Poisonings in Alberta – A Retrospective Population Based Study

by

Pritam Mansukh Chordiya

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science
in
Epidemiology

Public Health Sciences
University of Alberta

ABSTRACT

Poisoning injuries constitute a significant health problem worldwide. Suicide is one of the leading causes of deaths and poisoning is the most common method utilized for the same. The objectives of this program of research were: 1) to systematically review existing studies analyzing the relationship between incidence of poisoning and mental health conditions in adolescents; 2) to understand which patient factors are related to the receipt of a professional consultation in poisoning cases visiting the emergency department. Two chapters contributed to accomplish the overall study goals.

The first study (Chapter 2) was a systematic review that evaluated the relationship between incidence of poisoning and presence of mental conditions. The 10 included studies were abstracted, appraised, and their results were analyzed. We were unable to perform meta-analysis due to large heterogeneity across studies and lack of SE as included studies performed descriptive analysis. Studies included in the review demonstrated a trend indicating adolescents with a mental health condition to be at higher risk of poisoning related ER visit. Depression was the most dominant condition amongst those with a mental health condition; however the evidence is not sufficient to show a cause-effect relationship between presence of mental health condition and risk of poisoning.

The second study (Chapter 3) described the circumstances that lead to emergency department visits due to poisoning-related injury events across all age groups in Alberta for the year 2010. This retrospective chart review was conducted by collecting poisoning-related emergency department data from Alberta Health Services (AHS) and Covenant Health, which maintain healthcare information for all Alberta residents accessing these services. The categorical data

between groups was analyzed by using the Chi square test; odds ratio and confidence interval was calculated by multivariable logistic regression analysis. The retrospective study found prescription of form 1 or 10, underlying mental health conditions, history of self-harm and overdosing on recreational drugs to be associated to being referred for professional mental health consultations. While nuances exist by age between types of substances used, the problem is still highly prevalent across the lifespan. Joint efforts from different sectors including governments, health workers, schools, advocacy groups and mental health organizations is required to effectively reduce the impact from this important public health problem.

Preface

This thesis is an original work by Pritam Chordiya. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Poisonings in Alberta", No. Pro00024612, January 12, 2012.

Acknowledgement

This thesis would not have been possible without the help and contributions from several people. First and foremost, I would like to express my sincere thanks to my supervisor, Dr. Don Voaklander, for granting me an opportunity and guidance to work on this project, and supporting me throughout my graduate program. Secondly I would like to thank Dr. Dean Eurich for his assistance and feedback on all chapters in this thesis. In addition, I am also thankful to George Frost and Colleen Drul at the Injury Prevention Centre, University of Alberta for providing assistance with data management.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Abbreviations

CI – Confidence Interval

ED – Emergency Department

EMS – Emergency Medical Services

ETOH – Ethanol (Drinking Alcohol)

ICD – International Classification on Diseases

ICU – Intensive Care Unit

MHC – Mental Health Condition

OD – Overdose

OTC – Over The Counter

PADIS – Poison And Drug Information Service

SE – Standard Error

Rx – Treatment (Prescription) Drugs

Chapter 1: Introduction

## 1.1.	Statement of Problem

Poisoning injury, both intentional and unintentional, is a significant health concern and together it is the most common cause of injury deaths in Canada.[1] In 2004, an estimated 346,000 people worldwide died of unintentional poisoning. The pattern of poisoning varies over time, between nations and even within regions of nations. For example, in developed countries, deliberate self-poisoning mostly occurs in relation to alcohol, medications and household chemicals. On the other hand, agro-chemicals such as pesticides are more commonly used in developing countries. It is therefore important to regularly evaluate the trends so as to optimally adapt preventive measures and effectively treat poisoned patients.[2-10] According to the Center for Disease Control and Prevention (CDC), poisoning-related injury cases are grossly under-estimated. A significant number of cases never show up at the hospital as they are treated at home and are never recorded through poison control centers.[11]

Suicide

Worldwide death by suicide consistently ranks among the top three causes of death in 15-34 year age group.[12-13] In 2002, World Health Organisation (WHO) estimated 877,000 deaths worldwide were due to suicides and attempted suicides were forty times more frequent than completed suicides.[12] There have been reports of dramatic increase in deaths by suicide in North America over the past decade whereas other sources specific to Canada and Alberta, report little change over the same period.[14-17] In Alberta, 2001/02, the provincial rate of hospitalizations for self-inflicted injuries was 90.6 per 100,000 population. Approximately 75% of acute care hospital

discharges for self-inflicted injury were for drug overdoses.[18] According to the World Health Organization (WHO) statistics, suicide is the second leading cause of deaths in adolescent population.[12]

Risk Factors for Poisoning and Suicide

Many studies have shown young age and female gender to be a risk factor for self-poisoning.[19-21] Studies have suggested that women are more likely to use poison as a method of self-harm because they are crying for help and not really motivated to die.[21] Women ingest toxic substances or pills as it increases the probability of intervention.[21] According to a study in Denmark, where suicide rates have been declining in the last two decades for all age groups, the decline seems to be largest among females. The authors concluded the decline was mainly due to the focus on providing specialized treatment to psychiatric patients, especially schizophrenia-related disorders and homeless persons. The study identified male gender, young age, short duration of illness, multiple admissions during the prior year, shorter time since discharge from a healthcare facility, co-morbid depression, drug abuse, poor compliance with medication and high IQ to be the most significant risk factors for suicide.[22] According to a study in Mexico, high rates of depressive-disorder related suicides were observed in a predominantly female population. Drug products were more frequently used compared to home or work related chemicals. The mortality related to poisoning episode was very high at 27%, despite the availability of advanced life support and antidote medications.[23]

Many poisonings are accompanied by alcohol misuse. Although alcohol by itself does not usually result in severe poisoning it acts as a provoking factor. A Canadian population-based

study conducted in the Calgary Health Region, concluded that alcohol related disorders were common and overdose rates were higher in younger patients, females, aboriginals and social assistance recipients. Indeed, alcohol consumption and substance abuse constitute a significant number of poisoning cases and alcohol has been linked with impulsivity and suicidality.[24-25]

Substances ingested in overdose are spread over a wide variety, ranging from prescription, OTC, recreational, agricultural, household goods (e.g. detergents, cleaners, windshield washers, etc.). A report by the Centre for Disease Control (CDC) in United States stated an increase in drug poisoning in 11 states and noted that more deaths were due to prescription than illicit opioids such as heroin by 1999–2000.[26] A study in Adana, Turkey, from 1997 to 2002 showed 1.6% of emergencies to be poisoned cases and attempted suicides accounted for 76.4% of these poisoned cases. Commonly used poisons were medicinal drugs (59%) followed by pesticides (26.4%). Psychoactive agents (tricyclic antidepressants, benzodiazepines, psychotic and psychosomatic regulators) were most common among drugs (35.5%).[27] Indeed, drug abusers are more likely to be hospitalized, and 2.3 times more likely to use an emergency room than non-abusers.[28] Studies in the past have observed a direct relation between number of drugs ingested and severity of poisoning. A study by Kontaxakis et al. in Athens, Greece, demonstrated a relationship between number of tablets used for overdose and mental health condition.[29] The authors concluded that patients who used a greater number of tablets (>= 30) more often suffered from schizophrenia, had history of previous suicidal attempts, had a concurrent somatic illness and required hospitalization. Attempters using small number of tablets (=<12) more often manifested personality disorders and required outpatient management.[29] A study by Stein et al. concluded that use of two or more drugs were common and consistent practice over time along with the

3

consumption of alcohol. The use of more than one drug at a time has been found to put the patient at a greater risk of requiring intensive care interventions.[28] A study by Tountas, in Greece, recorded that approximately half the patients took one pharmaceutical drug, 27.4% took two substances, 21.2% took three substances and 2.8% took four or more substances for overdosing.[20]

Timing is considered to be an important variable in drug poisonings. Hendrix et al. conducted a retrospective study in Belgium to study the epidemiology of deliberate self-poisoning in overdose patients that visited the Emergency Department (ED) in 2009. The authors found that majority of the overdose cases presented to the ED between 1800 and 2300 hrs.[30] Another study in England concluded overdose presentations to ED to be outside normal office hours (9am – 5pm, Monday to Friday), and the peak period of presentations was from 8pm to 2am.[31] Moreover, marked seasonality was observed with a peak in spring and early summer. When classified according to suicidal intent, the rates of intentional (69%) and unintentional (25%) overdose showed similar temporal trends.[32]

Role of Mental Health

Presence of a relationship between mental health condition and poisoning-related injury has been outlined by various studies. A study in Utah concluded that people dying of overdoses from pharmaceutical substances had a diagnosis of mental illness in 49% of cases and a history of hospitalization for psychiatric reasons in 24% of cases.[33] Stein et al. in their study, titled 'Changes in the pattern of drug overdoses', concluded that majority of the overdose patients had

previous suicide attempts, which is a strong risk factor for completed suicide, and had been followed by a mental health professional.[28] Indeed a study conducted by Ichimura et al. suggested that depression is closely related to attempted suicide. The authors concluded that patients with depression and who attempted suicide were significantly more often male, married, older and used methods other than poisoning by solids or liquids compared to patients with other mental disorders.[34] Moreover, depression and bipolar affective disorder are closely linked to suicide. A study suggested that overdose involving antidepressant or antipsychotic agents had higher likelihood of hospital admission.[35] Indeed, a systematic review conducted by Hawton focussed on patients with bipolar disorder in which suicide or attempted suicide was reported as an outcome. Previous suicide attempt and hopelessness were identified by the study as major risk factors for suicide, whereas early onset of bipolar disorder, increasing severity of affective episodes, presence of mixed affective states, rapid cycling, family history of suicide, co-morbid Axis I disorders and alcohol and drug abuse were major risk factors for nonfatal suicidal behaviour.[36] Thus, appropriate prescribing and monitoring of antidepressant and antipsychotics treatment is important to help prevent overdose.

1.2.   Summary

Poisoning injuries constitute a significant health problem worldwide. Suicide is one of the leading causes of deaths and poisoning is the most common method utilized for suicide and suicide attempts. Various risk factors associated to poisoning have been identified in the literature. Some of them include young age, female gender, alcohol consumption, presence of mental health conditions (mainly depression) and so on. Wide spectrums of substances are utilized for poisonings namely prescription drugs, OTC, recreational, agricultural and household

goods (e.g. detergents, cleaners, windshield washers, etc.). This research will help in identifying some common circumstances or risk factors around poisoning-related injury events in order to develop effective intervention strategies.

1.3.   Objectives

The objectives of this program of research were: 1) to systematically review existing studies analyzing the relationship between incidence of poisoning and mental health conditions in adolescents; 2) to understand which patient factors are related to the receipt of a professional mental health consultation in poisoning cases that visit the emergency department visits. These objectives were accomplished through two complementary studies.

1.4.   Program of Research

Two papers contributed to the overall study goals. The first study (Chapter 2) was a Systematic review that assess whether there are differences in poisoning incidence between adolescents with mental health conditions and adolescents without mental health conditions (aged 11-18) in developed countries. The second study (Chapter 3) was a prospective study of ED visits in Alberta to identify patient factors that are associated with the receipt of a professional consultation in the hospital.

Chapter 2: Systematic Review

Differences in incidence of poisoning between adolescents/teenagers with and without mental health conditions: a systematic review

2.1.   Introduction

Poisoning-related injuries constitute a significant public health problem at the global and national levels. Poisoning is one of the various methods practiced for self-harm or suicide. The mental health problems that are associated with suicide include but are not limited to depression, alcohol dependence/use disorder, personality disorder and schizophrenia.[37] Suicidal death consistently ranks among the top three causes of death in the population aged 15-34 years and constitutes a major loss to societies in years of productive life lost.[12] Self-harm is a common problem in adolescence and most episodes of deliberate self-harm in adolescents who present to the hospital involve overdoses.[38-39]

It has been reported that adolescents with mental health conditions have higher intentional poisoning rates compared to adolescents without mental health conditions.[40-43] Studies have demonstrated mental disorders to be a risk factor for poisoning but this evidence has not been synthesized or systematically reviewed. A previous systematic review assessed factors associated with suicidal phenomena but the risk of poisoning in relation to mental health condition was not explicitly discussed.[44]

The objective of this study is to systematically identify and synthesise the existing evidence to assess whether there are differences in poisoning incidence between adolescents with mental

health conditions and adolescents without mental health conditions (aged 11-18) in developed

countries (Appendix 2). Understanding the poisoning-related health disparity between

adolescents with mental health conditions and adolescents without mental health conditions

would help to develop effective poisoning prevention strategies specific to each group of

patients.

2.2. Methods

Although this systematic review was not registered, our protocol was developed in advance

according to the Preferred Reporting Items for Systematic Reviews and Meta Analysis

guidelines.[45]

2.2.1. Search strategy

A research librarian and the first author developed search strategies, and the first author

conducted searches of the following electronic databases to identify reports: Cochrane Database

of Systematic Reviews (2005 to January 2013), MEDLINE (1950 to present), EMBASE (1974 to

2013 Week 06), PsycINFO (1806 to February Week 2 2013), Scopus, Web of Science, Safetylit,

and ProQuest Dissertations and Theses Databases. We applied supplementary approaches by

searching websites of institutions and government agencies in developed countries and checking

reference lists of relevant studies. There was no restriction by publication status, but the searches

were restricted to studies conducted in developed countries and published in English. The list of

developed countries was obtained from Central Intelligence Agency's World Factbook.[46] We

used all appropriate search terms that imply the concepts of 'mental health condition',

'poisoning' and 'adolescent', while applying them for controlled vocabulary as well as free text terms, when available. The search strategy for MEDLINE is presented in Appendix #1, and this search strategy was modified as appropriate to the specifications of other databases.

2.2.2. Study Selection

Eligible studies for review were population-based observational studies or surveys that compared incidence of poisoning between adolescents with and without mental health conditions. We considered poisoning that included overdose of both legal and illegal drugs as well as poisoning from alcohol, pesticides, chemicals and household products. Studies with a qualitative approach, reviews, case reports and case series were excluded. Populations considered were adolescents between 11-18 years of age. If the upper age limit exceeded 18 or lower age limit was under 11, studies were included if the majority (>50%) of participants were <18 or >11 or subgroup data for that age group were provided. For study selection, two independent reviewers first screened the titles and abstracts to remove obvious irrelevant reports and duplicates. Subsequently, full-text reviews of remaining studies were conducted using a standardized form that listed predefined inclusion criteria. Disagreements between reviewers were resolved by consensus or third reviewer adjudication.

2.2.3. Data Extraction

Data were extracted from reports using a standardized data collection forms to gather information on the study design, population, data sources, mental health condition definition,

outcomes, results and additional information for assessments of the risk of bias. Data extraction was performed by the first author, and independently verified by the second author. (Table 2-1)

2.2.4. Quality Assessment

The internal validity of included studies was assessed using the Newcastle-Ottawa Scales (NOS).[47] The NOS evaluates selection bias, comparability and outcome assessment with eight items. It scores the validity by awarding a maximum of two points for an item of comparability and one point each for other items. Scores are summed and range from zero to nine points. We modified the NOS for Cohort studies by removing three items (outcome status at start of study, follow-up period, and follow-up) that were assumed irrelevant to injury studies, leaving us with five items for a maximum possible score of six points.[48] As criteria to assess comparability, we chose age, as well as socioeconomic status as important factors to be controlled for or matched. Two authors independently conducted critical appraisal of the included studies. Disagreements were resolved by consensus or by third reviewer adjudication.

2.2.5. Data Analysis

Data were synthesised qualitatively and displayed using a forest plot with a point estimate of the number of events in the study population without pooling of data. An a priori subgroup analysis was planned to check the effect of individual mental health conditions on incidence of poisoning.

2.3. Results

2.3.1. Study Selection

The PRISMA flow diagram of study retrieval and selection is shown in Figure 1.[45] Overall, 3371 reports were identified from literature searches. The full texts of 330 reports were examined and, of these, 320 studies were excluded. A total of 10 studies were included for the review, eight of which were population-based retrospective studies (two surveys,[49-50] six studies using administrative health database[41, 51-55] and two were case-control studies[23, 40]). The majority of studies (8 studies) were carried out in Europe and 2 studies were undertaken in the United States of America (USA).

Figure 2 – 1: PRISMA Flow Diagram
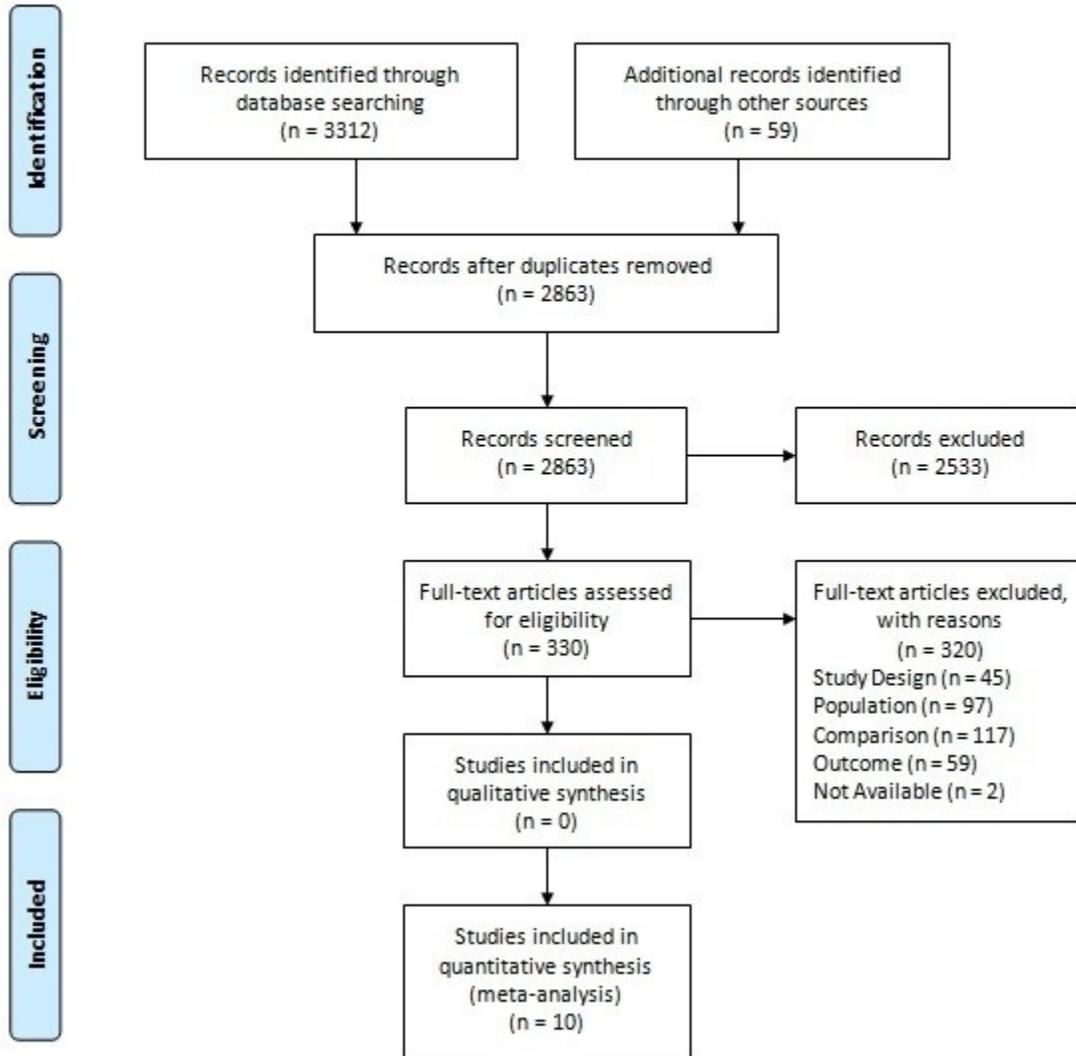
2.3.2. Study Characteristics

Table 2-1 demonstrates the primary study characteristics including study, sample source, age, number and proportion with mental health condition (MHC).

Table 2 – 1: Study Characteristics

    a) **Case-Control Studies**

Author, Year; Study Design; Location of Study	Setting and Subjects; Number (n) in study	Exposure; Mental Health Study Definition; How ascertained	Other Predictors Considered	Poisoning: How Ascertained; Comparison Group	Key Findings
Kerfoot, 1996; Case-Control; U.K.	Self-poisoning cases who had attended casualty departments in two inner city health districts in Manchester; 80	Psychiatric disorders; NR; DSM-III-R criteria (American Psychiatric Association, 1987)	Family background	Self-poisoning was defined as the intentional self-administration of more than the prescribed dose of any drug; psychiatric and community controls	Cases had high rates of major depression, specific association between taking an overdose and family dysfunction
Kingsbury, 1999; Case-Control; U.K.	Self-poisoning cases who presented at the General hospital in Oxford; 63	Psychological factors; NR; Diagnoses of depression were made in the overdose group by using DSM-IV criteria for major depression and Beck Depression Inventory (BDI)	None	Self-reported poisoning; psychiatric and community controls	Significant differences were found but when depressive affect (Beck Depression Inventory) was controlled for, all of these differences disappeared

13

b) Cohort Studies

Author, Year; Study Design; Location of Study	Setting and Subjects; Number (n) in study	Explanatory variable of interest: Mental Health Study Definition; How ascertained	Poisoning: How Ascertained; Comparison Group	Key Findings
Liisanantti, 2010; Retrospective Chart Review; Finland	Oulu University Hospital for acute self-poisoning; 309	NR; Determined by a child psychiatrist or pediatrician during the hospital stay	From the clinical charts; None	Over one-third of all intoxications were intentional self-harm, although previously diagnosed psychiatric diseases were rare
Hawton, 2010; Survey; England	All pupils in the identified classes were eligible in 41 schools in England; 86	NR; The hospital anxiety and depression scale (HADS)	Self-report questionnaire; Self-cutters	More of those who cut themselves had friends who had engaged in DSH, and fewer had sought help from friends before DSH or had wanted to die
Marbella, 2005; Retrospective population based study; U.S.A.	Discharge data files for patients classified as having medical injuries; 2893	NR; patient's medical records	Patient's medical files ICD code ; None	Females had twice as many medication-related injuries as males, 60% of medication-related injuries occurred in patients with a mental disorder diagnosis
Hawton, 1999; Retrospective population based study; U.K.	Admitted to the general hospital in Oxford because of self-	NR; Schedule for Affective Disorders and Schizophrenia,	Self-reported; None	Depression is a key factor associated with risk of repetition

	poisoning; 45	Child Version (K-SADS)		of adolescent self-harm
Nasr, 1997; Chart Review; England	Admitted to pediatric ward for taking an overdose; 54	According to ICD-10 criteria (WHO); Psychiatrist	NR; None	Psychiatric disorder was present in 51% of the cases
Schreiber, 1986; Chart Review; U.S.A.	Adolescent unit following acute drug ingestion; 38	NR; patient's medical records	Self-reported; None	It was generally the degree of depression, as assessed by the pediatrician, that determined whether a psychiatric consultation was requested
Kreitman, 1979; Chart Review; Scotland	Parasuicides reporting at the Regional Poisoning Treatment Centre (RPTC); 1075	NR; patient's medical records	NR; None	Marked, non-artefactual rise in the numbers of young female parasuicides admitted
White, 1974; Survey; England	Admitted to the General Hospital following self harm behavior; 50	NR; interviewed by the psychiatrist	Self-reported; None	Most patients had suffered family separation or disturbance and the overdose followed inter personal crises while few had formal psychiatric illness

All of the study populations were between 11-18 years old, except for the cohort studies by

Kreitman et.al. and White et al.. These studies were included because majority (78%) of the

population in the White et al. study were between 11-18 years old and subgroup data for 15-19

years age group was available in the study by Kreitman et.al. Percentage of females in the study population ranged from 54% to 100%; percent with presence of MHC ranged from 12% to 98%.

2.3.3. Data Analysis

Data were summarised and synthesised separately for eight retrospective studies and two case-control studies. We could not calculate relative risks or risk differences from the retrospective studies as they were single arm without a comparator group. Meta-analysis was not conducted due to large heterogeneity across studies as well as a lack of standard errors in the included studies as these studies mainly performed descriptive analyses. Therefore, data were synthesised qualitatively and displayed using a forest plot with a point estimate of the number of events in the study population without pooling of data. Two of the included studies included multiple comparisons with two categories of controls (psychiatric controls and community controls). Thus, for the purpose of our review, we only considered community controls as they were deemed the most appropriate comparison group to answer the question of this study. A test for publication bias was not performed because of an absence of standard errors.

2.3.4. Methodological quality of included studies

Table 2 – 2: Quality assessment of individual studies

a) Case-Control Studies

Study		Keerfoot 1996	Kingsbury 1999
Selection	**Is the case definition adequate?**	Yes	Yes
	Representativeness of the cases	Consecutive cases	Consecutive cases
	Selection of Controls	Community Controls	Community Controls
	Definition of Controls	No history of disease	No history of disease
Comparability	**Comparability of cases and controls**	Adjusted for age and sex	Adjusted for age and sex
Exposure	**Ascertainment of exposure**	Self Report	Self Report
	Same method of ascertainment for cases and controls	Yes	Yes
	Non-Response rate	Same for both groups	Same for both groups
Overall NOS score		7/9	7/9

b) Cohort Studies

| Study	Selection			Comparability	Outcome	
	Representativeness of the intervention cohort	Selection of the non intervention cohort	Ascertainment of intervention	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Overall NOS score
Liisanantti 2010	Representative	Same Commu.	Secure Record	No	Record	4/6
Hawton 2009	Representative	Same Commu.	Secure Record	No	Self Report	3/6
Marbella 2005	Representative	Same Commu.	Secure Record	No	Record	4/6
Hawton 1999	Representative	Same Commu.	Secure Record	No	Record	4/6
Nasr 1997	Representative	Same Commu.	Secure Record	No	Record	4/6
Schreiber 1986	Representative	Same Commu.	Secure Record	No	Record	4/6
Kreitman 1979	Representative	Same Commu.	Secure Record	No	Record	4/6
White 1974	Representative	Same Commu.	Secure Record	No	Record	4/6

NOS: Newcastle-Ottawa

The internal validity of studies was moderate. In total, 90% of studies (9 out of 10 studies) received four or more points out of a possible six on the NOS for Cohort and Case-Control studies. Points given to studies included three points (1 survey), four points (7 cohort studies) and seven points (2 case-control studies). The main reasons for lower point ranking were a lack of control for potential confounders and outcome assessment by self-report.

2.3.5. Primary Outcome (mental health condition prevalence)

All the eight retrospective studies and two case control studies reported the presence of mental health condition in poisoned adolescents. Amongst the retrospective studies, six studies used administrative data[41, 51-55] and two utilized school based surveys.[49-50] In a study by Hawton,[49] 85 of the 86 cases were diagnosed with at least one mental health condition. Except for two studies,[51, 53] all the studies showed higher events of poisoned adolescents diagnosed with at least one mental health condition (Figure 2.2). Of the two case-control studies, one demonstrated[40] an OR of 27 (95% CI 7.68 to 94.87; p<0.0001) for the presence of mental health condition amongst poisoned adolescents, while the other[23] showed consistent high scores on the Beck's Depression Index (BDI) in the case group (time 1 = 24.7, time 2 = 15.0) compared to the control group (time 1 = 7.4, time 2 = 5.6). Females were almost twice as susceptible to poisoning injuries compared to males.

Figure 2 – 2: Point estimates of events over study population
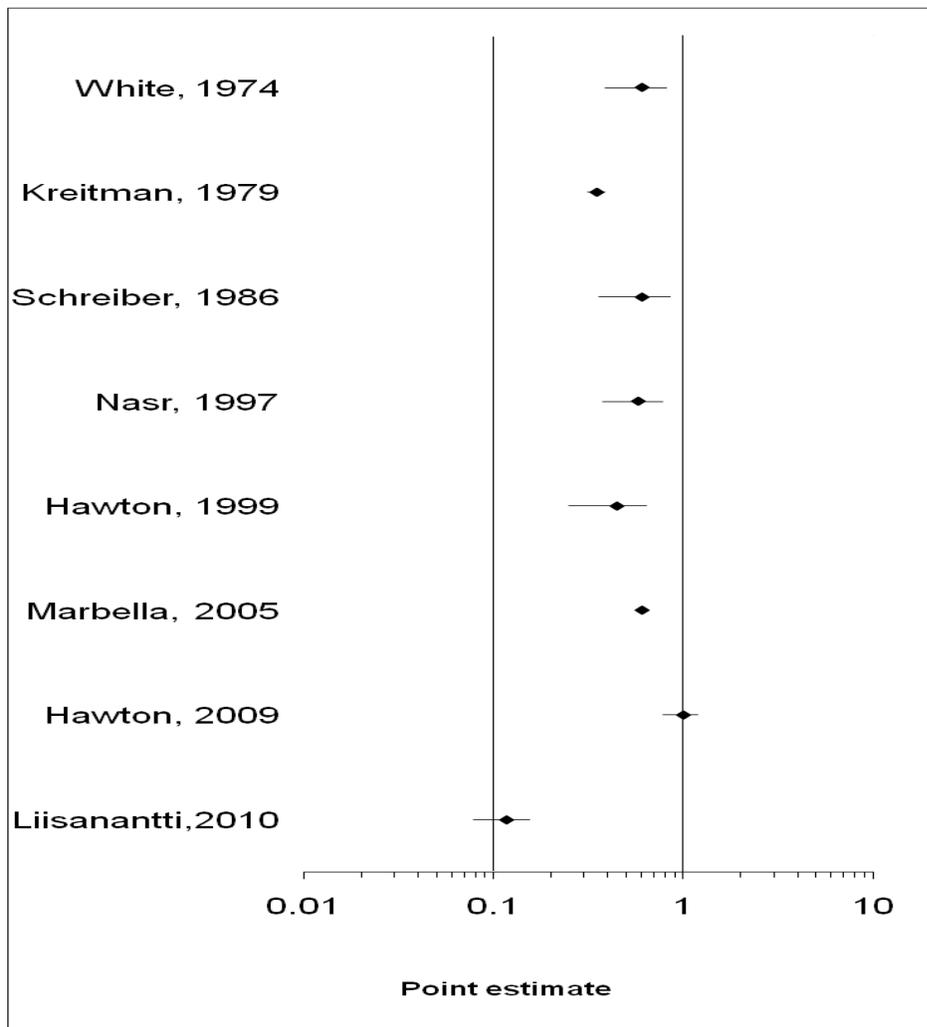
Point estimate = Total number of poisoning cases with MHC/Total study population

2.3.6. Subgroup Analysis

An a priori subgroup analysis was planned to check the effect of individual mental health conditions on incidence of poisoning. Out of those that demonstrated the presence of a mental health condition, majority were diagnosed with depression (Figure 2-3).

Figure 2 – 3: Incidence of depression amongst poisoning cases with a mental health condition per 1000 population
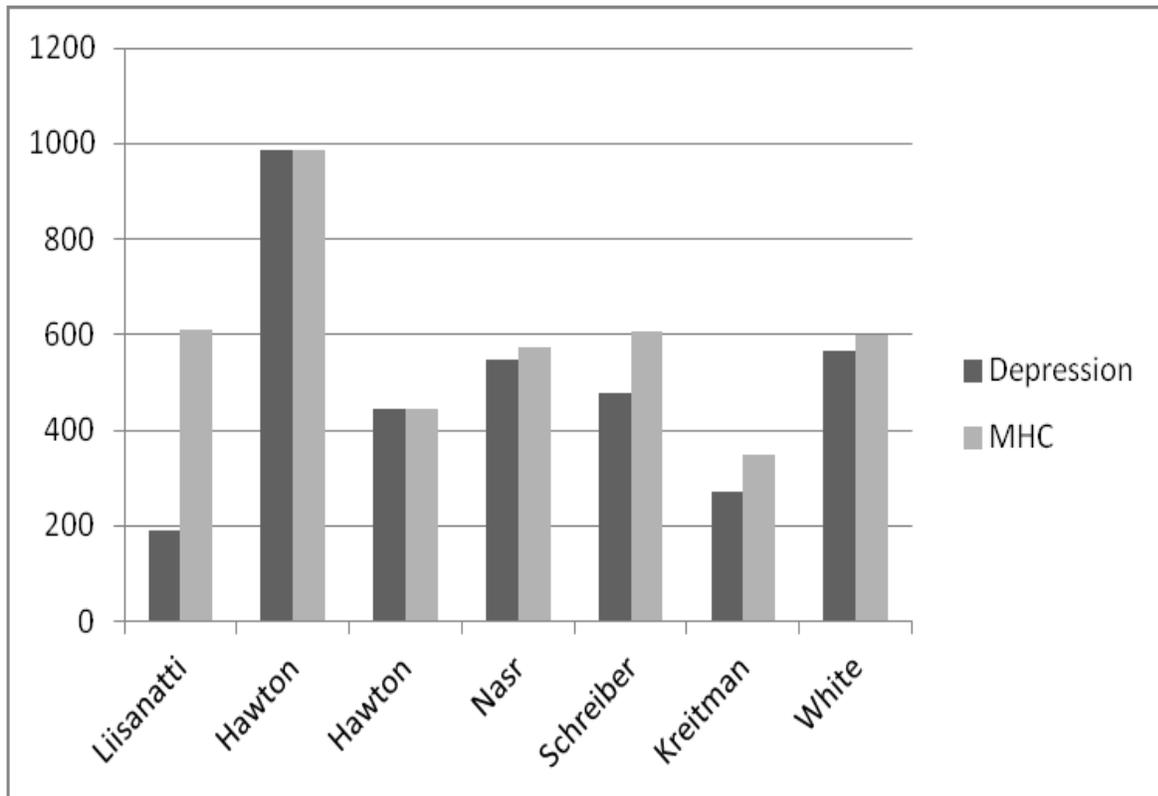
2.4. Discussion

2.4.1. Summary of evidence

Poisoning is a major public health issue in the adolescent age group according to World Health Organization.[12] This systematic review summarises the available evidence regarding risks of poisoning between adolescents with mental health conditions and adolescents without a mental condition in a qualitative fashion. Surprisingly, only 10 population-based studies conducted in Europe and USA met the criteria for the review. Overall, our results show a higher incidence of

poisoning injuries amongst adolescents with mental conditions compared to those without a mental health condition. Depression was the most predominant condition amongst those with a mental health condition. Poisoning incidence was almost twice more frequent among females than males.

2.4.2. Interpretation

Most of the retrospective studies demonstrated higher numbers with mental health conditions except for two studies. The study conducted by Liisanantti et al (2010), showed fewer adolescents with MHC. This can be attributed to a fact that in 72% of cases the reason for poisoning was alcohol resulting in unintentional poisoning. The higher incidence of alcohol intoxications may be reflective of binge drinking habits among Finnish adolescents.[51] In the other study (Kreitman and Schreiber), incidence of mental health condition was slightly on the lower side compared to other studies and this can be attributed to the fact that the category "None" for mental health conditions also included subjects with diagnosis of acute depression.

Overall, the number of poisoned females was consistently high compared to males across all the studies. Among the nine studies that included both males and females, the number of poisoned females was more than 75% of the total poisoning cases in seven out of the nine studies. Prevalence of mental health conditions among poisoned adolescents was high in majority of the studies. Mental health condition was recorded in more than 50% of the study population in five retrospective studies[41, 49, 52, 54-55] and both the case-control studies[23, 40] with depression being the most common MHC. Due to the absence of a comparator group in the retrospective studies, it is not possible to make conclusions on the poisoning-mental health condition relationship.

However, the two case-control studies suggest that depression is strongly associated with adolescent poisoning.

2.4.3. Strengths and Limitations

This systematic review was methodologically rigorous with a priori protocol and contained a comprehensive search strategy. However, there are some limitations. First, the risk of bias within the primary studies may limit the validity of the inference as majority of the studies applied descriptive rather than analytical statistics by calculating injury incidences without controlling for potential confounders. Descriptive statistics may be meaningful to show the real trends of prevalence; however, they may not be sufficient to examine the association of mental health conditions on poisoning episodes due to potential confounding. Second there was substantial heterogeneity among the included studies that originated from the clinical diversity (e.g. characteristics of participants including sex, race, and study setting), as well as from methodological variations (e.g. study design, data sources, mental health condition classification/definition, and statistical methods). The large heterogeneity precluded a statistical pooling of effect estimates and hindered valid comparisons of results across the studies. Even though this review was comprehensive, publication bias and selection bias (e.g. not including publications in languages other than English) may be possible.

2.5. Implications and conclusion

More studies with comparison groups are required in this area. Primary studies should report poisoning rates with appropriate denominators that allow the calculating of analytical statistics

controlling for potential confounders like socioeconomic status. Overall, our results show a trend of higher prevalence of mental health conditions in adolescents with poisoning, particularly depression. Females seem to be at a higher risk of poisoning compared to males. Studies also suggested that it is crucial to recognize adolescent psychiatric disorders in time and to consult mental health professionals in poisoning cases. However, to confirm a cause-effect relationship we need more studies that include control or comparison groups like community or hospital controls.

Conflict of Interest: None

Appendix 2 – 1: MEDLINE (Ovid Version) search strategy

1. north america/ or exp canada/ or greenland/ or exp united states/ or exp japan/ or exp korea/ or exp australia/ or exp europe/

2. exp Developed Countries/

3. 1 or 2

4. exp africa/ or exp caribbean region/ or exp central america/ or latin america/ or mexico/ or exp south america/ or exp asia, central/ or exp asia, southeastern/ or exp asia, western/ or exp china/ or mongolia/ or taiwan/

5. Developing Countries/

6. 4 or 5

7. 6 not (3 and 6)

8. Drug Overdose/

9. overdose.ti,ab.

10. poisoning/ or exp gas poisoning/

11. poisoning.ti,ab.

12. 8 or 9 or 10 or 11

13. 12 not 7

14. exp *Foodborne Diseases/

15. (food poisoning or oxygen poisoning).ti.

16. 14 or 15

17. 13 not 16

18. Mental Health/

19. mental

 health.ti,ab.

20. exp Attention Deficit Disorder with Hyperactivity/

21. attention deficit hyperactivity disorder.ti,ab.

22. exp Mental Disorders/

23. (depression or depressive or bipolar or adhd or schizophreni* or anxiety or dementia or

personality disorder* or eating disorder* or life stressor*).ti,ab.

24. 18 or 19 or 20 or 21 or 22 or 23

25. 17 and 24

26. adolescent/ or young adult/

27. (adolescent* or teenager* or young adult*).ti,ab.

28. 26 or 27

29. 25 and 28

30. case reports/

31. (case report or case series or case study).ti.

32. 30 or 31

33. 29 not 32

34. Animals/

35. 33 not 34

36. limit 35 to english language

Appendix 2 – 2: List of Developed countries according to Central Intelligence Agency

Andorra

Australia

Austria

Belgium

Bermuda

Canada

Denmark

Faroe Islands

Finland

France

Germany

Greece

Holy See

Iceland

Ireland

Israel

Italy

Japan

Liechtenstein

Luxembourg

Malta

Monaco

Netherlands

New Zealand

Norway

Portugal

San Marino

South Africa

Spain

Sweden

Switzerland

Turkey

United Kingdom

United States of America

Chapter 3: Poisonings in Alberta – A Retrospective Population Based Study

3.1.   Introduction

Among Canadians, poisoning is ranked third after falls and motor vehicle collisions as the most frequent cause of injury leading to hospitalization. According to Canadian statistics, in 2010, the number of estimated deaths due to unintentional poisoning was 1568 with 7,893 hospitalizations, 54,245 non-hospitalizations, 1,731 permanent partial disability cases and 109 permanent total disability cases. The total cost of unintentional poisoning related injury events was estimated at CDN$396 million in direct costs and CDN$868 million in indirect costs.[1] The number of deaths due to suicide/self-harm in the same report was found to be 3,948 with 16,131 hospitalizations, 34,677 non-hospitalizations, 3,443 permanent partial disability cases and 175 permanent total disability cases.[1]

In Alberta in 2010, the number of estimated deaths due to poisoning was 153 (40 unintentional and 113 due to intentional poisoning) and 2,908 hospitalizations (1,315 unintentional and 1,593 due to intentional poisoning). The total cost of unintentional poisoning-related injury events was estimated at CDN$66 million in direct costs and CDN$59 million in indirect costs. For intentional poisonings, the estimated direct and indirect costs were CDN$82 million and CDN$115 million, respectively.[1]

Research has shown that a psychosocial assessment for every patient admitted to hospital for drug poisoning was beneficial in terms of preventing repeat attempts.[56-59] However, a study by Okumura et al. found that despite evidence suggesting that all the drug poisoning patients should receive a psychosocial assessment only 30% of the study patients admitted to hospital received a psychiatric consultation.[60]

3.2.   Aims and Objectives

The goal of this study is to identify patient factors that are associated with the receipt of a professional mental health consultation in poisoned patients at the hospital.

3.3.   Methods and Material

3.3.1. Study Design

The study population consists of residents of the province of Alberta visiting any Emergency Departments (ED) in the province between 1st January 2010 and 31st December 2010. Approximately 3.6 million people are residents in Alberta and all ED visits are covered under a universal care system. Poisoning-related ED data were obtained from Alberta Health Services (AHS) and Covenant Health, which maintain healthcare information for all Alberta residents who access these services. The cause of hospitalization is classified and coded according to the 10th version of the International Classification of Disease (ICD-10). Patients were eligible for inclusion if they: i) were residents of Alberta, ii) visited the ED for acute care or day care as a result of poisoning, and iii) were discharged during our study period. Adverse effects resulting from legal drugs taken as directed and in the proper doses, and any other non-poisoning related ICD-10 codes, were not included in the study.

We classified patients as living in three types of areas: major metropolitan areas, cities and rural locales. Our definition for major metropolitan areas was Edmonton and Calgary (excluding commuting zones such as St. Albert, Airdrie, etc.). Remote/rural areas were those defined as areas in which less than 10,000 persons live in towns and municipalities outside the commuting zones of larger urban centers (Statistics Canada 2001). Regional centers were defined as centers

with a population of 10,000 or greater excluding the two metropolitan areas. We used 2010 Alberta census data for identifying centers as cities or rural areas. Proportion of charts selected in each category was equivalent to the proportion of the population residing in the three categories (i.e. approximately 50% of charts were from the metropolitan centers and 50% from cities and rural areas based on the Alberta 2010 population). In cases where there were more poisoning-related visits than the number of charts requested, we asked the hospital to provide a random sample from the total number of charts. In instances where fewer charts were available than requested, we added the difference to subsequent hospitals within the same category area. To limit variability, we only requested poisoning-related visits for 2010. The Health Ethics Research Board at the University of Alberta approved this study (Pro00024612).

3.3.2. Data Collection

Data were abstracted on-site (hospital) by trained research study staff. A standardized data abstraction form was used to obtain the following information: age, sex, date and time of visit, mental health assessment form (to check for unusual mental state), relevant previous medical history, type and route of exposure, type of substance(s), reasons for exposure, management, consultations and fatality. Documentation of a Mental Health Assessment was also abstracted for Forms 1 (application for psychiatric assessment), Form 8 (psychiatric assessment ordered by court) and Form 10 (brought in by police). Medical charts were reviewed to identify other contextual information on the poisoning-related injury. The poisoning diagnosis was made based on a documented acknowledgement by the patient of taking the drug or by a positive urine drug screen that is done systematically for any suspected exposure. Only one poisoning episode per person was collected. Poisoning exposures were grouped in four major categories: prescription

drugs, over the counter medications, recreational drugs and other substances. Intent was categorized into three groups based on information from patient chart: intentional, unintentional and suspected. The route of exposure was recorded as: inhalation, ingestion, injection, intranasal, intravenous, subcutaneous, anal/rectal, epicutaneous, intradermal and transmucosal. We also collected data regarding presence of any disease/condition focusing on mental health conditions and consultations by any professional encountered during treatment in the ED. No identifying information was recorded.

3.3.3. Data Analysis

Data were reviewed and checked for completeness before being entered into a database. Descriptive statistics are presented as means and frequencies. Multivariable logistic regression was used to evaluate the association between consultations and the presence of disease/conditions, previous self-harm attempts, intent for poisoning, mental health conditions and types of drugs. The purposeful selection method was used in model building procedures. Those factors associated with a mental health assessment at p-value less than 0.20 in the univariate logistic regression models were considered in the multiple logistic regression models. Additionally, we conducted subgroup analysis with regards to gender (males vs. females), age-group (adolescents vs. adults) and geographic location (metropolitan region vs. rural) to check for potential interactions. Results obtained are presented as odds ratios (OR) and 95 percent confidence intervals (95% CI). A two-sided p-value of less than 0.05 was considered significant. The data were analyzed using SPSS 20.0 statistical package.

3.4.   Results

Descriptive analysis: Between 1st January 2010 and 31st December 2010 a total of 1,360 individual poisoning encounters were sampled. The study population comprised of 902 (66.3%) people from metropolitan centers (Edmonton/Calgary), 229 (16.8%) from remote/rural sites and 229 (16.8%) from regional sites.

Table 3-1 provides a summary of patient characteristics. The mean age was 35.4 years (standard deviation (SD) =15.8) and 763 (56.1%) were female. Six hundred and two (44.3%) patients did not receive any professional mental health consultation. The frequency of poisoning was highest between 4pm and 11pm and seven hundred and sixty five (56%) patients required transportation to hospital with ground ambulance being the mode of transport on most occasions (98.9%). History of previous self-harm was present in 411 (30.2%) surviving patients and not documented in 552 (40.6%) patients.

Frequently used agents leading to poisoning were: analgesics 27.7% (377), anti depressants 13.3% (181), anxiolytics 10.5% (143), depressants 9% (123), noxious gas 7.8% (106) and hypnotics 7.2% (98). According to drug class, 620 (45.6%) cases consumed over the counter medications (OTC), 357 (26.2%) took recreational drugs such as marijuana, ecstasy, cocaine, etc., 217 (15.9%) took other medications and 166 (12.2%) overdosed on prescription drugs. The common routes of the poisoning exposure included ingestion 85.7% (1,165), inhalation 11.1% (151) and injection 1.5% (20). Ten percent of the study population used four or more different types of drugs to overdose, 78.2% of these underwent professional mental health consultation, with bulk of the consultations being for prescription and recreational drugs.

Intentional poisoning was most common (52.4%), followed by unintentional (36.3%) and suspected poisoning (11.4%). Overall, 67.1% (n=913) of the patients were treated and discharged, 15% (n=204) required further management and were admitted to inpatient services, 6% (n=82) were admitted to psychiatric unit, 4.2% (n=57) were admitted to an intensive care unit, 4.4% (n=60) were referred to detoxification centres, 2.9% (n=39) were transferred to another acute hospital for further treatment and 4.3% (n=58) left without being treated. Two patients died.

With respect to mental health assessments, only 356 (26.2 percent) patients received Form 1 or 10 (Appendix 3-1). Of those treated for intentional poisoning, only 42.5 percent received Form 1 or 10. Sixty four patients (18%) received Form 1 or 10 but did not get a professional mental health consultation. Eighty two percent of these were from metropolitan city centres, 81.3 percent required ambulance, and 76.6 percent were due to intentional poisoning. Among these patients the most common mode of poisoning (more than 50 percent) was overdose on prescription drugs. Four hundred and sixty six patients (34.3%) did not receive Form 1 or 10 but still received a professional mental health consultation. Of these 61.4 percent were from metropolitan city centres, 50 percent required ambulance, 53.4 percent and again, were mainly due to intentional poisoning with 47.9 percent related to overdose on prescription drugs.

Results from multiple logistic regression for Consultations

A purposeful selection procedure from univariate analysis was used to determine the significant factors resulting in a consultation in the multiple logistic regression analysis (Table 3 - 1). The following variables were included in the multiple logistic regression model: gender, geographic location, ambulance required, mental health form 1 or 10, exposure, mental health conditions,

35

history of self-harm and drug class (all p<0.20 from univariate analyses). Results from the final multiple regression model are shown below in Table 3 – 2. After controlling for all other factors, the following variables were statistically significant: mental health Form 1 or 10, history of mental health conditions, history of previous self-harm and use of recreational drugs for abuse.

Poisoning related visits in hospitals still remain a problem in Alberta. Based on our multivariable logistic regression analysis we observed that patients receiving mental health Form 1 or 10 were more likely to receive a professional mental health consultation compared to those not receiving mental health form (OR = 1.91, 95% CI 1.29 - 2.82). Patients with diagnosed mental health conditions were significantly more likely to be referred for professional mental health consultation compared those with no history of mental health conditions. Patients with a history of previous self-harm were significantly less likely to receive a professional mental health consultation compared to those with no history of previous self-harm (OR = 0.58, 95% CI 0.36 - 0.94). Those overdosing on recreational drugs were significantly less likely to receive a consultation compared to the ones overdosing on prescription drugs (OR = 0.47, 95% CI 0.27 - 0.80). (Table 3 - 2)

Although the following variables were not significant in the final model, they were significantly associated with referral for consultation in the univariate analysis. Our study found females to be less likely to be referred for a professional consult compared to males (OR = 0.43, 95% CI 0.29 - 0.54). Residents of metropolitan cities were 1.7 times more likely to get a consultation compared to those residing in rural areas (OR = 1.78, 95% CI 1.33 - 2.38). Patients requiring ambulance for transportation to the hospital were 1.5 times more likely to receive a consult compared to those not requiring the ambulance (OR = 1.52, 95% CI 1.28 - 1.89) (Table 3 - 1). Subgroup analysis,

with regards to gender (males vs. females), age-group (adolescents vs. adults) and geographic location (metropolitan region vs. rural) to check for potential interactions, did not indicate any statistical significance except for degree of severity amongst the respective groups.

3.5.   Discussion

This population-based study has provided important information regarding patients treated in EDs in Alberta for poisoning-related admissions. First, these results have identified patient factors associated with the receipt of a professional consultation and second, it is consistent with previous research that has identified significant associations between poisoning and mental health conditions.[28, 33-34, 36] The results of this research are important to patients and their families, healthcare providers and policy makers in developing prevention and intervention programs to improve the care and outcomes for patients who present to the ED with a poisoning-related diagnosis.

Our study found that patients with a mental health diagnosis and/or mental health form referral were more likely to receive a professional mental health consultation. Literature also suggests that those with mental health conditions are more likely to be referred for a psychosocial consultation.[61-62]

Regarding the association between history of self-harm and psychosocial consultation, the literature is not consistent. Studies by Kapur et al. and Bergen et al. found that consultations were equally likely for patients with a history of self-harm compared to those with no history;[56, 62] whereas another study found that those who self-harm repeatedly were less likely to receive a

psychosocial consult.[63] Studies in the past have suggested that consultations for drug overdose patients are beneficial in terms of preventing/avoiding future attempts.[56, 59-60] Literature also suggests that psychosocial assessment and interpersonal therapy is a necessary starting point in the treatment of self-harm patients.[57-58] Despite the literature suggesting psychosocial assessment to be beneficial for patients attempting self-harm, our study found that patients with a history of self-harm were less likely to receive a professional mental health consultation compared to those without a history of self-harm.

A report by CDC in United States of America that showed an increase in drug poisoning in 11 states noted that more deaths were due to prescription drugs than illicit opioids such as heroin in 1999–2000.[11] In our study we also found prescription drugs to be the cause of poisoning in little less than half of the study population. Those overdosing on prescription drugs were more likely to receive a psychosocial consult compared to those overdosing on recreational drugs. Alcohol has been known to induce impulsive and risk taking behaviour.[24-25] There appeared to be a significant relation between alcohol consumption and poisoning exposure.

Two variables, geographic location and history of previous self-harm, had a positive relationship with respect to receiving a consultation in the univariate analysis. When these variables were added to the multivariable analysis the direction of the effect reversed. We checked for any correlation between the variables that could explain the change in direction and did not find any significant results. Upon model building iteratively we found history of previous self-harm and exposure variables caused the reversing of the numbers. Upon further exploration we found differences in the crosstabs which suggested that the number of cases with not documented

history of previous self-harm were substantially higher in the rural population. We suspect it could be a case of Simpson's paradox. Simpson's paradox is a well known statistical phenomenon and it is observed when the relationship between two categorical variables is reversed after a third variable is introduced to the analysis of their association, or alternatively where the relationship between two variables differs within subgroups compared to that observed for the aggregated data.[64] In our case the direction of the effect for the association between geographic location and consultation is reversed upon adding history of previous self-harm variable to the model. Similarly, the direction of the effect for the association between history of self-harm and consultation is reversed upon adding exposure variable.

Study Limitations

The study is retrospective in nature and the information was collected from the patients' charts, which varied in accuracy and availability among cases. It was beyond the scope of this study to follow up on specific cases to find out if they have had any intent for self-harm. It is likely that many cases of self-harm were missed. Our sample only included patients admitted to the ED; less severe cases that did not require urgent medical care were not captured. A large number of cases that overdose never report to a hospital which results in loss of significant information.[11]

There is a potential for misclassification of cases with a diagnosis mental health condition in our study. In our study, patients could be classified as having a mental health condition based on previous records which might not be applicable at the time of poisoning. Another reason for misclassification could be that in some cases emergency physicians were making the diagnosis

of mental health conditions when they do not have special training to do so. Diagnostic workup bias is likely to result in a diagnosis of mental health condition in post-poisoning cases.

Conclusion

This research was able to characterize the circumstances of incidents of poisoning-related ED admissions in Alberta and provide a greater understanding of the extent of the problem and its burden on patients and on society. This study has identified factors associated with a referral for a psychosocial consultation such as mental health form referral, underlying mental health conditions, no history of self-harm and overdosing on prescription drugs. The results will be useful for patient management and provide direction for future research.

Table 3 – 1: Sample Characteristics

Factor		Consultations		
	Frequencies	**OR**	**95% CI**	**P**
Mean age in years (SD)	35.4 (15.8)	1.004	0.99, 1.01	0.167
Gender				
Male	43.9%	1.00		
Female	56.1%	0.426	0.29, 0.54	<0.001
Geographic Location				
Remote/Rural	16.8%	1.00		
Metropolitan Centre/City	66.3%	1.776	1.33, 2.38	<0.001
Regional Centre	16.8%	1.234	0.85, 1.78	0.262
Ambulance Required				
No	43.4%	1.00		
Yes	56.3%	1.52	1.28, 1.89	<0.001
Not Documented	0.4%	0.25	0.03, 2.25	0.216
Mental Health Form 1 or 10				
No	73.8%	1.00		
Yes	26.2%	5.267	3.91, 7.09	<0.001

Exposure			
Unintentional	36.3%	1.00		
Intentional	52.4%	4.297	3.36, 5.49	<0.001
Suspected	11.4%	1.808	1.26, 2.60	0.001
Mental Health Diagnosis				
ADHD	5.5%	8.77	3.13, 24.60	<0.001
Bipolar Spectrum	6.7%	2.48	1.42, 4.34	0.001
Depression	61%	5.90	4.62, 7.53	<0.001
Schizophrenia	2.6%	0.93	0.48, 1.80	0.835
Anxiety	16%	3.86	2.52, 5.91	<0.001
Dementia	0.8%	0.95	0.29, 3.14	0.936
Personality Disorder	17%	11.34	6.06, 21.17	<0.001
Alcohol abuse/dependence	28%	2.63	1.97, 3.50	<0.001
Current use of alcohol	34%	1.11	0.88, 1.40	0.361
Previous drug/alcohol rehabilitation	12%	7.24	3.83, 13.67	<0.001
Current life stressor	52%	4.46	3.49, 5.71	<0.001
Drug abuse/dependence	23%	1.72	1.30, 2.28	<0.001
History of drug abuse	35%	2.35	1.82, 3.03	<0.001
History of self-harm				

No	29.2%	1.00		
Yes	30.2%	1.932	1.41, 2.65	<0.001
Not Documented	40.6%	0.220	0.17, 0.29	<0.001
Drug Class				
Rx	12.2%	1.00		
Other	16%	2.64	1.87, 3.74	<0.001
OTC	45.6%	2.60	1.90, 3.58	<0.001
Recreational	26.2%	0.63	0.41, 0.96	0.033

Reference Category: No Consult; ADHD = Attention Deficit Hyperactivity Disorder

Table 3 – 2: Results from multivariable logistic regression for consultations in poisoning patients

	Consultations		
	OR	**95% CI**	**P**
Gender			
Male	1.00		
Female	0.83	0.63, 1.09	0.182
Geographic Location			
Remote/Rural	1.00		
Metropolitan Centre/City	0.66	0.45, 0.96	0.032
Regional Centre	0.67	0.43, 1.05	0.079
Ambulance Required			

No	1.00		
Not Documented	0.05	0.00, 1.50	0.084
Yes	1.06	0.79, 1.43	0.670
Mental Health Form 1 or 10			
No	1.00		
Yes	1.91	1.29, 2.82	0.001
Exposure			
Unintentional	1.00		
Intentional	1.22	0.81, 1.82	0.346
Suspected	0.63	0.38, 1.04	0.073
Mental Health Conditions			
ADHD	5.92	1.90, 18.45	0.002
Bipolar Spectrum	1.24	0.61, 2.53	0.545
Depression	1.98	1.38, 2.84	<0.001
Anxiety	1.85	1.10, 3.11	0.020
Personality Disorder	4.27	2.10, 8.65	<0.001
Alcohol abuse/dependence	1.83	1.22, 2.74	0.004
Previous drug/alcohol rehabilitation	2.94	1.40, 6.16	0.004
Drug abuse/dependence	0.69	0.44, 1.07	0.096
Current Life Stressor	1.45	1.01, 2.08	0.045
Historical drug abuse	1.05	0.68, 1.63	0.813
History of Self-harm			
No	1.00		

Not Documented	0.23	0.17, 0.33	<0.001
Yes	0.58	0.36, 0.94	0.028
Drug Class			
Rx	1.00		
Other	1.24	0.83, 1.85	0.284
OTC	1.44	0.94, 2.22	0.097
Recreational	0.47	0.27, 0.80	0.006

Appendix 3-1: Definition of Variables

Poisoning

For the purpose of this study, poisoning cases were defined as those with ICD-10 codes X40-X49 (unintentional poisoning), X60-X69 (self-poisoning), X85-X90 (assault by poisoning) and Y10-Y19 and Y90-Y91 (poisoning event of undetermined intent). This definition of poisoning includes overdose of both legal and illegal drugs as well as poisoning from alcohol, pesticides, chemicals and household products.

Intentional Poisoning

Suspected Suicidal: An exposure resulting from the inappropriate use of a substance for reasons that are suspected to be self-destructive or manipulative.

Intentional Misuse: An exposure resulting from the intentional improper or incorrect use.

Unintentional Poisoning

Therapeutic error: An unintentional deviation from a proper therapeutic regimen that results in the wrong dose, incorrect route of administration, administration to the wrong person, or administration of the wrong substance. Only exposure to medications or products as medications is included. Drug interactions resulting from unintentional administration of drugs or foods which are known to interact are also included.

Unintentional misuse: Unintentional improper or incorrect use of a non-pharmaceutical substance. Unintentional misuse differs from intentional in that the exposure was unplanned or not foreseen by the patient.

Unintentional unknown: An exposure determined to be unintentional, but the exact reason is unknown.

Abuse

In DSM-IIIR*, "psychoactive substance abuse" is defined as "a maladaptive pattern of use indicated by continued use despite knowledge of having a persistent or recurrent social, occupational, psychological or physical problem that is caused or exacerbated by the use [or by] recurrent use in situations in which it is physically hazardous.

Mental Health Assessment

Form 1: The physician can issue Form 1 to a patient if he believes that a person is suffering from a mental disorder, likely to cause harm to that person or others, or to suffer substantial mental or physical deterioration or serious physical impairment, and unsuitable for admission to a facility other than as a formal patient (section 2 of the Act).

Form 10: In the course of their work peace officers encounter people with mental illness - many of whom are not a danger to others or themselves. Peace officers become involved when they observe behaviors that are of concern, when they receive requests for assistance from family or healthcare workers, or complaints from a member of the community. They intervene under the Act when they are satisfied that the person is apparently a person with a mental disorder and

acting in a manner likely to cause harm to self or others, or to suffer substantial mental or physical deterioration, or serious physical impairment.

Geographic Location

Metropolitan Centre/City: Heavily populated regions consisting major city surrounded by smaller communities.

Regional Centre/Rural: Smaller towns or villages in sparsely populated areas.

Remote/Rural: Hamlets or sites with small residential populations or working populations.

Chapter 4: Summary

4.1.   Summary of Research

Poisoning injuries constitute a significant health problem worldwide. Suicide is one of the

leading causes of deaths and poisoning is the most common method utilized for the same.

Various risk factors associated to poisoning have been identified in the literature. Some of them

include young age, female gender, alcohol consumption, presence of mental health conditions

(mainly depression) and so on. Wide spectrums of substances are used for overdosing namely

prescription drugs, OTC, recreational, agricultural and household goods (e.g. detergents,

cleaners, windshield washers, etc.).

We were interested in systematically reviewing existing studies analyzing the relationship

between incidence of poisoning and mental health conditions in adolescents and understanding

which patient factors are related to the receipt of a psychosocial consultation in poisoning cases

that visit the emergency department visits. This research question is addressed with the help of

two chapters that contributed to accomplish the overall study goals. The first study (Chapter 2)

was a systematic review that evaluated the relationship between incidence of poisoning and

presence of mental conditions. The second study (Chapter 3) identified patient factors that are

associated with the receipt of a professional consultation in the hospital.

Concurring with some literature suggesting mental health conditions to be a risk factor for self-

poisoning among adolescents, our systematic review results show a higher incidence of

poisoning injuries amongst adolescents with mental conditions compared to those without a

mental health condition. Depression was the most dominant condition amongst those with a mental health condition. Poisoning incidence was almost twice more frequent among females than males. Among the nine studies that included both males and females, the number of poisoned females was more than 75% of the total study population in seven out of the nine studies. Prevalence of mental health conditions among poisoned adolescents was high in majority of the studies. Mental health condition was recorded in more than 50% of the study population in five retrospective studies[41, 49, 52, 54-55] and both the case-control studies[23, 40] with depression being the most common MHC. Due to the absence of a comparator group in the retrospective studies, it is not possible to make conclusions on the poisoning-mental health condition relationship. However, the two case-control studies suggest that depression is strongly associated with adolescent poisoning.

Our second study was a retrospective chart review conducted across hospitals in Alberta looking at poisoning-related injury events that resulted in emergency department visits across all age groups for the year 2010. In cases where MHC was present, our study found a significant relationship between consultations and ADHD, depression, anxiety, personality disorder, alcohol abuse/dependence, previous drug/alcohol rehabilitation and current life stressor. Depression has been described in the literature as a risk factor for poisoning because of the suicidal tendency that generally accompanies depressed patients.[34-35] Our data has reinforced this belief and illustrated a strong relationship between suicidal intent using drug poisoning method. The results of this study resonate with our findings from the systematic review in adolescents. Significant factors that lead to the poisoning cases being referred for a consultation include prescription of Form 1 or 10, presence of mental health conditions, history of previous self-harm and use of recreational

substances for abuse. This study highlights the severity of effect in patients taking various different drug/substances to self-poison. More variety of drug/substances used, results in more complex and prolonged treatment procedures. Alcohol has been known to induce impulsive and risk taking behaviour.[24-25] There appeared to be a significant relation between alcohol consumption and poisoning exposure.

4.2.   Future Recommendations

It is the nature of research that while some questions may be answered, other questions may arise for further research. For some this study may not have provided the desired answers but it may have facilitated the development of questions for others. Methodological issues exist in all types of research. More studies with comparison groups are required in this area. Primary studies should report poisoning rates with appropriate denominators that allow the calculating of analytical statistics controlling for potential confounders.

A prospective cohort design follows a group forward in time before the outcome of interest occurs (i.e. poisoning/drug overdose). The strength of evidence that is provided by this type of research design leads to greater strength of conclusions drawn, and can control for more sources of bias than a retrospective design. Since a trend for retrospective studies exists in literature, prospective designs should be considered. A good starting point will be to use administrative data to follow patients with diagnosis of mental health conditions over time. This will help to identify possible intervention points such as when a person is seeking for help or threatening to self-harm.

In our study only fifty percent cases with suspected poisoning and seventy percent cases with intentional poisoning received psychosocial consultations. Not all cases of poisoning receiving mental health form 1 or 10 were subjected to psychosocial consultation. Other groups have advocated for mandatory psychosocial assessments of patients in hospital, however, mixed results on their effectiveness have been reported in the reduction of later suicide attempts.[62] Mandatory psychosocial assessments for patients with unknown and/or definite intent to self-harm and those receiving mental health forms 1 or 10 can prove to be beneficial in terms of avoiding repeat poisoning attempts.

Research has shown that families given information on means restriction by hospital staff in emergency departments were receptive to suggestions and reduced the means of suicide in the home.[65] Given that a large proportion of serious self-poisoning attempts present to hospital, further research into the role of the emergency ward as a source of intervention would prove both useful and interesting. Following a strict protocol while treating poisoned patients with definite intentions or circumspect intentions to self-harm will be beneficial and secure same standards of treatment across the board.

4.3.   Conclusion

Deliberate self harm from self-poisoning is common across all age groups. While nuances exist by age between types of substances used, the problem is still highly prevalent across the lifespan. Joint efforts from different sectors including governments, health workers, schools, advocacy groups, and mental health organizations is required to effectively reduce the impact from this important public health problem.

References

1.   Parachute. The Cost of Injury in Canada. In; 2015.

2.   Michel K, Ballinari P, Bille-Brahe U, et al. Methods used for parasuicide: results of the WHO/EURO Multicentre Study on Parasuicide. *Soc Psychiatry Psychiatr Epidemiol* 2000;35(4):156-63.

3.   Subba SH, Binu VS, Menezes RG, et al. Pattern and trend of deliberate self-harm in western Nepal. *J Forensic Sci* 2009;54(3):704-7.

4.   Lee HL, Lin HJ, Yeh ST, Chi CH, Guo HR. Presentations of patients of poisoning and predictors of poisoning-related fatality: findings from a hospital-based prospective study. *BMC Public Health* 2008;8:7.

5.   Kristinsson J, Palsson R, Gudjonsdottir GA, Blondal M, Gudmundsson S, Snook CP. Acute poisonings in Iceland: a prospective nationwide study. *Clin Toxicol (Phila)* 2008;46(2):126-32.

6.   Cook R, Allcock R, Johnston M. Self-poisoning: current trends and practice in a U.K. teaching hospital. *Clin Med* 2008;8(1):37-40.

7.   Spiller HA, Appana S, Brock GN. Epidemiological trends of suicide and attempted suicide by poisoning in the US: 2000-2008. *Leg Med (Tokyo)* 2010;12(4):177-83.

8.   Buykx P, Loxley W, Dietze P, Ritter A. Medications used in overdose and how they are acquired - an investigation of cases attending an inner Melbourne emergency department. *Aust N Z J Public Health* 2010;34(4):401-4.

9.   Hawton K, Bergen H, Casey D, et al. Self-harm in England: a tale of three cities. Multicentre study of self-harm. *Soc Psychiatry Psychiatr Epidemiol* 2007;42(7):513-21.

10.   Serinken M, Karcioglu O, Sengul C, Turkcuer I, Keysan MK. Hospital costs of managing deliberate self-poisoning in Turkey. *Med Sci Monit* 2008;14(3):CR152-8.

11.   Centers for Disease Control and Prevention (CDC). Unintentional and undetermined poisoning deaths--11 states, 1990-2001. *MMWR Morb Mortal Wkly Rep* 2004;53(11):233-8.

12.   Fleischmann A, Bertolote JM, Wasserman D, et al. Effectiveness of brief intervention and contact for suicide attempters: a randomized controlled trial in five countries. *Bull World Health Organ* 2008;86(9):703-9.

13.   Rhodes A, Bethell J, Jaakkimainen RL, et al. The impact of rural residence on medically serious medicinal self-poisonings. *Gen Hosp Psychiatry* 2008;30(6):552-60.

14.   Brickman AL, Mintz DC. Datapoints: U.S. rates of self-inflicted injuries and suicide, 1992-1999. *Psychiatr Serv* 2003;54(2):168.

15.   Prosser JM, Perrone J, Pines JM. The epidemiology of intentional non-fatal self-harm poisoning in the United States: 2001-2004. *J Med Toxicol* 2007;3(1):20-4.

16.   Government of Canada. The Human Face of Mental Health and Mental Illness in Canada. In; 2006.

17.   Alberta Mental Health Board. Mental Health Needs of Albertans: Select Factors and Findings. Edmonton. In; 2007.

18.   Alberta Mental Health Board. A Call to Action: The Alberta Suicide Prevention Strategy In; 2005.

19.   McMahon GT, McGarry K. Deliberate self-poisoning in an Irish county hospital. *Ir J Med Sci* 2001;170(2):94-7; discussion 90.

20.   Tountas C, Sotiropoulos A, Skliros SA, et al. Voluntary self-poisoning as a cause of admission to a tertiary hospital internal medicine clinic in Piraeus, Greece within a year. *BMC Psychiatry* 2001;1:4.

21.   Callanan VJ, Davis MS. Gender differences in suicide methods. *Soc Psychiatry Psychiatr Epidemiol* 2012;47(6):857-69.

22.   Nordentoft M. Prevention of suicide and attempted suicide in Denmark. Epidemiological studies of suicide and intervention studies in selected risk groups. *Dan Med Bull* 2007;54(4):306-69.

23.   Kingsbury S, Hawton K, Steinhardt K, James A. Do adolescents who take overdoses have specific psychological characteristics? A comparative study with psychiatric and community controls. *J Am Acad Child Adolesc Psychiatry* 1999;38(9):1125-31.

24.   Danielson CK, Overholser JC, Butt ZA. Association of substance abuse and depression among adolescent psychiatric inpatients. *Can J Psychiatry* 2003;48(11):762-5.

25.   Bennett S, Coggan C, Hooper R, Lovell C, Adams P. Presentations by youth to Auckland emergency departments following a suicide attempt. *Int J Ment Health Nurs* 2002;11(3):144-53.

26.   Unintentional and undetermined poisoning deaths--11 states, 1990-2001. *MMWR Morb Mortal Wkly Rep* 2004;53(11):233-8.

27.   Seydaoglu G, Satar S, Alparslan N. Frequency and mortality risk factors of acute adult poisoning in Adana, Turkey, 1997-2002. *Mt Sinai J Med* 2005;72(6):393-401.

28.   Stein MD, Bonanno J, O'Sullivan PS, Wachtel TJ. Changes in the pattern of drug overdoses. *J Gen Intern Med* 1993;8(4):179-84.

29.   Kontaxakis VP, Havaki-Kontaxaki BJ, Stamouli SS, Margariti MM, Collias CT, Christodoulou GN. Comparison of four scales measuring depression in schizophrenic inpatients. *Eur Psychiatry* 2000;15(4):274-7.

30.   Hendrix L, Verelst S, Desruelles D, Gillet JB. Deliberate self-poisoning: characteristics of patients and impact on the emergency department of a large university hospital. *Emerg Med J* 2013;30(1):e9.

31.   Gunnell D, Bennewith O, Peters TJ, House A, Hawton K. The epidemiology and management of self-harm amongst adults in England. *J Public Health (Oxf)* 2005;27(1):67-73.

32.   Myers RP, Li B, Shaheen AA. Emergency department visits for acetaminophen overdose: a Canadian population-based epidemiologic study (1997-2002). *CJEM* 2007;9(4):267-74.

33.   Porucznik CA, Johnson EM, Sauer B, Crook J, Rolfs RT. Studying adverse events related to prescription opioids: the Utah experience. *Pain Med* 2011;12 Suppl 2:S16-25.

34.   Ichimura A, Matsumoto H, Aoki T, et al. Characteristics of suicide attempters with depressive disorders. *Psychiatry Clin Neurosci* 2005;59(5):590-4.

35.   Armstrong TM, Davies MS, Kitching G, Waring WS. Comparative drug dose and drug combinations in patients that present to hospital due to self-poisoning. *Basic Clin Pharmacol Toxicol* 2012;111(5):356-60.

36.   Hawton K, Sutton L, Haw C, Sinclair J, Harriss L. Suicide and attempted suicide in bipolar disorder: a systematic review of risk factors. *J Clin Psychiatry* 2005;66(6):693-704.

37.   World Health Organization. World Health Statistics 2011. In; 2011.

38.   Ougrin D, Zundel T, Kyriakopoulos M, Banarsee R, Stahl D, Taylor E. Adolescents with suicidal and nonsuicidal self-harm: clinical characteristics and response to therapeutic assessment. *Psychol Assess* 2012;24(1):11-20.

39.	Rodham K, Hawton K, Evans E. Reasons for deliberate self-harm: comparison of self-poisoners and self-cutters in a community sample of adolescents. *J Am Acad Child Adolesc Psychiatry* 2004;43(1):80-7.

40.	Kerfoot M, Dyer E, Harrington V, Woodham A, Harrington R. Correlates and short-term course of self-poisoning in adolescents. *Br J Psychiatry* 1996;168(1):38-42.

41.	Marbella AM, Yang H, Guse CE, Meurer JR, Layde PM. Adolescent hospital discharges associated with self-poisonings in Wisconsin, 2000-2002. *WMJ* 2005;104(7):59-64.

42.	Reith DM, Whyte I, Carter G, McPherson M, Carter N. Risk factors for suicide and other deaths following hospital treated self-poisoning in Australia. *Aust N Z J Psychiatry* 2004;38(7):520-5.

43.	Kivisto JE, Rimpela A, Mattila VM. Adolescent risk factors for poisonings - a prospective cohort study. *Acta Paediatr* 2011;100(12):1596-602.

44.	Evans E, Hawton K, Rodham K. Factors associated with suicidal phenomena in adolescents: a systematic review of population-based studies. *Clin Psychol Rev* 2004;24(8):957-79.

45.	Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ* 2009;339:b2535.

46.	Central Intelligence Agency. The World Factbook. Available at: https://www.cia.gov/library/publications/the-world-factbook/appendix/appendix-b.html. Accessed.

47.	GA Wells BS, D O'Connell, J Peterson, V Welch, M Losos, P Tugwell, . The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. In.

48.   Kim K, Ozegovic D, Voaklander DC. Differences in incidence of injury between rural and urban children in Canada and the USA: a systematic review. *Inj Prev* 2012;18(4):264-71.

49.   Hawton K, Harriss L, Rodham K. How adolescents who cut themselves differ from those who take overdoses. *Eur Child Adolesc Psychiatry* 2010;19(6):513-23.

50.   Hawton K, Kingsbury S, Steinhardt K, James A, Fagg J. Repetition of deliberate self-harm by adolescents: the role of psychological factors. *J Adolesc* 1999;22(3):369-78.

51.   Liisanantti JH, Ala-Kokko TI, Dunder TS, Ebeling HE. Contributing factors in self-poisoning leading to hospital admission in adolescents in northern Finland. *Subst Use Misuse* 2010;45(9):1340-50.

52.   Schreiber TJ, Johnson RL. The evaluation and treatment of adolescent overdoses in an adolescent medical service. *J Natl Med Assoc* 1986;78(2):101-8.

53.   Kreitman N, Schreiber M. Parasuicide in young Edinburgh women, 1968--75. *Psychol Med* 1979;9(3):469-79.

54.   White HC. Self-poisoning in adolescents. *Br J Psychiatry* 1974;124(578):24-35.

55.   Nasr A, Vostanis P, Winkley L. Child and adolescent self-poisoning: service-related characteristics. *The Psychiatric Bulletin* 1997;21:267-269.

56.   Bergen H, Hawton K, Waters K, Cooper J, Kapur N. Psychosocial assessment and repetition of self-harm: the significance of single and multiple repeat episode analyses. *J Affect Disord* 2010;127(1-3):257-65.

57.   Guthrie E, Kapur N, Mackway-Jones K, et al. Predictors of outcome following brief psychodynamic-interpersonal therapy for deliberate self-poisoning. *Aust N Z J Psychiatry* 2003;37(5):532-6.

58.   Hawton K, Arensman E, Townsend E, et al. Deliberate self harm: systematic review of efficacy of psychosocial and pharmacological treatments in preventing repetition. *BMJ* 1998;317(7156):441-7.

59.   National Collaborating Centre for Mental Health (UK). The Short-Term Physical and Psychological Management and Secondary Prevention of Self-Harm in Primary and Secondary Care. 2004.

60.   Okumura Y, Shimizu S, Ishikawa KB, Matsuda S, Fushimi K, Ito H. Characteristics, procedural differences, and costs of inpatients with drug poisoning in acute care hospitals in Japan. *Gen Hosp Psychiatry* 2012;34(6):681-5.

61.   Barr W, Leitner M, Thomas J. Psychosocial assessment of patients who attend an accident and emergency department with self-harm. *J Psychiatr Ment Health Nurs* 2005;12(2):130-8.

62.   Kapur N, Murphy E, Cooper J, et al. Psychosocial assessment following self-harm: results from the multi-centre monitoring of self-harm project. *J Affect Disord* 2008;106(3):285-93.

63.   Hickey L, Hawton K, Fagg J, Weitzel H. Deliberate self-harm patients who leave the accident and emergency department without a psychiatric assessment: a neglected population at risk of suicide. *J Psychosom Res* 2001;50(2):87-93.

64.   Tu YK, Gunnell D, Gilthorpe MS. Simpson's Paradox, Lord's Paradox, and Suppression Effects are the same phenomenon--the reversal paradox. *Emerg Themes Epidemiol* 2008;5:2.

65.   Hawton K, Townsend E, Deeks J, et al. Effects of legislation restricting pack sizes of paracetamol and salicylate on self poisoning in the United Kingdom: before and after study. *BMJ* 2001;322(7296):1203-7.