

**A RETROSPECTIVE STUDY ON DRUG AND CHEMICAL
POISONING IN HOSPITAL SULTAN ABDUL HALIM, KEDAH.**

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ABSTRAK

KAJIAN RETROSPEKTIF MENGENAI KERACUNAN BAHAN KIMIA DAN UBATAN DI HOSPITAL SULTAN ABDUL HALIM, KEDAH.

Pengenalan: Keracunan bahan kimia dan ubatan adalah masalah kesihatan awam dan kes masih berterusan dilihat di hospital-hospital Malaysia.

Objektif: Kajian kami bertujuan memahami corak kes keracunan bahan kimia dan ubatan, komplikasi yang dialami mangsa, serta mengenal pasti mereka yang berkemungkinan tinggi mendapat komplikasi teruk berikutan keracunan bahan kimia dan ubatan.

Kaedah: Kajian ini bercorak kajian pemerhatian retrospektif melibatkan kes-kes keracunan bahan kimia dan ubatan yang dirawat di Jabatan Kecemasan Hospital Sultan Abdul Halim (HSAH), Kedah, bermula dari tahun 2016 hingga 2020. Senarai pesakit diperoleh dari Unit Rekod Hospital Sultan Abdul Halim. Semua pesakit yang memenuhi syarat dimasukkan ke dalam kajian dan maklumat berkenaan latar belakang sosio-demografi, tanda-tanda klinikal dicatatkan. Analisa statistik dilakukan untuk mengenal pasti faktor-faktor penyumbang kepada komplikasi teruk berikutan keracunan bahan kimia dan ubatan. Analisa juga dilakukan untuk mengenal pasti faktor-faktor berkaitan dengan kejadian keracunan dengan sengaja oleh pelaku.

Keputusan: Sejumlah 147 subjek terlibat untuk kajian ini, dengan purata umur 27.35 ($\pm$ 15.97) tahun. Majoriti adalah lelaki (51%), berbangsa India (61.2%) dan daripada kumpulan umur dewasa. Majoriti terdiri daripada kumpulan bukan professional (79.6%), tanpa masalah kesihatan (76.2%) dan berkahwin (40.8%). Jenis racun paling kerap digunakan adalah produk pencuci dan peluntur (25.2%), ubatan (24.5%), racun rumpai (24.5%), racun haiwan perosak (19.0%) dan jenis racun lain-lain (6.8%). Jenis racun lain-lain merangkumi petroleum/ kerosin, asid industri dan methanol. Paracetamol adalah ubatan utama dan peluntur adalah bahan kimia utama terlibat dalam kes-kes keracunan bahan kimia. Majoriti kes keracunan adalah disengajakan oleh pelaku (74.8%). Komplikasi teruk berlaku dalam 33.3% kes. Kadar kematian

dalam kajian kami adalah 2.7%. Pesakit yang mempunyai masalah kesihatan (AOR=2.40, 95% CI=1.01, 5.70, p=0.046), mengalami kadar nadi tinggi (AOR=3.52, 95% CI=1.61, 7.73, p=0.002), muntah-muntah (AOR=4.88, 95% CI=1.40, 17.04, p=0.013) dan mengalami masalah bernafas (AOR=3.75, 95% CI=1.16, 12.06, p=0.027) berisiko tinggi untuk mendapat komplikasi teruk. Pesakit kaum India (AOR=17.31, 95% CI=6.62, 45.25, p=<0.001) dan kaum Cina (AOR=12.50, 95% CI=2.44, 63.96, p=0.002) memiliki risiko yang lebih tinggi untuk terlibat dalam keracunan yang disengajakan.

Kesimpulan: Komplikasi teruk berlaku dalam 33.3% kes. Pesakit yang mempunyai masalah kesihatan, mengalami kadar nadi tinggi, muntah-muntah dan mengalami masalah bernafas berisiko tinggi untuk mendapat komplikasi teruk. Sekiranya pesakit memiliki risiko-risiko berikut, perawat harus mengenalpasti dan memberi rawatan pantas kepada pesakit kes keracunan.

Kata kunci: *bahan kimia; ubatan; keracunan; faktor; komplikasi*

ABSTRACT

A RETROSPECTIVE STUDY ON DRUG AND CHEMICAL POISONING IN HOSPITAL SULTAN ABDUL HALIM, KEDAH.

Introduction: Acute poisoning is a major public health concern, and cases continue to be seen in Malaysian hospitals. Complications of poisoning vary depending on the implicated agents and can range from mild gastrointestinal irritation to fatal multiorgan failure.

Objectives: This study aims to determine the prevalence of poisoning presentations and the factors associated with severe outcome in acute drug and chemical poisoning. This study further looks into predictive risks of intentional poisoning.

Methods: This was a retrospective cross-sectional study, case review study involving acute drug and chemical poisoning patients presented to the Emergency Department (ED), Hospital Sultan Abdul Halim (HSAH), Kedah, from 2016 until 2020. The cases were extracted from a computerised system, and the patient's case records were retrieved from Medical Record Unit. Patients that fulfilled the study criteria were included. Their socio-demographic features and clinical presentation were collected. Logistic regression analysis was performed to determine the factors associated with severe outcome in acute drug and chemical poisoning. Logistic regression analysis was also performed to determine predictive risks of intentional poisoning.

Results: A total of 147 cases were included with a mean age of 27.35 (SD $\pm$ 15.97) years old. Majority were males (51.0%), Indians (61.2%) and from the adult age group. Most of them were 'non-professional' (79.6%), without underlying illness (76.2%) and married (40.8%). The most common type of poison involved household products (25.2%), followed by drugs (24.5%), herbicides (24.5%), pesticides (19.0%) and miscellaneous agents (6.8%). Miscellaneous agents include petroleum/kerosene based, industrial acid and methanol. The majority of cases were intentional ingestion (74.8%). The prevalence of severe outcome was 33.3%. The mortality rate in our study was 2.7%. Patient with underlying medical illness (AOR=2.40, 95% CI=1.01, 5.70, p=0.046), presented with tachycardia (AOR=3.52, 95%

CI=1.61, 7.73, $p=0.002$), presented with vomiting (AOR=4.88, 95% CI=1.40, 17.04, $p=0.013$) and presented with dyspnoea (AOR=3.75, 95% CI=1.16, 12.06, $p=0.027$) were found to have significant association with severe outcome. Indian (AOR=17.31, 95% CI=6.62, 45.25, $p<0.001$) and Chinese (AOR=12.50, 95% CI=2.44, 63.96, $p=0.002$) had higher predictive risks for intentional poisoning.

Conclusion: The prevalence of severe outcome was 33.3% in acute drug and chemical poisoning. Patients with comorbidities, who presented with tachycardia, vomiting and dyspnoea had a higher chance of severe outcome. The presence of these factors should alert clinicians on the need of rapid identification and early treatment in poisoning cases.

Keywords: *chemical poisoning; drug poisoning; acute poisoning, complication*

CHAPTER 1

INTRODUCTION

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INTRODUCTION

1.1 Background

Acute poisoning is a major public health concern, and cases are constantly seen in Malaysian hospitals. Acute poisoning is a significant health problem all over the world. In 2000, WHO reported that there were 315 000 fatalities due to poisoning worldwide. However this number accounted for <2% of the total reported cases of poisoning globally (M. Paden *et al.*, 2002). In Malaysia, nationwide data on poisoning pattern are scarce and incomplete. The objective of our study is to determine the pattern of acute drug and chemical poisoning in Hospital Sultan Abdul Halim, Kedah.

A national study on profile of poisoning admissions in Malaysia in 2007 reported northern states Perlis, Kedah, Penang and Perak are among highest cases of poisoning at more than 100 cases per 100,000 population (Rajasuriar *et al.*, 2007). It is also reported although Indian make up only small proportion of population in Malaysia (8%), they accounted for almost a quarter of the poisoning admissions and reported the highest fatalities (Rajasuriar *et al.*, 2007). Due to its national focus, this study does not provide specific pattern of poisoning in the northern region.

Another study that is geographically closer to our region was done in Penang General Hospital for demographic features of drug and chemical poisoning (Fathelrahman *et al.*, 2005). This study reported, largest number of cases were Chinese (37.7%) followed by Indian (31.6%) and Malays (26.6%) (Fathelrahman *et al.*, 2005). However, data used for this study were from Penang General Hospital and referrals from other five hospitals that were also located in urban population.

Complications of poisoning vary depending on the implicated agents and can range from mild gastrointestinal irritation to fatal multiorgan failure. However, clinical management

of drug and chemical poisoning may still be suboptimal due to the failure to identify and anticipate the severity of complications in patients with poisoning.

Currently, acute drug and chemical poisoning is not considered a notifiable disease. Hence, it is one reason for the lack of reliable information as many cases were not adequately reported. The socio-demographic characteristics and clinical presentations also differ globally, even between states in Malaysia (Rajasuriar *et al.*, 2007) (Fathelrahman *et al.*, 2005). This study aims to determine the prevalence of acute drug and chemical poisoning presentations and the associated factors with severe outcome in poisoning cases in Sungai Petani, Kedah. This study also further looks into predictive risks for intentional poisoning.

1.2 Justification of Study

Our study focuses on the population in Sungai Petani, a semi-urban town with a vast surrounding agricultural area. We believe acute drug and chemical poisoning patterns will differ in this region, and no similar study has been done in Sungai Petani, Kedah. Furthermore, similar local studies in other region were already more than 10 years ago. We hope this study will add useful information on poisoning patterns and characteristics, the prevalence of severe outcome, significant risk factors associated with severe outcome, and predictive risks associated with intentional poisoning. This will be essential to serve as a basis for future intervention programs in the region.

1.3 General Objectives

To study acute drug and chemical poisoning cases presented to Hospital Sultan Abdul Halim, Kedah, from 2016 to 2020.

1.4 Specific Objectives

- 1.4.1 To describe the presentation of acute drug and chemical poisoning in Hospital Sultan Abdul Halim, Kedah, from 2016 to 2020.
- 1.4.2 To describe the prevalence of non-severe and severe outcome of acute drug and chemical poisoning.
- 1.4.3 To identify the factors associated with severe outcome of acute drug and chemical poisoning cases.
- 1.4.4 To study factors associated with intentional poisoning in acute drug and chemical poisoning cases.

1.5 Hypothesis

Age, gender, ethnicity, occupational background, marital status, underlying medical illness, underlying psychiatric illness, mode of poisoning, tachycardia presence, gastrointestinal symptoms, respiratory symptoms, CNS symptoms, cardiovascular symptoms, liver impairment on arrival, renal impairment on arrival and haematological impairment on arrival are associated with increased risk of developing severe outcome among those presented with acute drug and chemical poisoning.

Age, gender, ethnicity, occupational background, marital status, underlying medical illness and underlying psychiatric illness are associated with an increased risk of intentional poisoning among those presented with acute drug and chemical poisoning.

CHAPTER 2

STUDY PROTOCOL

CHAPTER 2

STUDY PROTOCOL

Research Title

A Retrospective Study on Drug and Chemical Poisoning in Hospital Sultan Abdul Halim, Kedah.

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Co-researcher: Dr Junainah binti Nor (MMC No: 45851)

Introduction

This is a retrospective cross-sectional study on acute drug and chemical poisoning cases. Acute poisoning is a major public health concern all over the world. In 2000, the World Health Organization (WHO) reported 315 000 poisoning-related fatalities worldwide. However, this figure only represented less than 2 per cent of all poisoning cases reported worldwide (Paden M. *et al.*, 2002). In Malaysia, nationwide data on poisoning patterns are scarce and incomplete. The objective of our study is to determine the poisoning patterns and characteristics, the prevalence of severe outcome, significant risk factors associated with severe outcome, as well as predictive risk factors for intentional poisoning in Hospital Sultan Abdul Halim, Kedah.

Problem Statement and Study Rationale:

A national study on the profile of poisoning admissions in Malaysia in 2007 reported northern states- Perlis, Kedah, Penang and Perak are among the highest cases of poisoning at more than 100 cases per 100,000 population (Rajasuriar R. *et al.*, 2007). It is also reported that, despite making up only 8 per cent of Malaysia's population, Indians accounted for nearly a quarter of poisoning admissions and had the largest number of fatalities (Rajasuriar R. *et al.*,

2007). This study does not give a specific pattern of poisoning in the northern region due to its national emphasis.

Another study that is geographically closer to our region is published by Penang General Hospital for demographic features of drug and chemical poisoning in Northern Malaysia. This study reported most prominent number of cases were among Chinese (37.7 per cent), followed by Indian (31.6 per cent) and Malays (26.6 per cent) (Fathelrahman AI. *et al.*, 2005). However, we should point out that data used for this study came from Penang General Hospital and referrals from other five hospitals located in the urban population.

Our study focuses on the population in Sungai Petani, a semi-urban town with a vast surrounding agricultural area. We believe acute drug and chemical poisoning patterns will differ in this region, and no similar study has been done in Sungai Petani, Kedah.

We hope this study will add useful information on poisoning patterns and characteristics, the prevalence of severe outcome, significant risk factors associated with severe outcome, as well as predictive risk factors for intentional poisoning. This will be essential to serve as a basis for future interventional programs in the region.

Research Question

1. What are the presentations of acute drug and chemical poisoning cases in Hospital Sultan Abdul Halim?
2. What are the prevalence of non-severe and severe outcome of acute drug and chemical poisoning?
3. What are the factors associated with severe outcome of acute drug and chemical poisoning among those patients?
4. What are the factors associated with intentional poisoning among those patients?

Objectives

General objective:

To study acute drug and chemical poisoning cases presented to Hospital Sultan Abdul Halim, Kedah, from 2016 to 2020.

Specific objective:

1. To describe the presentation of acute drug and chemical poisoning in Hospital Sultan Abdul Halim, Kedah, from 2016 to 2020.
2. To describe the prevalence of non-severe and severe outcome of acute drug and chemical poisoning.

3. To identify the factors associated with severe outcome of acute drug and chemical poisoning cases.
4. To study factors associated with intentional poisoning in acute drug and chemical poisoning cases.

Literature Review

Introduction

Acute poisoning is a significant health problem all over the world. In 2000, the World Health Organization (WHO) reported 315 000 poisoning-related fatalities worldwide. However, this figure only represented less than 2 per cent of all poisoning cases reported worldwide (Paden M. *et al.*, 2002). In Malaysia, nationwide data on poisoning patterns are scarce and incomplete. The objective of our study is to determine the pattern of acute drug and chemical poisoning in Hospital Sultan Abdul Halim, Kedah.

Epidemiology of Poisoning in Malaysia

In 2007, national research on the profile of poisoning admissions in Malaysia showed 21 714 poisoning admissions from 1999 to 2001. It accounted for 0.43 per cent of all government healthcare admissions. In 1999, 2000, and 2001, the rate of admission for poisoning was 29.13, 31.77, and 31.79 per 100,000 people, respectively. The overall number of poisoning deaths was 779 over the three years investigated, resulting in a case fatality rate of 35.88 per 1000 admissions (Rajasuriar R. *et al.*, 2007). It is also reported that the northern states of Perlis, Kedah, Penang, and Perak have among the highest rates of poisoning, with more than 100 cases per 100,000 people, which is greater than the national average.

In terms of hospitalisation, females outnumbered males (55.1 versus 44.9 percent). Males are more likely to die (68.7 percent) than females. The age variables were recorded as child (0-12 years) or adult (13-99 years). The majority of poisoning admissions (89.7 percent) involved adults, with 1788 cases involving children. There were 439 instances (2.1 percent) with no age assigned. Only two (0.3 percent) of the 779 deaths reported occurred in children, 98.9 percent in adults, and 0.8 percent were undetermined ages (Rajasuriar R. *et al.*, 2007).

Malays accounted for the majority of admittance cases, accounting for 37.1 percent of all cases. The second-largest distribution, 25 percent, was made up of Indians, followed by Chinese (19.8 percent) and others (18.1 percent). Although Malays had the highest percentage of admissions, they had the fewest deaths and the lowest mortality rate. Poisoning was the leading cause of mortality among Indians, accounting for more than one-third of all deaths. Indians also had the greatest case fatality rates. Although Indians make up only 8% of the Malaysian population, they account for over a quarter of poisoning hospitalisations and have the highest fatality rate (Rajasuriar R. *et al.*, 2007).

The majority of poisoning occurred due to pharmaceutical agents (54.9 percent). However, in children was more often due to chemical substances. Some 55.1 percent of male poisoning cases involved chemical substances, while most females involved pharmaceutical agents. Chemical substance exposure had a higher fatality rate compared to pharmaceutical agents, and pesticides caused more than 75 percent of the total chemical substances. The circumstances of poisoning in 2914 (13.4 percent) cases could not be determined, as these cases did not have an external cause code assigned. Of the remaining 10,220 were due to accidental exposure, 4485 were due to intentional self-harm, 57 were cases of assault, and 4038 were events of undetermined intent. Six most common substances involved organic solvent (20.2 percent), pesticides (16.4 percent), diuretics and other unspecified substances (14.9 percent), Non-opioid analgesics, antipyretics and anti-rheumatics (13.9 percent), topical agents (8.5

percent) and corrosive substances (5.5 percent). Most deaths (46.5 percent) occurred in intentional self-harm, 27.9 percent in accidental exposure, 20.2 percent in undetermined intent, and only one (0.1 percent) death resulted from an assault. (Rajasuriar R. *et al.*, 2007).

However, not all cases of poisoning are reported to the National Poison Centre. Therefore, poisoning data derived from analysis of poisoning inquiries also fall short of representing the actual occurrence of poisoning in Malaysia. Another weakness of this study, it has failed to obtain a specific breakdown of population numbers for the smaller ethnic groups categorised as others. This study only reviewed cases of poisoning admissions and, therefore, probably only represents cases of moderate to severe poisoning. This study also highlights further research is needed to provide more insight into specific substances that are involved. There is also a need to assess further the distribution of poisoning cases among the various states in the country (Rajasuriar R. *et al.*, 2007). Due to its national focus, this study does not provide a specific pattern of poisoning in each state in the northern region, one of which is Sungai Petani, Kedah, our focus of study centre is located.

Epidemiology of Poisoning in Northern Malaysia- Penang Hospital Study

Since Malaysia comprises of 13 states with different ethnic compositions, the poisoning pattern may differ from one state to another. To our knowledge, there is only one study conducted in the northern region of Penang General Hospital (Fathelrahman AI. *et al.*, 2005).

This study is geographically closer to our region, published by Penang General Hospital titled Demographic Features of Drug and Chemical Poisoning in Northern Malaysia. This study reported 493 cases of poisoning from 2000 to 2002. The overall annual incidence rate of poisoning admissions was 25.2 per 100 000 persons. The largest number of poisoning cases was found in the patient age group 15.1 to 30 years old (55.2 percent). The median age was 23.6 years old (mean 25.9+/-14.9). The largest number of cases were Chinese (37.7 percent),

followed by Indian (31.6 percent) and Malays (26.6 percent). Other ethnic groups consisted of foreigners from other neighbouring Asian countries (Fathelrahman AI. *et al.*, 2005).

Intentional poisoning (51.5 percent) outnumbered accidental cases (39.8 per cent). There was a higher number of accidental than intentional cases among male patients. In contrast, many more cases involving female patients were classified as intentional poisoning (n=177) compared to accidental (n=117). These differences were statistically significant ($\chi^2=8.03$, $df=2$, $p=0.018$) (Fathelrahman AI. *et al.*, 2005). This study found that drug was the major substance implicated in most age groups. Poisoning by pesticides has been identified as the agent responsible for the majority of death in the developing world. (Eddleston M, 2000). However, pesticide poisoning in this study represented only 3.3 percent of all agents. This may be due to relatively low agricultural activities in Penang since the mainstay of the economy of the state's economy is manufacturing (Fathelrahman AI. *et al.*, 2005). Furthermore, we should highlight that the data used for this study came from Penang General Hospital and referrals from five other hospitals located in the urban population.

Our study focuses on the population in Sungai Petani, which is a semi-urban town with a vast surrounding agricultural area, whereas Penang is an urban city with a minimal agricultural area. Ethnic compositions in Penang, which are predominantly Chinese, followed by Indian and Malay, do not accurately reflect the demographic in northern Malaysia. As a result, the published study from Penang General Hospital cannot accurately represent demographic study on acute drug and chemical poisoning in Northern Malaysia. We believe acute drug and chemical poisoning patterns will differ in this region, and no similar study has been done in Sungai Petani, Kedah.

The population of Kuala Muda District

Hospital Sultan Abdul Halim, Sungai Petani is located in district of Kuala Muda, Kedah. According to Kedah Population Statistics, the population of Kuala Muda was estimated at 514,400 in 2018. There is no other recent data for 2019 or 2020.

Complications of Acute Drug and Chemical Poisoning

Complications of poisoning vary depending on the agents implicated. Poisoning by paraquat herbicide causes pneumonitis, lung fibrosis, renal impairment and liver damage (Indika B Gawarammana *et al.*, 2010).

Complications of organophosphate poisoning can be divided into acute and late complications. Acute complications include fits (16.6%), bradycardia (10%) and hyperglycaemia (5%). Delayed complications included monoplegia with mild sensory loss of lower limbs (2.66%) and paraplegia with upper limb weakness (0.66%). The mortality rate of organophosphate poisoning was 16.66% (Faiz MS *et al.*, 2011).

Petroleum product poisoning, such as kerosene ingestion, has also been reported. The main hazard is chemical pneumonitis, resulting from aspiration of vomitus following ingestion or inhalation of kerosene liquid. A rare complication of kerosene intoxication is cardiac arrhythmia and ventricular fibrillation (Robert P Chilcott *et al.*, 2006).

Corrosive acid poisoning can cause stenosis along the entire oesophagus at the level of physiological narrowing, in the antrum and pylorus. The intoxication may lead to death (Andon Chibishev *et al.*, 2012).

Paracetamol related hepatotoxicity has been reported with a greater risk of poor outcomes in a subgroup with staggered overdose, which had a higher mortality rate in comparison to a single ingestion of paracetamol overdose (Diego Castanares-Zapatero *et al.*, 2018).

Methanol poisoning results in neurological complications such as visual disturbances, bilateral putaminal hemorrhagic necrosis, parkinsonism, cerebral oedema, coma and seizures (Ji-Hyun Choi *et al.*, 2017).

Factors Associated with Fatality in Acute Drug and Chemical Poisoning

The national study on poisoning in Malaysia by Rajasuriar R. *et al.*, 2007 only describes the pattern of poisoning and rate of fatality but does not proceed with statistical analysis to determine significant factors associated with fatality in acute drug and chemical poisoning

On the other hand, the Penang General Hospital study by Fathelrahman AI. *et al.*, 2005 only focused on factors that affect the rate of exposure to poisoning but did not focus on severe complications in acute drug and chemical poisoning.

In an international study conducted by US Poison Statistics National Data published in 2014, the rate of poisonings with moderate or major effects or death occurred in about 7.84% (JB Mowry *et al.* 2014).

We hope this study will add useful information on poisoning patterns and characteristics, outcome and prevalence of severe complications, significant risk factors associated with severe complications, as well as predictive risk factors for intentional poisoning. This will be essential to serve as a basis for future interventional programs in the region.

WHO Poisoning Severity Score

A standardised scale for grading the severity of poisoning allows qualitative evaluation of poisoning morbidity, better identification of real risks and data comparability. The Poisoning Severity Score (PSS) has been published externally (Persson H. *et al.*, 1998). PSS is used in all

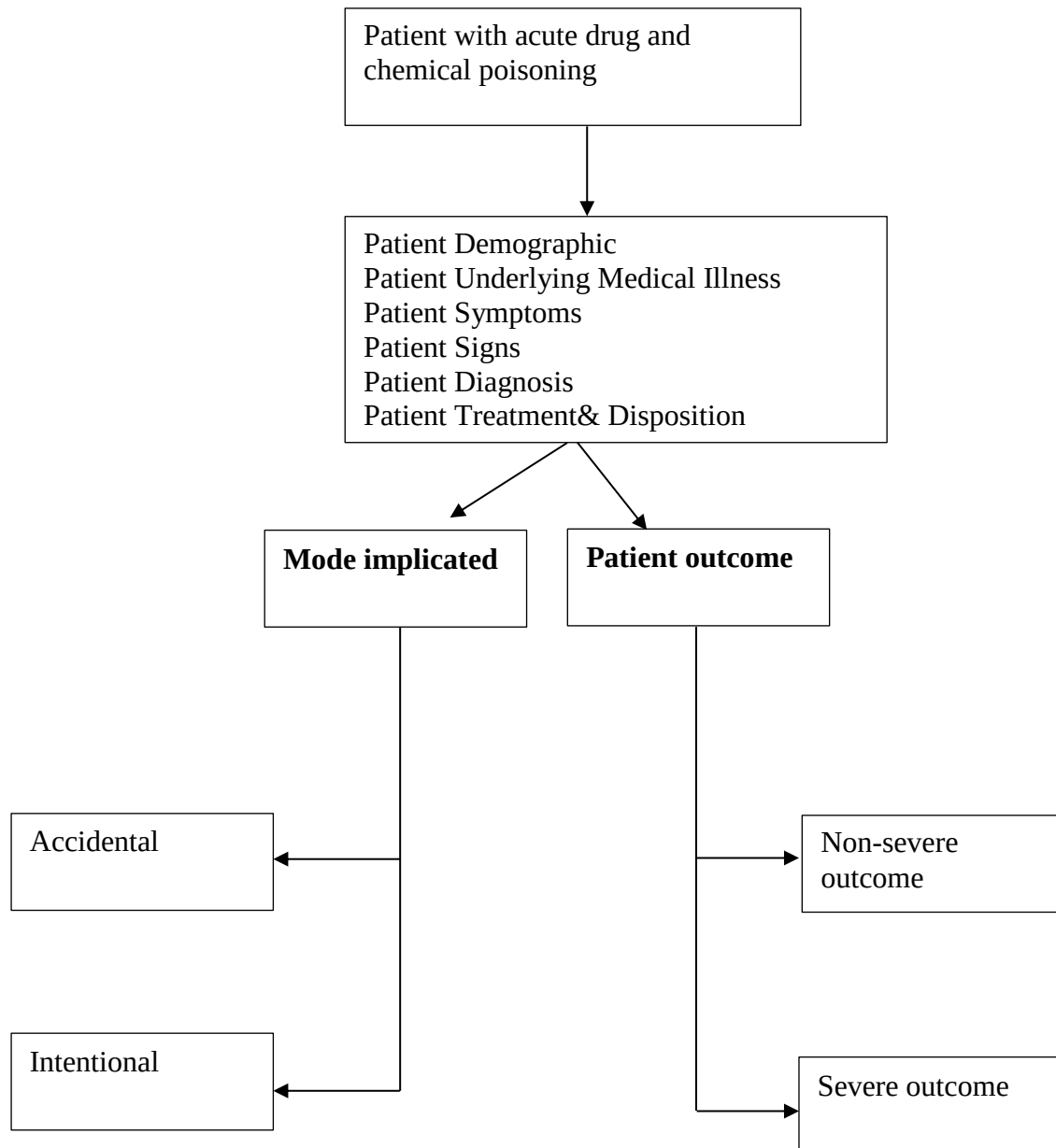
types of intoxications. This scale includes both subjective symptoms and objective findings, regardless of the type, amount, serum and plasma concentrations of substances taken (Persson H. *et al.*, 1998) (Ozdemir S. *et al.*, 2021).

PSS is calculated according to the most serious symptoms and signs of nine different organs or symptoms in the whole clinical process (Persson H. *et al.*, 1998) (Ozdemir S. *et al.*, 2021). The gastrointestinal tract, respiratory system, nervous system, cardiovascular system, metabolic balance, liver, kidney, haematology system and musculoskeletal system are evaluated for PSS (Persson H. *et al.*, 1998). PSS is scored from 0 to 4. No signs and symptoms is graded as 0, mild grade poisoning is graded as 1, intermediate poisoning is graded as 2, severe symptoms and signs are graded as 3, and 4 indicates death (Persson H. *et al.*, 1998) (Ozdemir S. *et al.*, 2021).

The Poisoning Severity Score was developed in the 1990s. While being a great concept, the score is not used very often due to PSS being very subjective and somewhat cumbersome to use. The American College of Medical Toxicology is working to develop the ToxIC Severity Score and the development process, which includes internal and external validation, is still ongoing.

Although PSS has been developed for the assessment of poisonings, Rajka T. *et al.*, 2007 used a simpler poisoning outcome classification in their study in Oslo. The poisoning was classified as mild (unaffected, with no or only minimal signs or symptoms), moderate (evidently affected, clear signs or symptoms, hospitalised) and severe (severely affected, complications, hospitalised) (Rajka T. *et al.*, 2007). Due to no single-robust scoring system available to date, we chose to use elements from both classifications to classify the severity of outcome in our poisoning cases. Three elements to classify outcome in our study include the most severe signs and symptoms documented, hospitalisation status, and documented complications developed.

Conceptual Framework



Research Design

This will be a retrospective cross-sectional study, case review study involving acute drug and chemical poisoning patients presented and treated in the Emergency Department of Hospital Sultan Abdul Halim, Kedah.

Study area and study population

Acute drug and chemical poisoning patients presented and treated in the Emergency Department of Hospital Sultan Abdul Halim, Kedah.

Subject criteria

Inclusion criteria:

1. Patients presented and treated with suspected drug poisoning or chemical poisoning in Hospital Sultan Abdul Halim from 2016 to 2020.
2. Only records available at the time of study will be reviewed.

Exclusion criteria:

1. Diagnosis resulted in poisoning due to an overdose of drug/ medication intended for treatment.
2. Poisoning is due to biological sources (food, plants material or animal bite).

Sampling method:

In this study, no sampling method will be used as all patients who fulfil the inclusion and exclusion criteria during the study period will be recruited.

Sample size estimation

1) Sample size estimation for Objective 1:

To describe the presentation of acute drug and chemical poisoning in Hospital Sultan Abdul Halim, Kedah, from 2016 to 2020.

The first objective is to describe or illustrate the data; no sample size calculation is needed as it is a description of our data.

2) Sample size estimation for Objective 2:

To describe the outcome of acute drug and chemical poisoning and the prevalence of non-severe and severe outcome among those cases.

The sample size was calculated using the single proportion formula. According to US Poison Statistics National Data 2013, the rate of poisonings with major effects or death occurred in about 7.84% (JB Mowry *et al.*, 2014).

The following formula was used (Daniel WW, 1999):

Sample size,

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Z= statistic for level of confidence

P= expected prevalence

d= precision

Taking the Z score as 1.96% (for 95% confidence interval), expected prevalence of poisonings at 7.84% and precision of 0.05, the sample size was calculated to be 111. Considering drop-out rate 20%, total sample required, N, was calculated:

$$\begin{aligned} N &= 111 + 20\% \text{ drop-out rate} \\ &= 134 \end{aligned}$$

3) Sample size estimation for Objective 3:

To identify the factors associated with severe outcome of acute drug and chemical poisoning cases.

Factors associated with severe outcome focused in this study include age, ethnicity, gender, occupation, marital status, underlying illness, mode of ingestion and agents implicated.

There is very limited literature studying associated factors with severe outcome of poisoning. Most available literature are only descriptive of their data findings.

3.1: Associated factor: Age

(a) Children (<19 years old)

Two proportion formula is used for categorical independent variables.

According to US Poison Statistics National Data 2013, children (< 19 years old) with severe outcome is about 21.06%, and children with non-severe outcome are approximately 40.69% (JB Mowry *et al.*, 2014).

The following formula was used (Wang H. and Chow, 2007)

$$n = \frac{(Z_{a/2} + Z_b)^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

n= sample size

$Z_{a/2}$ = critical value of normal distribution at $a/2$ (confidence interval 95%, a is 0.05, and critical value is 1.96

Z_b = critical value of normal distribution at b (for power 80%, b is 0.2 and critical value is 0.84)

P_1 = estimated proportion (larger)

P_2 = estimated proportion (smaller)

Taking the confidence interval of 95%, the sample size, n , was calculated

Sample size, $n = 84$

(b) Adults (>20 years old)

According to US Poison Statistics National Data 2013, for adults (>20 years old) with severe outcome is about 17.08%, while for adults with non-severe outcome are about 35.53%. (JB Mowry *et al.*, 2014).

The following formula was used (Wang H. and Chow, 2007)

$$n = \frac{(Z_{a/2} + Z_b)^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

n= sample size

$Z_{a/2}$ = critical value of normal distribution at $a/2$ (confidence interval 95%, a is 0.05, and critical value is 1.96

Z_b = critical value of normal distribution at b (for power 80%, b is 0.2 and critical value is 0.84)

P_1 = estimated proportion (larger)

P_2 = estimated proportion (smaller)

Taking the confidence interval of 95%, the sample size, n, was calculated

Sample size, n = 86

3.2: Associated factors of gender, marital status, ethnicity, occupation, underlying illness and agent implicated.

There is no available literature at the moment studying association factors of gender, marital status, ethnicity, occupation, underlying illness and agents implicated in relation to severe outcome of acute drug and chemical poisoning.

4) Sample size estimation for Objective 4:

To study factors associated with intentional poisoning in acute drug and chemical poisoning cases.

4.1: Associated factor: mode of ingestion

(a) Accidental mode

Two proportion formula is used for categorical independent variables.

For the mode of ingestion, according to US Poison Statistics National Data 2013, accidental mode with severe outcome is at 30.84%, while accidental mode with non-severe outcome is at 55.44 % (JB Mowry *et al.*, 2014).

The following formula was used (Wang H. and Chow, 2007)

$$n = \frac{(Z_{a/2} + Z_b)^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

n= sample size

$Z_{a/2}$ = critical value of normal distribution at $a/2$ (confidence interval 95%, a is 0.05, and critical value is 1.96

Z_b = critical value of normal distribution at b (for power 80%, b is 0.2 and critical value is 0.84)

P_1 = estimated proportion (larger)

P_2 = estimated proportion (smaller)

Taking the confidence interval of 95%, the sample size, n , was calculated

Sample size, $n = 60$

(b) Intentional mode

Intentional mode with severe outcome is at 2.69%, while intentional mode with non-severe outcome is at 12.32% (JB Mowry *et al.*, 2014).

The following formula was used (Wang H. and Chow, 2007)

$$n = \frac{(Z_{a/2} + Z_b)^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1-P_2)^2}$$

n= sample size

$Z_{a/2}$ = critical value of normal distribution at $a/2$ (confidence interval 95%, a is 0.05, and critical value is 1.96

Z_b = critical value of normal distribution at b (for power 80%, b is 0.2 and critical value is 0.84)

P_1 = estimated proportion (larger)

P_2 = estimated proportion (smaller)

Taking the confidence interval of 95%, the sample size, n, was calculated

Sample size, n =114

For the purpose of this study, the highest sample size calculated for objective 2, N= 134, will be used.

Research Tools

1. Total Hospital Information System (e-HIS)
2. Medical records
3. Data Collection Form

Operational Definition

Drug poisoning patient: subjects diagnosed with poisoning due to self-ingestion or inhalation of pharmacologic agent and medication.

Chemical poisoning patient: subjects diagnosed with poisoning due to ingestion or inhalation of chemical product.

Intentional poisoning: ingestion or inhalation of a drug or chemical with a clear intention of suicide or deliberate self-harm.

Accidental poisoning: ingestion or inhalation of drug or chemical without the intention of suicide or deliberate self-harm.

Non-severe outcome: no symptoms, or mild transient, spontaneously resolving symptoms or pronounced prolonged symptoms, with a severity grade of 1-2 from any organ system, in the

WHO poisoning severity score. This group of patients may or may not be hospitalised, and documented to have developed only self-limiting complications.

Severe outcome: severe or life-threatening, or death resulted, with a severity grade of 3-4 from any organ system in the WHO poisoning severity score. This group of patients are hospitalised and documented to have developed serious complications.

Data Collection Method:

A computer-generated list of drug and chemical poisoning cases treated in Hospital Sultan Abdul Halim from 2016 to 2020 will be obtained from the Medical Records Office database. All cases which fulfil all the inclusion and exclusion criteria will be included in this study. The case will be identified according to T-codes of the International Classification Disease- Tenth Revision (ICD-10). Keywords will be used when retrieving records. The medical record will be traced from the Total Hospital Information System (e-HIS). Details of each case will be recorded using Data Collection Form.