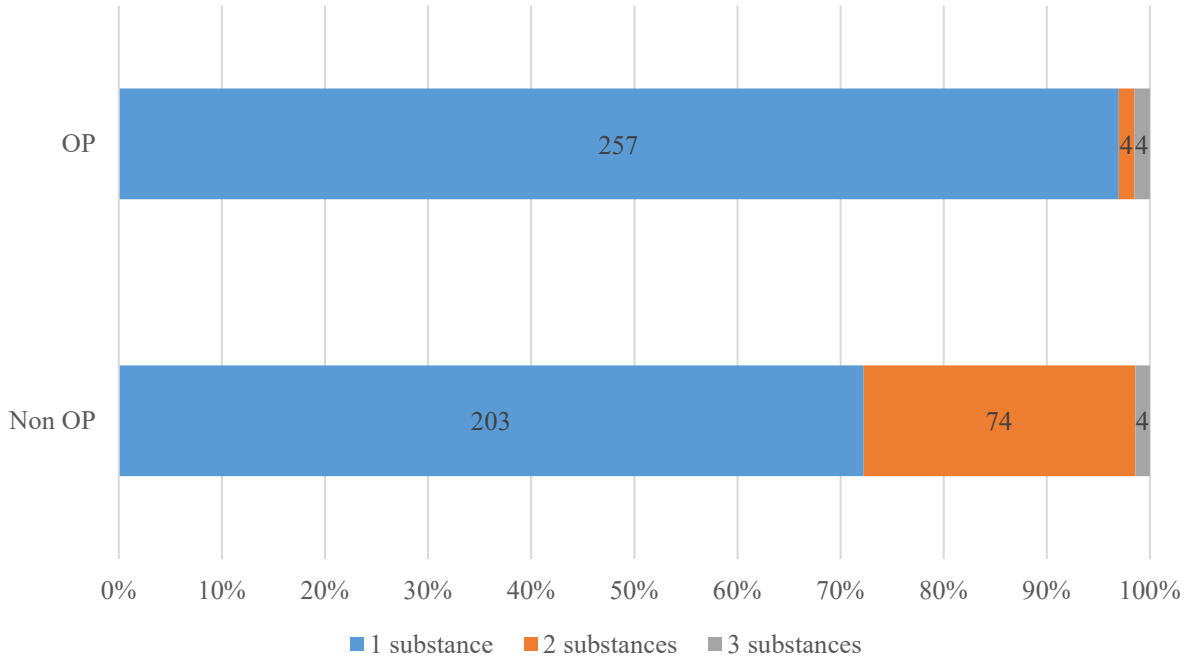


**Figure 4.12 Number of different poisons taken by the study participants**

### 4.4.2 Source of Poison Taken

Approximately fifteen percent (95) of the study population did not know the name of the substance and could not describe. Information on the source of the substance used for intentional poisoning was available on 545 study participants, they mentioned five sources of the substances used for intentional poisoning, and these were:

- friend,
- home,
- prescription,
- shop and
- street vendor.

Most (262/545; 48%) of the poisonous substances used by the participants for intentional poisoning were obtained from their own homes; (120/545; 22%) obtained substances from street vendors; (128/545; 23%) used own prescription and very few (35/545; 6%) study participants obtained the poison from the shops and friends.

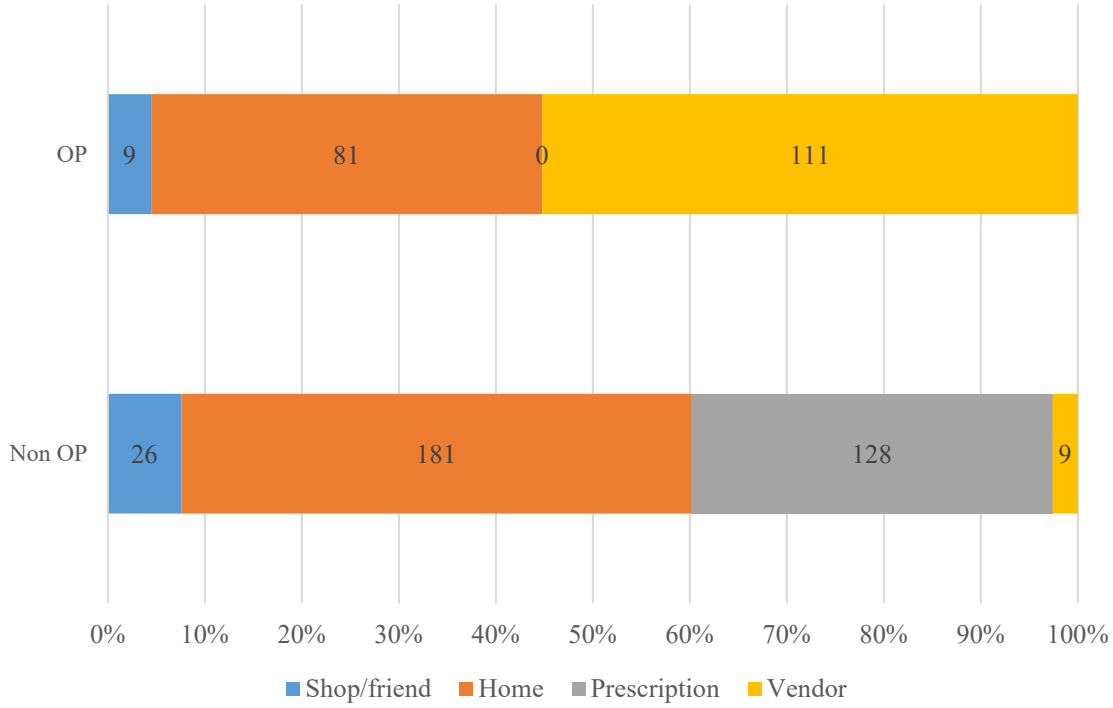


**Figure 4.13 Source of poisons taken for intentional poisoning**

More than half (55%, 111/201) of the participants that had taken OP obtained the substance from street vendors. Fifty two percent (181/344) of the Non-OP group obtained their substance from home and a significant number (128, 37.2%) used prescribed medication. There was a statistically significant difference between the source of poison and the type of poison used for intentional harm (Fischer's exact test, $p<0.001$). The participants that had obtained their poison from a street vendor were 36 times more likely to be using OP for poisoning than the ones that had obtained the poison from a friend/shop (OR=35.629; 95% CI 12.875-98.595).

### 4.4.3 Use and Cost of Substance Taken

The participants (545) that were interviewed raised multiple reasons for getting or purchasing the substance used for poisoning, illustrated in the diagram below. It is worth noting that 17% (91) of the study participants knew that the substance could be used to end life. Of these, 79 (81%) had taken OP.

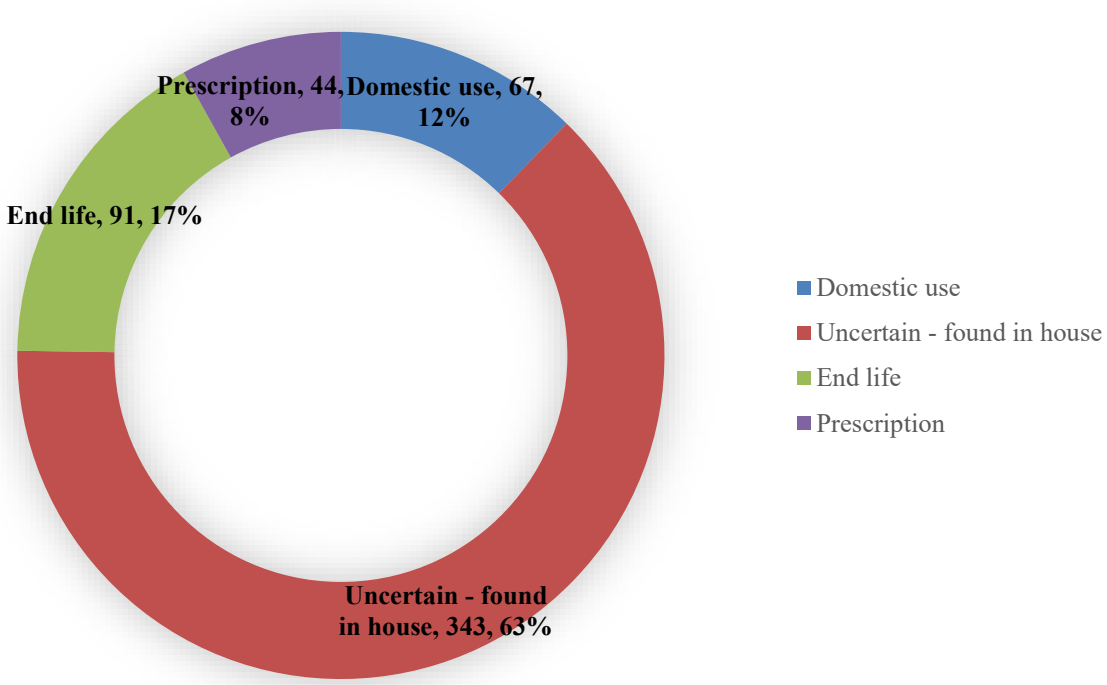


**Figure 4.14 Use of substances used for poisoning**

Three categories of the cost of substance taken for intentional self-poisoning were created:

- 0= Free
- 1=five rand to twenty rand
- 2=twenty one rand and above

Only 268/648 (41%) had information on the price of the substance used for intentional self-poisoning. Most (99) of the study part that took non-OP did not pay anything to get the substance and most (119) that took OP had paid between five rands and twenty rands. There was a statistically significant difference between the price paid for the substance used for poisoning and choice of poison, Fischer exact test, $p<0.001$. The participants that paid between R5 and R20 for their substance had 47 times higher odds of using OP for poisoning than the participants that had obtained substance used for poisoning free.

### 4.4.4 DESCRIPTION OF OP SUBSTANCE TAKEN

The OP participants that were interviewed in all study sites described the pesticide as grey/black granules that were sold to them in a clear plastic bag without any description of hazards related to the use of the substance (Figure 4.15). The study participants referred to the substance as "*Halipirimi*" meaning poison. No other name could be obtained from the study participants.

**Figure 4.15 Image of pesticide obtained from a street vendor**

The principal investigator purchased the substance from the street vendor for R5 and had an informal discussion with the vendor. He claimed that he was purchasing the material from Zimbabwe (Figure 4.15). The package had no label, WHO classification of the substance is unknown. An article published in 2010 by Rother (25) was used to obtain more information on the substance. The substance is most likely Aldicarb. According to the WHO Acute toxicity classification of pesticides, Aldicarb is a carbamate that is extremely hazardous, Class 1a and has neurotoxic, reproductive toxic, developmental toxic, cancerous and dermatotoxic and has been banned in the European Union. This substance is a cholinesterase inhibitor and patients presenting with Aldicarb poisoning present with a similar clinical picture as someone with organophosphate poisoning. The medical management of organophosphate poisoning and carbamate is the same.

## 4.5 OUTCOMES

Two outcomes of interest were evaluated in the study:

- Length of stay in hospital;
- Mortality (Dead or Alive)

### 4.5.1 DURATION OF ADMISSION AFTER INTENTIONAL POISONING

#### 4.5.1.1 INITIAL ADMITTING WARD

The study participants were admitted in three different types of wards depending on their clinical picture at the different study sites. They were admitted either in ICUs, or HCWs or in normal wards. The participants that were admitted in ICUs or HCWs were transferred to normal wards when their clinical condition had improved. Based on the information, two categories of a ward of admission were created:

- Direct to a normal ward
- Direct to ICU/HCW thereafter transfer normal ward

Sixty-nine percent (447) were admitted directly to normal wards after being managed in casualty and 31% (201) were admitted to HCWs or ICUs. On bivariate analysis, (Table 4.3) multiple variables were significantly associated with the type of ward of admission, namely:

- Type of poison
- Age
- Sex
- Use of medication
- Relationship status

- Participants between the ages of 35 to 45 were twice more likely to be admitted in HCW/ICU than participants between 18 to 25years of age (OR=2.180, 95% CI 1.339-3.551). When evaluating age as a continuous variable on the bivariate analysis, a unit increase in age is significantly associated with admission at HCW/ICU than the normal ward (OR=1.030, 95% CI 1.013-1.047).
- There was a statistically significant difference in the type of admission ward and the substance taken for poisoning, Chi square test, $p<0.001$. Those that were admitted in HCW/ICU had 6 times higher odds of having taken OP compared to those admitted in the

normal ward (OR=6.494; 95% CI 4.490-9.393). Participants that were on any medication for an illness were less likely to be admitted in ICU/HCW than the participants that were not on medication (OR=0.371, 95% CI 0.220-0.627).

- Females were less likely to be admitted in HCW/ICU than males (OR=0.680, 95% CI 0.485-0.955).
- Participants that were not in a relationship were less likely to be admitted in ICU/HCW than those that were in a relationship (OR=0.294, 95% CI 0.191-0.452).

**Table 4.3: Factors associated with the type of admission wards**

| Variables | | Total n= 648 | Normal ward n=(447) | Intensive /High care unit (n=201) | P value |
|---|---|---|---|---|---|
| Type of poison | Non OP | 382 (58.95%) | 324(72.48%) | 58(28.86%) | 0.000* |
| | OP | 266(41.05%) | 123(27.52%) | 143(71.14%) | |
| #Age | | 26(18-63) | 25(18-65) | 27(18-56) | 0.0007* |
| Age categories | 18-25 years | 312 (48.15%) | 231(51.68%) | 81(40.30%) | 0.006* |
| | 26-34 years | 200(30.86) | 138(30.87%) | 62(30.85%) | |
| | 35-45 years | 90(13.89%) | 51(11.41%) | 39(19.40%) | |
| | 45 years and above | 46(7.10%) | 27(6.04%) | 19(9.45%) | |
| Sex | Male | 249(38.43%) | 159(35.57%) | 90(44.78%) | 0.026* |
| | Female | 399(61.57%) | 288(64.43%) | 111(55.22%) | |
| Ethnicity | Other | 49(7.56%) | 31(6.94%) | 18(8.96%) | 0.368 |
| | Black | 599(92.44%) | 416(93.06%) | 599(92.44%) | |
| Income | No | 469(76.38%) | 341(76.29%) | 128(76.65%) | 0.925 |
| | Yes | 145(23.62%) | 106(23.71%) | 39(23.35%) | |
| Use of medication | No | 531(81.94%) | 349(78.08%) | 182(90.55) | 0.000* |
| | Yes | 117(18.06%) | 98(21.92%) | 19(9.45%) | |
| Relationship status | In a relationship | 254(45.93%) | 170(39.44%) | 84(68.85%) | 0.000* |
| | Not in a relationship | 299(54.07%) | 261(60.56%) | 38(31.15%) | |
| Level of education | Not completed high school | 323(58.41%) | 257(59.63%) | 66(54.10%) | 0.228 |
| | Completed high school | 188(34.00%) | 139(32.25%) | 49(40.16%) | |
| | Higher education | 42(7.59%) | 35(8.12%) | 7(5.74%) | |
| Alcohol use | No | 325(56.82%) | 263(58.84%) | 62(49.60%) | 0.065 |
| | Yes | 247(43.18%) | 184($1.16%) | 63(50.40%) | |
| Smoking | No | 424(74.13%) | 324(72.48%) | 100(80%) | 0.090 |
| | Yes | 148(25.87%) | 123(27.52%) | 25(20%) | |
| Drug use | No | 546(95.45%) | 430(96.20%) | 116(92.80%) | 0.107 |
| | Yes | 26(4.55%) | 17(3.80%) | 9(7.20%) | |

∗ P-value significant at <0.05

All the independent variables that were statistically significant on the bivariate analysis were included in the multivariate analysis. The type of poison and the relationship status were significant predictors of initial admission ward. Participants that had taken OP/pesticide were five times more likely to be admitted in HCWs or ICUs than participants that had taken other substances (OR=4.920, 95% CI 3.099-7.813). Being in a relationship was found to be positively associated, participants that were in a relationship had less odds of being admitted in an HCW or ICU (OR=0.345 95% CI 0.217-0.549) than the ones that were single.

#### 4.5.1.2 Length of Hospital Stay

The total admission days were obtained from adding up all the admission days within the various wards of the study sites for each individual participant. There were no study participants that were transferred to other institutions after admission into the different wards within the study period. The median length of stay in hospitals for the study participants was three days and the interquartile range was from one to 12 days. The length of stay in hospital ranged from 0 to 14 days. The total length of stay is right skewed and mesokurtic (Figure 4.16).

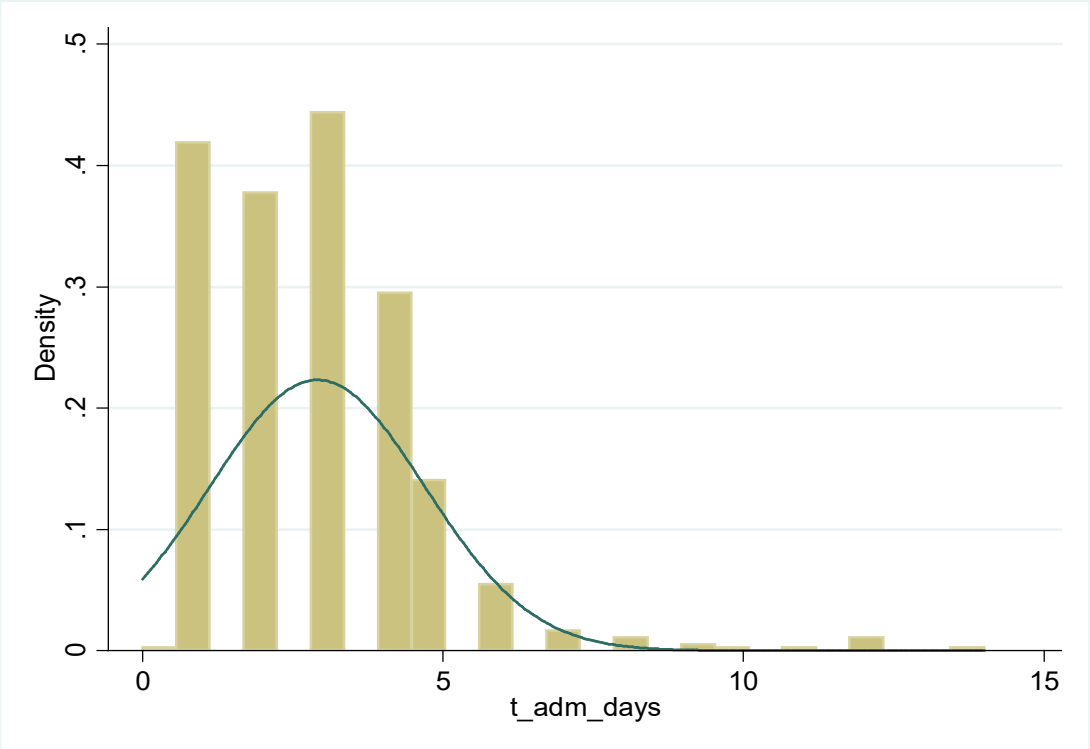


**Figure 4.16 Distribution of length of stay**

- The group that had ingested OP had a median length of stay of three days (IQR: 1-9) and
- The group that had taken non-OP had a median length of stay of 2 days (IQR: 1-10).

There was a statistically significant difference in the length of stay in the hospital and the type of poison ingested (Kruskal-Wallis test, p< 0.001).

#### 4.5.1.3 Factors Predicting the Length of Stay in Hospital after Intentional Poisoning

Using the median length of stay of the participants (three days), the study population was divided into two groups, namely:

•Group 1: Length of stay 3 - days and below (n=451; 69.60%)

•Group 2: Length of stay above 3 days (n=197; 30.40%)

Bivariate analysis

Table 4.3 shows some factors that were associated with the length of hospital stay after completing the relevant bivariate statistical tests (fischer's exact, Chi-square, Spearman and Kruskal Wallis tests). Variables that had a significant association (defined as p<0.1) were:

- Age (continuous and categories)
- Type of poison taken (OP and non-OP)
- Number of substances taken
- Sex
- Ethnicity
- Medical condition
- Relationship status
- Alcohol use
- Drug use

All these variables were included in the multivariate model to investigate factors predicting the length of stay.

**Table 4.4 Bivariate analysis of factors associated with length of stay in the hospital**

| **Variables** | | **Total n= 648** | **Length of stay =< 3 days N=451** | **Length of stay >3 days N=197** | **P value** |
|---|---|---|---|---|---|
| Type of poison | Non OP | 382 | 300 (66.52%) | 82 (41.62%) | 0.000* |
| | OP | 266 | 151(33.48%) | 115 (58.38% | |
| Number of poison substances taken | One substance | 460 | 307(69.30%) | 153(79.27%) | 0.013* |
| | Two substances | 78 | 56(12.64%) | 22(11.40%) | |
| | Three substances and above | 98 | 80(18.06%) | 18(15.41%) | |

| | | | | | |
|---|---|---|---|---|---|
| #Age | | 26 (18-63) | 25(18-56) | 29(18-63) | 0.0003* |
| Age categories | 18-25 years | 312 | 238(52.77%) | 74(37.56%) | 0.000* |
| | 26-34 years | 200 | 137(30.38%) | 63(31.98%) | |
| | 35-45 years | 90 | 52(11.53%) | 38(19.29%) | |
| | 45 years and above | 46 | 24(5.32%) | 22(11.17%) | |
| Sex | Male | 249 | 163(36.14%) | 86(43.65%) | 0.071* |
| | Female | 399 | 288(63.86%) | 111(56.35%) | |
| Ethnicity | Other | 49 | 29(6.43%) | 20(10.15%) | 0.099* |
| | Black | 599 | 422(93.57%) | 177(89.85%) | |
| Income | No | 469 | 332(74.94%) | 137(80.12%) | 0.176 |
| | Yes | 145 | 111(25.06%) | 34(19.88%) | |
| Presence of medical condition | No | 437 | 325(73.36%) | 112(65.88%) | 0.067* |
| | Yes | 176 | 118(26.64%) | 58(34.12%) | |
| Use of medication | No | 531 | 372(82.48%) | 159(80.71%) | 0.589 |
| | Yes | 117 | 79(17.52%) | 38(19.29%) | |
| Relationship status | In a relationship | 254 | 172(42.16%) | 82(56.55%) | 0.003* |
| | Not in a relationship | 299 | 236(57.84%) | 63(43.45%) | |
| Level of education | Not completed high school | 323 | 238(58.33%) | 85(58.62%) | 0.153 |
| | Completed high school | 188 | 134(32.84%) | 54(37.24%) | |
| | Higher education | 42 | 36(8.82%) | 6(4.14%) | |
| Alcohol use | No | 325 | 250(59.24%) | 75(50%) | 0.050* |
| | Yes | 247 | 172(40.76%) | 75(50%) | |
| Smoking | No | 424 | 310(73.46%) | 114(76%) | 0.542 |
| | Yes | 148 | 112(26.54%) | 36(24%) | |
| Drug use | No | 54 | 409(96.92%) | 137(91.33%) | 0.005* |
| | Yes | 26 | 13(3.08%) | 13(8.67%) | |

# = median (IQR-Interquartile range); *P-value significant at <0.1

Multivariate analysis

In the multivariate model (table 4.4), three independent factors were significantly associated with length of stay in hospital namely

- Ethnicity
- Medical condition
- Type of poison taken

It was found that:

- The type of poison taken for intentional self-poisoning was significant, the participant that took OP had two times higher odds of staying longer than three days in hospital than the participants that took non-OP (OR=2.685; 95% CI 1.656-4.351; p<0.0001).
- Participants that have another medical condition have 1.6 times higher odds of staying longer than 3 days in hospital than participants without any medical condition.
- Lastly, ethnicity was also a significant factor, participants that were black had less odds of being admitted longer than 3 days in the hospital compared to participants of other ethnic group (OR=0.464; 95% CI 0.217-0.993; p= 0.048)

The second model with age in categories was conducted; the model had similar findings as the previous model, however, age was no longer statistically significant.

The third logistic regression model that excluded ethnicity was created and this variable was not important for the model (p=0.05).

This showed that the first model with ethnicity had the best overall fit. The final model had a good fit (p=0.51) and the area under the ROC of 0.685 was good implying that this model could predict the length of stay of participants with intentional poisoning.

**Table 4.5 Multivariate analysis of factors identified to predict the length of stay**

| **Factors** | | **Adjusted OR** | **95% CI** | **P value** |
|---|---|---|---|---|
| Type of poison | Non OP | 1 | | 0.000* |
| | OP | 2.685 | 1.656-4.351 | |
| Number of poison substances taken | One substance | 1 | | |
| | Two substances | 1.695 | 0.894-3.211 | 0.105 |
| | Three substances and above | 0.707 | 0.353-1.415 | 0.328 |
| #Age | | 1.007 | 0.984-1.030 | 0.540 |
| Sex | Male | 1 | | 0.759 |
| | Female | 0.930 | 0.586-1.475 | |
| Ethnicity | Other | 1 | | 0.048* |
| | Black | 0.464 | 0.217-0.993 | |
| Presence of a medical condition | No | 1 | | 0.029* |
| | Yes | 1.668 | 1.054-2.641 | |
| Relationship | In a relationship | 1 | | 0.111 |

| | | | | |
|---|---|---|---|---|
| status | Not in a relationship | 0.710 | 0.466-1.082 | |
| Alcohol use | No | 1 | | 0.891 |
| | Yes | 0.969 | 0.620-1.514 | |
| Drug use | No | 1 | | 0.096 |
| | Yes | 2.195 | 0.869-5.546 | |

* = P-value significant at the 5 % level

### 4.5.2 Mortality in Hospitals

The case fatality rate among the study participants was 2.62% (17/648) over the study period, see figure below.

- The OP group had a case fatality rate of 4.51 %( 12/266)
- The Non-OP had a case fatality rate of 1.31 % (5/382).

There was a statistically significant difference in the type of poison ingested and the outcome (dead or alive), Fischer's exact, p=0.022. The participants that had taken OP have about 4 times higher odds of dying than those have taken a non-OP (OR=3.562; 95% CI 1.239-10.234; P<0.02).

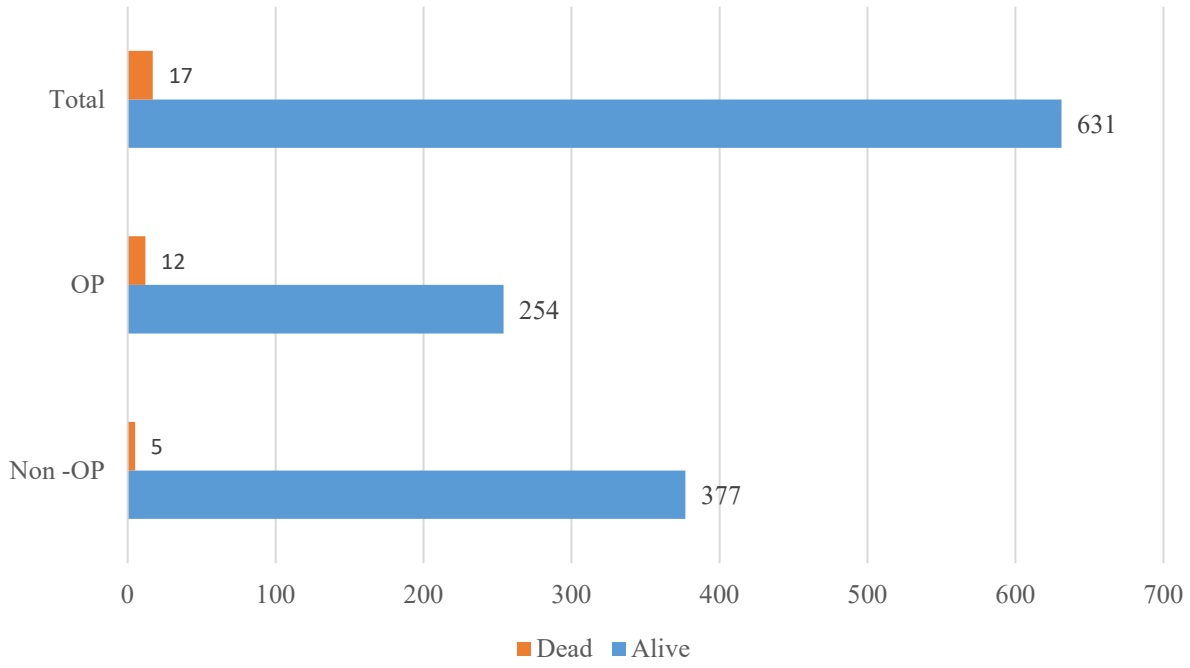


**Figure 4.17 Case fatality rate after intentional poisoning**

The number of study participants who died was 17 (Figure 4.18),

- 1.61%(4/248) were from Chris Hani Baragwanath Academic Hospital,

- 1.63%(4/246) were from Leratong Hospital and
- 5.84 %( 9/154) were from Sebokeng Hospital.

There was a statistically significant difference in the outcome and admitting hospitals (Fischer's exact, p=0.03). Study participants that were admitted to Sebokeng Hospital with intentional self-poisoning had 4 times higher odds of dying than the participants admitted at CHBAH, (OR=3.786; 95% CI 1.145-12.515; p=0.029).

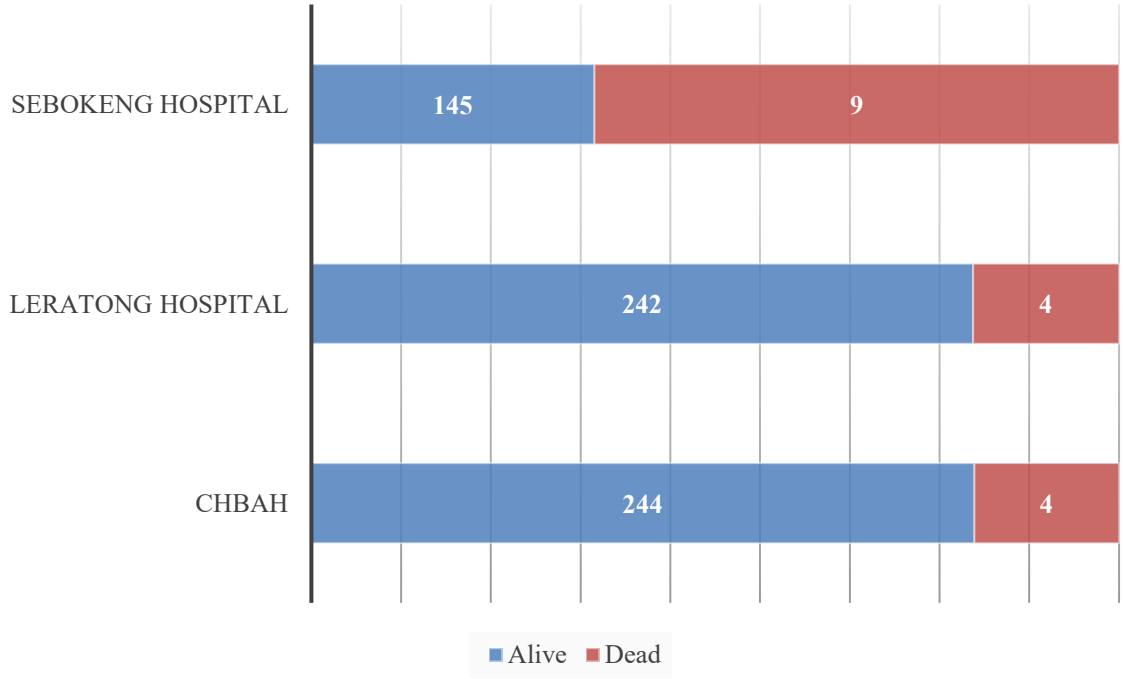


**Figure 4.18 Case fatality in the three study sites**

#### 4.5.2.1 Characteristics of Participants Depending On the Outcome

Table 4.5 below shows the characteristics of participants depending on their outcomes (dead or alive). Age of participants that were alive was not normally distributed, mesokurtic distribution and ranged from 18 years to 70 years. Age of participants that died is normally distributed, Shapiro Wilk test (p=0.462) and the kurtosis test for normality (p=0.2055).

- Participants within the 35 to 45year age group have 6 times higher odds of dying than the young participants 18 to 25year age group.
- Participants that are 46 years and above have 7 times higher odds of dying than the young participants in the 18 to 25 year age group.

**Table 4.6 Characteristics of those who died/survived after intentional self-poisoning**

| Variables | | Total N= 648 | Alive N=631 | Dead N =17 | P value |
|---|---|---|---|---|---|
| #Age (years) | | # 26(18-63) | # 26(18-62) | ~ 36(12.966) | 0.0034* |
| Age categories | 18-25 years | 312 | 309(48.97%) | 3(17.65%)) | 0.014* |
| | 26-34 years | 200 | 194(30.74%) | 6(35.29%) | |
| | 35-45 years | 90 | 85(13.47%) | 5(29.41%) | |
| | 45 years and above | 46 | 43(6.81%) | 3(17.65%) | |
| Sex | Males | 249 | 242(38.35%) | 7(41.18%) | 0.806 |
| | Females | 399 | 389(61.65%) | 10(58.82%) | |
| Ethnicity | Other | 49 | 48(7.61%) | 1(5.88%) | |
| | Black | 599 | 583(92.39%) | 16(94.12%) | |
| Level of education | Not completed high school | 323 | 320(58.29%) | 3(75%) | 1.000 |
| | Completed high school | 188 | 187(34.06%) | 1(25%) | |
| | Higher education | 42 | 42(7.65%) | 0 | |
| | Missing | 95 | 82 | 13 | |
| Income | No | 469 | 459(76.12%) | 10(90.91%) | 0.473 |
| | Yes | 145 | 144(23.88%) | 1(9.09%) | |
| | Missing | 34 | 28 | 6 | |
| Relationship status | In a relationship | 254 | 254(46.27%) | 0(0%) | 0.129 |
| | Not in a relationship | 299 | 295(53.73%) | 4(100%) | |
| | Missing | 95 | 82 | 13 | |
| Presence of medical illness | No | 437 | 431(98.63%) | 6(1.37%) | 0.310 |
| | Yes | 176 | 171(97.16%) | 5(2.84%) | |
| | Missing | 35 | 29 | 6 | |
| Use of medication | No | 503 | 498(99.01%) | 5(0.99%) | 0.135 |
| | Yes | 101 | 98(97.03%) | 3(2.97%) | |
| | Missing | 44 | 35 | 9 | |
| Smoking | No | 424 | 414(73.67%) | 10(100%) | 0.071 |
| | Yes | 148 | 148(23.33%) | 0 | |
| | Missing | 76 | | | |
| Alcohol | No | 325 | 318(56.58%) | 7(70%) | 0.527 |
| | Yes | 247 | 244(43.42%) | 3(30%) | |
| | Missing | 76 | 69 | 7 | |
| Drug use | No | 546 | 536(95.37%) | 10(100%) | 1.00 |
| | Yes | 26 | 26(4.63%) | 0 | |
| | Missing | 76 | 69 | 7 | |

| | | | | | |
|---|---|---|---|---|---|
| Number of different poison substances taken | One substance | 460 | 447(71.86%) | 13(92.86%) | 0.217 |
| | Two substances | 78 | 77(12.38%) | 1(7.14%) | |
| | Three substance and above | 98 | 98(15.76%) | 0 | |
| | Missing | 12 | 9 | 3 | |
| Length of hospital stay | =<3 days | 451 | 441(68.89%) | 10(58.82%) | 0.422 |
| | > 3 days | 197 | 190(30.11%) | 7(41.18%) | |

*# = median (IQR-Interquartile range);~=mean(standard deviation); * = P-value significant at the 5 % level*

Only six variables were statistically significant ($p<0.1$) on bivariate analysis namely:

- Poison
- Hospital
- Smoking
- Age
- Use of medication
- Relationship status

No further analysis could be conducted because of the small sample that died and the missing information.

# CHAPTER FIVE
# DISCUSSION

In this chapter, the findingss obtained from the analysis of the data will be discussed and compared with those from other published studies.

There are multiple factors that influence intentional self-poisoning, the substance used and the outcome of intentional self-poisoning and this could not be assessed in one study. This study focused more on the socio-demographic, lifestyle and physical illness that influence intentional self-poisoning.

## 5.1 DESCRIPTION OF THE STUDY

This study showed that intentional self-poisoning is a serious problem in the three selected institutions. Chris Hani Baragwanath Academic Hospital (n=248) had the largest number of participants admitted with intentional self-poisoning followed by Leratong Hospital (n=246) then Sebokeng Hospital (n=154). There was a statistically significant difference in the type of poison chosen for intentional poisoning across the different study sites, with participants admitted at Leratong Hospital having a more preference for non-organophosphate poisoning that organophosphate poisoning. This has been demonstrated in the reviewed literature that the substance used for intentional self-poisoning differs from region to region. In the published literature, pesticide poisoning was more commonly used for intentional self-poisoning in LMIC whilst in the UK; medicinal drugs were more commonly used for poisoning. (47) In South Africa, there is a similar finding where substances commonly used for intentional self-poisoning differs by different regions. (15,18,83) For example, in Cape Town, pharmaceutical drugs were the most common type of poison used whilst in East London organophosphates were the common agents for intentional self-poisoning.

## 5.2 PROFILES OF STUDY PARTICIPANTS

### 5.2.1 Sociodemographic Profiles

**(i) Age**

The median age of the participants is 26years and interquartile range is 18 to 63years. A multicentre study conducted in low and middle income countries reported the median age for females ranging from 21 to 30 years and for males 23 to 33 years, findings of the study when looking at age by different sex were also within the reported range. (89)

Looking at the different age categories, intentional self-poisoning predominantly occurred amongst the 18 to 34 year old age group, with the 18-25 years having the highest number. This finding was similar to other study findings conducted locally and internationally, demonstrating that this group should be at the centre of a strategy for the prevention of intentional self-harm. (15,17,90) The older participants (35-70years) were more likely to take OP than the younger age group, similar to the findings of the study done in Sri Lanka in 2013. (91) A study was done in Malaysia that compared drug and chemical intentional self-poisoning had a similar finding but the age grouping was slightly different. Participants between the ages of 31-60year were more likely to take chemical poisons (include pesticides) than drug overdose whilst the age group less than 30years and older than 60 years were more likely to take drug overdose than chemical poison. (39)

**(ii) Ethnicity**

Ethnicity was described using Statistics South Africa population groups' method, because of small numbers of study participants in another ethnic group there was re-classified to black and other. (92)

Most (92.4%) of the study participants were predominantly black which is in line with the population demographics served by the three study sites. A study conducted in South Africa in 2005 on acute poisoning which is inclusive of intentional self-poisoning cases reported that 90% of the population of their study participants were black which is similar to our findings.

(19) However, other literature has reported nonfatal suicidal behaviour more commonly among the minority population group, which is influenced by socioeconomic factors. (39,93,94)

**(iii) Sex**

Females were the predominant participants in this study, which is in line with most publications on intentional self-poisoning over the years. (36,39,58,59,95,96). Very few publications have reported most cases of intentional self-poisoning being males.(37,52) Females were found to be less likely to take OP than their male counterparts, which is similar to the findings of a study conducted in Sri Lanka. (59) On the contrary, in Malaysia they found that females were more likely to take chemical poison (includes pesticides) in comparison to their male counterparts. (39)

**(iv) Marital status**

Being married has been identified as both a risk factor and a protective for intentional self-harm. (29,52,97) Most of the study participants were not in a relationship, this included divorced, widowed and separated individuals, which is in agreement with most published literature.(34,53) The participants that were not in a relationship had fewer odds of taking OP than those in a relationship, which is similar to the findings of a study in Malaysia. (39) However, the study in Malaysia had a third category for divorced and widowed and they found that this group is more likely to take chemical poisoning (include pesticides). (39)

**(v) Socioeconomic conditions**

Most (58%) of the study participants had not completed high school, which is far below from the Gauteng demographic profile (75.9%) published by Statistics South Africa. (98) There was no statistically significant association between level of education and income and intentional self-poisoning. Literature has shown that being at a socio-economic disadvantage is associated with intentional self-harm. (34,52) In New Zealand in 2009, it was reported that admission rates for intentional self-poisoning were increasing with levels of deprivation. (99) Furthermore, high deprivation was also found to be associated with re-admission. (100) A study in Iran reported that most of the study participants were unemployed, which is similar

to this study where 76% of participants had no income. (53) A study was done in KZN in 2013 also found that education and unemployment were associated with deliberate self-harm. (17) Interestingly, the incidence of self-poisoning was low in poor socioeconomic conditions area in a study done in Sri Lanka in 2002, however, in depth analysis showed that education was associated with pesticide self-poisoning. (50)

Furthermore, the participants with medicinal overdose were found to be more likely to have an economic problem than those with chemical poisoning in Malaysia. (39)

**(vi) Substance use**

Alcohol was the predominant (53%) substance reportedly being used by the study participants, followed by cigarettes (26%) and lastly 5% using recreational drugs. Most (56.82%) of the participants that reported alcohol use were males, other studies have reported similar findings. (59,101) Intentional medicinal overdose with acetaminophen was associated with chronic ethanol intake. (57) Participants that are consuming alcohol had higher odds of taking OP. A study was done in KZN also found that other substances (alcohol, cigarette, dagga, wunga, cocaine, and heroin) were present during the deliberate self-harm episode. (17) Increased alcohol consumption has been linked with deliberate self-poisoning, with other literature reporting it and other substances being used for intentional self-poisoning. (53,60)

### 5.2.2 Presence of Co-Existing Medical Conditions

Twenty-eight percent of the study participants had other medical condition. Medical conditions have been noted to be associated with self-harm, this includes physical illness and mental illness. (34) The participants that had other medical condition or on other medication had fewer odds of taking OP for poisoning. Multiple studies have reported that self-harm is associated with the presence of a mental disorder. (57,59,61). About sixty-three percent of the study participants that had other co-morbidities have HIV followed by mental illness in fourteen percent. A study done in Cape Town reported that 20% of their participants with ISP had HIV, which is close to this study of 18%. (15) Presence of a medical condition in the elderly makes them more vulnerable to intentional self-poisoning. (102)

## 5.3 SUBSTANCE USED FOR INTENTIONAL SELF-POISONING

Fifty-nine percent of the study population had ingested a non-pesticide drug and 41% had ingested a pesticide, which acts as a cholinesterase inhibitor. Contrary to the finding of a study of a study done in East London, South Africa where cholinesterase inhibitors were frequently used for intentional self-poisoning in an intensive care unit setting. (83) However, the substance used for intentional poisoning differs from region to region as mentioned above, in India pesticides were common agents used for intentional poisoning, whilst in other areas medicines were a common agent used. (89,97,103–105) In Sri Lanka, pesticides are still the most common substance used for intentional poisoning but they have noted an increase in trend of using medicines for ISP. (38) The multivariate analysis exploring factors associated with the type of poison chosen revealed that age, sex, ethnicity, relationship status and being on medication for a physical illness was associated with the type of poison chosen for intentional poisoning in this study. Being older, male, black, in a relationship and not on any medication was associated with using a pesticide for intentional poisoning. The study done in Sri Lanka reported the same findings in terms of sex and type of poison, females commonly ingested medicines than males. (38)

More than 90% of participants that had taken a pesticide ingested a single substance and taking more than one substance for intentional poisoning was more prevalent in the non-pesticide group. Use of multiple substances for intentional self-poisoning has been commonly reported in medicinal intentional self-poisoning. (47) Four main sources of substances used for intentional self-poisoning were reported in the study. Most (48%) participants found substances used for ISP within their homes, 22% from street vendors, 23% own prescription, and 6% were from shops and friends. A study was done in Sri Lanka investigating the choice of poison used for ISP reported that most of their participants(more than 75%) stated that easy availability as being the main reason for the choice of poison, they found the substance at home. (66) Fifty-five percent of participants that had used pesticide for poisoning purchased it from street vendors and the rest found it at home and the description of substance was similar in terms of packaging and the actual substance. All participants that had been identified as OP participants reported ingesting a substance that was in clear plastic,

black and grey granules and based on their description and clinical picture of these participants after intentional self-poisoning and reviewed literature, the substance was identified as Aldicarb, a carbamate. (25) This demonstrates the ease of access to these harmful substances in the informal sector and how they are becoming a popular substance for self-poisoning. (25) The registration of Aldicarb has been withdrawn in South Africa but is still being sold in the informal sector and patients present with poisoning due to this substance.(25,106,107) Restriction to means for intentional self-poisoning has been shown to reduce suicide attempts with that particular substance. (68)

## 5.4 OUTCOMES OF INTENTIONAL SELF-POISONING

Two outcomes of interests were investigated in the study:

- Fatality
- Length of hospital stay

There are multiple factors affecting mortality and length of stay in hospital of patients with intentional self-poisoning, namely age, sex, the presence of other illnesses, substance ingested for poisoning, factors-antidote, the time taken to receive care, clinical status at a presentation in hospital, quality of care. (79,84,108) The study looked at socio-demographic, lifestyle and presence of medical diseases and type of poison ingested only.

### (i) Length of hospital stay

The median length of stay of the study participants was three days, the admission days ranged from one to fourteen days. The median length of hospital stay in reviewed studies ranged from 18 hours (IQR 13-23) to 3 days (IQR 2-3). (41,109) The participants that took OP/pesticide had a longer median length of hospital stay (3 days) than the participants that took non OP/pesticide (2 days). This concurred with findings of another study done in East London, South Africa in ICU, patients admitted with acetylcholinesterase inhibition due to OP or carbamate poisoning were admitted for a longer period than those with other agents. The mean duration was 4.2 days for acetylcholinesterase inhibitors and for other agents it was 2.1 days. (83) In the study's multivariate analysis of factors predicting the length of hospital stay, only three factors were found to be significantly associated with it, namely ethnicity, medical condition and the type of poison taken.

Participants that took OP/pesticide had two times higher odds of staying in the hospital than those that took non-OP/pesticide, Participants that had a medical condition had 1.6 times higher odds of staying longer than 3 days in hospital than those without a medical condition. It was surprising that age was not a significant predictor of length of stay in our model, even though there are publications that support this. (77,80) Age had a statistically significant association with length of hospital stay in the bivariate analysis; however, this was lost in the logistic regression model. When reviewing different literature to guide the conceptualisation of this research, surprisingly few publications went as far as exploring predictors of the different outcomes explored in this study, analysis ended at the bivariate analysis stage. An odd finding was that black people had fewer odds of staying longer in the hospital compared to participants of other ethnicity and qualitative research would have to be conducted to get an in-depth understanding of this finding, no literature could be found to support this finding.

In Malaysia, a comparison of drug versus chemical poisoning reported that admission to ICU and longer length of hospital stay was common amongst the drug overdose, however; death was higher amongst the chemical poisoning group, which constitutes pesticides and household products. (39)

**(ii) Case fatality**

Most of the study participants that died had ingested an OP/pesticide. The overall case fatality rate was 2.62; the OP/pesticide group was 4.51% and the non OP/pesticide was 1.31% which was seen previously in Malaysia. (39) In addition, a study done in Sri Lanka looking at intentional self-poisoning reported the fatality rate at 4.6 %.

Reviewed literature has shown that the highest fatality was predominantly in males, the 60 and above age group, and amongst those who ingested pesticides. (38,110,111) A study done in Sri Lanka reported that oleander and pesticides contributed more towards the high fatality than medicinal poisoning. (37,84) In East London there was a contrary finding, mortality was lower amongst those who ingested pesticides (5.2%) in comparison to those that took other agents (10.7%), which raises a question of maybe the WHO class of pesticides available in the different countries/regions.(83)

In this study, Aldicarb, a carbamate which inhibits acetylcholinesterase was the pesticide used for intentional self-poisoning, a WHO Class 1a pesticide. Literature has shown that there is an association between WHO Class and mortality. Participants that ingested WHO Class 1 pesticides had higher mortality in comparison to participants who ingested Class II or Class III. (86,87) Studies that have made a comparison between pesticide and medicinal drug use for intentional self-poisoning have reported low fatality amongst those who had taken medicine making OP/pesticide poisoning an important substance to be controlled globally to reduce pesticide related intentional poisoning. (38,40)

Age was found to be an important predictor of mortality and length of hospital and our study supports this. (77,80) Death was predominant amongst the 26-34 year age group and the 35 to 45year age group, however not in the 45 and above years age group as previously seen in other studies. In addition, in Sri Lanka similar findings were reported, the case fatality ratio was higher amongst men and it increased with age. The study did not find a statistically significant association between sex and fatality. In other areas, the fatality was higher amongst females than males demonstrating how interventions for suicide attempts need to be more context specific. (112)

## 5.5 LIMITATIONS OF THE STUDY

The possible limitations of this study include:

- The study was limited to patients admitted to the ICU, HCW and medical wards, during the week. Those that were discharged in the emergency unit or did not seek medical care or admitted in other wards (surgical or gynaecological) or not recorded in admission books or refused admission were excluded from the study making the study not generalizable to populations outside this group.
- The study was limited to patients admitted in the public sector in three hospitals in Gauteng. People of low socio-economic status who are mostly black and unemployed utilize the hospitals in the public sector. In the study, there was a very small representation of other ethnicities and for further analysis, they were grouped together
- Some of the hospital records were incomplete or lost and analysis was conducted only on available information.

- Information on lifestyle factors and medical condition were self-reported and are prone to social desirability bias and no verification method.
- Admitting medical personnel had inaccurately diagnosed patients as organophosphate poisoning based on the clinical picture. They should be made aware that there are various chemicals that can cause acetylcholinesterase inhibition and such diagnosis can only be made when there is toxicological confirmation.
- Use of specialist or medical officer diagnosis, which was based on clinical signs and symptoms, could lead to misclassification of study participants.
- Certain categorical variables (relationship status and ethnicity) were reduced to two categories for ease of analysis and information could be lost in this process. Length of stay is a continuous variable and it was changed to a categorical variable for the same reason.
- There are multiple factors that have described as risk and protective factors for intentional self-harm in published literature but not all these factors could be assessed in the study.
- The short duration of the study and the low case fatality rate led to limited analysis of determinants of fatality after intentional self-poisoning.

# CHAPTER SIX
# CONCLUSION AND RECOMMENDATIONS

In this chapter, the findings obtained from this study were assessed in relation to the aims and objectives of the study so that appropriate conclusions can be drawn. Based on the findings of the study, appropriate recommendations and suggestions for future research are included.

## 6.1 CONCLUSIONS RELATED TO THE AIMS OF THE STUDY

This was a cross-sectional study assessing patients admitted with intentional poisoning in three study sites (namely CHBAH, Leratong and Sebokeng Hospitals) during a one-year study period.

### 6.1.1 Description of the Socio-Demographic and Clinical Profiles of Patients Admitted to Three Hospitals

The majority of the study participants ingested a non OP/pesticide. The determinants of the intentional self-poisoning are multiple and include socio-demographic characteristics, social and family environment, medical conditions, psychological characteristics, neurobiological and genetic aspects, and situational factors. This study investigated some of these characteristics and these include; sociodemographic profile, medical condition and lifestyle factors. Several factors were found to be associated with the type of poison chosen for intentional self-poisoning; these include age, sex, ethnicity, relationship status and use of medication. Patients that were older and black were more likely to take OP/pesticides. Female participants that were not in a relationship and have medication that they take for a medical condition were less likely to take OP/ pesticide.

### 6.1.2 Determination of Substances That Were Taken By Patients Admitted to the Hospitals with Intentional Self-Poisoning and Description of the Source Of These Substances

The home environment and the vendors were the main sources of the substance used for poisoning. Street vendors were the main suppliers of pesticide used for intentional self-poisoning. The study participants that ingested a pesticide described the same substance, demonstrating how the substance is easily accessible. This substance has been banned from South Africa according to an article by HA Rother but remains easily accessible.

### 6.1.3 Determination of Differences between the OP Cases Vs Non-OP Cases In Terms of Their Profiles Outcomes and Availability of Substances

Participants that took OP/pesticide and have a medical condition were more likely to stay longer in the hospital (more than 3 days) whilst black participants were less likely to stay longer in hospital. Furthermore, participants that had taken OP/pesticide for intentional poisoning were five times more likely to be admitted in ICU/HCW on initial admission. Whilst those that were in a relationship were less likely to be admitted in ICU/HCW. Suicidal intent may be a factor influencing some of these results, which was not explored in the study.

Seventeen participants that had intentionally self-poisoned died during the study period at the different study sites. On the bivariate analysis, participants had taken an OP/pesticide had four times higher odds of dying, older participants had higher odds of dying. A surprising finding was that participants admitted at Sebokeng hospital had higher odds of dying than those admitted at CHBAH indicating a need to explore health system related factors that influence the outcome of patients in the hospital.

In conclusion, the findings of this cross-sectional study conducted in three hospitals in the Gauteng Province demonstrated how access to means for intentional self-harm was a problem. It also showed that the inadequate implementation of legislation and policies in SA for limiting access to pesticides and the population that was vulnerable to self-poisoning. Addressing this problem would require a multifaceted, context specific approach.

## 6.2 RECOMMENDATIONS

An innovative and multifaceted approach to prevention of intentional self-poisoning which is the most common method of intentional, self-harm should be developed.

- South Africa needs to improve restriction of access to means of self-poisoning, like pesticides. Enforcement of global agreements and local legislation should be done to reduce access to pesticides and fatality that is related to it.
- South Africa should explore introduction of regulations for removing highly hazardous pesticides from street vendors and replacing them with less hazardous alternatives.
- Public education on the prevention and home management of intentional self-poisoning patients should be done using different communication platforms.
- The Department of Health should work on improving its surveillance of pesticide poisoning and collaborate with the Department of Agriculture in controlling and managing access to pesticides.

### 6.2.1 Follow-Up and Future Research

- A larger cohort of intentional self-poisoning patients followed over a longer period to gain an in depth understanding of factors associated with the clinical outcomes

- A study that will explore all factors associated with intentional self-harm so that the interventions implemented in South Africa are more comprehensive, this should be inclusive of the private sector, private hospitals.

- A costing study looking at how much intentional self-poisoning is costing the Department of Health and advocate for improved control of access to means.

### 6.2.2 A Plan for Utilisation And Dissemination Of Results

The study report would hopefully be utilized by the Department of Agriculture as evidence of poor implementation of act and policy to control access to pesticides and implement quality improvement strategies.

The management of the three hospitals could also use the repot to improve identification and management at risk population in the hospital and in communities.

The principal investigator will also look at publishing some of the study findings.

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# APPENDICES

# PLAGIARISM FORM

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | FACULTY OF HEALTH SCIENCES

PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I _Babalwa Ndyebokazi Dunga__ (Student number: ___587414_____) am a student registered for the degree of _Master of Medicine in Community Health_____ in the academic year __2019_____.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature: ____  _____ Date: ____28/03/2019_____

## APPENDIX A: INFORMATION SHEET

Information Sheet for Informed Consent: Questionnaire and record review patients with Intentional Poisoning in the three hospitals in Johannesburg

Hello. My name is _____. I am a field worker currently employed at the University of Witwatersrand and I am working with Dr Babalwa Dunga who is a registrar in public health medicine doing this research as part of her Masters in Medicine degree. You are being invited to participate in a research study to understand Intentional poisoning amongst the patients admitted at the three hospitals in Johannesburg.

**What is the purpose of our study?**

We want to find out about the poisons that patients take what it is, where they get it, why they chose it and how it affects those patients. This study involves face-to-face interviews with the field workers using a questionnaire, looking at your medical records and we will call you in six weeks to ask about symptoms of any neurological complications.

**Why have you been chosen?**

You have been chosen to participate in this study because we want find out about poisoning. I (the field officer) will conduct the interview and requires about 30 minutes of your time, answering various questions about yourself and your health. We will also look at your file to obtain more information.

**Participation is voluntary:** I would like to stress that this is voluntary, and you may choose not to participate or to discontinue participation at any time and there will be no consequences. There is no direct benefit from being involved in the study.

**Risks:** There are no foreseeable risks to your participating.

**Benefits:** The benefits of taking part in this study include having a role in providing evidence for improving current policies on pesticide management and surveillance in South Africa.

**Confidentiality**

Your identity will not be revealed and your confidentiality will be protected in any reviews and reports of this study, which may be published. , the completed forms all records and documentation will be housed securely at the School of Public Health, University of Witwatersrand and electronic records will be kept in a password-protected computer.

**Contact details**

If you have any questions or concerns or would like more information about this study please contact: Babalwa Dunga, Principal Investigator on the study, at 0784287558 or e-mail babalwa.dunga@wits.ac.za

If you are unhappy with the way this research is conducted, you are welcome to contact the Chair of the Wits Human Ethics Committee Prof Cleaton-Jones through his secretary Ms Anisa Keshav on 0117171234

*Thank you for taking time to read this sheet.*

**Dr Babalwa Dunga**

## APPENDIX B: INFORMED CONSENT FORM

Consent to participate in the study "Intentional organophosphate poisoning: A study in three hospitals in Johannesburg"

I, _____ (full names of the participant) confirm that I understand this consent form and the nature of the study and agree to take part in it. The study and its purpose were explained to me. I understand that I am agreeing out of my own free will to be part of this study. I understand that I can withdraw from the study at any time. I am not forced to be part of this study.
I acknowledge that the results of this research project will be published in a journal and your name will not be mentioned.

Signature of participant: _____
At: _____
Date: _____
Witness: _____

## APPENDIX C: PATIENT QUESTIONNAIRE

Intentional organophosphate poisoning: A study in three hospitals

| | | |
|---|---|---|
| 1. | Hospital number | |
| 2. | Name of Hospital | |
| 3. | Study ID | |

**DEMOGRAPHIC INFORMATION**

4. Sex:

| | |
|---|---|
| | Male |
| | Female |

5. Ethnicity:

| | |
|---|---|
| | Black |
| | White |
| | Coloured |
| | Indian |

6. What is your age?

7. What is your marital status?

| | |
|---|---|
| | Single / no partner |
| | Never married / never living together |
| | Living with partner /Married |
| | Divorced |
| | Widowed |

8. Have you ever attended school?

| | |
|---|---|
| | Yes |
| | No |

9. What is the highest level of education you have achieved?

| | |
|---|---|
| | Never been to school |
| | Pre-primary school |

| | |
|---|---|
| | Completed Primary school |
| | Completed High school |
| | Tertiary |
| | Don't know |

AND

| | |
|---|---|
| | Grade 1-5 |
| | Grade 6-7 |
| | Grade 8-11 |
| | Grade 12 |
| | Higher |

10. Are you currently earning any money?

| | |
|---|---|
| | Yes |
| | No |

11. What kind of work do you do?

| | |
|---|---|
| | Self-employed |
| | Skilled labour |
| | Unskilled labour |
| | Services (e.g. policemen, firemen, nurses, etc.) |
| | Professional/Management |
| | Clerical (clerks, secretaries, receptionists etc.) |
| | Agriculture |

12. How much money do you take home?

| | |
|---|---|
| Daily **OR** | |
| Weekly **OR** | |
| Monthly | |

## MEDICAL HISTORY

13. Do you have any illnesses apart from the one you are in the hospital for?

| | |
|---|---|
| | No |
| | Yes, list the illness / illnesses:<br>_____<br>_____<br>_____ |

| | |
|---|---|
| | _____<br>_____ |

14. Are you currently on any medication apart from the ones started during this hospital admission?

| | |
|---|---|
| | No |
| | Yes, list all the medications that you are currently taking:<br>_____<br>_____<br>_____<br>_____<br>_____ |

15. Do you consume alcohol?

| | |
|---|---|
| | No |
| | Yes |

16. How often do you drink?

| | |
|---|---|
| Daily **OR** | |
| Weekly **OR** | |
| Less than monthly **OR** | |
| Monthly | |

17. Do you smoke?

| | |
|---|---|
| | No |
| | Yes |

18. How often do you smoke?

| | |
|---|---|
| Daily **OR** | |
| Weekly **OR** | |
| Less than monthly **OR** | |
| Monthly | |

19. Do you take any recreational drugs?

| | |
|---|---|
| | No |
| | Yes |

20. How often do you take recreational drugs?

| | |
|---|---|
| Daily **OR** | |
| Weekly **OR** | |
| Less than monthly **OR** | |
| Monthly | |

**POISON EXPOSURE RECORD**

| | | |
|---|---|---|
| 1. | How many substances did you take? | |

| | Substances | Substance 1 | Substance 2 | Substance 3 |
|---|---|---|---|---|
| 2. | Do you know the name of the substance you took? | | | |
| 3. | If yes, what is the name of the substance(s) you took?(proceed to question 7) | | | |
| 4. | If you don't know the name of the substance you took(Answer question 5 and 6) | | | |
| 5. | What colour is the container of the substance or describe the container if you can? | | | |
| 6. | What do you use the substance for? | | | |
| 7. | Was the substance a solid or liquid or gel or tablet or powder? | | | |
| 8. | What colour was it? | | | |
| 9. | Where did you get the substance? | | | |
| 10. | Was it lying around the house? Answer Yes or No. | | | |
| 11. | Why did you buy the substance? | | | |

| | | | | |
|---|---|---|---|---|
| 12. | How much did you pay for the substance? Estimate. | | | |

## APPENDIX D: RECORD REVIEW TOOL

Intentional organophosphate poisoning: A study in three hospitals

| | | | | |
|---|---|---|---|---|
| 1. | Name of Hospital | | | |
| 2. | Hospital number | | | |
| 3. | Study Id | | | |
| 4. | Date of presentation to hospital | | | |
| 5. | Time of admission | | | |
| 6. | Date of discharge or death | | | |
| 7. | How was the diagnosis of poisoning made? | | Clinically | |
| | | | Laboratory investigation | |
| 8. | Other medical condition noted in the patient records? | | No | |
| | | | Yes, list the medical conditions: | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 9. | Is the patient on any other medications according to the medical records? | | No | |
| | | | Yes, list the medications: | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| 9. | In which ward was the | | ICU | Specify the number of days admitted: |

| | | | | |
|---|---|---|---|---|
| | patient admitted? | | HCW | Specify the number of days admitted: |
| | | | Normal ward | Specify the number of days admitted: |
| 10. | Severity of clinical effects of poisoning on presentation | | No symptoms | |
| | | | Mild poisoning: headache dizziness , tremors on the tongue and eyelids, abdominal pain, sweating | |
| | | | Moderate poisoning: unable to walk, muscle fasciculations, small pupils, nausea, vomiting, salivating, bradycardia | |
| | | | Severe poisoning: unconscious, flaccid paralysis, no pupillary reflexes, increased bronchial secretions, dyspnoea, respiratory failure, diarrhoea, convulsions, heart block | |
| 11 | What is the outcome of the patient? | | Dead | |
| | | | Alive | |

## APPENDIX E: POISON INFORMATION SHEET

Intentional organophosphate poisoning: A study in three hospitals

Name of hospital: ----------

Study Id: ----------

Trade name of pesticide: ----------

Manufacturer: ----------

Biohazard classification of the pesticide: ----------

Is the pesticide container clearly labelled regarding its toxic effects?

☐ Yes ☐ No

Is the pesticide restricted for use in South Africa? ☐ Yes ☐ No

Explain restriction ----------

# APPENDIX F: ETHICS CLEARANCE CERTIFICATE

R14/49 Dr B Dunga

**HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)**
**CLEARANCE CERTIFICATE NO. M1811129**

| | |
|---|---|
| **NAME:** (Principal Investigator) | Dr B Dunga |
| **DEPARTMENT:** | School of Public Health<br>Medical School<br>University |
| **PROJECT TITLE:** | Intentional organophosphate poisoning; a study in three hospitals in Johannesburg |
| **DATE CONSIDERED:** | Ad hoc |
| **DECISION:** | Approved unconditionally |
| **CONDITIONS:** | Renewal of M120285 |
| **SUPERVISOR:** | Professor S Naidoo and Dr J Moorman |
| **APPROVED BY:** | Dr CB Penny, Chairperson, HREC (Medical) |
| **DATE OF APPROVAL:** | 07/12/2018 |

**This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.**

**DECLARATION OF INVESTIGATORS**

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on 3rd floor, Phillip V Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit to the Committee. I agree to submit a yearly progress report. When a funder requires annual re-certification, the application date will be one year after the date of the meeting when the study was initially reviewed. In this case, the study was initially reviewed in November and will therefore reports and re-certification will be due early in the month of November each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

Date

**PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES**

# APPENDIX G: APPROVALS FROM THE HOSPITALS

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

**Enquiries: Dr.L.M.Mpye**
**Tel:** (011) 411 3508
**Fax:** (011) 410 8421
**Email: Mike.Mpye @ gauteng.gov.za**

**TO WHOM IT MAY CONCERN**

**RE: PERMISSION TO CONDUCT RESEARCH**

**Permission is hereby granted for Dr.B.N.Dunga to conduct research on Organophosphate poisoning at Leratong hospital. Kindly afford her whatever support she may require.**

**Yours truly**

**Dr.L.M.Mpye**
**Clinical Manager**
**12/07/2013**

**Leratong Hospital**
**1 Adcock Street**
**CHAMDOR**

**Private Bag X2078**
**KRUGERSDORP**
**1740**

**Tel: 011 411 3500**

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

**CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL**
**CHIEF EXECUTIVE OFFICER**
**Enquiries: Mrs. J. More**
**Tel. number: (011) 933-8145/9154**
**Fax number: (011) 938-1005**
**Email: Johanna.More@gauteng.gov.za**

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**To: Dr Babalwa Ndunga**
**Community Health Registrar**
**Charlotte Maxeke Academic Hospital**
**Gauteng Department of Health**

**Cc: Prof Huddle – Head of Internal Medicine CHBAH**
**Prof Dickerson – Head of Emergency Medical Department CHBAH**

**Re: Research Approval- Intentional Organophosphate Poisoning Study at CHBA Hospital**

**Dear Dr B Ndunga**

**It is my honour and pleasure to inform you that permission is granted to yourself, for the above study, at Chris Hani Baragwanath Academic Hospital (CHBAH). This office further note that the official outcome of the Ethics Committee has not pronounced, though correspondences between yourself and the Human Research Ethics Committee Secretariat confirm that such approval has been granted. Please therefore kindly ensure that you provide this office with a copy of the approval as soon as possible.**

**In granting you this permission, please kindly ensure that:**

1. **You proceed with the study as per Ethics Committee approval.**
2. **Please kindly ensure confidentiality regarding the patients information, and all patient records are eventually returned to Patient Archives Department at CHBAH.**
3. **Once the study is completed and verified, please provide a copy thereof to this office.**

**Yours truly,**

**Mrs. J More**
**CEO, CHBAC**

2014/7/31

Chris Hani Baragwanath Academic Hospital
Chris Hani Road
DIEPKLOOF Ext. 6
SOWETO

PO Bertsham
2013

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