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Etiological Characterization of Emergency Department Acute Poisoning

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Etiological Characterization of Emergency Department Acute Poisoning

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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psychosis, hospital cost, length of stay

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DEDICATION

I dedicate this dissertation to my family and to my friends. A special feeling of gratitude to my loving parents, Bacha & Fajrah Khlifi for their patience and their sacrifice and support.

To my son Skandar and to my Wife, for their patience
& support throughout all these long years of school

To my sisters Dalila, Sabah, Mounjia, Yamina

&

to my brothers Rchid, Noureddine Faisal and Houcine.

I also dedicate this dissertation in memory of my mother in law who died of a liver failure
and never had access to a transplant.

To my many friends who have always supported me throughout and I will always appreciate
all they have done for me.

I also dedicate this work to two special friends Dr. Carney & Mr. M. Labidi.

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LIST OF ABBREVIATIONS

LOS: Length of stay
CU: Cocaine Users
DA: Drug Abuse
IDU: Illicit Drug Use
HU: Heroin Users
HCU: Heroin & Cocaine Users
PCP: Primary Care Physician
MDU: Multiple Drug Users
Binned: Grouped
UK: Unknown or missing
AA: African American
ED: Emergency Department
Hisp: Hispanic
PMH: Personal Medical History
CVD: cardio vascular diseases
ED: Emergency Department

ETIOLOGICAL CHARACTERIZATION OF EMERGENCY DEPARTEMENT ACUTE
POISONING

AbdMalek S. Khlifi, M.D.

ABSTRACT

Poisoning is frequently associated with psychological and physiological co-morbidities that can be assessed in order to improve patients' management and reduce cost. The primary objective of this study is to conduct a review of emergency department (ED) poisonings to characterize its demographics and assess associated co-morbidities. The second objective is to explore correlation between personal history of diseases and poisonings. Predictors for poisonings and its outcomes were investigated and risk factors for suicidal poisoning and how it relates to mental illnesses were explored. Six hundred and forty nine cases admitted to ED between 2004 and 2007 were studied. Results indicate that difference in ethnic background was substantial as poisoning cases were predominantly African Americans (79.9%) between 36-45 years old with a male to female ratio of 1.3. Intentional illicit drug overdose was the greatest risk factor for ED poisonings, and among the 649 cases, heroin overdose was the most common cause of poisoning at 35.4% (n=230), cocaine overdose at 31.7% (n=206), heroin and cocaine overdose at 4.3% (n=28), multiple drug poisoning at 5.5% (n=36), and antidepressant/antipsychotic poisoning at 6% (n=39). A significant correlation between heroin poisonings and asthma

($F=20.29$, $DF=1$, $p= .0001$) was found, as well as between cocaine poisoning and hypertension ($F=33.34$, $DF=1$, $p=.0001$), and cocaine poisoning and cardiovascular diseases ($F=35.34$, $DF=1$, $p=.0001$). Another significant finding is the change in the pattern of the route of illicit drug use from injection to inhalation; it is thought this may reduce the rate of HIV and Hepatitis transmission via hypodermic needles among illicit drug users. As well, inhalation and insufflation may be risk factors that aggravate preexisting asthma. Mental illnesses, chiefly depression, remain one of the greatest risk factors for suicidal poisoning beside age, Hispanic race, gender, ingestion route and unemployment. This study provides supporting evidence that poisoning, particularly deliberate poisoning with illicit drugs remains a serious issue that significantly aggravates co-morbidities and raises treatment cost by increasing both the rate of hospitalization and hospital length of stay (LOS). Pragmatic guidelines and innovations in reducing heroin and cocaine abuse in these patients may lessen the severity of diseases and reduce its burden on the healthcare system and on society.

INTRODUCTION

Poisonings from intentional substance abuse, as well as from unintentional toxic exposures, remain a significant health concern for hospital emergency departments. It is estimated that there are more than four million incidents of poisoning in the United States each year. The Institute of Medicine has recently identified that poisonings are the second leading cause of injury-related mortality, with an estimated cost of over \$12.6 billion annually (*Koplan et al. 1993*).

The majority of poisonings, particularly minor and moderate cases, are commonly managed at home with the direction of local poison centers via telephone. While the surveillance of moderate poisonings is well documented in this way, severe cases of poisoning that necessitate an emergency department (ED) admission are often not reported to poison control centers, and subsequently, the magnitude and trends of severe poisonings is unknown, and can only be analyzed using patient data from hospital emergency departments. This study is intended to fill these data gaps, to study the etiological causes of poisonings and to characterize its demographics and trends.

The substances responsible for accidental poisoning and the methods used for self-poisoning have changed considerably over time (*Howton et al. 1997, Townsend et al. 2001*). In many countries, especially in Western Europe and North America over the last two decades, the most common agents taken by adults have been illicit drugs (*Byard et al. 2004, Townsend et al. 2001*).

The annual incidence of intentional and unintentional poisoning in developing countries varies from 0.2 to 9.3 cases per 1,000 population, and continue to increase annually worldwide (*Gulsah & al*). The characteristics of poisoning in third world countries are slightly different from what is seen in the western world. Agricultural chemicals, particularly pesticides, are still on the top of the list for both intentional and unintentional poisoning and are still serious public health concerns in these countries.

In the United States, emergency department (ED) visits for attempted suicide and self-inflicted injury are relatively common, serious, and most frequent among adolescents and young adults. Self-poisoning is the most common method for suicide. The high prevalence of psychiatric and substance abuse disorders suggests there is an association between the two.

Knowledge of condition-specific morbidity and mortality for patients with asthma as well as other aggravating factors is essential for making critical decisions. Substantive differences have been reported in terms of the prevalence of drug abuse among asthma patients; however the etiology and the mechanisms of action for this association have not been explained.

There is a need, especially for the underserved minority communities that have high frequencies for certain methods of drug use, to understand the factors involved in poisoning and how to effectively design prevention programs for the purpose of reducing their occurrence and adverse outcomes.

STUDY AIMS AND OBJECTIVES

The objectives of the study are: To conduct a retrospective chart review to characterize the demographics of acute poisoning of patients that visited or were admitted to ED (ED poisoning) between December 2004 and May 2007; To identify the most common substances associated with poisonings and stratify them by route, age, gender, time of the day and reason for admission. Co-morbidities of mental disorders, asthma, diabetes, chronic hypertension, cardiovascular diseases, arthritis, cancer, drug abuse and occupational exposures will also be examined to assess their correlation with ED treated poisoning.

A cost assessment was also designed to assess the burden of heroin and cocaine poisoning on asthma patients. Specifically this study will assess the type and route of poisoning and stratify them by illicit drug, pharmaceutical, chemical, occupational, industrial or domestic poisonings. This investigation will assess the circumstances of the poisoning including accidental or intentional suicidal. The rate of hospitalization and the final outcome of poisoning events will be examined. This study will evaluate the rates of complications from poisonings as well as the length of stay and the casualty rates if any have occurred. On site initial management received by patients at home or administered by patients' families before arrival to ED and its effect on the final outcome of the case will be examined in order to estimate which of these factors are most predictive of the outcome and poisoning final disposition.

BACKGROUND AND LITERATURE REVIEW

Poison exposure is a significant health concern and it is the third most common cause of death that occurs at home (*Schauben & Spillane, 1991*). While the overall true incidence is unknown, it is estimated by many researchers that there are over four million poison exposures per year (*Litovitz et al. 1995*.)

According to the Center for Disease Control and Prevention (CDC), cases of poisoning are grossly underestimated and a significant number of them never reach the hospital since many of the minor case are treated at the patient's home and are never recorded through poison control centers. Among all deaths due to poisoning, carbon monoxide intoxication is the most prevalent.

Over 86 percent of all reported poisoning cases were related to accidental exposure, while suicidal or self poisoning accounted for less than 8% of the total reported poisonings (*Litovitz et al. 1995; Simonsen, 1992*). The largest proportion of accidental poisonings represented events that were preventable. The "Healthy People 2000" report has called for the importance of the reduction, prevention, and treatment of poisoning (*Litovitz et al. 1994*).

In a study conducted in Barcelona, Spain, it was estimated that poisoning constituted 5.2% of all emergencies. Among poisoning cases reviewed in this study 87.2% were due to heroin related events, 13.1% were due to acute alcohol intoxication and 6.2% were due to acute medicinal intoxication. During the study period of 3 years, the authors identified over 233 emergencies involving cocaine. Of these, 55% were

female with a mean age of 28.3 years. The authors also reviewed 1,134 patients with episodes of acute poisonings seemingly related to pharmaceutical drugs. The most commonly used drug was benzodiazepines at 56.7%, followed by analgesics at 12.6% and barbiturates at 11.7%. The Barcelona study also identified 1,456 toxicological emergencies; 62% of these were suicidal attempts, and 12.6% accidental intoxications. It is important to note that in this study the author has included withdrawal syndrome within the definition of heroin and cocaine poisoning in his statistics (*Monteis Catot et al. 1990*).

Drug abusers are more likely to be hospitalized, and 2.3 times more likely to use an emergency room than non-abusers (*Stein et al. 1993*). Patients using drugs are frequently seen in EDs and drugs encountered generally reflect regional and city variation, as drug obsession sweeps through subcultures. It is now known that there is a tendency for specific drug subcultures to grow locally around the use of specific agents. The overall local drug use trends in the United States indicate that cocaine abuse decreased between 1992 and 2002 (*Bernstein et al. 2005*). On the other hand cocaine abuse decreased in five states by more than 60% it increased 100% or more in four other states.

A considerable part of emergency care is treating medical complications of substance abuse, but the actual abuse of drugs is often not addressed in ED (*Bernstein et al. 2005*). This lack of interest to identify drug abuse may relate to the fact that physicians, particularly emergency physicians (EPs), use illicit drugs as often as the general population (*Hughes et al. 1999*).

Marijuana is the most commonly used drug in the United States, but leads to less ED visits than other drugs. Researchers estimated that there were over 2.6 million new marijuana users in the year of 2001. Over 3.1 million Americans use marijuana daily, and

over 14 million of Americans aged 12 and older use marijuana at least once a month (NIDA 2008). In recent years marijuana has become more potent than of what it was in the 1970s and 1980s, which resulted in more ED visits among youth, and in 2002, marijuana became the third most common drug seen in ED. Marijuana use increased by over than 24% between 2000 and 2002 (*Whalen et al. 2006, NIDA 2008*)

Another significant increase seen in recent years is the use of non-crack cocaine among tenth graders, which has risen from 1.1% in 2003 to 1.5% in 2004. The same study, however, reported that heroin, crack cocaine, hallucinogens, phencyclidine amphetamine, tranquilizers, sedatives, and methaqualone use remained stable among youth from 2003 to 2004 (*NIDA, 2006*). Heroin use remains to be a serious problem in some regions of the United States. A recent change in the route of use of heroin was noted, and there is a new practice of mixing heroin and heating it in aluminum foil then inhaling through a straw, or mixing it with cocaine promoting the significant shift from heroin injection to heroin inhalation. Heroin abuse is associated with fatal overdose, spontaneous abortion, and serious infectious diseases like HIV and hepatitis among IV abusers, and rare cases of spongiform leukoencephalopathy.

Although heroin, cocaine, and marijuana remain the most frequently abused drugs leading to ED visits, ED visits involving narcotic analgesics increased 153% from 1995 to 2002. The use of drug combinations were involved in 75% of the drug abuse-related ED visits, and dependence was the underlying factor in these ED visits. In 2003, about 4% and 4.5% of high school seniors reported nonmedical use of oxycodone. These users have a higher economic status. (*D'Onofrio Gail et al, 2006*).

The Substance Abuse and Mental Health Services Administration estimates that in 2003, 6.3 million Americans abused prescription drugs. Most abused pain relievers (4.7 million); others abused tranquilizers (1.8 million), stimulants (1.2 million), and sedatives (0.3 million). Nonmedical use of oxycodone increased from 11.8 million users in 2002 to 13.7 million users in 2003. (*Volkow, NIDA 2004/2005*).

A shift to smoking has occurred for the use of stimulants and this route has increased from 12% in 1992 to over 50% in 2002. In 2003, an estimated 378 thousand drug users met the diagnostic criteria for stimulant dependence in the United States (*NIDA, 2006*).

Cocaine is a strong central nervous system stimulant. It can result in acute myocardial infarction or stroke and sudden death. Cardiac complications, such as cardiac arrest and seizures are generally the main causes of cocaine-related deaths. The use of cocaine occurs in a binge pattern, during which the drug is repeatedly taken at high doses. If cocaine is mixed with alcohol, the product is cocaethylene intensifies cocaine's euphoric effects, but also increases the risk of sudden death. The wanted effect of cocaine is usually the resulting euphoria that lasts 15 to 20 minutes if snorted and 5 to 10 minutes when smoked. In addition to euphoria, cocaine can raise blood pressure, cause tachycardia, constrict vessels, and dilate pupils.

The wanted effect of heroin users is euphoria, (also called "rush"); heroin can also cause flushing of the skin, and dry mouth. When tolerance develops, heroin users become obliged to use higher doses in order to achieve the same wanted effect.

Opioid overdose causes respiratory depression that can be reversed by Naloxone. The onset, severity, and duration of withdrawal symptoms depend on the opioid abused

and the extent of dependence. Sixty-two percent of primary heroin admissions reported injection as the route of administration, 33% reported inhalation, and 3% reported smoking. Maintenance treatment for heroin addicts involves daily oral synthetic opiate administration usually methadone. Buprenorphine is also a medication now available for treating addiction to opiates.

Treatment of teenagers for marijuana dependence and abuse has increased 142% since 1992. Marijuana is known as a recreational drug, particularly to teens. Teenagers are three times more likely to be treated for marijuana than for alcohol and six times more likely to be in treatment for marijuana than for all other drugs combined (*Stephens et al. 2000*).

The proportion of admissions for abuse of stimulants increased from 1% to 7% between 1992 and 2002. Abuse of prescription medications has increased in all segments of the population. In 2003, about 4% to 4.5% of high school seniors reported nonmedical use of oxycodone (*NIDA, 2006*).

“Club drugs” are sometimes preferred over other types of drugs like marijuana and heroin or methamphetamine because some users see them as social interaction enhancers. Club drugs such as GHB, flunitrazepam or ketamine are taken in combination, or with alcohol. They are easy to acquire and they are generally favored over marijuana, lysergic acid diethylamide, methamphetamine, and opiates (*Gahlinger, 2004*).

Hallucinogens are less commonly used. Most users of lysergic acid diethylamide voluntarily decrease or stop its use over time. Lysergic acid diethylamide is not considered addictive (*NIDA, 2006*).

Gulsah et al. 2005 reviewed the frequency and mortality risk factors of acute adult poisoning in Adana, Turkey from 1997 to 2002 and included 2,229 adult patients. The authors reported that 1.6% of their emergency cases were poisoned and the majority of these poisoned cases were attempted suicides (76.4%). Drugs were the most common (59.0%) poison used, and pesticides were the second (26.4%) most common substance encountered. Among drugs, psychoactive were the most common (35.5 %).

The number of drug abusers is increasing across the U.S. at an alarming rate, though many of the related deaths are preventable. According to a recent report conducted in Multnomah County, Oregon, heroin alone was implicated in over 3805 deaths between 1993 and 1999 (*Koplan et al., 2000*).

Heroin has greatly increased in popularity in recent years. For many young people, it is now the drug of choice, with a dose or "hit" available on some streets for the same price as a pint of beer.

The low price indicates there is a significant supply of the drug. Low and middle class youth seem to be particularly lured by the drug; and the most prevalent route of administration has also shifted since the early 1990s to sniffing and snorting over injecting the drug. The drug has been widely available, and heroin on the street now is of a higher purity and better quality than before.

The association of drug abuse co-morbidity, particularly cocaine and asthma, has been reported in few articles. A study conducted in Bronx, NY, where the author studied the occurrence of new onset bronchospasm or recrudescence of asthma, established a correlation between cocaine use and new onset asthma. (*Osborn & Al. 1997*).

The evidence of heroin's effect on the respiratory system, particularly the lungs, has been studied by Steensen et al in 1993 who established a direct relationship between heroin abuse and pulmonary edema. This research did not clearly describe the mechanism of action but it was concluded that one possibility is the increased pulmonary permeability of the lung capillaries in response to the exposure. In 2004 Marby et al found a pattern of heroin overdose-induced pulmonary edema.

In the early twenty first century, cocaine and heroin abuse was studied, and were found to increase the rate of intubations and hospital utilization in patients with acute asthma exacerbation (*Levine et al. 2005*).

When heroin was first discovered to be correlated to patients with life threatening asthma in the early 1990s from a limited set of cases, it was initially thought that this was a novel phenomenon that did not exist before, and was related to the change in the pattern of the drug exposure from injection to inhalation (*Krantz et al, 2003*). For the purpose of verifying if this is a new phenomenon, a limited retrospective study was conducted which concluded that this relationship has existed prior to the 1990s.

In reviewing the literature however, it was found that this model of correlation was also described in 1988 when an unexplained exacerbation of asthma in 3 cases that required intubations was linked to heroin use (*Hughes et al.*).

Heroin insufflation was then studied by *Krantz et al. 2002* to further investigate this theory and attempted to demonstrate that the insufflation of heroin functioned as a trigger for patients with life threatening asthma. In this study, the authors reported that of the total 104 patients admitted to ICU, most patients were not significantly different in mean age or sex between groups of patients with diabetic ketoacidosis (DKA) and

asthma. Although the racial distribution did differ in that the DKA group had more Hispanics than whites in the asthma group. However compared to ICU admissions with DKA, asthmatic patients reported higher prevalence of heroin use (41.3% vs. 12.5%). Asthmatics were also more likely to report cocaine use, but the difference between the two groups was not significant.

Levine et al. identified 152 ICU patients of which he found 27.6% used cocaine without heroin (and they were classified as cocaine users) and 30.9 % used heroin with or without cocaine (and were classified heroin users). Cocaine users had longer lengths of stay than non-users (3.4 vs, 2.5 days $p<0.049$) and were more frequently hospitalized and intubated. Heroin users were intubated more frequently than non-users. Neither hospital stay nor percentage of ICU admissions was significant (*Levine et al. 2005*). The author showed that both cocaine and heroin might have induced asthma exacerbation by multiple effects on the bronchus, such as the morphine bronchoconstrictive effect (a metabolite of heroin through deregulation of mast cells and subsequent release of inflammatory mediators particularly histamine) (*Withington et al. 1993*).

In a case series reported in late 2005, Cygan et al. described 5 cases of status asthmatics that were induced by heroin inhalation. Though he hypothesized that the cases were directly triggered by the inhalation of the drug, the author was unable to establish a single mechanism of how heroin triggered asthma.

There are several suggestions about the mechanism of action of heroin related asthma effects, but pulmonary mast cell degranulation secondary to heroin may be very plausible as indicated by an experiment that used intradermal and IV morphine and synthetic opiate administration, resulting in a stimulation of mast cells to release

histamine. This release of histamine is a direct pharmacologic mechanism independent of opiate receptors. However, none of the studies that suggest heroin acts as a trigger for asthma have reported that the exacerbation occurred at the time of the first use. This makes the histamine release theory very unlikely though it seems very appealing. Unless the heroin sensitization period is extremely long, which is contrary to what is currently known about immunological sensitization. Association of other factors that are receptor independent might be also possible. The controversy regarding this issue remains, given the fact that opioid receptor action is thought to result in reduction of bronchoconstriction by blocking the cholinergic factor in bronchoconstriction.

Asthma is a multifactorial disease influenced by genetic and environmental factors (*Matthis et al. 2006*). A recent study have revealed the involvement of some receptors regulated by inherited genes in the pathogenesis of asthma that could predispose some families or ethnic groups to higher risk for acquiring asthma (*Lachheb et al. 2008*). In the past decade, several loci and over 1100 genes have been found to be associated with the disease in some populations. Among these loci, region 12q13-24 has been implicated in asthma etiology in multiple populations, suggesting that it harbors one or more asthma susceptibility genes (*Balaci et al. 2007*). On the other hand there are significant and distinct changes in the profile of gene expression in the human nucleus associated with cocaine and heroin abuse (*Albertson et al. 2006*) and several gene variants have been also detected and inferred to contribute to heroin abuse and addiction. For most of these genes, however, the relationship to the pathophysiology of asthma remains speculative, and none appear to be directly involved in the activation of airway inflammatory

processes or allergies, or explain fully all the aspects of the complex mechanism of addiction and abuse of heroin.

Several studies suggest the presence of a relationship between mental illnesses and poisoning for self-harm. Attempted suicide is known to be risk factor for committed suicide, and certain characteristics were seen among those who commit suicides such as having made previous suicide attempts, or having a family member who has attempted suicide. One of the studies has shown that attempted suicide is most closely related to depression. But the study concluded that patients with depression were significantly more often aged, male, married, and used methods other than poisoning by solids or liquids compared with patients with other mental disorders (*Ichimura et al. 2005*).

Depression is the disease most often implicated in suicide. In many countries, there has been a consistent increase in suicides among adolescents and young adults, as well as a decrease in suicides among women. The management of depression includes antidepressant medication. However, appropriate antidepressant prescribing is a very important factor in terms of preventing fatal antidepressant overdose. The actual risk of suicide in patients prescribed an antidepressant may be up to 10 times greater than for others. The likelihood for serious and potentially fatal poisoning following overdose differs considerably among the drugs available. Most deaths from overdose are attributable to tricyclic antidepressants (*Henry 1996*).

Howton, in a meta-analysis focused on patients with bipolar disorder in which suicide (13 studies) or attempted suicide (23 studies) was reported as an outcome. The study identified the main risk factors for suicide as previous suicide attempt and hopelessness. The main risk factors for nonfatal suicidal behavior included family history

of suicide, early onset of bipolar disorder, extent of depressive symptoms, increasing severity of affective episodes, the presence of mixed affective states, rapid cycling, co-morbid Axis I disorders, and abuse of alcohol or drugs. The author concluded that in patients with bipolar disorders, prevention should include attention to these risk factors in assessment and treatment, including when deciding whether to initiate treatment aimed specifically at reducing suicide risk (*Hawton, et al. 2005*).

According to Nordentoft et al. 2007, who focused their work on the prevention of suicide 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. Their conclusion is that the decline is mainly due to the focus on psychiatric patients, especially schizophrenic related disorders and homeless persons. In his study he identified that the most significant risk factors for suicide are: 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 (*Nordentoft et al. 2007*).

Another study conducted in Mexico in 1999 concluded that there were high rates of suicide related depressive disorders in a predominantly female population. Drug products, according to the author, were more frequently used than home or work related chemicals. The mortality related to poison exposure was very high at 27% and 16% with permanent sequel, though advanced life support and antidote medications were available (*Kingsbury et al. 1999*).

STUDY HYPOTHESES

- 1- Drug abuse overdose is the greatest risk factor for ED poisoning compared to the other environmental, occupational or prescription medication drugs.
- 2- There is a correlation between preexisting history of chronic disease, such as asthma and intentional poisoning using heroin or cocaine.
- 3- Mental illness, such as depression and psychotic disorders, are risk factors for ED poisoning.
- 4- Illicit drug poisoning is a burden on asthma patients, and it incurs longer hospital stays and higher hospital costs compared to those who do not present with a history of illicit drug poisoning.

METHODS AND MATERIAL

1.0- DESIGN OF THE STUDY

The study population consists of Chicago city residents visiting the Emergency Department (ED) of the Sinai Hospital between December 2004 and May 2007. The Sinai System provides virtually all-medical and surgical care in the area and it also includes a children's hospital and a rehabilitation center. The hospital is serves the population 5 miles west of down town. This population is diversified between African American, Hispanic, white, and Indian ethnicities.

This study is retrospective, and all cases of poisonings were identified through a search of the electronic records using the International Classification of Disease Ninth Revision, Clinical Modification (ICD-9-CM). A database of all ED poisoning cases was compiled from ED electronic records. Data pertaining to history of chronic disease co-morbidities, as well as to poisoning by illicit drugs, pharmaceutical, and chemical agents was collected.

The poisoning exposure variable described the type of poison, the poisoning exposure route, and the circumstances of intoxications; (intentional, unintentional or self-poisoning or attempted suicide). Initial management of the event was also collected to determine its adequacy and to correlate it to the final outcome and final disposition of the poisoning cases.

Data on the history of prior poisoning was collected in addition to smoking, alcohol, and illicit drug use. The data collection preprinted sheet included also personal history of mental illness such as depression, psychosis and anxiety disorders.

Data on the initial management received and follow-up, as well as the outcome of the event as assessed by the treating physician at the time of transfer or discharge was collected.

In order to assess hospital cost and the burden of drug abuse on asthma, a follow up study was designed to collect cost data and assess expenses, including expenses paid by insurance and by self-payers. Two groups of patients were selected: the first group of 137 patients was selected from the 649 patients initially compiled for poisoning. The second group was randomly selected from the pool of asthmatics that were not known to have any abuse history or hospitalization for any drug related event. Age, race, and insurance coverage data was collected as well as hospital charges, and amounts collected, expenses, and length of stay for those hospitalized.

2.0. DATA COLLECTION & MATERIAL STUDIED

The data collection was performed according to HIPAA regulations and after approval by the hospital's Institutional Review Board (IRB) committee. The system database was queried for cases of poisoning during the period between December 2004 and May 2007 to generate a list of patients to be enrolled into the study.

Data abstracted from patients' medical records included age, gender, race, date and time of the visit, marital status, employment, insurance coverage, chief complaint and vitals on admission. Information on the patient's personal medical history of diabetes,

mellitus, hypertension, cardio-vascular diseases, asthma, arthritis, HIV, hepatitis and seizure disorders was recorded.

Initial medical management and assessment of the gravity of the case was recorded and then weighed against the final outcome in order to discern the cases that were not considered serious, but resulted in an adverse outcome; this may help ED determine areas to implement preventive measures in order to avoid any possible underassessment of patients at risk. Any discrepancy in time of initiation of the treatment after patient arrival was recorded and delays will be compared and correlated to the final outcome of the patient. This includes the cases that were managed in a non-health care facility or at the site of exposure. The percentages of patients initially treated and referred from another health care facility have also been evaluated.

Treatments, such as the use of antidotes, were recorded to assess the availability of necessary treatment as well as any deviation from the recommended standards. The management provided was then classified in the following categories: Decontamination only, Observation only, No therapy provided, Decontamination and other therapy, “other” therapy only (without decontamination). Patients’ health coverage, unemployment, and history of mental illness such as depression, psychotic disorders, or personality disorders were analyzed. Significance of mental illness in the group of patients who repeatedly attempted drug or chemical intentional self poisoning has been explored and the correlation of addiction history with mental illness co-morbidity has been examined.

Voluntary vs. unintentional, domestic chemical use vs. agricultural and industrial, occupational vs. environmental, pharmaceutical intentional vs. pharmaceutical adverse

reaction illicit drug use, and recreational intoxication have been stratified by age, sex, socio- economic status, employment, presence of history of chronic illness, alcohol use and mental illness have been examined for correlation with the final outcome of the poisoning cases.

Although morbidity and mortality of acute poisoning are increased in elderly compared to younger patients, little has been published on this issue. To investigate the influence of age on the clinical course of acute poisoning, the cause of acute poisoning and the clinical outcome have been recorded. As compared with younger patients, mean length of stay at the ICU, if found to be significantly higher this might indicate a more serious course of acute poisoning.

3.0. DEFINITION OF VARIABLES

Poisoning was defined as a condition or physical state produced by the ingestion, injection or inhalation of, or exposure to a deleterious agent. Poison exposure may include any medicinal drug, environmental, agricultural, industrial, or occupational substance that may or may not result in a visit to the Emergency Department (ED).

Environmental poisoning is any passive, non-occupational exposure that results from contamination of air, water, or soil.

Occupational exposure is an exposure that occurs as a direct result of the workplace.

Therapeutic error is 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.

Drug interactions resulting from unintentional administration of drugs or foods which are known to interact are also included.

Unintentional misuse differs from intentional misuse in that the exposure was unplanned or not foreseen by the patient.

Bite/sting includes all animal bites with or without stings.

Food poisoning is a suspected or confirmed ingestion of food contaminated with microorganisms.

Suicidal poisoning is a poisoning that results from an inappropriate use of a substance for reasons that are suspected to be self-destructive.

Intentional misuse is defined as an exposure resulting from the intentional improper or incorrect use of a substance for reasons other than the pursuit of a psychotropic or euphoric effect.

Unintentional poisoning is all unintentional exposures not otherwise defined.

Intentional abuse is defined as an exposure resulting from the intentional improper or incorrect use of a substance where the victim was likely attempting to achieve a euphoric or psychotropic effect. All recreational use of substances for any effect is included.

The category *malicious poisoning* is used to capture patients who are victims of another person's intent to harm them.

Minor effect is a situation where the patient developed some signs or symptoms as a result of the exposure, but they were minimally bothersome and resolved rapidly with no residual disability or disfigurement.

Moderate effect occur when patient exhibits signs or symptoms as a result of the exposure that were more pronounced, more prolonged, or more systemic in nature than minor symptoms. Some form of treatment is indicated but Symptoms were not life threatening, and the patient had no residual disability or disfigurement

Major effect is defined as when patient exhibits signs or symptoms as a result of the exposure that was life-threatening or resulted in a hospitalization or in ICU with or without significant residual disability or disfigurement

Death occurs when patient dies as a result of the exposure or as a direct complication of the exposure.

4.0. DATA ANALYSIS

Data collected was reviewed and checked for completeness before being entered into a database and missing values were excluded using a pairwise deletion. The data was then analyzed using SPSS 16.0 statistical package. Continuous variables such as age, duration of hospital stay, and duration of time between poisoning and hospital arrival was analyzed using student's t test or one-way analysis of variance (ANOVA) between groups. The categorical data between groups was analyzed by using the Chi square test; Odds Ratio, and confidence interval, (CI) was calculated by a full factorial univariate analyses and stepwise multiple logistic regression analysis. Correlation analysis was conducted using the Pearson r correlation coefficient. Results obtained will be presented as mean \pm SD and percent (%). A p value of less than 0.05 will be considered significant for the various association between variables specifically association between asthma and exposure, between exposure and outcome, final disposition, suicidal poisoning and chronic diseases such as depression psychosis

RESULTS

Between December 2004 and May 2007 a total of 649 patients' encounters were identified. The poisoning diagnosis was made based on a documented acknowledgement by the patient for taking the drug or by a positive urine drug screen that is done systematically for any suspected specific exposure. The first section will present the demographics of the exposure, the second section will explore poisoning agents of exposure, the third will describe co-morbidities, the fourth section will describe the correlations between variables, and the fifth section will describe predictors.

1.0. DEMOGRAPHIC CHARACTERIZATION

1.1- Age and Gender

The distribution of age and gender is shown in Table 1 and Figure 1; age varied between 1 and 89 years with a median of 39.7 years and a standard deviation of 13.6.

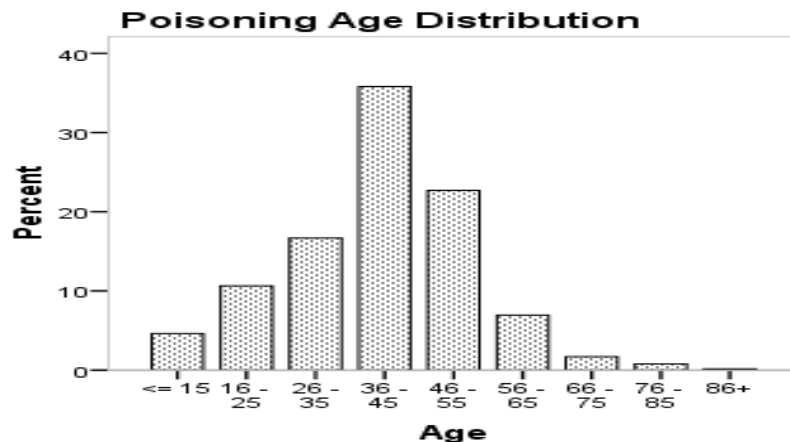


FIGURE 1: Age distribution: cases were predominantly adult between 36 and 45 years old. Pediatric cases younger than 15 years old represented only 4.6%.

In the pediatric population 4.6 % were younger than 15 years old and, as shown in Figure 1, the most frequently affected age was 48 years old and the most commonly affected age group was between 36 and 45 years old. The middle aged adult population for both sexes represented 35.7% of the total cases. The younger adult group of 16 to 35 years old represented only 10.6% and ranked third after the 46-55 years old that scored 22.7%. Of the total of 649 poisoning cases there were more male, than female, with 42.7% (n=277) females and 55.9% (n=363) male to female ratio of 1.3.

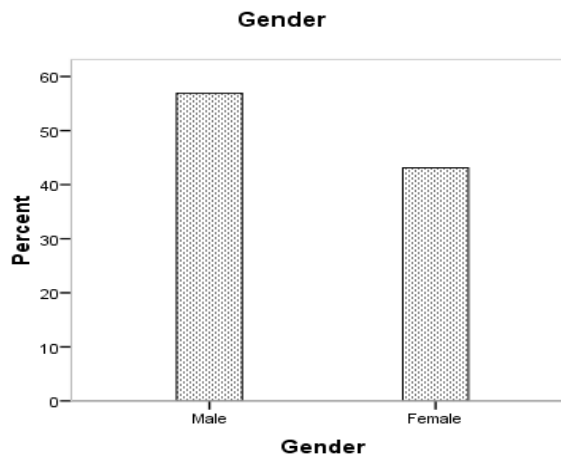


FIGURE 2: Poisoning distribution by gender: more male, than females were seen with male to female ratio of 1.3.

Below (Figure 3) is a side-to-side (or a mirror effect) graph of the male to female frequency on an age range. This population pyramid allows a better comparison of the various gender differences by age brackets. The distributions of gender by age seem globally similar, but clearly the peaks look different where females are more common at ages 40 to 43 as compared to males that peak at 46 to 49 years old. Among children it

seems there were more poisoning cases among male infants at very early age (2-3 years) than females.

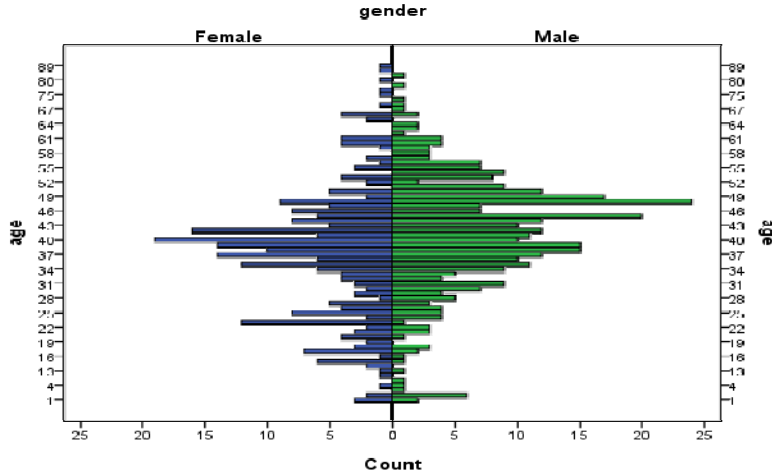


FIGURE 3: Population Pyramid: distribution of poisoning cases by gender and by age. Poisoning population peaks at 49 years old in males and at 40 to 43 in females.

1.2- Race and Marital Status

The difference in ethnic background was substantial as the poisoning cases were predominantly African Americans (79.9%).

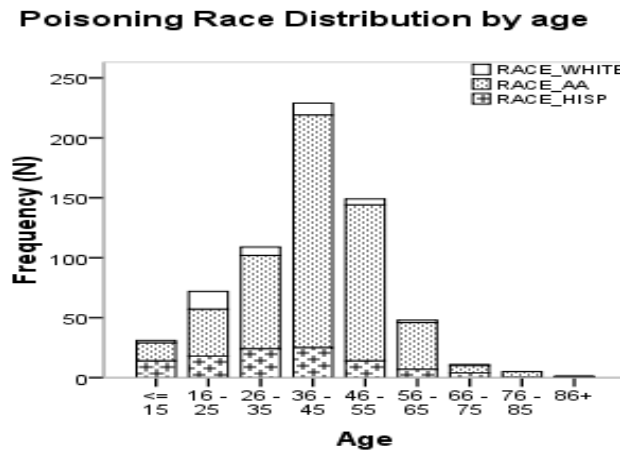


FIGURE 4: Poisoning distribution by race and age: The poisoning population race is predominantly African American then Hispanics and Whites in third position. (Race_AA: African American, Race_Hisp: Hispanic)

Hispanics were the second most prevalent with 11.9%, followed by Whites at 6.6%. Over 69.3% (n=450) of the total cases were single in comparison to only 12.3% (n=80) were married. Results of the married and unmarried patients by age are displayed in Figure 5.

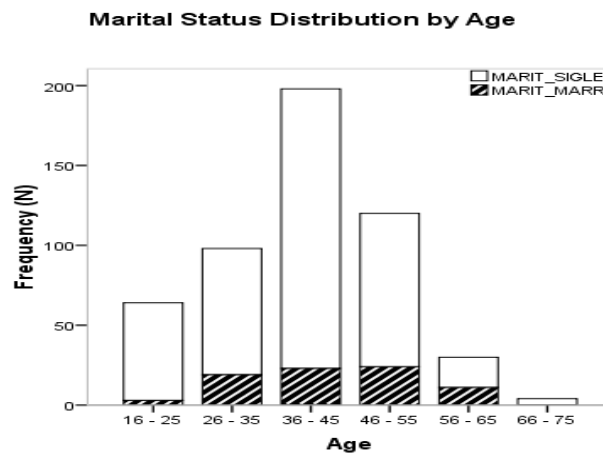


FIGURE 5: Marital Status. Distribution of married versus unmarried patients shows a predominantly single population as compared to only less than 20% married (Marit_Single: Marital status single; Marit_Marr: Married)

There were more singles cases than married cases and singles cases were predominantly aged between 37 and 49 years old.

1.3- Employment and Insurance Coverage

Most patients were self-covered 45.8% (n=297), 35.1% (n=228) of the cases were covered by the Illinois Department of Public Aid (IDPA). Only 5.9% (n=38) patients had private coverage. Medicare and Medicaid covered only 8.2% of the total cases.

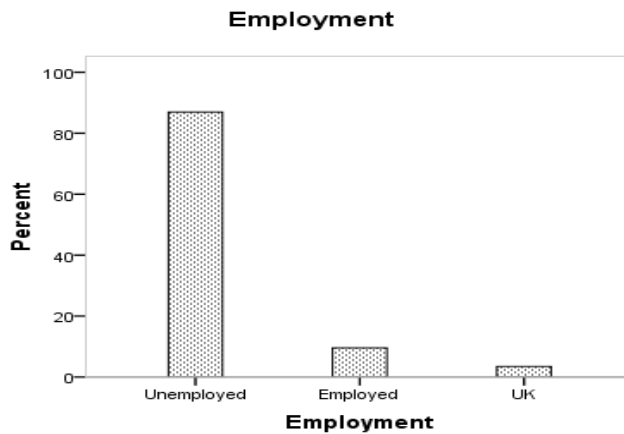


FIGURE 6: Poisoning by employment status. Most poisoning cases were unemployed and not covered by any insurance, shown in Figure 6 and Figure 7.

Most patient with poisoning episodes brought to the hospital were unemployed 87.4% (n= 567) as opposed to only 9.4% (n=62) of employed.

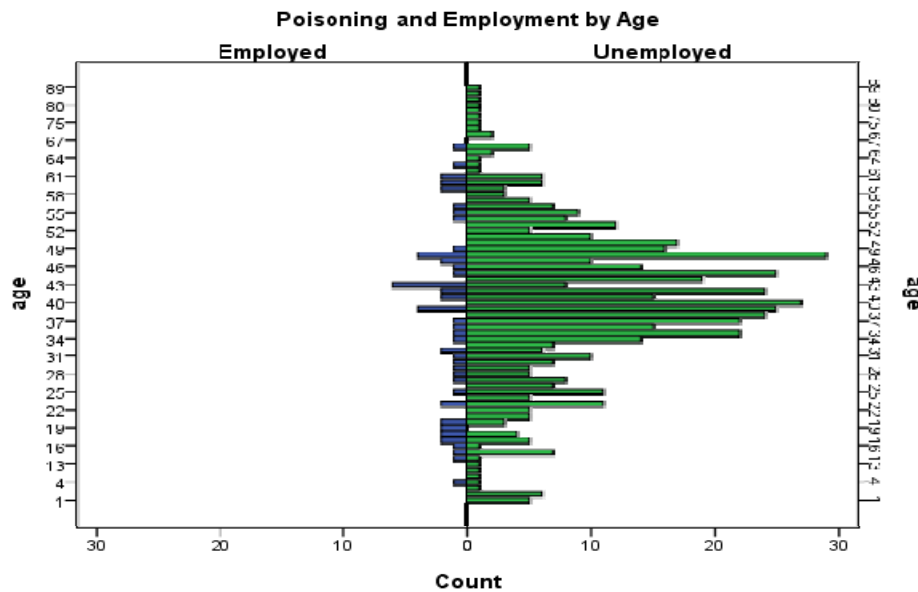


FIGURE 7: Population pyramid, Employment distribution by age. The age group that is the mostly affected was between 37 and 52 years old.

1.4- Mode of Arrival

Fifty three percent (n=345) of patients with poisoning were brought by the Chicago fire department in response to a 911 call from a patient's families, or from the police department. Twenty nine point six percent of patients (n=192) walked in the emergency department or were brought by a family member or in a wheelchair. Only 0.5% of the case visited their primary care physician (PCP) before presenting to the emergency department.

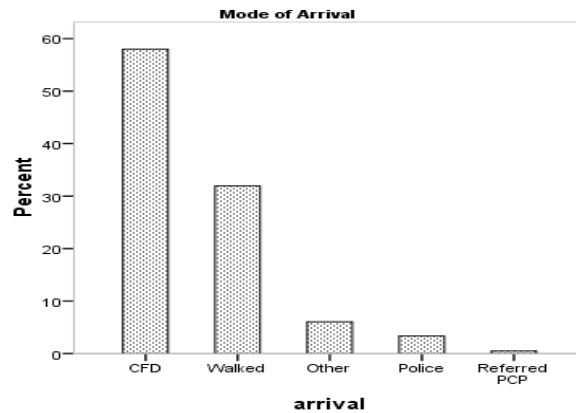


FIGURE 8: Mode of arrival of patients with poisoning to ED. Chicago Fire Department brought more than half of the total cases.

The Pearson correlation test showed that there was a significant correlation between mode of arrival and age ($r=-.119$, $DF=589$, $p=.004$), marital status ($r=.113$, $p=.006$ and $DF=627$), pulse ($r=-.111$, $DF=622$, $p=.007$), exposure ($r=-.134$, $DF=591$, $p=.001$) and also with the final disposition ($r=.111$, $DF=582$, $p=.007$). Though these correlations are not strong, it could reflect that the predominance of heroin and cocaine cases mostly brought by police and fire department resulted in more hospitalizations compared to the other patients that just walked in or were brought by other means. Also, these correlations could be related to the fact that the outcome is generally worse when

EMS brings patients given that EMS is generally called only for situations that seemed severe or had potential for complications.

Arrival mode was also significantly correlated with the final disposition particularly to hospital admission ($p=0.04$). No correlation was established between death and the way the patient arrived to ED.

1.5- Chief Complaint Analysis

Given the wide variation of the diverse symptoms related to poisoning, the chief complaint was classified in seven categories that were estimated to be the most common. Category one includes unresponsiveness, Loss of consciousness and or Coma and it included 22% ($n=143$) of the total patients.

Category two includes cardio vascular complaints such as chest pain, angina, and or coronary artery disease. This category was the most representative in our series and more than 25.9% ($n=168$) of the cases presented with these chief complaints.

Category three is pulmonary related complaints such as Shortness of breath (SOB), cough, wheezing or exacerbation of a preexisting asthma. In our series, 22.2% ($n= 144$) of patients presented with this latter complaint. Category four is drug overdose related symptoms, this category involved 15.4 % ($n= 100$) of our patients.

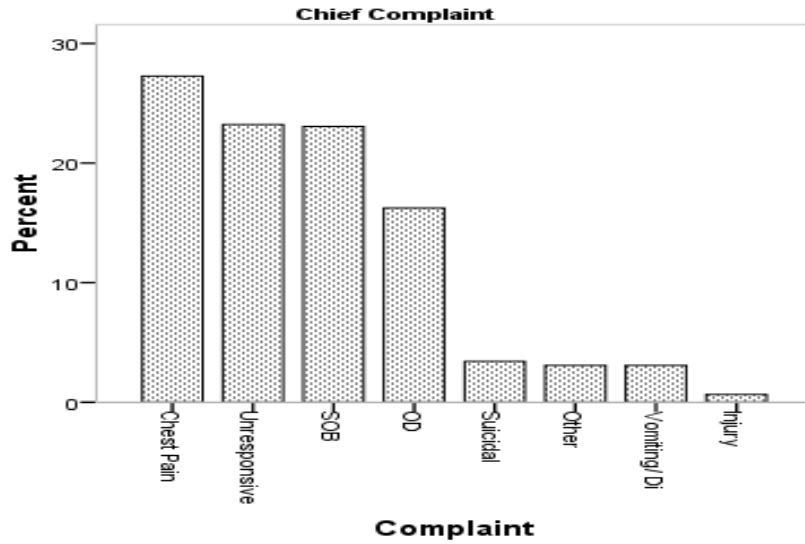


FIGURE 9: Chief complaint at the level of ED triage. Most patients presented for chest pain or were brought by CFD unresponsive or with shortness of breath.

1.6- Vitals on Admission

1.6.1- Temperature on Admission

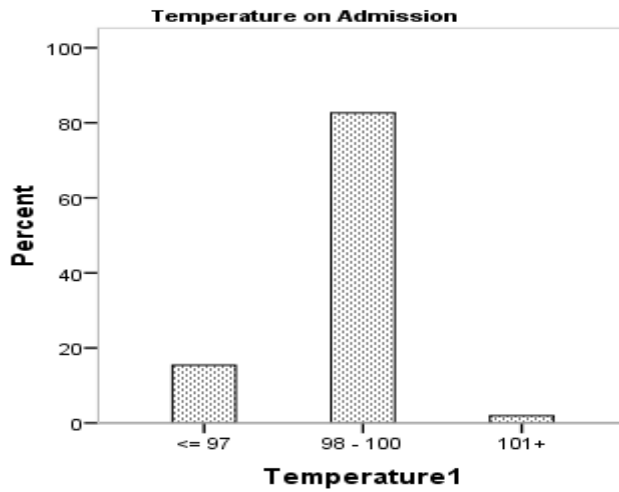


FIGURE 10: Admission temperature ranged between 86.0 and 105.0 with a median of 98.0 degree Frenheight.

1.6.2- Heart Rates

As shown below in Figure 12, only 2.6% presented with a bradycardia less than 50 and 56.4% (n=366) presented with pulse between 50 and 100 and 39.4% (n=249) with pulse over 100.

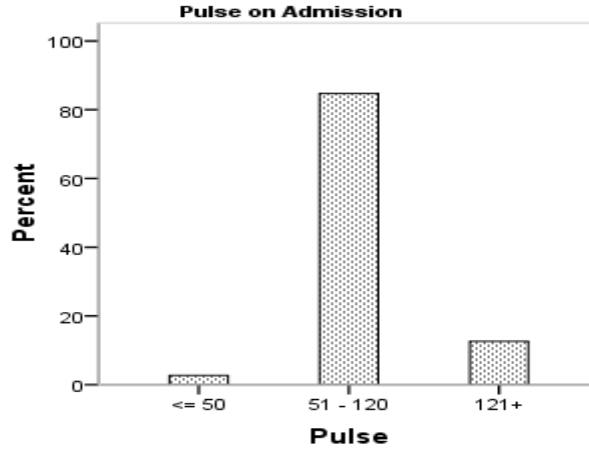


FIGURE 11: Pulse at arrival to ED. over 35 % of patient had a tachycardia that was higher than 100beat per min.

1.6.3- Respiratory Rate

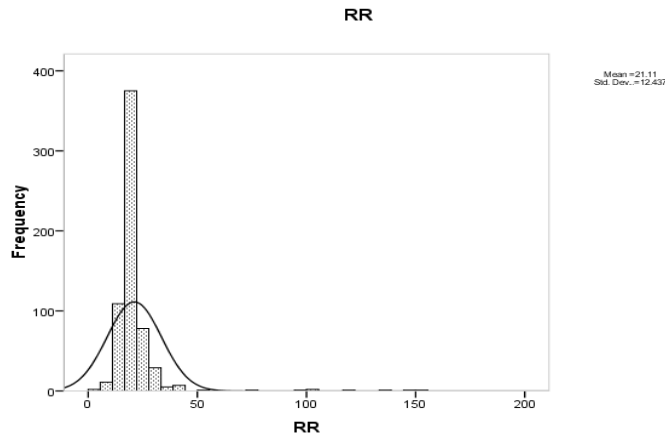


FIGURE 12: Respiratory rate on admission. RR was normally distributed that peaks in the high 20s

1.6.4- Blood Pressure Systolic

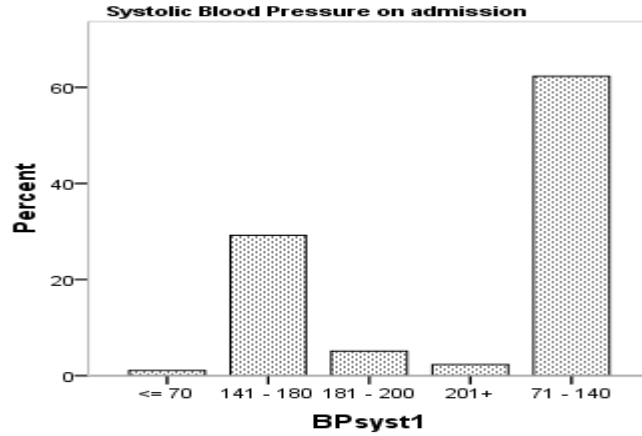


FIGURE 13: Frequency and percent systolic blood pressure on arrival to ED. Over 30% of patients presented with systolic high BP over 140 and 10% presented with a systolic BP over 200mm/hg.

1.6.5- Blood Pressure Diastolic

Diastolic blood pressure was not significantly correlated with either heroin or cocaine use, but it was correlated to alcohol use ($p= 0.015$) analgesics ($p= 0.24$) and to marijuana use ($p=. 006$).

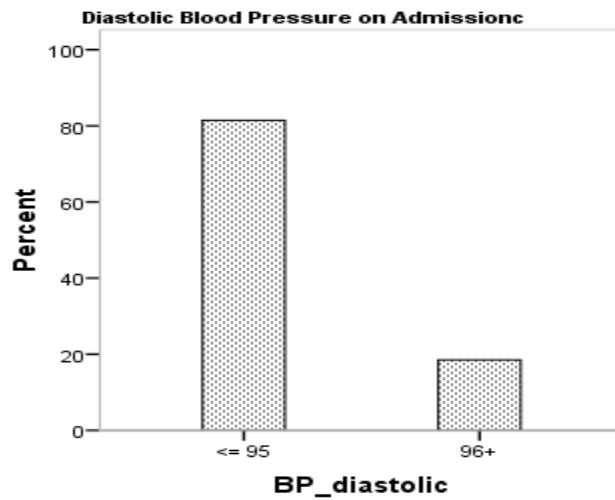


FIGURE 14: Frequency and Percent of diastolic Blood Pressure on arrival to ED

1.6.6- Glasgow Scores

Glasgow coma scale, known as Glasgow score; a reliable tool for assessing consciousness was significantly correlated to heroin ($p=0.002$) and to cocaine overdose ($p=0.002$)

2.0. POISONING AGENTS

Poisoning exposure was grouped into fifteen toxic substances or drugs and in four different categories: pharmaceutical or medicinal drugs, recreational drugs, chemicals or chemical industrial. Circumstances of the exposure were also captured and categorized into seven intent groups that included: suicidal, abuse, intentional, misuse, unintentional and therapeutic and adverse drug events (ADE); the route of exposure was recorded as: inhalation, ingestion, and injection, dermatological, vaginal and or rectal.

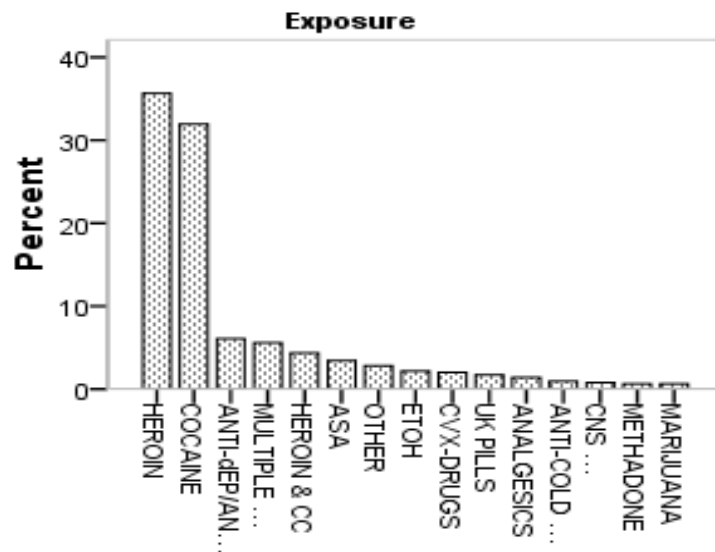


FIGURE 15: ED poison exposure. The poisoning exposure most commonly encountered was heroin followed by cocaine and anti- depressant and antipsychotic medications. Multiple drugs intakes were the fourth most commonly seen poisoning exposure in this study population.

The fifteen exposure substances identified and most commonly encountered in ED included heroin, cocaine, alcohol, heroin concomitantly with cocaine, multiple drugs, ASA (aspirin), anti-depressors and antipsychotics, stimulants, analgesics, methadone, marijuana, multiple drugs, unknown pills, cardio vascular drugs, anti-cold drugs and others.

In summary agents of poisonings encountered was as follow: heroin represented 35.4% (n=230), cocaine 31.7% (n=206), heroin and cocaine concomitantly taken 4.3% (n=28), alcohol 2.2% (n=14), multiple drugs 5.5% (n=36), anti depressant antipsychotic 6% (n=39), ASA 3.4% (n=22), cardio vascular drugs 2% (n=13), anti-cold medications 1.1% (n=2.2), methadone .6% (n=4), CNS stimulants .8% (n=5), Analgesics 1.5% (n=10), Marijuana .5% (n=3), unknown pills 1.7 (n=11), other substances 2.9% (n=19). The route of the poisoning exposure included inhalation 61.5% (n=400), ingestion in 21.1% (n=137), rectal vaginal 10.6(n=69) and injection at 5.2% (n=34.).

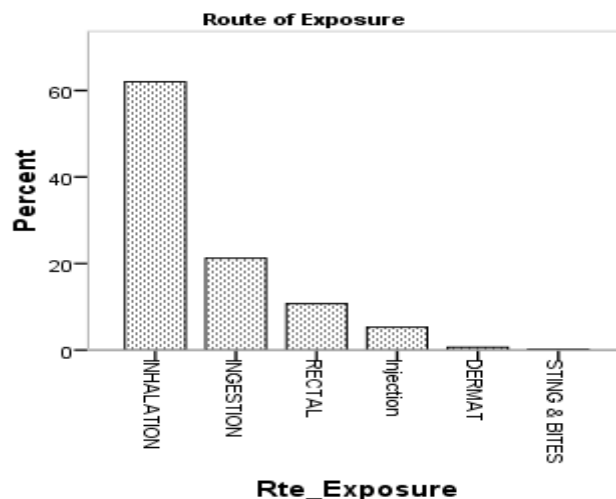


FIGURE 16: Overall route of poisoning exposure. Inhalation as route of exposure was the most commonly seen route particularly for cocaine and heroin.

The exposure circumstances included: abuse 76% (n=498), suicidal 13.4% (n=87), misuse 2.2% (n=14), unintentional 3.2% (n=21), therapeutic 2.5% (n=16) and ADE .6% (n=4).

2.1- Poisoning and Medical History

There was a significant relationship between asthma and the exposure to heroin (F=20.4, DF=1, p=0.0001) as well as between history of cardio vascular disease and exposure to cocaine (F=35.34, DF=1, p=0.0001). Another significant relationship was revealed between the use of cocaine and history of preexisting hypertension (F=33.34, DF=1, p=0.0001). Depression and Psychosis were significantly associated with the overall poisoning exposure variable with (F=42.59, DF=1, p= .0001) and (F=6.96, DF=1, p=.0001) respectively.

2.2- Relationship of Poisoning to Smoking and Alcoholism

A set of significant relationships were established between poisoning exposure and the history of smoking (F=2.90, DF=14, p=0.0001). Another significant relationship (F=3.76, DF=14, p=0.0001) was established between the history of alcohol drinking and the exposure to poison. History of recreational drug use was also found significantly related (F=33.64, DF=14, p=0.0001) to the overall exposure variable.

3.0. POISONING CO-MORBIDITY

3.1. Personal Medical History of Diabetes mellitus

There were over 93 diabetic cases that visited the emergency department for poisoning during the study period and they represented 14.3 %. Twelve cases were accounted unknown as the history of prior diagnosis was not clear from the patients' records.

PMH of Diabetes and Hypertension

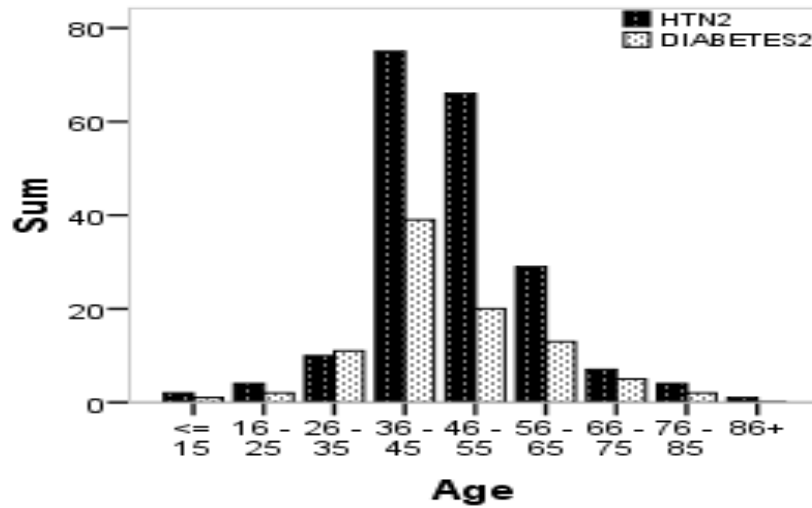


FIGURE 17: Personal medical history of diabetes and hypertension by age. The distribution of the cases of diabetes looks uniformly distributed and it reflected the distribution of the poisoning exposure within the total population (on the Y access Sum refers to frequency).

The diabetic patients' ages ranged between 1 and 89 years with a mean of 46.5 and a standard deviation of 11.96, similar to the overall age distribution of the population studied. More than 59.1% (n=55) were male, 44.1% (n=41) used exclusively cocaine and 29% (n=27) used exclusively heroin, 2.2% used a combination of both heroin and cocaine, and 6.5% (n=6) combined multiple drugs.

Among poisoned diabetics patients there were 59.1% (n=55) who also had an associated hypertension and 35.5% (n=33) with cardio vascular diseases and 48.4% (n=45) of asthmatics. Depression was prevalent among diabetics with 21.5% (n=20), no correlation with the overall poisoning exposure variable was established.

3.2- Personal Medical History of Hypertension

Over 31% (n=199) cases were diagnosed with prior history of hypertension. Among these there were 27.1% (n=54) who used heroin and 47.2% (n=94), who used cocaine, 4% (n=8) who combined both heroin and cocaine, and 5.5% (n=11) who used anti-depressants/ anti-psychotics. Smoking was prevalent at 72.4% (n=144) of the hypertension group, 60.3 % (n=199) were alcoholics and over 85.4% (n=170) had history of drug abuse. Sixty point eight percent (n=121) reported had taken other prescription medications the day of their poisoning. Over 71.9% (n=143) of the hypertension patient were hospitalized as opposed to only 26% who were discharged form ED; .5% (n=1) died, 58.3% had major effect, and 38.7% were categorized in minor events.

PMH of Hypertension & Cardio Vascular Diseases

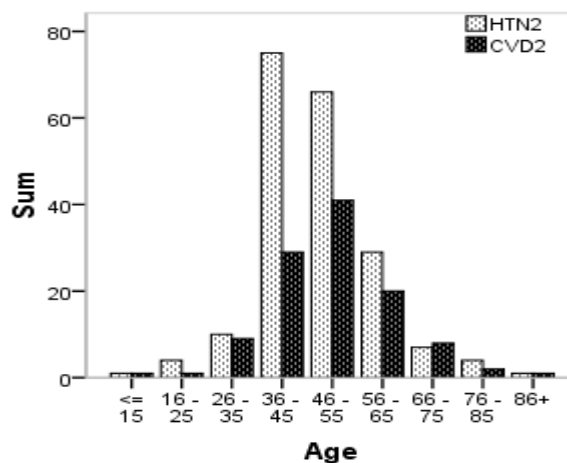


FIGURE 18: Prevalence of chronic hypertension compared to cardio-vascular co-morbidity with poisoning. Hypertension (HTN2) and cardio vascular disease (CVD2) were similarly distributed in all age groups.

Hypertension was not correlated to the overall poisoning exposure, however it was correlated to cocaine exposure ($p= .0001$). No age difference was seen that could explain this significance level.

3.3. Personal Medical History of Cardio-vascular Diseases

The number of patient that presented to emergency department with a preexisting history of cardio vascular diseases (CVD) represented 17.4 % ($n=113$). Cardiovascular disease included all heart problems and a Pearson correlation test indicated heart disease was significantly correlated to cocaine abuse ($r=.227$, $DF=645$, $p= .0001$).

3.4. Personal Medical History of Arthritis

Personal medical history of arthritis was only seen in 3.5% of the cases ($n=23$) and no significant correlation with any other variable was established, including the exposure to heroin that has been previously indicated to cause a degree of arthritis.

3.5. Personal Medical History of Malignancy

Malignancy was rarely seen among cases of poisoning of our study; only 7 patients presented for poisoning among the 649 cases identified, and no correlation between history of cancer and drug abuse or suicidal attempts were found. Contrary to the initial hypothesis, that patients with cancer might be at higher risk for poisoning because of multiple toxic chemotherapies, as well as their depressive mental state, that make them more susceptible for attempting suicide.

3.6. Personal Medical History of Asthma

Asthma was of special interest to this study and it was investigated for possible correlation with multiple other variables, we identified the following findings:

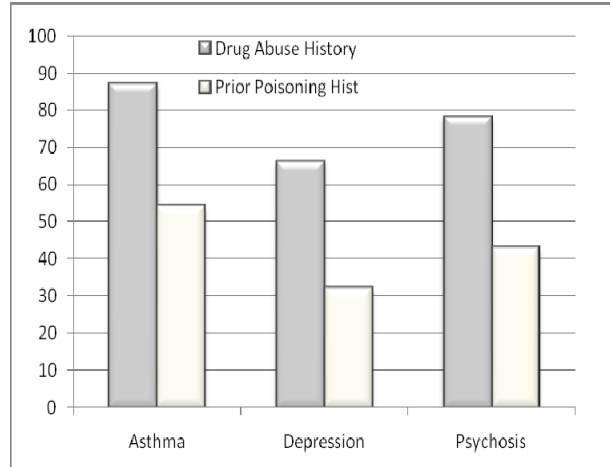


FIGURE 19: Smoking & regular drinking habits in Asthma, Depression & Psychosis

Over 41.4 % of our study population had a history of confirmed diagnosis of asthma (n=269). Among the 269 asthmatics, there were 45.4% (n=122) who presented to ED for a complication related to heroin intake during the last 24 hours before admission. Cocaine related visits among asthmatics represented 30.5% (n=82), and alcohol poisoning accounted for 2.6% (n=7) of all asthma cases. Concomitant use of heroin and cocaine represented 5.2% (n=14), and multiple drugs intoxication was seen in 4.5% (n=12) of cases. Marijuana seems to be rare as a cause for emergency visit among asthmatics and our population rate was recorded at only 1.1% (n=3.)

Asthma patients who visited ED for a poisoning event had almost equal distribution of gender; 50.9% (n=135) were female, 49.1% were male. Over 72% (n=195) were single as opposed to 11.9% married (n=32). Asthma cases were predominantly African American 85.9% (n=231) with 3.3% Hispanic (n=9) and 3.7% (n=10) of white descent. Sixteen percent of our asthmatic population were also diabetics, 31.6% (n=85) had hypertension, 14.5% (n=39) reported cardio-vascular problems, 3.7% of them had been diagnosed with an arthritis, and 2.6(n=7) had a past or current malignancy.

Depression co-morbidity among asthma patient was recorded at 18.2% and 8.6% (n=23) were diagnosed and treated for a psychotic disorder. Most asthma patients had a history of recreational drug use 86.1% (n=229), 24 cases (9%) were seen in the emergency department for a self poisoning. Therapeutic adverse events were also reported among asthma patients at a rate of 2.2% (n=6) and misuse of drugs at a rate of 1.1% (n=2).

History of prior poisoning and ED visit or hospitalization for similar events was prevalent. In fact over 54.3% (n=146) of asthmatics were documented with prior incidents of poisoning that needed a trip to ED at least once. Inhalation was the most commonly reported mode of exposure of asthmatics 75.5% (n=203), ingestion was seen in 11.5% (n=31), then injection 6.3% (n=17), rectal or vaginal at 4.5% (n=12), and dermatological 1.1% (n=3.) Smoking was prevalent among asthmatics at 65.1% (n=175) and regular alcohol intake was associated with asthma in 54.6% (n=147). Only 25% (n=68) of asthma patients had received initial management on the site of the poisoning exposure or immediately at arrival to the emergency department and 11.5% (n=31) were given immediate antidote administration.

From the total 269 patients only 14.5% (n=39) were discharged and 71.7% (n=193) were admitted to the hospital or to the ICU for further management. According to the ER physician, the assessment of the outcome reported that the poisoning events were major in 55.8% where the patient needed extra measures in order to treat their poisoning exposures, necessitating sometimes ICU hospitalization, intubation or admission to the hospital.

The records showed that 84% had had a follow up at the outpatient clinic or were referred to their primary care physician. At the time of the exposure, 67.7% of asthma patients reported that they were taking their asthma routine maintenance medication and 53.2% of the total asthma groups were under albuterol treatment.

A significant relationship between the exposure to heroin and history of Asthma was established ($p=0.0001$). Asthma was not correlated to any of the other substances of exposure including cocaine, alcohol, or concomitant use of heroin and cocaine. ANOVA test resulted in a statistically significant relationship between asthma and depression ($p=.044$) and to psychosis ($.028$), however smoking was not significantly associated with asthma ($p=.066$).

TABLE-1: Summary Table for Diabetes, Asthma and hypertension; demographics and agents responsible for poisonings.

	Diabetes	HTN	Asthma
Total study population(N)	14.3% (n=93)	31% (n=199)	41.4% (n=269)
Age	45.9 +/- SD 11.8	47.6 +/- SD 11.3	39.2 +/- 11.9
Gender	M=60.4%, F=39.6%	M=66.3%, F= 33.7%	M=49.1%, F= 50.9
Heroin	29% (n=27)	27.1% (n=54)	45.4 % (n=122)
Cocaine	44.1% (n=41)	47.2 % (n=94)	30.5% (n=82)
Smoking	67.7% (n=63)	72.4% (n=144)	65.1 % (n=175)
Alcohol	53.8% (n=50)	60.3% (n=121)	54.6% (n=147)
Depression	21.5% (n=20)	17.6 % (n=35)	18.2% (n=49)
Psychosis	11.8% (n=11)	11.6 % (n=23)	8.6% (n=23)
Hospitalization rates	73.1% (n=68)	71.9 % (n=143)	71.7% (n=193)

3.7. Personal Medical History of Depression

In our series Depression accounted for 21.6% (n=140) of the total cases and a significant relationship was found between poisoning and history of depression. Many patients that attempted suicide ingested a higher dose of their own medications for the purpose of self-harm. A smaller number presented for adverse drug reaction of anti-depressor mainly Tricyclics. Over the 141 cases 27.1% (n=38) visited ED for cocaine related poisoning event and 17.1% (n=24) presented for heroin poisoning. The third most common poisoning seen in depressed patients presenting to ED was anti-depressants 15.7% (n=22), multiple drugs 11.4% (n=16), salicylic acid (ASA) 9.3% (n=13), and unknown pills .7% (n=1).

In patients with depressive mood disorders, gender distribution was slightly in favor of females with 53.6% (n=75) versus 46.4% (n=65) males with a male female ratio of .8 mostly single 70.7% (n=99) versus only 11.4% of married. African American was the major race in this group with 72.9% (n=102); Hispanics were 7.1% (n=10) and 8.6% (N=12) were Whites. The majority in the depression group were unemployed at 85.8% (n=121), 47.1% covered with IDPA, and 35% were self-payers.

Over 48.6% (n=68) of the depression group were brought by the EMS and 25.7% (n=36) arrived to ED unresponsive and 25% (n=35) of them had a heart related complaint, 12.9% (n=18) had a chief complaint that was classified as overdose (OD). Suicidal intent was recorded in 42.9% (n=60), and another major circumstance of poisoning in the depression group was drug abuse at 52.1% (n=73). Unintentional and misuse was only seen in less than .7% (n=1). Medication was the most commonly used in this group at 45% (n=63). The main route of poisoning in this study group of documented

depression patients was the ingestion route 47.1% (n=66) and the inhalation route 45.7% (n=64). Rectal or injection routes were equally recorded at 2.9% (n=4) each.

Co-morbidity of depression was recorded as follow: Asthma 34% (n=48), diabetes 14.3% (n=20) hypertension 25% (n=35) Psychosis 33.6% (n=47) cardio vascular diseases 17.9% (n=25) and arthritis 3.5% (n=5). Of the 141 patient 15% (N=21) that received immediate management at the site of the poisoning, and 8.5% received Naloxone antidote on arrival to the emergency room. Beside antidote and initial intervention on the site 20% (n=28) received decontamination only, 35% (N=49) received decontamination combined to other appropriate therapy and 36.4% (n=51) received other therapy without decontamination.

Fifty-four percent of the depression group acknowledged smoking tobacco, 55% (n=76), regular alcohol intake, 66.7% (n=94) admitted the use of recreational drugs. Over half of the intoxication resulted in minor effects, 47.5% had some complication and resulted in a major outcome (but not death), and 75.7% (n=106) were admitted to the hospital for further evaluation and management. The average length of stay was at 1.4 days. Of the regular prescription medication noted taken for asthma maintenance treatment, albuterol was reported by 14.2% (n=20), anti-depressant medication in 8.5 % of patients, anti-hypertensive medication 8.55 (n=12), and clonidine in 1.45 (n=2).

Of the total cases 11.9% (n=77) were diagnosed and documented with a psychotic disorder. Their age varied between 20 and 66 years old, with a mean of 39.32 and a standard deviation of 9.55. Patients in this group were predominantly single (79.2%, n= 61) African American (83.1%, n=64), male (58.4%, n=45) with a male to female ratio of 1.4.

Hispanics represented 3.9% (n=3) of cases and whites represented 9.1% (n=7); only 6.5% (n=5) were employed. Insurance coverage was provided by IDPA 51.9% (n=40), Medicare 7.8% (n=6), and 27.3% (n=21) were self-payers.

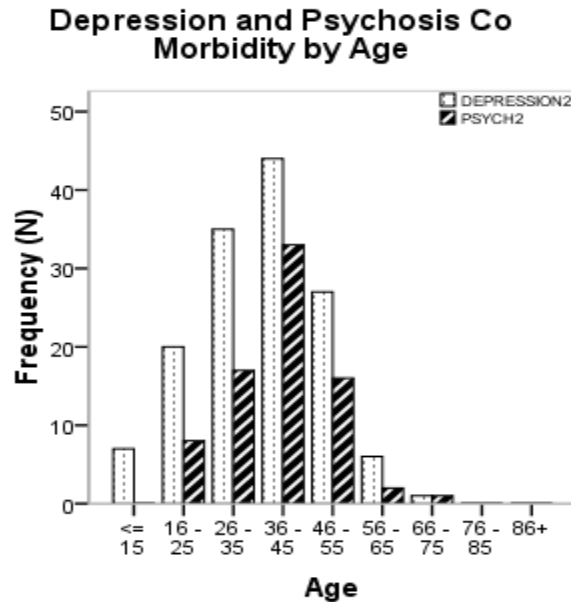


FIGURE 20: Depression and of Psychosis (PSYCH2) by age. The age group the most involved is the middle aged between 36 and 45 years old, the same age group affected by asthma and diabetes and hypertension.

3.8. Personal Medical History of Psychosis

Chicago fire department EMS brought over 56% (n=39) of them to ED and 31.2% (n=24) were walk-ins. Over 24.7% (n=19) had a heart related complaint, 13% (n=10) had chest complaint like shortness of breath, 5.2% presented for nausea and/or vomiting. Overdose as the chief complaint was seen in 13% (n=10) and none of the psychotic patients presented for injury following an event of poisoning.

Among the group of psychotics there were 14.3% of diabetics (n=11), 29.9% (n=23) hypertensive, 18.2% (n=14) with cardio vascular diseases, 29.9% (n=23)

asthmatics, 62.3% (n=48) with a diagnosed depression disorder, and (1.3%) with a malignancy. Of the total patients with known psychotic disorders 42.9% (n=33) had previously visited ED or were hospitalized for a poisoning related event.

Over 19.5% (n=15) of the patients with history of psychotic disorders had heroin poisoning, 33.8% (n=26) had cocaine poisoning, 18.2% (n=18) were poisoned with their own prescription medication, and 7.8% (n=6) to multiple drugs combination. Alcohol resulted in intoxication in this group only in one case (1.3%).

In summary, the above poisoning exposures were distributed in 5 categories: 58.4% (n=45) illicit drug overdoses, 33.8% (n=26) pharmaceutical poisoning (though some drugs were also taken for recreational purposes), 7.8% (n=6) chemical industrial poisoning. Circumstances of the poisoning were collected from the History and physical (H&P) report and were as follow: suicidal 28.6% (n=22), recreational 64.9% (n=50) unintentional accidental 2.6% (n=2), and therapeutic error 2.6% (n=2). Concomitant medication intake was reported for antidepressant/antipsychotic for 13% (n=10), for albuterol in 11.7% of the cases, for anti hypertension medications 9.1% (n=7) of cases and clonidine in 2.6% (n=2) of the cases.

The route of exposure was recorded as follow: inhalation 53.2% (n=41), ingestion 35.1% (n=27), rectal or vaginal 10.4% (n=8), and injection for 1.35% (n=1). Over 15.6% (n=12) received initial management on site, and 11.7% were given Narcan by the EMS technicians or immediately at arrival to ED. Decontamination only was ordered in 16.9% (n=13), observation only was done in 7.8% (n=6), 27.3% received decontamination with some other therapeutic measures, and 42.9 % received other therapy without decontamination.

Over 76% (n=59) of the psychotic patients that presented to ED for a poisoning related complaint reported smoking tobacco, and 61% (n=47) reported taking alcohol regularly. As many as 77.9% (n=60) of this group with documented psychotic disorders acknowledged to their ER physicians that they took illicit drugs. Among the total 77 patients in this group only 11.7% (n=9) of patients were discharged home, the rest (77.9%, n=60) were hospitalized. The final outcome was subjectively assessed as major in 49.4% (n=38), as a minor effect in 46.8% (n=36); no deaths occurred in this group. The average length of stay was 1.3 days and follow up after discharge was done in 87%, through outpatient clinics and primary care physicians.

3.9. Personal Medical History of other Mental Illnesses

In the process of data collection, it was deemed logical to collect information on other mental illnesses that might be associated with depression and psychotic disorders that may influence the patient's risk for self poisoning. However, the data was limited and only 3.5 % (n=19) had other concomitant psychiatric disorders such as generalized anxiety disorders, seen in 1.3% of the cases.

3.10. History of Smoking

Since the review of literature has shown only rare cases of isolated tobacco intoxication where tobacco was the primary poison that necessitated emergency visit, smoking exposure was not initially considered the list of poisons of interest. However, an assessment of smoking status was included in order to assess its prevalence among ED related poisoning cases. Over 60.9 % (n=395) were tobacco smokers; smoking was self reported on admission and documented on the patient chart systematically as part of the initial H&P assessment.

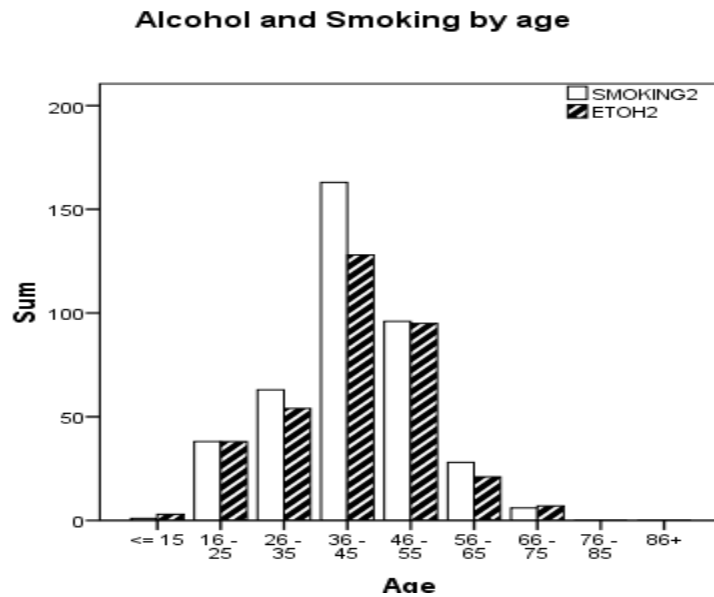


FIGURE 21: Smoking and alcohol (ETOH2) co-morbidity by age.

Smokers were aged between 17 and 72 years with a mean of 41.37 and a SD 10.44. Over 41.7% were female and 58.3% male with a sex ratio of 1.4. Of the total 395, 13.2% (n=52) were married and 71.9% (n=284) were single. Eighty two percent (n=324) of the smoking patients were African American, 5.1% (n=21) Hispanic, and 5.3% (n=21) White. Smokers' rate of unemployment was 88.4% within our population. Over 34.7% (n=137) were covered by public aid, 5.8% (n=23) by Medicare, 1.5% (n=6) by Medicaid and the rest did not have any insurance coverage 46.1% (n=182). Patients arrived to the ED primarily by walking 29.9% (n=118) or by the Chicago Fire Department 54.2% (n=214). Their chief complaints were chest pain and heart related complaints (33.4%, n=132), shortness of breath (25.1%, n=99), unresponsiveness, confusion to coma (18.7%, n=74), drug overdose (11.1, n=44), vomiting (2.8%, n=11), and suicidal acknowledgement at arrival to ED for (1.3%, n=5).

Among the smokers' group 15.9% (n=63) were diabetics, 36.5 % (n=144) had a history of chronic hypertension, 19.7% (n=78) had a history of cardio-vascular diseases, 3% (n=12) had chronic arthritis and there were .8% (n=3) cases of diagnosed cancer. History of depression among smokers visiting ED for poisonings was noted in 19.2% (n=76) and history of psychosis was recorded in 14.9% (n=59). The proportion of regular alcohol drinkers among smokers was 73.4% (n=290) and a history of prior similar poisoning events that necessitated emergency visit was 47.6%. Among the same group, 77.5% (n=306) presented to ED for illicit drug related poisoning, as opposed to only 12.7% (n=50) for pharmaceutical drug poisoning and 9.1% (n=36) for industrial chemical poisoning. Tobacco smokers were poisoned with cocaine in 39.2% (n=155), heroin in 35.9% (n=142), heroin cocaine combination in 4.8% (n=19), multiple drugs in 5.1% (n=20) salicylates in 2% (n= 8) and analgesics in 1% (n=4). Methadone, stimulants, and marijuana all together accounted for 1.3% (n=5).

The route of the poisoning exposure in smokers was mainly inhalation in 70.6% (n=179) followed by ingestion in 12.4% (n=49), rectal and vaginal in 9.9% (n=39), and injection in 5.8% (n=23). Poison exposure in smoking patients was categorized as follows: drug and medicinal abuse for 85.1% (n=336), suicidal for 9.6% (n=38), misuse and unintentional for 1.8% (n=7) and therapeutic and adverse drug reaction for 2.5% (n=10). Over 19.5% (n=77) of cases received initial management intervention at the site of the exposure and another 13.4% (n=53) patients received injection of Narcan antidote. ED management among smokers consisted of decontamination only 15.4% (n=61), observation only 6.1% (n=24), decontamination and other therapy in 28.6% (n=113).

Among this group of smoking patients, there were 46% who were managed by using other means that does not include decontamination.

History of drug abuse in poisoning related ED visits in tobacco smokers was reported to be 91.4% (n=361). As many as 65.3% (n=258) were admitted to ICU or to a department other than ED and only 20.8% (n=82) were discharged; no death was reported among poisoned smokers. After discharge from the hospital 82.8% of poisoned smokers were given an appointment for follow up in outpatient clinics or with their primary physician. Concomitant consumption of other prescription medication taken for any other reason but poisoning the day of the poisoning was as follow: Albuterol 24.3% (n=96), anti-hypertensive 7.8% (n=31), anti depressant or anti psychotic 5.1% (n=20), clonidine in 1.5% (n=6) and analgesics 1% (n=4). The average length of stay among the smokers group was .9 day.

3.11. History of Alcohol Intake

This study also had an interest in assessing the prevalence of alcohol consumption and its effect on possible intoxication events, considering alcohol alone, or its involvement in potentiating other substances.

Over 53.5% (n=347) reported alcohol intake routinely but the information available failed to provide a consistent assessment of the quantity taken and how often. Seventy four cases had unknown alcohol use and information was not available on the chart. Only 4 cases were missing altogether. The age ranged between 15 and 66 years, 41.5% (n=144) female and 57.1% (n=198) male with a male to female ratio of 1.3. Sixty nine point five percent (n=241) were single and 15% (n=52) married. Over 81% (n=282) were African American, 5.8% (n=20) were Hispanics and 5.8% (n=20) were whites.

Most of the poisoned alcoholic group (87%, n=302) were unemployed. Only 34.9% were covered with IDPA, 44.7% (n=155) were self-payers, 6.3% (n=22) covered by Medicare, and 2% (n=7) by Medicaid. Chicago fire department (CFD) brought 51.9% (n=180), and 28.8% (n=100) of alcoholic poison related patients visiting ED were walk in. twenty one percent (n=73) were confused or unresponsive, 31.1% (n=108) had a chief complaint that was heart related 21.6% (n=75) had shortness of breath and 13.8% complained expressed an overdose related event at arrival to ED triage system. Vomiting was a chief complaint in 2.9% (n=10), suicidal attempts was found in 2.6% (n=9) of cases, and one case of injury related poisoning. Diabetes mellitus was present in 14.4% (n=50), Chronic Hypertension in 34.6% (n=120), cardio vascular diseases in 20.2% (n=70), arthritis in 4% (n=14), asthma in 42.4% (n=147) and cancer in 1.7% (6 cases).

Depression was present among alcohol users (22.2%, n=77) and diagnosed psychosis was present in 13.5% (n=47). The rate of smoking among alcoholics was 83.6% (n=290), history of poisoning events that necessitated ED consultation was at 48.1% (n=167) and history of illicit drug use was very high among them (92.2%, n=320).

Among alcohol users, cocaine was the highest poisoning exposure (39%, n=135), then heroin (33.4%, n=116); heroin. Cocaine combination was seen in 4% (n=14) of cases. Though the rate of abuse is very high in this group, it seems that alcohol using patients are cautious with their intake in that the rate of alcohol related ED visits was very low (2.9%, n=10). It is important to note that alcohol intoxication might have been coded in a separate category other than poisoning, such as in an abuse category that is not part of this study. Multiple drugs were taken in 7.8% (n=27) of cases, aspirin intoxication in 2% (n=7), anti depressors and antipsychotics in 6.1% (n=21), and unknown pills,

marijuana, analgesics stimulants, and methadone were 2.7% (n=9) of cases. The major route of exposure reported was inhalation with 66.9 (n=232), then ingestion in 16.1% (n=56), and rectal and or vaginal at 10.4% (n=36); in this group drug injection was seen in only 5.5% (n=19).

The circumstances of poisoning was not much different from the smoking group as abuse represented 83.6% (n=290), misuse and un-intentional 2.1% (n=7), and therapeutic and adverse drug reaction were at 1.5% (n=5). Suicidal circumstance was high in poisoned cases with habit of regular consumption of alcohol at 11.6% (n=41) but not as high as suicidal poisoning among smokers. Twenty one point three percent (n= 74) were discharged, and 65.7% (n=228) were admitted to the hospital. Of the hospitalized patients, follow up was offered to 80.4 % (n=279). Patient reported that other prescription medications were taken within last 24 hours before the poisoning event as follow: albuterol in 21% (n=730), antidepressant anti psychotic 6.1% (n=21), and anti hypertensive in 7.5% (n=26).

3.12. History of Recreational Drug Use

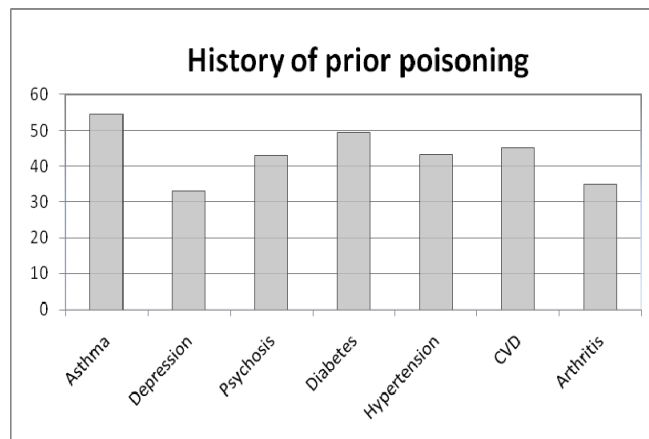


FIGURE 22: Prior History of illicit drug abuse by co-morbidity. Approximately 80% of the patients have had a history of prior use of illicit drug use.

Overall, 80% of the cases that presented to the ED reported past history or current use of illicit drugs for recreational use. Among those 80% who voluntarily acknowledged the use of recreational drugs, 39.4% (n=256) were single heroin users 35.5% (n=231) were single cocaine users. Marijuana was only reported in 1.7% of the cases, this very low rate of marijuana related events could be explained by the low toxicity of marijuana that results in very rare cases of ED poisoning related visits, however similar to alcohol, some of the marijuana events could have been coded under a different code such as abuse instead of poisoning. Twenty nine percent (n=190) of patients who reported the use of at least 2 drugs concomitantly, such as: cocaine concomitantly with something else 14% (n=91), heroin with something else 5.1% (n=33) alcohol with something else 5.7% (n=37) and 2.6% (n=17) who smoked marijuana while using another type of drug.

4.0. ANALYSIS OF ER MANAGEMENT & FINAL OUTCOME

ED management included decontamination in only 16.9% (n=110) of cases, while combined decontamination with other therapeutic measure was seen in 28.5% (n=185) of cases. Seven point four percent (n=46) benefited from observation without any other intervention. Therapeutic measures were given to 43.1%. Only 2 cases were documented as refusing treatment offered (.3%). There were 25 cases (3.8%) where information treatment was missing.

4.1- Initial Site Management Effect on the Final Outcome

Of the total patients, over 34.7% (n=128) needed an urgent intervention at the site of the exposure and it was documented in the patients chart or in the Chicago Fire department transfer sheet attached to patients' charts. No specific details about the intervention were collected, as it varied from simple perfusion to mechanical ventilation,

but the need for Naloxone administration on site or upon the patient’s immediate arrival to ED was captured. Fourteen point five percent (n=92) were found unconscious and Naloxone (Narcan®) administration was immediately administered at the site of the exposure or at arrival to ED in order to counteract the effect of the poison.

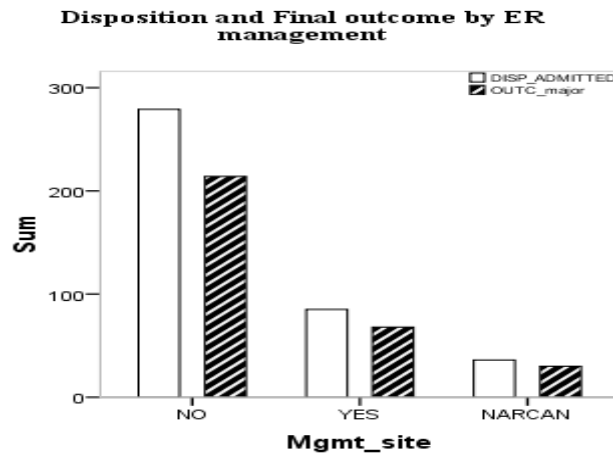


FIGURE 23: Major Outcome and final disposition by Initial Management at the Site of the poisoning event. Both the final outcome (OUTC_MAJOR) and the number of patients that were admitted (DISP_ADMITTED) to the hospital following a poisoning event depended on whether or not they have received initial management such as Narcan® injection or other treatment on the site of the poisoning.

4.2. Poisoning Final Outcome

The outcome for each case is assessed and categorized into four categories: No effect; fair or minor effect; complicated or major effect; and death. Major effect was issued if the patient had been admitted to ICU, if he was injured; case resulted in permanent damage, long hospitalization or in a significant complication of his associated preexisting diseases.

In our series, there were 49% (n=318) major effects recorded, versus 45.3% minor effect and 3.8% were classified as no effect of the exposure on the patient. Death was recorded in .6% (n=4) cases.

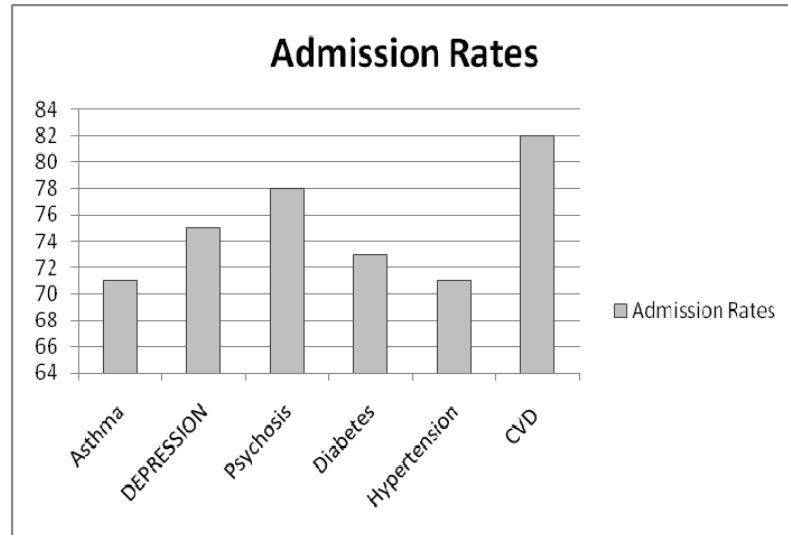


FIGURE 24: Rates of admissions by various co morbidities. Admission rates of the six above groups of patients with co morbidities ranged between 70% and 80%, but history of cardio vascular diseases was the highest group to be hospitalized.

Of the cases that were classified as major effect, there were 37.9% (n=118) female and 62.1% (n=194) male cases aged between 14 and 80 years old. Eleven point nine percent (n=38) were suicidal and 83.3% (n=265) had used an illicit drug for the purpose of recreation. Fourteen point five percent of them were married and 68.6% were singles, 80.5 % were African American. Sixteen point four percent of the total 318 patients arrived to ED unresponsive or confused, 36.8% presented with a heart related complaint and 28.3% were short of breath. There were 16.4% (n=52) were diabetics, 36.5% (n=116) had hypertension, 23% (n=73) had cardiovascular diseases and 47.2% (n=150) had chronic asthma. In this group the adverse outcome of depression was present

in 20.8% (n=66), psychosis in 11.9% (n=38). Sixty seven percent (n=213) of tobacco smokers and 59.4% (n=189) of alcohol users. Heroin exposure resulted in a major outcome in 29.9% (n=95), cocaine in 44.3% (n=141), multiple drugs intoxication in 5% (n=16), and anti-depressors in 5.3% (n=17).

4.3- Correlation of Outcome and Emergency Site Management

A significant relationship ($F= 6.035$, $DF=2$ and $p= .003$) was found between the type of the initial on-site management and the final outcome. Patients who had some kind of management on the site of the exposure seemed to have recovered better. A significant relationship was also seen between final disposition, and initial site management ($F=20.37$, $DF=2$, $p= .0001$).

4.4. Prior History of Poisoning

Over 40% (n=265) of patients reported prior history of poisoning that needed a visit to ED, and were documented and verified in their charts. Of these 265 cases 17.2 % (n=112) overdosed with heroin and 18% (n=117) overdosed with cocaine.

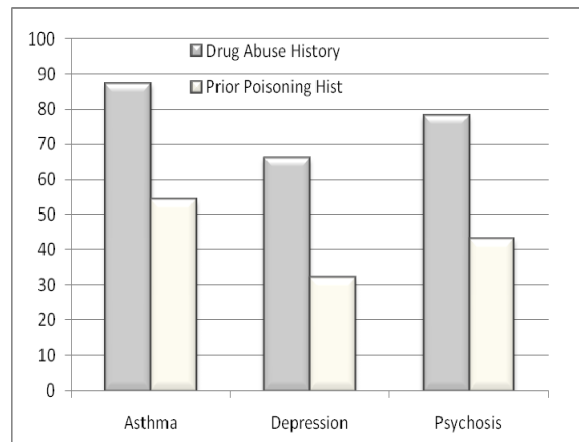


FIGURE 25: Documented prior history of poisoning and illicit recreational drug uses by comorbidity.

One point four percent (n=9) were poisoned with heroin in association with a second agent, and 3.7% visited the ED for cocaine poisoning concomitantly with something else. In summary, there were 6.6% (n=43) cases had a history of double agent poisoning and 1.1 % (n=7) had triple agent poisoning.

4.5. Follow-Up

As shown in figure 27, over 80.8% (n=525) of patients were sent for follow up to the outpatient services or to their primary care physician, of these 525 patients 64.8% (n=340) were sent to outpatient care and 17.5% (n=92) were sent to their primary care physician (PCP).

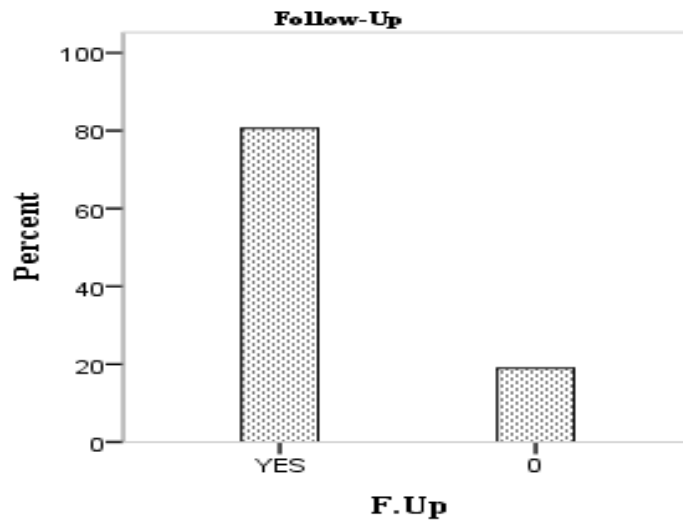


FIGURE 26: Percent of after hospitalization follow-up. Approximately 20% of the total cases were lost for follow up.

4.6. Final Disposition

Overall, 62.9% (n=409) of patients required further management measures other than that received in the emergency department, and were transferred to inpatient services. Seventy eight percent were admitted to the emergency department for

observation, .6% (n=4) died, and the remaining 22.5% (n=146) were discharged except for 2.2% (n=14) which were missing and may represent cases that left against medical advice or eloped from the emergency department.

More males 62.1% (n=90) than females 37.9% (n=55) were discharged from ED, and the age median was 40 years for this group of patients. This may indicate that more females were hospitalized because their poisoning event looked more serious or because they did not respond to the initial management in ED.

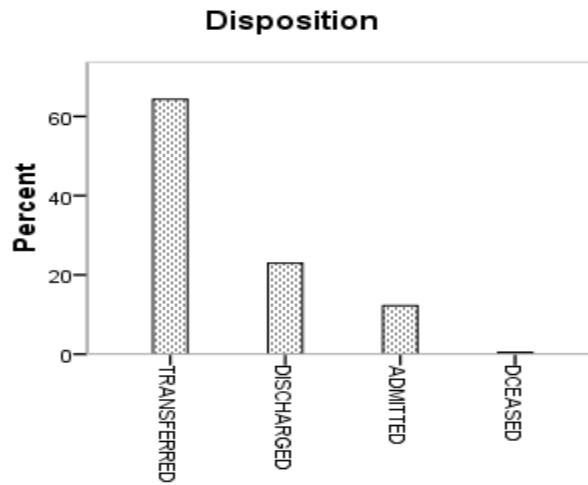


Figure 27: Final disposition distribution. Most patients were transferred to another department in the same hospital, approximately 10% were admitted to ED for observation and around 20% were discharged.

Among the group of patients that were discharged from ED, 79.5% (n=116) of them had an event related to the use of a recreational drug, 15.1% (n=22) from the use of pharmaceutical drugs and 4.8% (n=7) were poisoned with a chemical that was industry-based.

In the Admitted group, patients' ages varied between 1 and 85 years, mean 40.69 (+/- SD 13.067), 45.2% were females and 54.8% were males; 70.2% of them were single and 11.2% married; 65% were exposed to illicit drugs and 23.5% to pharmaceutical drugs.

Over 47.2% (n=193) were asthmatics, 35% (n=143) had chronic hypertension, 22.7% (n=93) had cardio vascular disease, 4.4% (n=18) had chronic arthritis, and 1.2% (n=5) had a malignancy. Depression was present in 25.9% of the hospitalized group, psychosis in 14.7% (n=60), smoking in 63.1% (n=258), and alcohol use in 55.7% (n=228). Suicidal poisoning were present in 16.1% (n=66) and abuse in 73.8% (n=302); their average length of stay was 1 day.

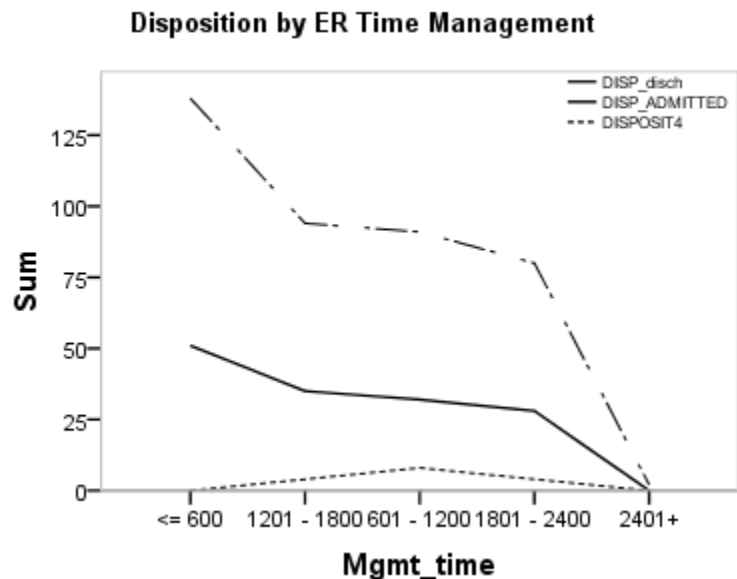


FIGURE 28: Admissions and discharge were highest during the first shift then decline sharply during the third shift (Disp_Disch: disposition discharged; Disp_Admitted: Disposition Admitted to hospital, disposit. 4= died).

5.0- ANALYSIS OF CORRELATION

One of the primary interests of this study was to explore the significance of the relationship between asthma and heroin use in the population of ED that was reported in the literature, for which many mechanisms were speculated, but none confirmed. In fact Chicago has one of the highest mortality rates and prevalence of asthma, and also one of the highest prevalence of drug abuse which makes these two variables of special interest for this study.

After checking the observations' independence and verifying the normality of the population, bivariate analysis with computation of both a Pearson test and a (2-tailed) t test was performed. It is a measure of correlation that varies between -1 and +1, with 0 indicating no relationship (random pairing of values) and 1 indicating perfect relationship, i.e. "The more the x, the more the y, and vice versa." A value of -1 is a perfect negative relationship, i.e. "The more the x, the less the y, and vice versa. *R square* is the coefficient of determination, the square of the Pearson correlation coefficient, and it represents the percent of the variance in the dependent variable explained by the independent. The significance level of the Pearson test was set at 0.01

After bivariate analysis, a partial correlation test was performed. Both the bivariate and the partial test have shown a statistically significant relationship between asthma and heroin use with coefficient at ($r = .175$, $DF = 647$, $p = 0.001$). This relationship is positively correlated, indicating that an increase of one variable results significantly in an increase of the second and may be explained as such: the overuse of heroin may exacerbate asthma. Or the opposite effect could also be true: when having a history of asthma this may predispose this group of patients to over-use heroin, knowing that the

latest research is pointing toward genetic predisposition for both of them (Matthias 2007, Xuei et al., 2007, Balaci, 2007)

The bivariate correlation (2 tailed) t test showed a strongly significant correlation between heroin and asthma with ($r=.175$, $p= .0001$). An “r” partial Pearson correlation test, which gives the advantage of correcting for the effect of other confounding factors by blocking the effect of other variables that may participate in the correlation of interest, was also performed.

After correcting for the effect of depression, psychosis, smoking, alcohol, ASA exposure, prior history of poisoning, anti-depressor and anti-psychotic drugs, methadone, and cocaine exposure, it was found that the significance between asthma and heroin disappeared, and the Pearson coefficient dropped to $.074$, the p value increased to 0.061 , becoming statistically non significant. This could be interpreted to mean that there was no true correlation between variables of interest.

5.1- Depression Correlations

Depression was significantly correlated with the variable suicidal attempt ($r=.275$, $DF=647$, $p=.0001$), and with multiple drugs exposure, (which is most likely deliberate intake for the purpose of suicide or abuse), ($r=.136$, $DF=645$, $p=.001$). Another significant relationship was found between depression and history of psychosis ($r= .352$, $DF=647$, $p= .0001$) and between depression and the exposure to anti-depressors/antipsychotic drugs ($r= .215$, $DF645$, $p= .0001$), as well as with the use of ASA ($p=.172$, $DF=645$, $p=.0001$). Heroin exposure was negatively correlated to depression ($r=-.200$, $DF=645$, $p= .0001$).

As far as the route of exposure the bivariate analysis has shown that ingestion route was significantly correlated ($r=335$, $DF=647$, $p=.0001$), inhalation route was also found significant but it was negatively correlated ($r=-175$, $DF=647$, $p=.0001$). Disposition was categorized in discharge, admission to the hospital and death. The analysis revealed that depression and discharge from the hospital were negatively correlated ($r=-.103$, $DF=647$, $p=.009$). Depression and admission to the hospital were positively correlated ($r=.138$, $DF=647$, $p=.0001$), which simply translates to an unfavorable prognosis of poisoning when depression was present. This could also be due to the higher dose intake of the drug due to the presence of depression or it may be due to the choice of the drug itself that is different when the patient is depressed and having suicidal thoughts.

The poisoning agents were categorized as: pharmaceutical drugs/medications, chemical domestic, chemical industrial, or occupational and recreational exposure. Only pharmaceutical drugs/medications were significantly correlated to depression ($r=.307$, $DF=647$, $p=.0001$).

Suicidal poisoning were positively correlated ($r=.453$, $DF=647$, $p=.0001$), abuse was also significantly correlated to depression ($r=-.305$, $DF=647$, $p=.0001$)

TABLE 2: Summary list of depression significant Correlations.

Variable 1	Variable 2	R	DF	p Value
Depression	ASA	.172	645	.0001
	Heroin	-.200	645	.0001
	Admission to Hospital	.138	647	.0001
	Pharmaceutical drugs	.307	647	.0001
	Suicidal poisoning	.453	647	.0001

5.2- Psychotic Disorders

Psychosis was significantly correlated to depression as previously mentioned, to heroin ($r = -.121$, $DF=645$, $p = .002$), to smoking ($r = .118$, $DF=647$, $p = .003$), to insurance coverage (particularly IDP) ($r = .129$, $DF=647$, $p = .001$) and self-coverage ($r = -.137$, $DF=647$, $p = .0001$). Similar to depression psychotic disorders were also found to be significantly correlated to prescription medication of anti-depressant and anti-psychotics ($r = .190$, $DF=645$, $p = .0001$), which is generally their prescription medication and to ingestion the route ($r = .125$, $DF=647$, $p = .001$).

Admission disposition is also strongly correlated with psychotic disorders ($r = .113$, $DF=647$, $p = .004$) as well as to pharmaceutical drugs ($r = .114$, $DF=647$, $p = .004$). Suicidal circumstance was also significantly correlated with psychotic disorders ($r = .163$, $DF=647$, $p = .0001$) and to abuse circumstances ($r = .102$, $DF=647$, $p = .009$).

TABLE 3: Psychotic disorders significant correlations with poisoning.

Variable 1	Variable 2	R	DF	p Value
Psychosis Co-morbidity	Smoking	.118	647	.003
	Insurance IDP	.129	647	.001
	Anti-Depr/Anti-Psych	.190	645	.0001
	Ingestion route	.125	647	.001
	Admission	.113	647	.004
	Prescription drugs	.114	647	.004
	Suicidal poisoning	.163	647	.0001
	Illicit drug abuse	.102	647	.009

5.3- Heroin Poisoning Correlations

Heroin was found to be correlated to many other variables in our population, such as depression, psychosis, cardio vascular diseases ($r = -.181$, $DF=644$, $p = .0001$), to cocaine ($r = -.508$, $DF=645$, $p = .0001$), to abuse of heroin and cocaine combination ($r = -$

.158, DF=645, p= .0001), to multiple drugs exposure (r= -.180, DF=645, p=000), history of drug abuse (r=.286, DF=635, P=000), to the Hispanic race (r=-.146, DF=645, p=000), to self insurance (r=.212, DF=644,p=000), to arrival by CFD (r=.213, DF=643, p=000), arrival to ED by walking (r= -.143, DF=645, p=000), chief complaint Unresponsive (r=.152, DF=645, p=000), chief complaint heart related (r=.268, DF=645, p=000), shortness of breath chief complaint (r=.177, DF=645,p=000), Aspirin intoxication (r= -.139, DF=645, p=000), anti depressor/anti-psychotic exposure (r= -.139, DF=645, p=000), ingestion route (r=-.359, DF645, p=000), rectal vaginal route (r=.350, DF= 645, p=000), management at the site of the exposure (r=.111, DF=630, p=000), suicidal poisoning (r= -.234, DF=245, p=000), circumstance abuse (r= .324, DF645, p=000) and concomitant intake of other substances (r=.258, DF=645, p=000).

TABLE 4: Summary of heroin poisoning correlations.

Variable 1	Variable 2	R	DF	p Value
Heroin Poisoning	Vaginal or rectal route	.350	645	.0001
	History of drug abuse	.286	635	.0001
	Heart related CC	.268	645	.0001
	History Illicit drug abuse	.324	645	.0001
	SOB (CC)	.117	645	.0001
	Asthma	.174	645	.0001
	Depression	-.118	644	.0001
	Suicidal poisoning	-.234	645	.0001

5.4- Cocaine Poisoning Correlations

Cocaine was found to be significantly correlated to chronic hypertension (r= .220, DF=745, p=.0001), and to cardiovascular diseases (r= .227, DF=645, p=0001). Cocaine was also significantly correlated to heroin, to heroin cocaine combination, (r= -.145, DF=745, p=000), to multiple drugs (r=-.166, DF=645, p=000), to smoking (r=.201,

DF=645, p=000), and to the habit regular alcohol intake (r=.165, Df=645, p=000), to history of drug abuse(r= .245, DF=645, p=000,), to age (r= .227, DF=645, p=000), to race White (r=-.140, DF=645, p=000), arrival mode through CFD (r=-.149, DF=645, p=000), arrival walking (r=.173, Df=645, p=000), chief complaint unresponsive (r=-.234, Df=645, p=000), chief complaint heart related symptoms such as chest pain (r= .507, Df=645, P=000), chief complaint vomiting (r=-.200, Df=645, p=000), anti depressors and anti psychotic exposure (r=-.173, Df=645, p=000), ingestion route (r= -.353, DF=645, p=000), inhalation (r=.430, Df=645, p=000) to rectal/vaginal (r=-.225, DF=645, p=000), to outcome minor (r= -.222, DF=645, p=000), to major outcome (r= .266, Df=645, p=000), to discharge disposition (r= -.274, DF=645, p=000), admitted disposition (r=.181, DF=645, p=000), exposure to medication and pharmaceutical products (r=-.353, DF=645, p=000), to recreational drugs (r=.283, DF=645, p=000), suicidal category of exposure (r= -.258, DF=645, p=000).

TABLE 5: Significant correlations with cocaine poisoning.

Variable 1	Variable 2	R	DF	P Value
Cocaine poisoning	Inhalation	.430	645	.0001
	Major outcome	.266	645	.0001
	Chest pain	.507	645	.0001
	History of drug abuse	.245	645	.0001
	Age	.227	645	.0001
	History of Illicit drug abuse	.283	645	.0001
	Unresponsiveness	-.234	645	.0001
	Hospital admission	.181	645	.0001
	Antidep/antipsych	.173	645	.0001
	Prescription medications	-.353	645	.0001

6.0. PREDICTION ANALYSIS

One of the interests in this study is to determine predictors for the final outcome of ED poisoning, which could be useful for improving patients' management and also in implementing preventive measures. Predictors for poisoning final outcome, asthma, and for the risk of suicide in our population were computed using regression analysis.

The stepwise regression analysis for outcome resulted in the construction of the following models.

$$\text{Final Outcome of Poisoning} = 0.108 + 0.200 * \text{Cocaine} + 0.114 * \text{Inhalation} + 0.121 * \text{CVD} + 0.103 * \text{Asthma} + 0.94 * \text{Gender} + 0.09 * \text{Prior Poisoning History}$$

Cocaine was the most predictive for the major outcome of poisoning, route of inhalation was the second most important predictor. Cardiovascular diseases were third, asthma, gender and prior history of poisoning.

Stepwise regression analysis was also run to compute predictors for the risk of suicide attempts using poison. Predictors' intercept and coefficient, as well as the significance of the overall model and the individual models produced, as well as the regression assumptions described in addendum 1. Measures of association are expressed in the following mathematical formula:

$$\text{Model (Suicide)} = 0.394 + 0.330 * \text{Depression} - 0.005 * \text{Age} - 0.99 * \text{Gender} + 0.072 * \text{Prior poisoning history} - 0.055 - 0.082 * \text{unemployed}$$

Depression is the greatest risk factor for suicide attempts; age and gender, prior poisoning event, and employment were also significantly correlated to suicide, and

remarkably, psychotic disorders, though known for their possible risk for suicide, particularly, in younger schizophrenics, our data did not support this assumption.

A stepwise regression was performed for both asthma as a dependant variable and heroin as an independent with the assumption that heroin affects asthma and exacerbates it. The measure of association was expressed in the following mathematical formula:

$$\text{Model (Asthma)} = 0/419 + 0.221 * \text{Inhalation} + 0.147 \text{ Prior Poisoning History} - 0.140 * \text{Gender} + 0.149 * \text{Heroin} + 0.728 \text{ Cancer} + 0.136 * \text{Race_AA} - 0.004 * \text{Age}$$

Again, inhalation is the greatest predictor of asthma with prior history of abuse, heroin, gender, age, and race of African American being the most other important predictors for asthma (Table 9, Table 10).

Similarly, another regression was run and asthma was the independent variable to check on the assumption that asthma predisposes patients to abusing heroin. The measure of association is expressed in the following formula:

$$\text{Model (Heroin)} = 0.284 + 0.794 * \text{Rectal/Vaginal route} + 0.142 * \text{Asthma} + 0.273 * \text{Inhalation} + 0.394 * \text{Injection} - 0.193 * \text{CVD} - 0.110 * \text{Prior documented Poisoning history} - 0.077 * \text{Alcohol} + 0.111 * \text{Psychosis}$$

Asthma was second strongest heroin abuse predictor (Table 3, Figure 41, 42, 43). This could also be that the observed correlation might indicate asthma is predisposing heroin addiction, or at least that the overall association is just a mixed effect from both variables in both directions. Inhalation is also a predictor of heroin abuse. Rectal and vaginal route of drug use is also very prevalent in heroin abusers. Psychosis is also a predictor of heroin abuse, which supports the study's third hypothesis.

DISCUSSION

Poisoning in the emergency department is still a problem, especially when it relates to the use of recreational drugs. The magnitude of this problem has been explained elsewhere, however its implications in ED, have been actively illustrated in this investigation.

In exploring the relationship between asthma and heroin, our data revealed that there are two other significantly correlated co-morbidities with drug abuse, particularly chronic hypertension and cardiovascular diseases that were correlated to cocaine use. In reviewing the literature, we were unable to find any evidence of similar correlations, though, in our study it was found to be strongly correlated ($r = .220$, $DF=745$, $p=.0001$) for hypertension and ($r = .227$, $DF=645$, $p=0001$) for cardio vascular diseases. While the relationship of asthma to drug abuse is complicated, and many authors have suggested numerous theories to explain how heroin correlates to asthma, hypertension correlation to cocaine might be due to a more direct effect of cocaine on vessels. In fact, cocaine was extensively studied, especially its effect on enzymatic modulation and its ability to affect the fate of cell necrosis and apoptosis in the liver (*Harbison et al., 2003, Harbison et al. 2000, Price et al. 1999*). Cocaine has also been shown to have numerous other effects on the cell signaling system and on the vascular bed by modifying the peripheral resistance and inducing a potent vasospasm that raises the blood pressure and increases the cardiac output. The vasopressor effects of cocaine are mostly mediated by norepinephrine of sympathetic nervous system (Hollander et al. 2008). By the same mechanism, cocaine

induces a vasoconstriction in coronary vessels and results in chest pain that mimics unerringly an angina or a myocardial infarct. Cocaine abusers may present chest pain similar to angina or coronary infarct which could result in a hospitalization. On discharge, a patient will generally be categorized as having a history of chest pain that will be documented in the patient's medical history but without any mention of its temporal relationship to cocaine. This type of documentation might have interfered with a more accurate heart assessment and resulted in significant misclassification of cases in the cardiovascular diseases group. As a result, an apparent correlation of cocaine to heart disease might have been seen as a result of this misclassification. In summary, the apparent correlation of hypertension to cocaine might just be due to the direct effect of cocaine on the vasculature and in the case of cardiovascular disease and it seems that some of these cardiovascular comorbidities that were captured were partially, if not totally, cocaine-related diagnoses

In a study conducted in ED to assess the prevalence of cocaine use in patients with hypertension who presented to ED for complaints not related to cocaine use, the author reported that only 13% of the total 99 cases of hypertension tested positive for cocaine, and 38% of them presented for chest pain or for congestive heart failure and were prescribed beta-adrenergic antagonist medications. In our series, the prevalence of cocaine admissions among hypertension patients was 47.2% (n=94) which is higher compared to what was previously reported.

As a result of the high prevalence rate of heroin and cocaine use in our population, it is unlikely that patients who have underreported their drug use have affected the results of our study. The higher prevalence of drug use cannot be explained

by over reporting because patients are more likely to underreport than to over-report the use of controlled substances. However, even if they have underreported, one would expect our observed difference to be even larger. Thus, if any drug controlled user was incorrectly misclassified into a non-user group rather than a user group, our results would be expected to show a higher difference.

Many cases were reported in recent years in relation to sudden and severe asthma incidents that were temporally correlated to the abuse of cocaine and heroin, and numerous authors report this relationship. They further conclude that heroin may be triggering asthma attacks and that heroin associated with status asthmaticus. Another study reviewed death reports in the state of Maryland and demonstrated that a high percentage of patients who died from asthma had also abused drugs and their post mortem urine drug tests were positive (Weitzman et al.).

Over 4% of all admissions for asthma in the US require mechanical ventilation, though there is still controversy regarding the optimal treatment for severe asthma requiring intensive care optimal intubations; some authors have also reported that many of the asthma patients requiring intubations are heroin abusers.

Asthma patients, it seems, tend to use various drugs for abuse, and both legal and illicit drugs were described to be abused by asthma patients, including illegal inhalers (Thompson et al., 1983) and prescription drugs (including the ones that were not widely used by others such as glucocorticoids, and inhalers salbutamol) (Kinirons, 1983. Quddusi et al. 1998). There was also a study conducted that was designed to compare tobacco and alcohol use in asthmatic students to non-asthmatics. This study found that high school students with current asthma used cigarettes, cigars, marijuana, and inhalants (huffing) at

rates greater than high school students without current asthma (Boyd et al. 2006; Jones et al. 2006). It appears that asthma patients are subject to higher abuse susceptibility; this might be due to many reasons. The high anxiety of asthmatics could drive asthma patient to reduce their level of anxiety by abusing various drugs. There is still much to know about asthma co-morbidities, in particular its associated behavioral changes and effect on patients' psychological well being. Recently Blackman et al. (2007) reported that children with asthma have higher rates of attention deficit/hyperactivity disorders; diagnoses of depression, behavioral disorders, learning disabilities, and missed school days. Behavioral changes were also seen in the adult population, and the effect on asthma management has always been a concern for increased morbidity and mortality in asthma. (Volicer et al. 2006). Moreover, there is evidence that drug dependence can run in families and that a person's genetic makeup can affect how the body processes a drug, and could also determine the drug's effect. These individual differences can make some people more likely to use drugs and to become dependent upon them.

Due to its prospect in therapeutic and its role as an analgesic, heroin's mode of action and mechanism of abuse and dependence has been heavily studied; particularly its genetic aspect where basic animal research and human studies have shown that complex genetic mediators exist, many gene and receptors are implicated in this behavioral aspect of heroin addiction. (Xuei et al., 2007)

The relationship between asthma and heroin poisoning has been seen in previous reports from an asthma management point of view; heroin and asthma were observed to be temporally related. It was then concluded that heroin exacerbates asthma but a mechanism could not be established. Though this approach seems simple but logical,

researchers are skeptical of a receptor mediated effect on the bronchus as opiates favor blocking bronchoconstriction through these receptors instead of stimulating it.

Researchers have also argued that the heroin effect on bronchoconstriction might occur through a non-receptor mediated mechanism that might also be potentiated by an inflammatory response. No supporting evidence has been produced regarding this theory other than heroin may deregulate mast cells and release histamine.

Depression has been described in the literature as a risk factor for poisoning because of the suicidal tendency that generally accompanies depressed patients. Our data has reinforced this belief and illustrated a strong relationship between suicidal intent using poison. Suicidal intent was found to be positively correlated ($r=0.453$), which statistically translates into an r^2 that is equal to $.205$. This value may be described as: over 20% of suicide events seen in ED were attributed to this preexisting depression. Though depression as a risk factor has been previously reported, little description of the magnitude of the depression contributes in causing patients to commit suicide using poison. In our series, and according to our data, this component was estimated to 20.5%.

It is known that there are certain triggers, for depressed patients with suicidal thoughts, which intensify suicidal urges. The question that remains unanswered is how much drug addiction is related to the modification, intensification, or renewal of suicidal triggers in comparison to non-addicted, depressed or psychotic patients. How much impact does drug addiction have on decision capabilities regarding self harming, assuming that he or she is in fact under extremely high stress from his or her need for drugs, and additional stress that originates from his or her depressed mood or psychotic

illusion. If that is the case, what determines the patient's behavior in choosing the dose, the method, and the timing for shifting from intent to action?

In this study, psychotic disorders were also identified as being significantly correlated with suicide attempts, but the coefficient of significance was relatively smaller than the one seen in depression. The Pearson's coefficient was $r = .163$ which translates to only 2.6% of suicidal effect that can be attributable to preexisting psychotic disorders. However, another correlation was also established between psychosis and the use of anti-psychotic and anti-depressors that could indicate that patients with psychotic disorders are subject to the risk of auto intoxicating themselves by using their own prescription medication. A similar pattern was seen in patients with depression that are under tricyclic medication, but this scenario is even more complicated with anti-depressors given the fact that these medications have a very narrow safety window, and many depressed patients overdose unintentionally. Patient education regarding tricyclic toxicity has become routine now after all the accidents that were seen in ED. Moreover, the current recommended best practice is to limit the prescription of tricyclic antidepressants in favor of the newer selective serotonin reuptake inhibitors (SSRI).

Poisoning and drug addiction remain a significant burden on the healthcare system, particularly on the asthmatic. Our follow up cost study was designed to compare asthmatics with a history of drug addiction and poisoning to another group of asthmatics without any history of drug poisoning or addiction. Both groups were compared with respect to length of stay (LOS) inpatient, age, gender, and expenditures. The mean LOS for asthmatics without drug abuse was 1.21 days and a SD of .695, and for the asthmatic patient with history of illicit drug poisoning of 7.07 days. The hospital charges ranged

between \$99.00 and \$18096.00 with a mean of \$2941 for asthmatic without abuse and between \$52.00 and \$695874.00 with a mean of \$28028.00 for the group of asthmatics with illicit drug poisoning. A significant difference was established ($p < .001$) between the LOS of asthma with heroin and/or cocaine abuse as compared to LOS of asthma without abuse, and a significant difference in hospital cost was also established between the 2 groups ($p < .0001$).

There are several potential limitations to this study. The study is retrospective and the information was collected from the patients' charts, which varied in accuracy and availability between cases. Due to the high rates of drug abuse history, it does not seem that this study underestimated the abuse; however it might have underestimated some co-morbidity such as arthritis, and particularly depression, which is still not screened systematically for every patient visiting ED, especially in a setting of drug overdose emergencies. Another potential limitation of this study was that there was no way for the study to follow up on specific cases and screen patients for suicidal ideation to find out if they have had any intent for self-harm.

One of the other limitations to this study is inherent to case capture, given the initial design that did not take in consideration the complexity of the coding process. Unfortunately this issue was discovered after the data collection started; in fact cases like alcohol poisoning were not coded under poisoning, but under abuse, and similarly, marijuana use was not captured under poisoning, but under a separate code. In the case of alcohol and marijuana use, our study has accounted mainly for events with overdose that resulted in significant effects. Similarly, adverse drug reaction and therapeutic poisoning were not coded under poisoning unless they resulted in a significant effect. The study aim

was not adverse reaction, marijuana or alcohol abuse, which was the reason why these deficiencies did not affect the validity of the study results nor its ability to be generalized.

CONCLUSION

In conclusion, the findings of this research supported the hypothesis that drug abuse is the greatest risk factor for poisoning in the emergency department over prescription drugs, environmental and occupational exposures. This research has shown that there is correlation between chronic diseases and intentional poisoning using illicit drugs, in particular cocaine and heroin. This study has also shown a correlation between chronic hypertension and cocaine, cardiovascular diseases and cocaine, and a correlation between asthma and heroin abuse. Our data has verified that there is an ongoing change in illicit drug route of intake that is shifting from injection to inhalation; expectantly this shift will have a positive effect on reducing the prevalence of HIV and hepatitis B in the future. However, it seems that the heavy use of illicit drugs through inhalation has resulted in novel problems to asthma patients. A measure of association was established between asthma and heroin use, and inhalation was found to be the greatest predictor for asthma in this population.

The results suggest that suicidal behaviors are not infrequent occurrences among drug users, and that they often coexist and complicate other medical conditions. Predictors for suicide attempts were produced, and it was determined that interventions designed to reduce suicidal behaviors should simultaneously address preexisting medical conditions that could predispose or increase the patient's risk for transitioning from ideation to action. Rates of depression and associated psychotic disorders in drug addicts

with asthma indicates a need to systematically screen young and middle aged adults with asthma and drug abuse for depression and for suicide risk.

This study provides evidence supporting the idea that heroin and cocaine abuse are serious issues that significantly raise the cost of asthma and increase both the rate of hospitalization and hospital LOS. Pragmatic guidelines and innovations in reducing heroin and cocaine abuse in patients with asthma may improve the severity of the disease, and reduce its burden on the healthcare system and on society.

This research was able to characterize the circumstances of incidents of poisoning and provide a greater understanding of the extent of this problem and its burden on patients and on society. It has also identified numerous predictors that can be used by healthcare organizations, practitioners, and health policy makers for improving the management of asthma and its complications that result from drug use. This study has helped in consolidating a considerable amount of information on co-morbidity, drug use, smoking and alcohol prevalence that may be very useful for patient management and future research.

Drug abuse is a burden on asthma patients, particularly those that are not covered by insurance. Asthma education and self-management techniques in patients acknowledging the use of recreational drugs, specifically heroin or cocaine by insufflations, need to be provided and patients must be informed about the potential risk and educated on how to prevent significant asthma exacerbation by avoiding common triggers, drug use, and other additional stress. Enrollment of asthma patients in free drug rehabilitation programs may be the way of the future; these programs can be sponsored by the state or by insurance companies. Similar programs will cut down significantly on

asthma costs that are still a top public health concern in many states such as the state of Illinois. The magnitude of loss from the additional burden that poisoning is placing on the society and on insurance companies, as well as on asthmatics, can be minimized if similar steps were taken.

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APPENDICES

APPENDIX A: MODELS CALCULATION TABLES

TABLE 6: Model Summary for Poisoning Final Outcome

Model		Sum of Squares	df	Mean Square	F	Sig.
6	Regression	19.545	6	3.257	14.796	.000 ^f
	Residual	131.655	598	.220		
	Total	151.200	604			

a. Predictors: (Constant), Cocaine

b. Predictors: (Constant), Cocaine, INHALATION

c. Predictors: (Constant), Cocaine, INHALATION, P_POISON_HIS

d. Predictors: (Constant), Cocaine, INHALATION, P_POISON_HIS, CVD2

e. Predictors: (Constant), Cocaine, INHALATION, P_POISON_HIS, CVD2, ASTHMA2

f. Predictors: (Constant), Cocaine, INHALATION, P_POISON_HIS, CVD2, ASTHMA2, Gender

g. Dependent Variable: OUTC_major

TABLE 6 (Continued): Model Summary for Poisoning Final Outcome

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
6	(Constant)	.108	.070		1.552	.121
	Cocaine	.200	.047	.186	4.283	.000
	INHALATION	.114	.046	.111	2.489	.013
	P_POISON_HIS	.090	.041	.089	2.215	.027
	CVD2	.121	.052	.092	2.336	.020
	ASTHMA2	.103	.042	.101	2.466	.014
	Gender	.094	.039	.094	2.401	.017

Model for Final Outcome of Poisoning = 0.200*Cocaine + 0.114 * Inhalation + 0.121 * CVD + 0.103 * Asthma + 0.94 * Gender + 0.09 * Prior Poisoning History

TABLE 7: Stepwise Regression Model Summary for Suicidal Predictability.

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Change Statistics				
					R Change	Square F Change	df1	df2	Sig. F Change
1	.453 ^a	.206	.204	.304	.206	161.427	1	624	.000
2	.505 ^b	.255	.253	.295	.050	41.508	1	623	.000
3	.519 ^c	.269	.266	.292	.014	11.931	1	622	.001
4	.534 ^d	.285	.281	.289	.016	13.884	1	621	.000
5	.540 ^e	.291	.286	.288	.006	5.498	1	620	.019
6	.545 ^f	.297	.290	.287	.006	5.085	1	619	.024

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
6	(Constant)	.394	.074		5.285	.000
	DEPRESSION2	.330	.028	.398	11.617	.000
	Age	-.005	.001	-.195	-5.656	.000
	Gender	-.099	.024	-.144	-4.149	.000
	PP.doc.his	.072	.024	.104	2.962	.003
	ASTHMA2	-.055	.024	-.079	-2.256	.024
	unemployed	-.082	.036	-.077	-2.255	.024

Predictors Model (Suicide) = 0.394 + 0.330 *Depression - 0.005* Age - 0.99* Gender + 0.072* Prior poisoning history - 0.055 - 0.082*unemployed.

TABLE 8: Heroin poisoning Predictors Model Summary

Model Summary									
Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	Change Statistics				
					Change	F Change	df1	df2	Sig. F Change
1	.351 ^a	.123	.122	.449	.123	87.441	1	624	.000
2	.423 ^b	.179	.176	.434	.056	42.557	1	623	.000
3	.461 ^c	.212	.209	.426	.033	26.366	1	622	.000
4	.500 ^d	.250	.245	.416	.037	30.942	1	621	.000
5	.523 ^e	.273	.267	.410	.023	19.940	1	620	.000
6	.531 ^f	.281	.274	.408	.008	7.152	1	619	.008
7	.537 ^g	.288	.280	.406	.007	5.968	1	618	.015
8	.542 ^h	.294	.285	.405	.005	4.800	1	617	.029

TABLE 8: (Continued)

a. Predictors: (Constant), RECTAL_VAGINAL

b. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2

c. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION

d. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION, INJECTION

e. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION, INJECTION, CVD2

f. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION, INJECTION, CVD2, PP.doc.his

g. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION, INJECTION, CVD2, PP.doc.his,

h. Predictors: (Constant), RECTAL_VAGINAL, ASTHMA2, INHALATION, INJECTION, CVD2, PP.doc.his,

Dependent Variable: Heroin

TABLE 8 (Continued): Heroin poisoning Predictors ANOVA and Model Coefficients**ANOVAⁱ**

Model	Sum of Squares	df	Mean Square	F	Sig.
8	Regression	42.078	8	5.260	32.087 .000 ^h
	Residual	101.141	617	.164	
	Total	143.220	625		

Model Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
8	(Constant)	.284	.079		3.576	.000
	RECTAL_VAGIN	.793	.061	.511	13.019	.000
	AL					
	ASTHMA2	.142	.035	.146	4.060	.000
	INHALATION	.273	.043	.278	6.414	.000
	INJECTION	.394	.080	.183	4.896	.000
	CVD2	-.193	.043	-.153	-4.484	.000
	PP.doc.his	-.110	.035	-.113	-3.110	.002
	ETOH2	-.077	.033	-.080	-2.306	.021
	PSYCH2	-.111	.051	-.075	-2.191	.029

a. Dependent Variable: Heroin

Model (Heroin) = 0.284 + 0.793* Rectal/Vaginal route + 0.142* Asthma + 0.273 * Inhalation + 0.394*Injection – 0.193* CVD – 0.110* Prior documented Poisoning history – 0.077* Alcohol – 0.111 * Psychosis

TABLE 9: Asthma Model Predictors.

A NOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.212	10	2.821	14.007	.000 ^l
Residual	124.674	619	.201		
Total	152.886	629			

- a. Predictors: (Constant), INHALATION
- b. Predictors: (Constant), INHALATION, P_POISON_HIS
- c. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine
- d. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender
- e. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA
- f. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA, Hist.D.A
- g. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA, Hist.D.A, DERMAT
- h. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA, Hist.D.A, DERMAT, Age
- i. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA, Hist.D.A, DERMAT, Age, DIABETES
- j. Predictors: (Constant), INHALATION, P_POISON_HIS, Cocaine, Gender, RACE_AA, Hist.D.A, DERMAT, Age, DIABETES2, Heroin
- k. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, RACE_AA, Hist.D.A, DERMAT, Age, DIABETES2, Heroin
- l. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, RACE_AA, Hist.D.A, DERMAT, Age, DIABETES2, Heroin, RECTAL_VAGINAL
- m. Dependent Variable: ASTHMA2

TABLE 10: Asthma Regressions' Model Summary.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.242 ^a	.059	.057	.480
2	.304 ^b	.092	.090	.472
3	.336 ^c	.113	.109	.467
4	.365 ^d	.133	.128	.462
5	.390 ^e	.152	.145	.457
6	.401 ^f	.161	.153	.455
7	.411 ^g	.169	.160	.453

TABLE 10 (Continued): Asthma Regression Model Summary.

a. Predictors: (Constant), INHALATION

b. Predictors: (Constant), INHALATION, P_POISON_HIS

c. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender

d. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, Heroin

e. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, Heroin, CANCER2

f. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, Heroin, CANCER2, RACE_AA

g. Predictors: (Constant), INHALATION, P_POISON_HIS, Gender, Heroin, CANCER2, RACE_AA, Age

TABLE 10 (Continued) Asthma Regression Model's coefficients.

h. Dependent Variable: ASTHMA

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.419	.081		5.158	.000
INHALATION	.221	.040	.217	5.579	.000
P_POISON_HIS	.147	.039	.147	3.815	.000
Gender	-.140	.037	-.141	-3.772	.000
Heroin	.149	.039	.143	3.841	.000
CANCER2	.728	.187	.143	3.884	.000
RACE_AA	.136	.045	.114	2.994	.003
Age	-.004	.001	-.096	-2.481	.013

a. Dependent Variable: ASTHMA2

ABOUT THE AUTHOR

Dr. Khlifi A. Malek graduated from Monastir medical school in Tunisia, he practiced medicine for four years and provided both clinical and administrative role in a very prestigious organization in Tunis capital. He then decided to move to the States, and soon after his arrival he enrolled into a Ph.D. program at the University of South Florida. He successfully passed all his medical board exams in 2001 and got certified by ECFMG. He then accepted a job as a Program coordinator of a UN funded project in Saudi Arabia to assess the health damages from the 1991 Gulf war as part of the oil for food program and he coauthored the United Nations Compensation Commission's health claims report "F4" for compensation of Saudi Arabia on health. Dr. Khlifi was then hired as director of a legal and risk management department in a tertiary hospital in the Persian Gulf. He then returned from his overseas assignments to the states to pursue his career in toxicology.