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Drug-related mortality: Postmortem findings in Clark County, Nevada for 2005

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DRUG-RELATED MORTALITY: POSTMORTEM FINDINGS IN CLARK COUNTY, NEVADA FOR 2005

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ABSTRACT

**Drug-Related Mortality:
Postmortem Findings in
Clark County, Nevada
For 2005**

By

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Drugs, such as *Cannibis*, alcohol, cocaine and prescription medications can have deleterious effects on the body. This thesis analyzed toxicology results in relation to modes of death, and discusses who is at risk for deaths related to drug abuse. The modes of death studied were homicides, suicides, accidents, and natural causes. Data (N=2426) from Clark County, Nevada's Coroner's office were statistically analyzed using Chi-square analysis.

Major findings included relationships between drugs, ethnicity, age, gender and mode of death. Opioids and morphine derivatives were the most common drugs found in Caucasians, females and those who died of natural and accident-related deaths. Homicides were most commonly associated with ethanol and stimulants. The prevalence of ethanol was also most common within African Americans, Hispanics, Asians, males, high school aged decedents and in suicides. The purpose of this study is to inform the public and public health professionals of the associations found with drugs and death.

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CHAPTER 1

INTRODUCTION

Clark County, Nevada is home to Las Vegas, one of the fastest growing cities in the nation (Research Applications, Inc., 2003). Along with this rapid population growth, greater numbers of people in Clark County are dying every year. In 2005 over 10,000 deaths were reported to the Clark County Coroner's Office (Clark County Coroner's Office). Of the deaths that were investigated, toxicological findings were recorded; they include a variety of drugs commonly found on the streets, prescribed or accessible over-the-counter

Drugs can be either misused or abused. The difference between the two is that when one misuses a drug, they are practicing inappropriate use of prescription or nonprescription drugs (Levinthal, 2005). Such drugs are misused when dosages are increased beyond the level prescribed, or when dangerously mixed with alcohol or other drugs that affect the nervous system (Inaba & Cohen, 2004). The abuse of a drug applies to when one utilizes a licit or illicit drug, "in ways that produce some form of physical, mental, or social impairment" (Levinthal, 1999, p.6). Drugs which are commonly abused involve not only common street drug such as cocaine or heroin, but also involve legal psychoactives such as caffeine, nicotine, alcohol and inhaled solvents (Inaba & Cohen, 2004). Prescription drugs are also being abused for purposes non-medicinal. Recreational prescription drug use is often found in adolescents, teens, college students, adults and the

elderly (Compton & Volkow, 2005; Kolek, 2006). Prescription drugs such as oxycodone, hydrocodone, methadone and morphine are now being used recreationally. (Compton & Volkow, 2005). Although illicit drugs such as cocaine and heroin are extremely dangerous and potentially fatal, the danger of recreational misuse with prescription medications can also lead to a deadly overdose.

Four different modes of death, namely, natural, accident, suicides and homicides were studied and the statistics of postmortem toxicological findings were examined. Ethnicity, age and sex were also studied to see who was at greatest risk for drug-related deaths.

CHAPTER 2

LITERATURE REVIEW

The drugs discussed in this section can be classified into five different levels or schedules. Inaba & Cohen (2004) suggest that by controlling the manufacture, sale and use of psychoactive drugs, the imports and exports of such drugs can be limited and criminal penalties can be defined. Table 1 shows a list and description of the five drug schedules.

Drug Categories

The drugs detected have been classified into 11 different categories by The National Institute on Drug Abuse (NIDA): Antidepressants, prescription medications, depressants, analgesics, dissociative anesthetics, cannabinoids, opioids and morphine derivatives, stimulants, anabolic steroids, inhalants and over-the-counter medications.

*Antidepressants

Over 17 million Americans a year are affected by depression, which results in sadness, loss of pleasure and a decline in the capacity and willingness to enjoy life (Levine, 1999; Levinthal, 2005). First generation antidepressants were found by accident and were originally used for treatment of tuberculosis (Levinthal, 2005). After realizing

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* See Appendix I for common names, brand names, street names and molecular structures.

patients were in better spirits, antidepressants started being prescribed for depression (Inaba & Cohen, 2004; Levinthal, 2005). Owing to the fact that these drugs help people feel good and overcome depression would lead one to believe that prescription overdose in relation to these drugs may be problematic.

Table 1 Drug Schedules

Schedule	Description	Examples
I	High abuse potential and supposedly no accepted medical use	Narcotics such as: Heroin, LD, marijuana, peyote, psilocybin, mescaline, and MDMA
II	High abuse potential with severe psychic or physical dependence liability even though there are medical uses for the drugs	Narcotics such as: Cocaine, methamphetamine, opium, morphine, hydromorphone, codeine, meperidine, oxycodone, methylphenidate (Ritalin®)
III	Less abuse potential and include schedule II drugs when used in compounds with other drugs	Prescription drugs such as: Tylenol®, with codeine, some barbiturate compounds, and paregoric
IV	Even less abuse potential	Depressants such as: chloral hydrate, meprobamate, fenfluramine, diazepam (Valium®), other benzodiazepines and phenobarbital
V	Very low abuse potential because they contain limited quantities of narcotic and stimulant drugs	Over the counters such as: Robitussin AC® (DXM), Lomotil®

Information for table adapted from Drug Enforcement Agency website: www.usdoj.gov retrieved on August 25,2006

Monoamine oxidase (MAO) is the key enzyme inhibited by first-generation antidepressants (Levine, 1999; Levinthal, 2005). Although MAO inhibitors are beneficial in treating depression, hindering this enzyme has detrimental effects on the liver (Levinthal, 2005). MAO functions in the liver by helping break down the chemical tyramine. If MAO is inhibited, high levels of tyramine will accumulate and potentially increase the chance of having a stroke (Levinthal, 2005). Therefore, there are strict dietary considerations when taking these medications (Kent, 2000).

Tricyclic antidepressants (TCAs) are another class of first-generation antidepressants (Levine, 1999; Levinthal, 2005). Chemically, their structure contains three-rings, hence the name *tricyclic* (Levinthal, 2005). They inhibit the reuptake of serotonin or norepinepherine, or both, and have been found to be among the leading causes of drug-related deaths in the world because of their high toxicity (Levine, 1999). However, because TCAs do not inhibit MAO, they are generally safer than the first generation MAO inhibitors (Levinthal, 2005).

The pharmacologic action of second-generation antidepressants also inhibits the reuptake of serotonin or norepinepherine or both neurotransmitters associated with mood (Levine, 1999; Inaba & Cohen, 2004). These antidepressants increase the amount of serotonin distributed throughout the nervous system, and hence are called serotonin selective reuptake inhibitors (SSRIs) (Inaba & Cohen, 2004). Thus, by this action, they correct the imbalance of serotonin. SSRIs are the most commonly prescribed group of antidepressants and are also used in treating obsessive-compulsive disorder and bulimia (Levine, 1999). SSRIs are more commonly prescribed than TCAs and have fewer troublesome side effects. They also lack the cardiovascular toxicity associated with TCAs

(Levine, 1999). The most recognized SSRI antidepressant is fluoxetine (brand name, Prozac®). It was introduced in 1987 and aside from having few side effects it is also safe for patients with cardiovascular problems (Levinthal, 2005). Thus, it can be used in place of the tricyclic antidepressants mentioned above.

Serotonin and Norepinephrine Reuptake Inhibitors (SNRIs) are a newer class of antidepressants, which have lower side effects than SSRIs, yet are efficient in treating mood disorders and generalized anxiety disorders (Mattia, Paoletti, Coluzzi, & Boanelli, 2002). The newest and most studied antidepressant of this class is Venlafaxine (brand name, Effexor®), which is advantageous in its effectiveness in treating pain (Kent, 2000). An interesting therapeutic result of Venlafaxine is that it has the capacity to act as either a SSRI at low dosages or a TCA at high dosages (Mattia et al., 2002; Kent, 2000).

*Depressants

Depressants ("downers") affect individuals by reducing the activity of the brain, or by inducing sedation, muscle relaxation and drowsiness (Levine,1999; Inaba & Cohen, 2004). They are often used for those who feel immense stress and to help reduce anxieties and problems encountered on a daily basis (Levinthal, 2005).

Barbiturates, benzodiazepines, meprobamate, buspirone, and zolpidem are a few of the common central nervous system (CNS) depressants available today (Levine, 1999). Barbiturates are one of the oldest classes of depressants and were first synthesized in 1863 (Inaba & Cohen, 2004; Levine, 1999). They may be used during the induction of surgical anesthesia, to induce coma, as sedative-hypnotic agents, to control seizures or for

* See Appendix II for common names, brand names, street names and molecular structures.

the relief of intracranial pressure in patients with head trauma (Inaba & Cohen, 2004; Levine, 1999).

Benzodiazepines represent the other major class of CNS-depressant drugs. They absorb slowly into the bloodstream, making their effects longer lasting than barbiturates (Levinthal, 2005). Benzodiazepines also have a lower fat-solubility, greater water-solubility and are absorbed from the small intestine instead of the stomach like barbiturates (Levinthal, 2005). They have been approved for use in people with obsessive-compulsive disorders, as anxiolytics, muscle relaxants, anesthetic adjuncts, and anticonvulsants (Levine, 1999). The safety of benzodiazepines is the major advantage of these drugs. They have fewer side effects and lower withdrawal symptoms than barbiturates; however, they are often abused concomitantly with methamphetamine, cocaine or even heroin (Inaba & Cohen, 2004; Levine, 1999).

Studies have found that alcohol is one of the most commonly abused depressants, and in fact it is estimated that annually over 2 million people die worldwide owing to alcohol (Inaba & Cohen, 2004). Numerous physiological effects are associated with alcohol consumption, such as gastric irritation, liver disease, cardiovascular effects, sleeping problems and pregnancy defects (Levinthal, 2005). Not only does alcohol have detrimental effects on the body, but it has been found that the relationship of alcohol, drugs and violence has grown tremendously (Parker & Auerhahn, 1998). Studies have shown that violent acts are overwhelmingly associated with alcohol use, more than any other illicit or non-illicit substance (Parker & Auerhahn, 1998). Alcohol abuse and its relation to violence, suicide and death will be discussed in greater detail in later sections.

Assuming many people use depressants in order to run away from the many ordeals and challenges life brings, would also lead one to believe that overdoses in these drugs may potentially be a problem in relation to death.

*Stimulants

Stimulants are prescribed for disorders such as narcolepsy, attention deficit disorder and obesity (Inaba & Cohen, 2004). However, the fact that stimulants trigger the reward/reinforcement center of the brain makes addiction to theses drugs problematic (Inaba & Cohen, 2004). Misuse of stimulants continues to be a problem, and in 2002 a survey found that more than a third of the American population admitted to misusing Attention-Deficit/Hyperactiviy Disorder (ADHD) stimulants in their lifetime (Kroutil, Van Brunt, Herman-Stahl, Heller, Bray, & Penne, 2006).

Unlike depressants, stimulants ("uppers") increase the chemical and electrical activity in the central nervous system (Inaba & Cohen, 2004). They make the user more alert, cause feelings of intense pleasure, and feelings of increased energy after being taken (Inaba & Cohen; Levine, 1999). The most commonly used stimulants are amphetamines and methamphetamines (Levine, 1999). Manipulating the neurotransmitters epinephrine and norepinephrine, stimulants force the release of these energy chemicals giving the body bursts of energy (Inaba & Cohen, 2004).

Limited to disorders such as obesity, narcolepsy and attention deficit disorder, prescription of psychostimulants can have serious side effects. Fenproporex, a drug used for treatment of obesity, and modafinil, used for treatment of sleep and concentration disorders, have been found to be extremely dangerous (Pelissier-Alicot, Piercecchi-Marti,

* See Appendix III for common names, brand names, street names and molecular structures.

Bartoli, Kuhlmann, Coiffait, Sanvosisin, Giocanti, & Leonetti, 2006). A study by Peliser-Alicot et al. (2006) showed that fenproporex is incredibly addictive, and therefore it was withdrawn from the market in 1999 because of lack of efficacy relating to obesity management. However, this drug is still available on the Internet, thereby potentially causing serious public health issues (Pelissier-Alicot et al., 2006). Modafinil was found to have side effects including agitation, aggressive behavior and anorexia. As a central nervous system stimulant, it has been used to treat ADHD in children 6 years of age and older. Other side effects are insomnia and dependence therefore restricting Modafinil to a maximum of 28 days (Pelissier-Alicot et al., 2006). Along with Modafinil, drugs such as Ritalin, Dexedrine, Adderall and Cylert are all used for treatment of ADHD (Inaba & Cohen, 2004). Of the children treated with these drugs, about 75% have effectively controlled hyperactivity (Inaba & Cohen, 2004). Furthermore, easy accessibility of prescription stimulants can lead to overdose or death if misused or abused.

*Opioids and Morphine Derivatives

Opioids are alkaloid analgesics, which occur naturally in the opium poppy, *Papaver somniferum* (Levine, 1999). The plant grows three to four feet high and its flowers are about four or five inches in diameter. The flowers vary in color (white, pink, red or purple) and the pods of these flowers contain opium (Levinthal, 2005). Clinically, opioids are used in postoperative analgesia and also have therapeutic uses for pain management in cancer and terminal illnesses (Levine, 1999).

Opium poppies were first used in Egypt and Greece, and then spread to Asia (Inaba & Cohen, 2004). They were utilized for illness, as pleasure-inducing substances and as

* See Appendix IV for common names, brand names, street names and molecular structures.

poisons (Inaba & Cohen, 2004). After opium use spread to the United States it was utilized more by women than men because of the stigma towards women at the time (Levinthal, 2005). Because alcohol use was not accepted with women, it was no surprise to find men drinking alcohol in the saloon while women took opium at home during the 1940s (Levinthal, 2005). Opium smoking was introduced to the western US by Chinese, who used it as a painkiller and for diarrhea treatment (Levinthal, 2005).

Morphine and codeine are extracts that come naturally from the unripe seed pod. (Levine, 1999; Inaba & Cohen, 2004). Heroin, hydromorphone, hydrocodone and oxycodone are semisynthetic opiates synthesized from morphine (Levine, 1999; Inaba & Cohen, 2004). Methadone, meperidine and propoxyphene are fully synthetic opiate-like drugs (Inaba & Cohen, 2004).

*Analgesics

Analgesics include nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin, ibuprofen, naproxen sodium and acetaminophen. They are most commonly found in groceries and pharmacies (Levinthal, 2005). Although NSAIDs are most commonly found as over-the-counter medications, they are also prescribed for arthritic pain. Celebrex is one popular brand of prescription NSAID (Levinthal, 2005). Analgesics, commonly used by athletes, help reduce inflammation and deaden pain (Inaba & Cohen, 2004; Levinthal, 2005). Athletes often take analgesics to mask pain, which can furthermore aggravate injury (Inaba & Cohen, 2004).

The analgesic compound salicylic acid was the first NSAID used to treat pain in the 19th century; however, it was extremely irritating to the digestive tract (Levinthal, 2005).

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* See Appendix V for common names, brand names, street names and molecular structures

Years later a chemist manipulated salicylic acid by adding an acetyl group in order to lessen its toxicity. Because it was derived from spirea plants, salicylic acid was named "aspirin." It can be used to reduce inflammation, for mild pain such as headaches and also to lower elevated body temperature (Levinthal, 2005). While opioids such as morphine or hydrocodone work on the central nervous system, aspirin works by blocking synthesis of hormones called prostaglandins via inhibition of cyclooxygenase (Hawkey, 1999; Levinthal, 2005). When injury occurs, prostaglandins encourage inflammation in the joints and act on the hypothalamus of the brain, increasing body temperature. Thus, aspirin is a helpful therapeutic drug in treating such ailments. Unfortunately, physiological effects such as gastric bleeding, a reduction in blood clotting and Reye's syndrome may occur in children who are using aspirin for infections such as chicken pox (Levinthal, 2005).

Ibuprofen is also used to lower body temperature, reduce pain or inflammation and for menstrual cramps. As with aspirin, Ibuprofen has the same method of action in blocking the production of prostaglandins (Levinthal, 2005). However, ibuprofen causes less gastric irritation than aspirin, but may also cause kidney damage or failure (Levinthal, 2005). Acetaminophen is also a popular over-the-counter analgesic, which is used for pain and inflammation. It is less toxic on the stomach and does not interfere with the clotting processes (Levinthal, 2005). A problem arising from usage of acetaminophen is liver damage, especially if combined with alcohol (Levinthal, 2005). After this was discovered, the FDA recommended warnings on the labels to advise users of such toxicity (Levinthal, 2005).

*Prescription Medications

Prescription drugs may be purchased after licensed physicians or other licensed health professionals have certified utilization for a medical condition requiring such drugs (Levinthal, 2005). In 2002 approximately $154.5 billion was spent on prescription medications in America (Inaba & Cohen, 2004). The top ten leading brands of prescription drugs include: Lipitor, Prevacid, Prilocec, Zocor, Celebrex, Zoloft, Paxil, Zyprexa, Norvac and Nexium (Levinthal, 2005). After approval from the Food and Drug Administration (FDA), prescription drugs are dispersed to a large population of patients. Safety, effectiveness, and levels of dosage are finalized through the FDA (Levinthal, 2005). Although the FDA approves the distribution of prescription drugs, their safety is only guaranteed if taken at recommended dosage (Levinthal, 2005). Thus, it is common sense that the abuse of prescription drugs may be dangerous.

**Over-the-Counter Drugs

Over-the-counter drugs are available to the public without a prescription and have potential of misuse. Analgesics, sleep aids, and cough-and-cold remedies all can be bought without the supervision of a physician (Levinthal, 2005). Corticosteroids are also popular drugs found over-the-counter, and are used to control inflammation and pain (Inaba & Cohen, 2004). Although easily accessible, NSAIDs can produce serious problems if abused (Levinthal, 2005).

Over-the-counter drugs such as cough/cold preparations, analgesics and vitamins also can be harmful to children (Chien, Marriott, Ashby, & Ozanne-Smith, 2003). The fact

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* See Appendix VI for common names, brand names, street names and molecular structures

**See Appendix VI for common names, brand names, street names and molecular structures

that they are widely available in homes, and stored in easily accessible cabinets and cupboards, places children at a higher risk for overdose (Chien et al., 2003).

*Dissociative Anesthetics

Dissociative anesthetics can be classified as hallucinogens, which produce feelings of being dissociated or separated from oneself and the environment (Levinthal, 2005). The most notorious of this drug category is called phencyclidine (PCP) and causes not only hallucinogenic effects, but also stimulant and depressant effects (Levinthal, 2005). A common street name for PCP is "angel dust" because of the powdered form; liquid PCP is sometimes mixed with marijuana ("sherm") and smoked in order to enhance the effects of marijuana (Levinthal, 2005, Inaba & Cohen, 2004). Initially phencyclidine was used clinically as an anesthetic or analgesic in humans until adverse psychological reactions were observed (Levine, 1999). It was also used as a tranquilizer for large-animals, yet the legal manufacture of PCP discontinued in 1979 (Levine, 1999). Behavioral and psychological effects resulting from use of phencyclidine are perceptual distortions, feelings of power and strength, disorientation, agitation, aggressive behavior and amnesia (Levine, 1999; Levinthal, 2005). Other hallucinogenic drugs consist of LSD, psilocybin "shrooms", and peyote buds (Inaba & Cohen, 2004).

**Cannabinoids

Cannabinoids are found in numerous species of the *Cannabis* plant, the most common of which is *C. Sativa* (Levine, 1999). They are found in the resin that accumulates on the leaves and stems of this plant (Levinthal, 2005). It originated in Central Asia and was

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* See Appendix VII for common names, brand names, street names and molecular structures

** See Appendix VIII for common names, brand names, street names and molecular structures

used therapeutically for relief of pain, muscle spasms, convulsions, epilepsy, asthma, and rheumatism (Levine, 1999). In 1910, cannabis was introduced to the United States and continues to be the most commonly used drug (Levine, 1999). Interestingly, it is classified by the Drug Enforcement Agency (DEA) as having no accepted medical uses for any disease because other medications are available that are more effective (retrieved from: http://www.usdoj.gov/dea/ongoing/marijuanap.html on August 2, 2006).

The primary psychoactive agent in the *Cannabis sativa* plant is delta-9-tetrahydrocannabinol (THC) (Levinthal, 2005; Levine, 1999). Several different substances contain THC; these are marijuana, hashish, hash oil, and prescription Marinol, which can produce hallucinogenic or a 'pleasurable high' depending on the dose (Levine, 1999). Marijuana is the most common psychoactive drug originating from the cannabis plant, which contains different THC concentrations (Levinthal, 2005). Feelings of euphoria and well being as well as sharpened sense of sight and sound are all psychological and behavioral effects that have been reported with marijuana's intoxicating characteristics (Levinthal, 2005).

*Anabolic Steroids

Anabolic steroids are used to promote the synthesis of proteins in the body, which in turn increase muscular development and masculine characteristics (Inaba & Cohen, 2004; Levinthal, 2005). The promotion of secondary male sexual characteristics is called an androgenic effect while the acceleration of muscle growth is an anabolic effect (Karch, 2002).

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* See Appendix IX for common names, brand names, street names and molecular structures

Before World War II, anabolic steroids were used to promote healing, speed recovery time, and treat depression (Karch, 2002). They are popular with athletes because they are believed to improve performance and strength (Karch, 2002). Derived from the male hormone testosterone, steroids are clinically used to treat testosterone insufficiency, osteoporosis and some breast cancers (Inaba & Cohen, 2004). Although they are sometimes used to enhance personal appearance, when misused they can produce undesirable effects such as feminization in males and masculinization in females (Inaba & Cohen, 2005).

Inhalants

Inhalants consist of volatile organic solvents, hydrocarbon gases, anesthetic gasses and nitrites (Levine, 1999). Inhalants are sometimes classified as deliriants, producing feelings of euphoria. They are similar to alcohol in that they depress the central nervous system (Inaba & Cohen, 2004; Levine, 1999). They can be inhaled through the nose and/or mouth, or even smoked after being heated or burned like tobacco and heroin (Inaba & Cohen, 2004). Differences between inhalants and other psychoactive drugs is that they are quick acting, yet have intense effects and are readily available and inexpensive (present in the home, garage and workplace). However, they do not get the attention from media, educators or parents like illicit drugs such as phencyclidine (Inaba & Cohen, 2004). Formaldehyde is often used as an inhalant for its depressant and psychedelic effect. Marijuana joints are sometimes soaked in formaldehyde ("frysticks") resulting in visual and auditory hallucinations, pain tolerance and feelings of being invincible (Levinthal, 2005, NIDA, 2004). Unfortunately, inhalants can cause permanent

damage to the liver, kidney, lungs and the CNS after just a short period of use (Inaba & Cohen, 2004).

*Other Compounds

In this study, other compounds consisted of substances such as caffeine, arsenic, carbon monoxide, cyanide, mercury and lead. Although these compounds were found in a select number of individuals, this paper focuses on the 11 drug categories discussed above and will not go into great detail on the use of these compounds relating to death.

Socioeconomic Class, Age, Gender and Drug Abuse

Socioeconomic class, age and gender all play roles in the types of drugs that are abused and potentially lead to fatalities. Blumstein (1995) suggests that there is a higher correlation between the illicit drug market and rates of lethal violence among Blacks compared to Whites. This conclusion was drawn because of the fact that crack cocaine market transactions were more common in impoverished, predominantly African American communities (Blumstein, 1995). On the contrary the less dangerous and private settings were correlated with a more expensive form of the drug (powder cocaine). These transactions were more likely to occur in predominantly White communities. Furthermore, Blumstein (1995) suggests that because the drug trade in predominantly Black ghetto communities is highly correlated to a more hostile environment, it would be reasonable to conclude that there is a link between drug-market activity and homicide within these communities. However, Kilpatrick, Acierno, Saunders, Resnick and Best (2000), found that when controlling effects of demographics, victimization history and

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* See Appendix X for common names, brand names, street names and molecular structures

familial substance use, Caucasian adolescents were between three to nine times more likely to be at risk for substance abuse and dependence as opposed to African Americans.

A study conducted by Ousey and Lee (2004) found that there is a positive relationship between Black cocaine/opiate distribution arrest rate and Black homicide rate. However, the same relationship was found with the White drug market and White homicide rate. Thus, it was found that cities having high arrest rates associated with an increasing drug market also exhibit a high rate of homicide, regardless of ethnicity (Ousey & Lee, 2004).

The University of Maryland at College Park studied the risks associated with adolescent substance abuse (Gottfredson & Koper, 1996). Findings suggested that social integration, self-esteem, and self-efficacy all have low predictive validity (Gottfredson & Koper, 1996). Positive peer influence does not affect black adolescents, yet decreases the prevalence of drug use for Whites. Furthermore, drug use is more likely found in female adolescents than for males, regardless of ethnicity. Peer influence predominantly affects White adolescents and drug use is more strongly predicted for White male adolescents in relation to rebellious behavior (Gottfredson & Koper, 1996).

In a study conducted by the National Household Survey of Drug Abuse in 1997, marijuana use was highest among people between the ages of 18 and 24 at 22%, while cocaine use was found in 4% of this group (Kilpatrick et al., 2000). Using data from the National Health Interview Survey between 1987-1990 and the National Death Index data through 1991, Kallan (1998) found that Males, Blacks, and Hispanics were identified as high-risk subgroups for drug-related mortality. Males had a higher death rate than females for fatalities owing to cocaine, or opiate abuse. Cocaine-related deaths were higher for Black than Whites or Hispanics. Socioeconomic status also played a role in

higher mortality rates for Blacks and Hispanics (Kallan, 1998). Violence has been suggested to a play a role in not only adolescent, but also adult substance abuse as well (Kilpatrick et al., 2000). Those substance abusers who were victimized at one point in their lives were found to have started using drugs at a younger age than those who were not victimized. Moreover, substance abuse has been found to be a way for adolescents and adults to cope with stressors such as interpersonal aggression, whether it results from sexual abuse or physical violence (Kilpatrick et al., 2000).

Specific Drugs and Fatalities

Research investigating the connection between the use of drugs and crime suggests that there was a spike in violent crime when the crack-cocaine market emerged during the 1980s (Varano, McCluskey, Patchin, & Bynun, 2004). Studies found a correlation between poor-young-minority men and serious violent crimes during the late 1980s and early 1990s (Varano et al., 2004). In 1998 the Drug Abuse Monitoring Program (ADAM) found that the majority of adult male arrestees were positive for cocaine use (Varano et al., 2004). Both marijuana and cocaine have been reported as drugs related to violence (Varano et al., 2004).

When looking at the involvement of drug circumstances in homicide events, research shows that over half of all homicides potentially involve drugs (Varano et al., 2004). Research conducted on 800 homicide cases across the United States found that nearly a quarter of these cases involved drugs (Varano et al., 2004). Among homicide victims killed in Bexar County, Texas 63% were positive for ethyl alcohol. Within these cases alcohol and cocaine were found in abundance with alcohol being detected in more than

half of the victims (Garriott, DiMaio, & Rodriguez, 1986). People associated with the drug market, whether it be abusing or selling, have been found to be involved in violent disputes and homicides (Ousey & Lee, 2004).

A study conducted in Bexar County, Texas found a high correlation of drugs and/or alcohol in homicide victims during the years of 1985, 1986, 1990 and 1991. The concentrations ranged between 66% and 73% (Garriott, 1993). Although heroin metabolites were detected in only a small amount of these cases, cocaine increased to 18.7% by 1991 from 1.6% of cases in 1985. A metabolic byproduct of the combination of cocaine and alcohol, cocaethylene, was measured as well during these years. It was found that 58% of those who were positive for cocaine and alcohol also had concentration of cocaethylene, which is possibly more toxic than cocaine alone (Garriott, 1993). Furthermore, cocaethylene has been linked to increased rates of violent behavior (Inaba & Cohen, 2004). Among other drugs found in homicide victims were phenobarbital, benzodiazepines, diazepam, propoxyphene and antihistamines. Although found in fewer numbers of cases, methadone and antidepressants were also identified in homicide victims (Garriott, 1993).

Alcohol and Crime

Increases in aggression have been found with consumption of alcohol because it interferes with the main inhibitory neurotransmitter, gamma amino butyric acid (GABA). (Inaba &Cohen, 2004). Impulse control may also be inhibited due to decreases in the levels of serotonin (Inaba &Cohen, 2004). When looking at violent crime, Inaba & Cohen (2004) state that, "About one-fourth of the 11.1 million victims of violent crime report that the offender had been drinking alcohol prior to committing the crime" (p. 207).

Studies have found that when one is provoked and under the influence of alcohol, aggression leading to violence may occur (Bushman, 1997; Lipsey, Wilson, Cohen, & Derzon, 1997). It is known that alcohol causes reduced intellectual functioning, reduced self-awareness, selective disinhibition, and inaccurate assessment of risks, it is highly likely that violence may result when one is under the influence (Chermack & Giancola 1997; Ito, Miller, Pollock, 1996; Parker & Auerhahn 1998). This may further lead to one's involvement in aggression and homicide.

Alcohol and Suicide

As alcoholics age, they are more likely to have social, health and interpersonal problems. Thus, their risk for suicide increases (Inaba & Cohen, 2004). Furthermore, along with increased age, suicide rates among alcoholics are twice as high than that of the general population. The typical alcohol-suicide victim is a white, middle aged, male (Inaba & Cohen, 2004). Depression, loss of job, living alone and poor social support are other potential risk factors associated with suicide (Inaba & Cohen, 2004).

Overdose

As defined by the Office of National Statistics, drug related deaths may result from long-term substance abusers, or occasional recreational users. Drugs involved may be prescribed, controlled, or a mixture of both, and death may result from long-term use, direct or long term effects. Furthermore, the deceased may die accidentally, through suicide, or even homicide (Christophersen, Rooney, & Kelly, 1998).

Alcoholic overdose results from large amounts of alcohol, such as a blood alcohol content (BAC) at a level of 0.40 (Inaba & Cohen, 2004). When this poisoning occurs, depression of the central nervous system results, which may furthermore lead to death

(Inaba & Cohen, 2004). Although a 0.40 BAC has been noted as the threshold for alcohol poisoning, levels at 0.20 or greater can depress respiration and lead to death in those with low tolerance levels (Inaba & Cohen, 2004).

Opioid users, such as those who abuse heroin, are likely to experience toxic overdoses (Inaba & Cohen, 2004). When looking at the number of people who use oxycodone, oxycontin and other opioids, the risk of overdose owing to these types of drugs is no surprise. Heroin overdose occurs when blood pressure drops and the lungs fill with fluid, causing the victim to experience cardiac arrhythmias and convulsions, which may lead to severe respiratory depression and death (Inaba & Cohen, 2004).

Motor Vehicle Fatalities

One of the major causes of mortality, motor vehicle accidents, kills around 300,000 people in the world every year. Alcohol, prescription drugs and illicit drugs can be correlated to many of these unfortunate motor vehicle fatalities (Kelly, Darke, & Ross, 2004).

Alcohol

Alcohol is the most common psychoactive substance found in the blood of victims involved in motor vehicle crashes (Bates & Blakely, 1999). It reduces motor coordination as well as alertness and depth perception. In order to drive safely, one must be alert and able to make fast decisions in order to compensate for unexpected driving conditions and situations. Alcohol, as a depressant drug, slows your brain and body, which can limit awareness and coordination (Levine, 1999). Overconfidence is a common effect after consumption of alcohol, which can alter judgment and driving skills (Levine, 1999).

Among motor vehicle drivers killed in Bexar County, Texas, 55% of the drivers were positive for ethyl alcohol (Garriott et al., 1986). Laboratory studies, simulator and driving studies have all confirmed that performance after drinking alcohol increases deficits in concentration, coordination, speed control, lane control, and brake reaction time (Kelly et al., 2004). Depending on their blood alcohol concentration, Christophersen et al. (1999) found that accident risk can be anywhere from four to twelve times greater than those who drive without being intoxicated.

Cannabis

Cannabis may affect short-term psychomotor and cognitive effects in an individual (Bates & Blakely, 1999). These effects not only alter perception and memory, but also impair motor coordination tests (Inaba & Cohen, 2004). Psychomotor effects of *Cannabis* use have been studied and it was found that following distance increased while driving and that when *Cannabis* was mixed with alcohol, driving performance was affected (Bates & Blakely, 1999). *Cannabis* is the second most frequent drug detected in motor vehicle crashes (Bates & Blakely, 1999). In 1985, a study in Bexar County,Texas found that approximately 50% of homicide and motor vehicle victims were tested positive for the presence of cannabinoids (Garriott et al., 1986). When looking at epidemiological studies examining the incidence of drug use in traffic collisions, between 2.7% and 13.9% of drivers tested positive for cannabinoids (Soderstrom, Dischinger, Kerns, & Trifillis, 1995; Mercer & Jeffrey, 1995). On the contrary, although *Cannabis* users have impairment while driving, experimental evidence has shown that they may modify their driving behavior in order to compensate for impairment. Thus, they are less likely to take

risks or drive at high speeds, which could possibly result in less fatalities or serious injuries (Bates & Blakely, 1999).

Prescription and Illicit Drugs

In addition to alcohol, prescription depressants and painkillers may also affect driving (Inaba & Cohen, 2004). Other drugs, which affect a person's ability to drive include cough, cold or allergy medications (Inaba & Cohen, 2004). Combining alcohol with such drugs intensifies the effect and makes driving even more dangerous than either drug on its own (Inaba & Cohen, 2004). After alcohol, cannabis, benzodiazepines and cocaine are the next most commonly detected drugs in drivers involved in motor vehicle accidents (Kelly et al., 2004). High levels of benzodiazepines were detected in many European countries as well as the United States (Kelly et al., 2004). Studies have found that benzodiazepines, stimulants and opioids equivocally impair driving performance (Kelly et al., 2004). While the most common drugs found in motor vehicle fatalities in Canada were cannabinoids, benzodiazepines, codeine, cocaine and barbiturates, in the United States, *Cannabis*, cocaine, PCP and opiates were more common (MacDonald, 2002). Woods, Katz, and Winger (1992) found that rates of benzodiazepines in arrested, injured and fatally injured drivers ranged from 2% to 9.6% in America.

Of depressants, benzodiazepines are the most commonly studied in relation to psychomotor performance (Ferrara, 1987; Woods et al., 1992). In Britain, people who had prescriptions for sedatives such as benzodiazepines were almost five times more likely to be involved in a serious road accident (Skegg, Richards, & Doll, 1979). In a study conducted over 17 months in Belgium, urine tests were taken from injured drivers

at emergency rooms. Of those tests, it was found that those who died as a result of motor vehicle accidents were more likely to test positive for benzodiazepines, cannabis, or methadone than any other drug (MacDonald, 2002). Laboratory tests have found that benzodiazepines may be detrimental to people when trying to operate motor vehicles. Inhibition of visual and speed perception, information processing, coordination, reaction time, memory and attention are all affected when one is taking such depressants (Kelly et al., 2004).

Mortality Rates in the U.S. and Nevada

In Nevada, unintentional injuries were among the top three leading causes of death in ages up to 54 years old while nationally, unintentional injuries were the leading cause of death through age 34 (Research Applications, Inc., 2003). The top four mechanisms of injury resulting in deaths in Nevada during the year 2001 were suicides, firearm related deaths, motor vehicle crashes, and poisonings (including overdoses) (Research Applications, Inc., 2003). The leading causes of death resulting from injury among Nevada residents in 2001 are as follows: <1 (unintentional suffocation), 1-4 (Homicide by other means), 5-9 (Unintentional Motor Vehicle Crashes traffic), 10-14 (Unintentional Motor Vehicle Crashes Traffic), 15-24 (Unintentional Motor Vehicle Crashes Traffic, 25-34 (Unintentional Motor Vehicle Crashes traffic), 35-44 (Accidental Poisoning or Overdose), 45-54 (Accidental Poisoning or overdose), 55-64 (Unintentional Motor Vehicle Crashes Traffic) and 65+ (Unintentional Motor Vehicle Crashes Traffic) (Research Applications, Inc., 2003).

During 2001, homicide in Nevada was the second most frequent cause of death for people ages 15-24 and fourth for those between the ages of 25-34 (Research Applications, Inc., 2003). Although homicides are most common among teenagers and young adults, they occur in all age categories (Research Applications, Inc., 2003). Furthermore, males are more likely to be victims and perpetrators in homicides, and between the years of 1976 and 1997, a study conducted by Fox (Bureau of Justice Statistics, 1998) found that blacks are 7 times more likely than whites to be murdered.

In the United States, approximately 30,000 Americans commit suicide in any given year (Wray, 2004). In 2000, Nevada's residents compromised 19.1 suicides per 100,000. These numbers were twice the national average of 10.7 (Wray, 2004). More than 400 people in Nevada die annually by suicide and of these people, males, residents' aged 45 and over, Whites and Native Americans, and those who live in rural counties have higher suicide rates (Research Applications, Inc., 2003). Between the years of 1952 and 1996, adolescent suicide rates almost tripled in America and from 2000 to 2002, deaths of 219 Nevada teens (ages 15-19) resulted from homicide, accident or suicide (Wray, 2004). Within the same time frame, an alarming 10.8% of middle school students and 8.8% of high school students living in Nevada made an attempt at suicide (Wray, 2004).

In 2001, 29,368 people in Nevada were involved in motor vehicle crashes (including pedestrians and bicyclists) and a total of 330 deaths resulted from these injuries (Research Applications, Inc., 2003). When looking at gender differences in relation to motor vehicle crashes, males were more likely than females to have injuries, whether they be minor, moderate or fatal (Research Applications, Inc., 2003).

Prescription Drug Abuse

Over the past 10 years, the abuse of prescription drugs has increased in the United States (Compton & Volkow, 2005). Many problems arise when looking at the "epidemic" of drug abuse such as addiction, unintentional drug overdose, suicide and crime. Oxycontin, oxycodone, benzodiazepines, methadone and psychostimulants are a few of the drugs discussed herein. Although used for medicinal purposes, these prescription drugs can be extremely harmful to the body if abused illicitly. The public needs to be aware of illicit prescription drug abuse in order to help prevent unintentional drug overdose and hopefully find treatment programs for people who are at risk of dying from a prescription drug overdose. Prescription drug abuse can be defined as: "any intentional use of a medication with intoxicating properties outside of a physician's prescription for a bona fide medical condition, excluding accidental misuse" (Compton & Volkow, 2005, p. 4).

In 2003 approximately 15 million people ages 12 and over living in the United States used a psychotherapeutic for non-medicinal purposes (Compton & Volkow, 2005). Another study from the National Household Survey on Drug Abuse (NHSDA, 2001) reported that Americans between the ages of 18 and 25 were found to have the highest prevalence of illicit use of prescription drugs (Office of Applied Studies, 2002). The most common sources of illicit prescription drugs contain opioid analgesics, stimulants, anxiolytics/sedatives, and sleeping medications. These drugs were easily accessible through peers, roommates, boyfriend/girlfriend, family members, and even drug dealers (McCabe & Boyd, 2005).

During the course of any given year, approximately 11% of the United States adult population has been found to have a substance abuse problem (Lester, Andreozzi, & Appiah, 2004). Over-the-counter and prescribed medications are the most common drug used by pregnant women. Owing to this fact, not only can they be harmful to the mother using them, but may harm the unborn fetus as well. The placenta is important in protecting the fetus from diffusion of foreign matter into fetal blood; however, it is quite permeable to a diverse number of drugs and toxins (Mooney, Boggess, Herbert, & Layfield, 1998). Therefore, many prescription drugs may cross the placenta barrier and harm the fetus as well. When studying a group of newborns, it was found that half had NSAIDs in their first intestinal discharge (Inaba & Cohen, 2004). Drugs such as benzodiazepines are incredibly difficult for a fetus to metabolize and can remain in their systems for days leading to fetal depression and the possibility of death (Inaba & Cohen, 2004). This may occur via a phenomenon called ion trapping, which is due to differential pH levels or through an increased number of rapidly dividing cells present (Williams, James, & Roberts, 2000).

Oxycontin, Oxycodone and Other Opioids

One of the fastest growing concerns for public health and non-medical use and abuse of prescription opioids is OxyContin and its generic competitor, Oxycodone (Bailey, Barton, Lezotte, Lowensstein, & Dart, 2006). Approved in 1995 by the FDA, OxyContin is an analgesic prescribed to individuals with moderate to severe pain having properties similar to that of a narcotic (Cicero, Inciardi, & Munoz, 2005). Far exceeding reports for heroin misuse, the 2003 National Survey on Drug Use and Health (NSDUH) reported that 4.7 million Americans used prescription pain relievers illicitly within the past month

(Bailey et al., 2006). When looking at the generic drug, oxycodone, it should be noted that it is cheaper to purchase than OxyContin, making the abuse of this drug more accessible to the public. Five years after its approval by the FDA, OxyContin abuse arose and reports have shown that analgesic abuse can be classified as a national epidemic (Cicero, 2005).

In 2002 prescription drugs such as hydrocodone and oxycodone were found to be the most prevalent opioids resulting in trips to the emergency room, especially when used concomitantly with other drugs (McCabe et al., 2005). Showing an upward trend in the use of medications illicitly, it has been found that over two million persons aged 12 and older in the United States reported using opioid analgesics in 2000 for their first time (Sung, Richter, Vaughan, Johnson, & Thom, 2005). In the mid-1980s it had only been recorded that about 400,000 individuals experimented with such drugs for their first time. Furthermore, between the years of 1994 and 2001, the number of emergency room visits increased over 300% for oxycodone and over a hundred percent for that of hydrocodone (Sung et al., 2005). This rising trend further confirms how opioid abuse is now becoming a drug abuse epidemic.

Methadone and Bupronorphine

The opiate methadone has been designed to be a legal substitute for heroin. Its effects are not as intense as the narcotic heroin, yet can be just as addicting (Inaba & Cohen, 2004). Although methadone maintenance has been used for heroin substance abusers since 1994, the abuse of this drug has lead to alarming statistics. Between 1993 and 1994, there was a 100% increase in methadone-related deaths in Scotland, whereas there was only one reported death attributed to methadone in 1991 (Seymour, Black, Jay, Cooper,

Weir, & Oliver, 2003). In North Carolina, between the years of 1997 and 2001, the number of methadone- related deaths increased from 7 deaths to 58, a 729% increase. In 2001, a study found that of methadone-related deaths, 21% percent of the decedents were prescribed methadone for pain, another 8% was prescribed for an unstated reason and 19% of the methadone was obtained illegally (Sanford, 2002).

An alternative to methadone, buprenorphine, was approved by the FDA in 2002 (Jones, 2004). It has been described as a partial agonist for mu receptors in the brain, meaning that in some ways it works as a pure opiate agonist such as methadone and heroin, but in other ways is non-addictive and has relatively no clinical effects (Resnick, Galanter, Pycha, Cohen, Grandion, & Flood, 1992).

Buprenorphine can be distinguished from other opioids such as methadone and heroin because it interacts with the mu receptor, uniquely helping people overcome opioid addiction (Jones, 2004). Unlike heroin and methadone, once buprenorphine is discontinued, withdrawal symptoms are relatively mild (Resnick, 1992). Although more expensive than methadone, buprenorphine has a lower rate of illicit use and has also been found to be safer with low withdrawal symptoms after discontinuation (Jones, 2004). One of buprenorphines beneficial characteristics involves the fact that since it has high affinity for the mu receptor, it displaces other opioids (methadone and heroin) from binding to the receptors. Thus, if it is given to an individual who has already taken an opioid such as heroin, buprenorphine will compete with heroin and help with symptoms of withdrawal (Jones, 2004).

Problems With Prescription Drugs

Crime

Prescription drugs have been linked to aggression. Studies in rats have shown that benzodiazepines may be linked to aggression at moderate dosages. If mixed with alcohol, this type of behavior may be increased (Pihl & Peterson, 1995). Benzodiazepines are most commonly used with other drugs such as methamphetamines, cocaine and heroin (Inaba & Cohen, 2004). The combination of these drugs, especially cocaine, puts users at risk for violence. It has been found that pharmacological effects of cocaine induces feelings of paranoia, which may lead to cocaine-associated violence (Parker & Auerhahn, 1998). Thus, prescription drugs such as benzodiazepines can be linked to violence if used not only alone, but also in conjunction with illicit drugs such as cocaine.

Suicide

Antidepressants have been found to increase the incidence of suicide. Such prescription drugs include Prozac, Zoloft and Paxil. In the United Kingdom it was found that people were more likely to commit suicide when first put on antidepressants (Jick, Kaye, & Jick, 2004). The FDA has taken action by regulating these drugs with "black box" labels warning people of the possibility of suicide. However, it is not certain if the suicides were related to the drugs, or that of a mental illness (Prescriptions May Increase Risk of Suicide. Retrieved April 8, 2006 from http://www.anxiety-and-depression-solutions.com/articles/news/suiciderisk102004.htm). Moreover, in Virginia, antidepressants were the most common prescription drugs found in suicide related deaths among adolescents and children (Vieweg, Linker, Anum, Turf, Pandurangi, Sood, Fierro, & Fernandez, 2005).

Benzodiazepines have been found to be involved in drug overdoses leading to death within all age groups (Carlsten, Waern , Holmgren, & Allebeck, 2003). In younger and middle-aged suicide cases, analgesics are most commonly used; however, there has been an increase in suicides with benzodiazepines in the elderly population of Sweden over the past two decades (Carlsten et al., 2003).

Unintentional Drug Overdose

In North Carolina, the number of poisoning-related deaths has increased fastest in the nation between the years of 1997 and 2001. More than half of the unintentional related overdoses were due to legal or illegal drugs and have increased over a hundred percent between these years (Sanford, 2002). In order to prevent unintentional drug-related overdoses, counselors, drug rehabilitation centers, and family members of people with substance abuse problems need to be aware of the statistics involved with drug overdoses. When looking at the deaths caused by accidental drug overdoses, it was found that in North Carolina, three quarters of the individuals who died had a history of "one or more health problems at the time of their death, including substance abuse (53.8%), alcohol abuse or alcoholism (23.8%), chronic pain (20.1%), or mental illness (20.4%)" (Sanford, 2002, p. 5). Furthermore, "the increase of single-drug deaths resulting from prescription narcotics (eg. Oxycodone, methadone) in the five-year period increased from 32 to 96, a 300% increase" (Sanford, 2002, p. 7).

Elderly and Prescription Drugs

The elderly represent 13% of the population, but consume 35% of prescription medications in the United States (Hanlon, Schmader, Boult, Artz, & Gross, 2002). The most common of these prescriptions include those related to cardiovascular, analgesic and central nervous system drugs (Hanlon et. al. 2002). A study conducted in North Carolina found that of the following eight different drug classes: calcium channel blockers (CCB); angiotensin-converting enzyme (ACE); histamine2 receptor antagonists; nonsteroidal anti-inflammatory drugs; benzodiazepines; antipsychotics and antidepressants; benzodiazepines were found to be the most inappropriately prescribed drugs (Hanlon et al., 2002). Of the two different groups of participants studied in North Carolina, 21% of one group (n=3,234) and 19.2% of the other group (n=2,508) were inappropriately prescribed one or more elements from the eight different drug classes (Hanlon et al., 2002). Another study conducted in Canada found three categories of inappropriate prescribing for the elderly:

"(1) the prescription introduces a substantial and clinically significant increase in the risk of a serious adverse effect, (2) equally effective or more effective and less risky alternative therapy is available for most patients, and (3) the practice is likely to occur often enough that a change in practice could decrease morbidity in elderly people" (McLeod, Huang, Tamblyn, & Gayton,1997, p. 386).

Benzodiazepines, tricyclic antidepressants and SSRIs were common drugs found in these three categories, and account for a disproportionate amount of prescribed medications in the elderly (McLeod et al. 1997). Unfortunately, because the elderly suffer

from more illnesses than the young, it is no surprise that they are prescribed a greater majority of medications and are at risk for inappropriate use.

Accessibility of Drugs

More and more people are being prescribed medications for a variety of ailments. This places a diverse number of drugs on the shelves and in the medicine cabinets of potential substance abusers (NIDA Community Drug Alert, 2005).

Street drugs such as amphetamines and methamphetamines have been a problem since the early '70's (Inaba & Cohen, 2004). Not only can substance abusers find cheap forms of these drugs on the streets, but the fact that they can be easily manufactured in homes or methamphetamine laboratories also explains why these types of drugs may be easily accessible (Inaba & Cohen, 2004). Although the Controlled Substance Act of 1970 helped to regulate the purchase and prescription use of amphetamines, the illegal manufacture of these drugs in the form of "crank" became a huge problem. Not only was "crank" easily manufactured on the streets, but its purity also made it appealing to drug substance abusers (Inaba & Cohen, 2004). Methamphetmaine can be manufactured easily with pseudoephedrine. Some common over-the-counter brand names, which are popularly used to convert pseudoephedrine to methamphetamine include, Advil Cold and Sinus®, Claritin D®, and Sudafed® (Cline, 2005).

Prescribing drugs over the Internet is also a problem. This technology allows access to prescription medications, which may explain why an increase in their abuse has occurred (Henney & Shuren, 2000). Unfortunately, anyone who has a credit card can access the Internet and purchase prescription drugs, without being monitored by a

physician. Thus, easy access of these drugs via the Internet could explain the reason why prescription drugs are being abused throughout the country.

Accessibility of over-the-counter medications can also be a problem, especially owing to the recent rise in methamphetamine laboratories (Cline, 2005). Over-the-counter medications are not only easily accessible at grocery and convenience stores, but can be abused for the psychoactive effects as well (NIDA Research Report Series, 2005).

Large cities such as New York, Dallas, Miami and Philadelphia commonly have high accessibility of illicit drugs and sales (Lurigio & Davis, 1992). Also, those who live in lower socioeconomic class neighborhoods and inner cities are predisposed to problems with drugs and crime (Lurigio & Davis, 1992). Since the 1980's violence and hard-drug selling has increased among inner cities and drug-trafficking has been found to be higher within inner cities rather than in the suburbs (Ensminger, Anthony, & McCord, 1997; Johnson, Williams, Dei, & Sanabria, 1990). Between 1990 and 2000, Las Vegas was the largest of the fast-growing cities (O'Hare, 2001). Not only is Las Vegas at risk for high drug trade on the streets, but is also a potential reservoir for illicit drug use and crime.

Based on review of the literature, several research questions became apparent.

Question 1: What are the major drugs associated with the four different modes of death (suicide, homicide, accident, natural)?

Q2: Is there a relationship between age, gender and ethnicity with the types of drugs detected in the body after death?

Q3: Is there an association between prescription drugs and mortality?

Several testable hypotheses were generated from these research questions and are presented in the following chapter.

CHAPTER 3

OBJECTIVES, QUESTIONS, HYPOTHESES

This chapter presents objectives, questions and hypotheses. Objectives will be presented first, followed with three questions and corresponding hypotheses.

Objectives

The following objectives were developed for this thesis.

- This study will identify the most common drugs found in postmortem toxicology screenings in Clark County, Nevada for 2005
- This study will evaluate the drugs found in toxicology screenings of decedents related to age, gender and ethnicity
- This study will evaluate drugs found in toxicology screening related to accidents, homicides, suicides and natural related deaths
- This study will examine pharmacotherapeutic interventions and determine what prescription drugs are associated with mortalities

Questions and Hypotheses:

From the above objectives the following questions and hypotheses were developed for this thesis.

Question 1

What are the major drugs associated with the four different modes of death (suicide, homicide, accident, natural)?

Hypothesis 1(a): Those drugs that are easily accessible (e.g. Prescription drugs, over-the-counter medications) will be most common in postmortem toxicology screenings

Method: A contingency table will be used to examine the distribution of drugs

Hypothesis 1(b): Inexpensive drugs (e.g. prescription, over-the-counter medications) will be highly prevalent in postmortem toxicology screenings

Method: A contingency table will be used to examine the distribution of drugs

Hypothesis 1(c): Alcohol will be most prevalent in motor vehicle fatalities

Method: A contingency table will be used to examine the distribution of drugs

Question 2

Is there a relationship between age, gender and ethnicity with the types of drugs detected in the body after death?

Hypothesis 2(a): Teenagers will be more likely to have drugs such as cannabis and alcohol

Method: A contingency table will be used to examine the distribution of drugs

Hypothesis 2(b): Males will be more likely to have a higher prevalence of drugs in their bodies than females

Method: A contingency table will be used to examine the distribution of drugs

Hypothesis 2(c): There will be a difference in drug use among ethnicities

Method: A contingency table will be used to examine the distribution of drugs

Hypothesis 2(d): Accidents and homicides will be one of the leading causes of deaths for children/infants

Method: A contingency table will be used to analyze causes of death in children/infants

Question 3

Is there an association between prescription drugs and mortality?

Hypothesis 3(a): Owing to easy accessibility in prescription drugs, there will be higher rates of prescription drug related mortalities

Method: Analyses of frequencies will be used to determine the distribution of drugs

Hypothesis 3(b): Depressants (benzodiazepines, barbiturates) will be the most commonly found drugs in the elderly (aged 65+)

Method: Analyses of frequencies will be used to determine the distribution of drugs

CHAPTER 4

METHODOLOGY

This chapter discusses the methodology associated with postmortem toxicology findings. Furthermore, the collection, categorization and statistical analyses of data will be presented.

Data

The data analyzed were taken from toxicology reports from the Quest Diagnostics Laboratory in Las Vegas, Nevada. Gas-Chromatography-Mass-Spectrometry was used to determine what toxicological substances were found in postmortem specimens. Specimens analyzed were blood, urine, liver, brain tissue, decomposition fluid and vitreous fluid. An Institutional Review Board (IRB) exemption (0606-1993) was filed with the UNLV Office for the Protection of Human Subjects and approved in order to conduct research with the data obtained.

All data in the database represented counts; therefore all data were analyzed using contingency tables. A chi-square or equivalent statistic was calculated for each contingency table.

After analyzing all data, some of the results were broken down into two different tables. One of the tables examined the results out of the total N (2426) while the other table examined the data within age, drug, gender or ethnicity categories. This was done

because different patterns were seen when examining the data within the total N as opposed to a particular category.

Age Categories

The following age categories, taken from the National Survey on Drug Use and Health, will be examined in order to find associations among age, fatalities and the types of drugs found postmortem. The following age categories were used: gestation, newborn/infant (<1 year), toddlers (1-4), children (5-11), middle and high school (12-17), college age (18-25), young adulthood (26-34), career and family (35-49), middle age (50-64) and retired (65+).

CHAPTER 5

RESULTS

The following results will address each question and relevant hypotheses addressed in this thesis. Appropriate chi-square distributions will be listed, as well as tables presenting overall results for all statistical analyses conducted in this thesis.

Males, Caucasians and those 65 years and above represented the greatest number of decedents. Accident-related deaths were highest of all modes of death (41.2%) with natural related deaths (37.6%) consisting of the next largest number of deaths found. Suicides consisted of 13.4% of all deaths, while homicides were at 7.8% (Tables 2 & 3).

[1]Table 2 Prevalence of mode of death separated by gender (within total N).

MODE	Female % (n)	Male % (n)
Natural	12.3 (298)	25.3 (613)
Accident	13.9 (336)	27.4 (663)
Suicide	3.0 (72)	10.4 (252)
Homicide	1.6 (39)	6.2 (151)

[1] A Chi-square analysis was used to determine the prevalence of mode of death separated by gender within 2,426 decedents from the Clark County Coroner's Office in 2005.

[2]Table 3 Prevalence of gender, ethnicity, mode of death and age.

Variable	*Category*	*Percent	Frequency
Gender	*Male*	69.2	1679
	Female	30.7	745
Ethnicity	*Caucasian*	75.1	1823
	African American	11.0	267
	Hispanic	11.1	269
	Asian	2.8	67
Mode of Death	*Natural*	37.6	913
	Accident	41.2	999
	Suicide	13.4	324
	Homicide	7.8	190
Age	*Gestation*	.5	12
	<1 (Newborn/Infant)	1.5	36
	1-4 (Toddler)	1.2	30
	5-11 (Childhood)	.5	11
	12-17 (Middle and High school)	1.7	42
	18-24 (College)	9.2	224
	25-34 (Young Adulthood)	9.6	234
	35-49 (Career and Family)	23.8	684
	50-64 (Middle Age)	23.5	571
	65+ (Retired)	28.2	684

*Total percent may not sum to 100% owing to non-reporting within certain variables

A more interesting result is found when examining death within the gender specific death category. When examining the data this way, females represented a greater majority of natural (40.0%) and accident-related deaths (45.1%) than males (Table 4).

Table 4 Prevalence of mode of death found within gender specific categories.

MODE	Female n=745 % (n)	Male n=1679 % (n)
Natural	40.0 (298)	36.5 (613)
Accident	45.1 (336)	39.5 (663)
Suicide	9.7 (72)	15.0 (252)
Homicide	5.2 (39)	9.0 (151)

[2] Prevalence of gender, ethnicity, mode of death and age categories found in 2,426 decedents from the Clark County Coroner's Office in 2005.

Question 1 addressed the major drugs found in four different modes of death (suicide, homicide, accident, natural). Of all decedents, ethanol was the most common substance found in natural-related deaths (7.1%) followed by opioids and morphine derivatives (3.4%) and depressants (2.0%). In accident-related deaths, opioids and morphine derivatives were highest (14.2%) followed by ethanol (9.7%) and stimulants (9.4%). Ethanol was found to be the most prevalent substance found in those who committed suicide (4.3%) followed by opioids and morphine derivatives (2.8%) and depressants (2.7%). In homicide-related deaths, ethanol (2.3%), stimulants (2.3%) and cannabinoids (1.7%) were the most prevalent substances found. More prescription medications, including antidepressants, depressants and opioid and morphine derivatives were found than expected by chance (χ^2=71.458, p<.05) in accident and suicide-related deaths. However, less over-the-counter medications were found than expected by chance in accident, suicide, and homicide-related deaths (χ^2=12.366, p=.015). Furthermore, the prevalence of alcohol in relation to suicides and homicides was found to be dependent (χ^2=29.095, p<.001) (Table 5).

[3]Table 5 Prevalence of mode of death separated by drug category (within total N)

Drug Categories/Mode of Death	Natural % (n)	Accident % (n)	Suicide % (n)	Homicide % (n)
Anabolic Steroids	0 (0)	0 (0)	0 (1)	0 (1)
Analgesics	1.7 (42)	2.3 (55)	1.4 (33)	0.1 (2)
Antidepressants	0.6 (14)	1.8 (43)	1.0 (24)	0.0 (1)
Cannabinoids	1.2 (28)	3.8 (92)	1.2 (28)	1.7 (41)
Depressants	2.0 (49)	7.0 (170)	2.7 (66)	0.5 (12)
Dissociative Anesthetics	0 (0)	0 (1)	0 (0)	0.1 (2)
Ethanol	7.1 (173)	9.7 (235)	4.3 (104)	2.3 (57)
Inhalants	0 (0)	0 (1)	0 (0)	0 (0)
Opioids and Morphine Derivatives	3.4 (82)	14.2 (343)	2.8 (67)	0.5 (12)
Other Compounds	1.1 (29)	1.5 (36)	0.5 (11)	0 (1)
Over-the-Counter Medications	1.0 (24)	0.8 (20)	0.7 (18)	0.2 (4)
Prescription Medications	1.7 (41)	5.2 (125)	1.3 (32)	0.4 (9)
Stimulants	1.5 (36)	9.4 (227)	1.9 (47)	2.3 (56)

[3] Data from 2,426 decedents were statistically analyzed using chi-square analysis. The prevalence of drugs present in decedents was determined within each mode of death.

A more striking pattern is found when examining drugs found within the four modes of death. Of all natural deaths, ethanol (18.7%) was the most common substance found in decedents followed by opioids and morphine derivatives (9.0%) and depressants (5.4%) Of all accident-related deaths, opioids and morphine derivatives were most prevalent (24.4%) followed by ethanol (23.7%) and stimulants (22.8%). Of all those who died of suicides, ethanol (32.0%), opioids and morphine derivatives (21.0%) and depressants (20.4%) were the most common substances found. Of all homicide-related deaths, ethanol (29.3%) stimulants (28.8%) and cannabinoids (21.2%) were most prevalent.

[4]Table 6 Prevalence of mode of death separated by drug categories (within mode of death

Drug Categories/Mode of death	Natural n=925	Accident n=1008	Suicide n=328	Homicide n=198
Anabolic Steroids	0 (0)	0 (0)	0.3 (1)	0.5 (1)
Analgesics	4.5 (42)	5.6 (56)	10.4 (34)	1.0 (2)
Antidepressants	1.5 (14)	4.2 (42)	7.3 (24)	0.5 (1)
Cannabinoids	3.0 (28)	9.1 (92)	8.5 (28)	21.2 (42)
Depressants	5.4 (50)	17.2 (173)	20.4 (67)	6.6 (13)
Dissociative Anesthetics	0 (0)	0.1 (1)	0.0 (0)	1.0 (2)
Ethanol	18.7 (29)	23.7 (36)	32.0 (11)	29.3 (1)
Inhalants	0 (0)	0.1 (1)	0 (0)	0 (0)
Opioids and Morphine Derivatives	9.0 (83)	34.4 (347)	21.0 (69)	6.6 (13)
Other Compounds	3.1 (173)	3.6 (239)	3.4 (105)	0.5 (58)
Over-the-Counter Medications	2.6 (24)	2.0 (20)	5.8 (19)	2.0 (4)
Prescription Medications	4.5 (42)	12.4 (125)	9.8 (32)	5.1 (10)
Stimulants	4.0 (37)	22.8 (230)	14.3 (47)	28.8 (57)

[4] Drugs were statistically analyzed using chi- square analysis. Each mode of death was examined and the prevalence of drugs present in decedents was determined.

Of all decedents who died of motor vehicle accidents (MVA), 25.5% had ethanol in their toxicology results, 10.8% had cannabinoids and 6.9% had opioid and morphine derivatives. More alcohol was found than expected by chance in all decedents who died of motor-vehicle fatalities (χ^2=29.095, p<.001; Table 7). When examining all suicide-related deaths, 2.1% of the decedents were found to have both ethanol and opioid/morphine derivatives in their toxicology screening.

Table 7 Prevalence of drugs present in decedents who died of motor vehicle fatalities in Clark County Nevada, 2005.

Drug Categories/Motor Vehicle Accidents	Motor Vehicle Accidents n=259 % (n)
Anabolic Steroids	0 (0)
Analgesics	2.7 (7)
Antidepressants	0.4 (1)
Cannabinoids	10.8 (28)
Depressants	5.0 (13)
Dissociative Anesthetics	0 (0)
Ethanol	25.5 (66)
Inhalants	0 (0)
Opioids and Morphine Derivatives	6.9 (18)
Other Compounds	3.9 (10)
Over-the-Counter Medications	1.5 (4)
Prescription Medications	4.6 (12)
Stimulants	10.4 (27)

Question 2 addressed the relationship among age, gender and race with the types of drugs detected in the body after death. After examining age and the type of substance found in decedents, there were more cannabinoids than expected by chance within those

between the ages of 12 and 17 (χ^2=225.483, p<.001). This finding was also consistent with those who were between 18 and 25 years of age. A greater number of college-age decedents (18-25) were also found to have more alcohol in their toxicology screenings than expected by chance (χ^2=108.505, p<.001).

Of all decedents, stimulants were most commonly found within the gestation age category (0.2%) while depressants and analgesics were most commonly found in those less than one year of age. Ethanol (3.0%) was the most prevalent substance found in college age decedents followed by cannabinoids (2.5%) and stimulants (2.0%). Ethanol (3.1%), opioids and morphine derivatives (2.9%) and stimulants (2.7%) were most common in young adulthood. Opioids and morphine derivatives (7.5%) represented the majority of substances found in those within the career and family age group followed by ethanol (6.7%) and stimulants (6.6%). Furthermore, ethanol was the most common substance found in middle age decedents (6.4%) and those who were 65 years of age and older (3.7%) (Table 8).

Of all antidepressants, prescription medications, depressants, analgesics, cannabinoids, opioid and morphine derivatives, stimulants, and ethanol, decedents within the career and family age group (aged 35-49) represented the highest number of these substances. Of all dissociative anesthetics (n=3), those in young adulthood represented the highest majority of decedents. When examining all over-the-counter medications (n=66) found in decedents, those who were between the ages of 50 and 64 had the highest prevalence of these substances (34.8%) (Table 9).

Furthermore, it is important to examine drug prevalence within specific age categories. Of all decedents who were between 12 and 17 years of age and those within

college years (18-25), ethanol and cannabinoids represented the majority of substances. Ethanol and opioids and morphine derivatives were most common among all those who were 26 years or older. Ethanol represented the majority of substances found within the elderly population (65+) followed by opioid and morphine derivatives and depressants. Although depressants were not the most common substances detected, they did represent 5.8% of the drugs found within those who were of 65 years of age and older. (Table 10).

[5]Table 8 Prevalence of drug categories separated by age (within total N)

Drug Categories/Age	Gestation % (n)	<1 yr (newborn or infant) % (n)	1-4 (Toddler) % (n)	5-11 (Childhood) % (n)	12-17 (Middle and high school) % (n)	18-25 (College) % (n)	26-34 (Young Adulthood) % (n)	35-49 (Career and Family) % (n)	50-60 (Middle Age) % (n)	65+ (Retired) % (n)
Anabolic Steroids	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.1 (2)	0 (0)	0 (0)	0 (0)
Analgesics	0 (0)	0.2 (4)	0.1(2)	0 (0)	0.1 (2)	0.2 (5)	0.7 (17)	2.0 (48)	1.4 (33)	0.9 (21)
Anti-depressants	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0.1 (3)	0.2 (5)	1.4 (35)	1.1 (27)	0.4 (10)
Cannabinoids	0 (0)	0 (0)	0 (0)	0 (0)	0.3 (8)	2.5 (60)	1.6 (38)	2.5 (60)	0.9 (21)	0.1 (2)
Depressants	0 (0)	0.2 (4)	0 (0)	0.1 (2)	0.1 (2)	0.8 (20)	1.8 (43)	4.4 (106)	3.3 (80)	1.7 (40)
Dissociative Anesthetics	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0.1 (2)	0 (0)	0 (0)	0 (0)
Ethanol	0 (1)	0 (1)	0 (0)	0 (1)	0.4 (10)	3.0 (73)	3.1 (75)	6.7 (162)	6.4 (155)	3.7 (89)
Inhalants	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Opioids and Morphine Derivatives	0 (1)	0.1 (2)	0 (1)	0 (0)	0.1 (3)	1.5 (37)	2.9 (71)	7.5 (181)	5.7 (138)	2.9 (70)
Other Compounds	0.0 (1)	0.0 (1)	0 (0)	0 (0)	0.0 (1)	0.3 (8)	0.3 (8)	1.2 (28)	0.7 (18)	0.5 (12)
Over-the-Counter Medications	0 (0)	0.1 (2)	0 (0)	0 (0)	0 (1)	0.2 (6)	0.2 (6)	0.6 (15)	0.9 (23)	0.5 (13)
Prescription Medications	0 (0)	0.1 (3)	0.0 (0)	0.0 (1)	0.1 (3)	0.6 (15)	1.0 (25)	3.5 (85)	2.0 (48)	1.1 (27)
Stimulants	0.2 (5)	0.1 (3)	0 (1)	0 (0)	0 (0)	2.0 (48)	2.7 (66)	6.6 (161)	2.8 (68)	0.5 (13)

[5] Data from 2426 decedents were taken from the Clark County Coroner's Office in 2005. The prevalence of drugs found in decedents was examined using chi-square analysis.

[6]Table 9 Prevalence of drug categories separated by age (within drug categories)

Drug Categories/Age	Gestation % (n)	<1 yr (newborn or infant) % (n)	1-4 (Toddler) % (n)	5-11 (Childhood) % (n)	12-17 (Middle and High school) % (n)	18-25 (College) % (n)	26-34 (Young Adulthood) % (n)	35-49 (Career and Family) % (n)	50-60 (Middle Age) % (n)	65+ (Retired) % (n)
Anabolic Steroids n=2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	100.0 (2)	0 (0)	0 (0)	0 (0)
Analgesics n=132	0 (0)	3.0 (4)	1.5 (2)	0 (0)	1.5 (2)	3.8 (5)	12.9 (17)	36.4 (48)	25.0 (33)	15.9 (21)
Anti-depressants n=81	0 (0)	0 (0)	0 (0)	0 (0)	1.2 (1)	3.7 (3)	6.2 (5)	43.2 (35)	33.3 (27)	12.3 (10)
Cannabinoids n=189	0 (0)	0 (0)	0 (0)	0 (0)	4.2 (8)	31.7 (60)	20.1 (38)	31.7 (60)	11.1 (21)	1.1 (2)
Depressants n=297	0 (0)	1.3 (4)	0 (0)	0.7 (2)	0.7 (2)	6.7 (20)	14.5 (43)	35.7 (106)	26.9 (80)	13.5 (40)
Dissociative Anesthetics n=3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	33.3 (1)	66.7 (2)	0 (0)	0 (0)	0 (0)
Ethanol n=569	0.2 (1)	0.2 (1)	0 (0)	0.2 (1)	1.8 (10)	12.9 (73)	13.2 (75)	28.6 (162)	27.3 (155)	15.7 (89)
Inhalants n=1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	100.0 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Opioids and Morphine Derivatives n=504	0.2 (1)	0.4 (2)	0.2 (1)	0 (0)	0.6 (3)	7.3 (37)	114.1 (71)	35.9 (181)	27.4 (138)	13.9 (70)
Other Compounds n=77	1.3 (1)	1.3 (1)	0 (0)	0 (0)	1.3 (1)	10.4 (8)	10.4 (8)	36.4 (28)	23.4 (18)	15.6 (12)
Over the Counters Medications n=66	0 (0)	3.0 (2)	0 (0)	0 (0)	1.5 (1)	9.1 (6)	9.1 (6)	22.7 (15)	34.8 (23)	19.7 (13)
Prescription Medications n=207	0 (0)	1.4 (3)	0.0 (0)	0.5 (1)	1.4 (3)	7.2 (15)	12.1 (25)	41.1 (87)	23.2 (48)	13.0 (27)
Stimulants n=366	1.4 (5)	0.8 (3)	0 (1)	0 (0)	0 (0)	13.2 (48)	18.1 (66)	44.1 (161)	18.6 (68)	3.6 (13)

[6] Chi-square analysis was conducted on data from the Clark County Coroner's Office, 2005. Of all drug categories, the prevalence of drugs was found separated by age.

[7]Table 10 Prevalence of drug categories separated by age (within age categories)

Drug Categories/ Age	Gestation n=12 % (n)	<1 yr (newborn or infant) n=36 % (n)	1-4 (Toddler) n=30 % (n)	5-11 (Childhood) n=11 % (n)	12-17 (Middle and High school) n=42 % (n)	18-25 (College) n=224 % (n)	26-34 (Young Adulthood) n=234 % (n)	35-49 (Career and Family) n=578 % (n)	50-64 (Middle Age) n=571 % (n)	65+ (Retired) n=684 % (n)
Anabolic Steroids	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.9 (2)	0 (0)	0 (0)	0 (0)
Analgesics	0 (0)	11.1 (4)	6.7 (2)	0 (0)	4.8 (2)	2.2 (5)	7.3 (17)	8.3 (48)	5.8 (33)	3.1 (21)
Anti-depressants	0 (0)	0 (0)	0 (0)	0 (0)	2.4 (1)	1.3 (3)	2.1 (5)	6.1 (35)	4.7 (27)	1.5 (10)
Cannabinoids	0 (0)	0 (0)	0 (0)	0 (0)	19.0 (8)	26.8 (60)	16.2 (38)	10.4 (60)	3.7 (21)	0.3 (2)
Depressants	0 (0)	11.1 (4)	0 (0)	18.2 (2)	4.8 (2)	8.9 (20)	18.4 (43)	18.3 (106)	14.0 (80)	5.8 (40)
Dissociative Anesthetics	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.4 (1)	0.9 (2)	0 (0)	0 (0)	0 (0)
Ethanol	8.3 (1)	2.8 (1)	0 (0)	9.1 (1)	23.8 (10)	32.6 (73)	32.1 (75)	28.0 (162)	27.1 (155)	13.0 (89)
Inhalants	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.4 (1)	0 (0)	0 (0)	0 (0)	0 (0)
Opioids and Morphine Derivatives	8.3 (1)	5.6 (2)	3.3 (1)	0 (0)	7.1 (3)	16.5 (37)	30.3 (71)	31.1 (181)	24.2 (138)	10.2 (70)
Other Compounds	8.3 (1)	2.8 (1)	0 (0)	0 (0)	2.4 (1)	3.6 (8)	3.4 (8)	4.8 (28)	3.2 (18)	1.8 (12)
Over the Counter Medications	0 (0)	5.6 (2)	0 (0)	0 (0)	2.4 (1)	2.7 (6)	2.5 (6)	2.6 (15)	4.0 (23)	1.9 (13)
Prescription Medications	0 (0)	8.3 (3)	0 (0)	9.1 (1)	7.1 (3)	6.7 (15)	10.7 (25)	14.7 (85)	8.4 (48)	3.9 (27)
Stimulants	41.7 (5)	8.3 (3)	3.3 (1)	0 (0)	0 (0)	21.4 (48)	28.2 (66)	27.9 (161)	11.9 (68)	1.9 (13)

[7] Data from the Clark County Coroner's office in 2005 were analyzed statistically using chi-square analysis. Of all decedents who were categorized into different age categories, the prevalence of drugs present was reported.

Of all decedents, opioids and morphine derivatives were the most commonly found substances found in females (7.8%) followed by depressants (4.9%) and ethanol (4.0%). Males were most likely to have ethanol in their toxicology screenings (19.5%) followed by opioids and morphine derivatives (13.0%) and stimulants (11.6%). More prescription medications were found than expected by chance in females, whereas less were found in males (χ^2=18.600, p<.001; Table 11).

[8]Table 11 Prevalence of drug categories separated by gender (within total N)

Drugs/Gender	Female % (n)	Male % (n)
Anabolic Steroids	0 (0)	0.1 (2)
Analgesics	2.1 (52)	3.3 (80)
Antidepressants	1.6 (38)	1.8 (43)
Cannabinoids	1.2 (30)	6.6 (159)
Depressants	4.9 (118)	7.4 (179)
Dissociative Anesthetics	0 (0)	0.1 (3)
Ethanol	4.0 (96)	19.5 (473)
Inhalants	0 (0)	0 (1)
Opioids and Morphine Derivatives	7.8 (190)	13.0 (313)
Other Compounds	0.9 (21)	2.3 (56)
Over-the-Counter Medications	0.9 (23)	1.8 (43)
Prescription Medications	3.8 (91)	4.8 (116)
Stimulants	3.5 (85)	11.6 (281)

[8] Data from 2426 decedents were taken from the Clark County Coroner's office in 2005. Chi-square analysis was used to statistically analyze the prevalence of drugs present in decedents who were categorized by gender.

Of all drug categories, males outnumbered females in the prevalence of substances found in toxicology screenings (Table 12).

[9]Table 12 Prevalence of drug categories separated by gender (within drug categories)

Drugs/Gender	Female % (n)	Male % (n)
Anabolic Steroids (n=2)	0 (0)	100.0 (2)
Analgesics (n=132)	39.4 (52)	60.6 (80)
Antidepressants (n=81)	46.9 (38)	53.1 (43)
Cannabinoids (n=189)	15.9 (30)	84.1 (159)
Depressants (n=297)	39.7 (118)	60.3 (179)
Dissociative Anesthetics (n=3)	0 (0)	100.0 (3)
Ethanol (n=569)	16.9 (96)	83.1 (473)
Inhalants (n=1)	0 (0)	100.0 (1)
Opioids and Morphine Derivatives (n=504)	37.7 (190)	62.3 (314)
Other Compounds (n=77)	27.3 (21)	72.7 (56)
Over-the-Counter Medications (n=66)	34.8 (23)	65.2 (43)
Prescription Medications (n=207)	44.0 (91)	56.0 (116)
Stimulants (n=366)	23.2 (85)	76.8 (281)

[9] Data taken from the Clark County Coroner's Office from 2005 were analyzed statistically. Each drug category was examined and the prevalence of drugs separated by gender was determined using chi-square analysis.

Of all female decedents, 25.5% had opioids and morphine derivatives in their toxicology screenings followed by depressants (15.8%) and ethanol (12.9%). Of all male decedents, ethanol (28.2%) represented the majority of all substances followed by 18.5% of opioid and morphine derivatives and 16.7% of stimulants (Table 13).

[10]Table 13 Prevalence of drug categories separated by gender (within gender)

Drugs/Gender	Female n=707 % (n)	Male n=1636 % (n)
Anabolic Steroids	0 (0)	0.1 (2)
Analgesics	7.0 (52)	4.8 (80)
Antidepressants	5.1 (38)	2.6 (43)
Cannabinoids	4.0 (30)	9.5 (159)
Depressants	15.8 (118)	10.7 (179)
Dissociative Anesthetics	0 (0)	0.2 (3)
Ethanol	12.9 (96)	28.2 (473)
Inhalants	0 (0)	0.1 (1)
Opioids and Morphine Derivatives	25.5 (190)	18.7 (314)
Other Compounds	2.8 (21)	3.3 (56)
Over-the-Counter Medications	3.1 (23)	2.6 (43)
Prescription Medications	12.2 (91)	6.9 (116)
Stimulants	11.4 (85)	16.7 (281)

[10] Data taken from the Clark County Coroner's Office from 2005 were analyzed statistically. Each gender category was examined and the prevalence of drugs was determined using chi-square analysis.

Ethanol (2.3%), stimulants (2.1%) and cannabinoids (1.4%) were the most common substances found in African Americans. Opioids and morphine derivatives (18.0%) were most common in Caucasians followed by ethanol (17.8%) and depressants (10.8%). Ethanol,was most commonly found in Hispanics and Asians (Tables 14 & 15).

[11]Table 14 Prevalence of drug categories separated by ethnicity (within total N)

Drug Categories/Ethnicity	African American % (n)	Caucasian % (n)	Asian % (n)	Hispanic % (n)
Anabolic Steroids	0 (0)	0.1 (2)	0 (0)	0 (0)
Analgesics	0.5 (12)	4.2 (102)	0.1 (2)	0.7 (16)
Anti-depressants	0.3 (8)	2.7 (66)	0 (1)	.2 (6)
Cannabinoids	1.4 (35)	5.5 (133)	0 (0)	0.9 (21)
Depressants	0.7 (16)	10.8 (262)	0.2 (4)	0.6 (15)
Dissociative Anesthetics	0.1 (2)	0 (0)	0 (0)	0 (1)
Ethanol	2.3 (57)	17.8 (432)	0.4 (9)	2.9 (71)
Inhalants	0 (0)	0 (0)	0 (0)	0 (1)
Opioids and Morphine Derivatives	1.4 (33)	18.0 (436)	0.3 (8)	1.1 (27)
Other Compounds	0.5 (11)	2.5 (60)	0 (0)	0.2 (6)
Over the Counter Medications	0.3 (8)	2.1 (50)	0 (1)	0.3 (7)
Prescription Medications	.7 (17)	7.0 (171)	.2 (4)	.6 (15)
Stimulants	2.1 (50)	10.7 (260)	0 (1)	2.3 (55)

[11] Data from 2426 decedents were taken from the Clark County Coroner's Office in 2005. A chi-square analysis was used to statistically analyze the prevalence of drugs present in decedents who were separated by ethnicity.

[12]Table 15 Prevalence of drug categories separated by ethnicity (within ethnicity)

Drug Categories/Ethnicity	African American n=267 % (n)	Caucasian n=1823 % (n)	Asian n=67 % (n)	Hispanic n=269 % (n)
Anabolic Steroids	0 (0)	0.1 (2)	0 (0)	0 (0)
Analgesics	4.5 (12)	5.6 (102)	3.0 (2)	5.9 (16)
Anti-depressants	3.0 (8)	3.6 (66)	1.5 (1)	2.2 (6)
Cannabinoids	13.1 (35)	7.3 (133)	0 (0)	7.8 (21)
Depressants	6.0 (16)	14.4 (262)	6.0 (4)	5.6 (15)
Dissociative Anesthetics	0.7 (2)	0 (0)	0 (0)	0.4 (1)
Ethanol	21.3 (57)	23.7 (432)	13.4 (9)	26.4 (71)
Inhalants	0 (0)	0 (0)	0 (0)	0.4 (1)
Opioids and Morphine Derivatives	12.4 (33)	23.9 (436)	11.9 (8)	10.0 (27)
Other Compounds	4.1 (11)	3.3 (60)	0 (0)	2.2 (6)
Over-the-Counter Medications	3.0 (8)	2.7 (50)	1.5 (1)	2.6 (7)
Prescription Medications	6.4 (17)	9.4 (171)	6.0 (4)	5.6 (15)
Stimulants	18.7 (50)	14.3 (260)	1.5 (1)	20.4 (55)

[12] Data taken from the Clark County Coroner's Office from 2005 were analyzed statistically. Each ethnicity category was examined and the prevalence of drugs was determined using chi-square analysis.

As hypothesized, accident and homicide-related deaths were most common among toddlers (aged 1-4) and those in childhood years (aged 5-11). Furthermore, more accident and homicide related deaths were found than expected by chance (χ^2=637.484, p<.001). Of the 30 children that died between the ages of 1 and 4, over half of them died of accidents, and nearly a quarter of them died as a result of homicide. Approximately 64% of those within childhood ages (aged 5-11) died from accidents (45%-motor vehicle accidents), while 27.3% died as a result of homicide (Table 16)

Those who were 65 years of age and older represented the majority of all natural-related deaths followed by those who were in middle age (aged 50-64) and those within career and family ages (aged 35-49). Accident-related deaths and suicides were highest among those between 35 and 49 years of age, and homicides were highest among those between the ages of 18 and 26 (Table 17 & 18). Natural-related deaths were highest among those in gestation and who were newborn or infant. Of all decedents who were toddlers (aged 1-4), accident-related deaths were highest (56.7%) followed by homicides (23.3%). Of all decedents who were between 12 and 49 years of age, accident-related deaths were highest while natural-related deaths were most common among all decedents who were 50 years of age and older (Tables 16 & 17).

[13]Table 16 Prevalence of age categories separated by mode of death (within total N)

Age/Mode of Death	Natural % (n)	Accident % (n)	Suicide % (n)	Homicide % (n)
Gestation	0.3 (7)	0.2 (5)	0 (0)	0 (0)
<1 (Newborn/infant)	0.9 (29)	0.4 (9)	0 (0)	0.2 (6)
1-4 (Toddler)	0.2 (6)	0.7 (17)	0 (0)	0.3 (7)
5-11 (Childhood)	0 (1)	0.3 (7)	0 (0)	0.1 (3)
12-17 (Middle and High school)	0.2 (5)	1.1 (26)	0.4 (9)	0.1 (2)
18-25 (College)	0.7 (16)	4.7 (113)	1.6 (39)	2.3 (56)
26-34 (Young Adulthood)	1.2 (29)	4.7 (114)	2.1 (50)	1.7 (41)
35-49 (Career and Family)	6.1 (148)	12.0 (289)	3.7 (90)	2.1 (51)
50-64 (Middle Age)	11.0 (267)	8.6 (209)	3.3 (79)	0.7 (16)
65+ (Retired)	17.1 (413)	8.6 (208)	2.3 (56)	0.3 (7)

[13] Data from 2426 decedents were taken from the Clark County Coroner's Office in 2005. A chi-square analysis was used to statistically analyze the age categories of decedents separated by mode of death.

[14]Table 17 Prevalence of age separated by mode of death (within age)

Age/Mode of Death	Natural % (n)	Accident % (n)	Suicide % (n)	Homicide % (n)
Gestation n=12	58.3 (7)	41.7 (5)	0 (0)	0 (0)
<1 (Newborn/infant) n=36	58.3 (21)	25.0 (9)	0 (0)	16.7 (6)
1-4 (Toddler) n=30	20.0 (6)	56.7 (17)	0 (0)	23.3 (7)
5-11 (Childhood) n=11	9.1 (1)	63.6 (7)	0 (0)	27.3 (3)
12-17 (Middle and High school) n=42	11.9 (5)	61.9 (26)	21.4 (9)	4.8 (2)
18-25 (College) n=224	7.1 (16)	50.4 (113)	17.4 (39)	25.0 (56)
26-34 (Young Adulthood) n=234	12.4 (29)	48.7 (114)	21.4 (50)	17.5 (41)
35-49 (Career and Family) n=578	25.6 (148)	50.0 (239)	15.6 (90)	8.8 (51)
50-64 (Middle Age) n=571	46.8 (267)	36.6 (209)	13.8 (79)	2.8 (16)
65+ (Retired) n=684	60.4 (413)	30.4 (208)	8.2 (56)	1.0 (7)

[14] Data taken from the Clark County Coroner's Office from 2005 were analyzed statistically. Each age category was examined and the mode of death was analyzed using chi-square analysis.

Question 3 addressed if there is an association between prescription drug use and mortality. Of all decedents who died with prescription medications in their toxicology screenings, accident-related deaths were most common, followed by those who died of natural-related deaths. Of all decedents who had depressants and antidepressants in their toxicology results, accident-related deaths were most common followed by suicides. Of those who had opioid and morphine derivatives in their toxicology screenings, 68.1% died of accident-related deaths (Table 18).

Of all those who had prescription medications in their toxicology screenings, accident-related deaths (60.4%) were most common, followed by those who died of natural causes (19.8). Within the antidepressant drug category accident-related deaths were highest (51.9%) followed by suicides (29.6%). Of all those who died with cannabinoids, accidents were most prevalent (48.7 %) followed by homicides (21.7%). Within all depressants, accidental deaths were highest (57.2%) followed by suicides (22.2%). Of all those who died with ethanol in their toxicology screenings, accident-related deaths were highest (41.3%). Among all opioids and morphine derivatives, accident-related deaths (68.1%).

[15]Table 18 Prevalence of mode of death separated by drug category (within drug category).

Drug Categories/Mode of Death	Natural % (n)	Accident % (n)	Suicide % (n)	Homicide % (n)
Anabolic Steroids (n=2)	0 (0)	0 (0)	50.0 (1)	50.0 (1)
Analgesics (n=132)	31.8 (42)	41.7 (55)	25.0 (33)	1.5 (2)
Antidepressants(n=81)	17.3 (14)	51.9 (42)	29.6 (24)	1.2 (1)
Cannabinoids (n=189)	14.8 (28)	48.7 (92)	14.8 (28)	21.7 (41)
Depressants (n=297)	16.5 (49)	57.2 (170)	22.2 (66)	4.0 (12)
Dissociative Anesthetics (n=3)	0 (0)	33.3 (1)	0 (0)	66.7 (2)
Ethanol (n=569)	30.4 (173)	41.3 (235)	18.3 (104)	10.0 (57)
Inhalants (n=1)	0 (0)	100.0 (1)	0 (0)	0 (0)
Opioids and Morphine Derivatives (n=504)	16.3 (82)	68.1 (343)	13.3 (67)	2.4 (12)
Other Compounds (n=77)	37.7 (29)	46.8 (36)	14.3 (11)	1.3 (1)
Over-the-Counter Medications (n=66)	36.4 (24)	30.3 (20)	27.3 (18)	6.1 (4)
Prescription Medications (n=207)	19.8 (41)	60.4 (125)	15.5 (32)	4.3 (9)
Stimulants (n=366)	9.8 (36)	62.0 (227)	12.8 (47)	15.3 (56)

[15] Drugs present in decedents were statistically analyzed using chi- square analysis. Each drug category was analyzed and the prevalence of drugs present in decedents was determined within each mode of death.

CHAPTER 6

DISCUSSION

The major drugs found in postmortem toxicology screenings as well as associations among age, gender and ethnicity will be discussed in this section. Potential prevention strategies will also be presented as possible solutions in decreasing the occurrence of drug-related deaths.

Major Drugs Found in Modes of Death

Antidepressants, depressants and opioid and morphine derivatives (including heroin metabolites) were not included in the prescription medication category analyzed. However, all these medications, cumulatively, represented the majority of substances found in decedents. Thus, as hypothesized, prescription medications were the most common substances found in all decedents who died in Clark County, Nevada in 2005. The high number of prescription drugs found in decedents could be a result of over-prescribing medications from physicians as well as the fact that Internet prescribing is a common way of accessing medications for the general population (Henney & Shuren, 2000). In order to help overcome this problem of prescription medications potentially leading to death, future research should be examined this issue in order to change policies and laws in regards to doctors who write prescriptions on the Internet, as well as to those Internet sites, which allow purchase of prescription drugs. This could help in preventing

unfortunate instances from occurring, such as prescription drug overdose leading to death. In order to prevent unintentional drug-related overdoes, counselors, drug rehabilitation centers and family members of people with substance use problems need to be aware that prescription drugs are highly prevalent within decedents in Clark County.

After examining the amount of prescription drugs found in decedents, the results indicate that we should consider changing policies for physicians in prescribing refills on medications, which have the potential for addiction (e.g. hydrocodone, methadone, benzodiazepines). Although, the research conducted did not examine whether or not it was prescription refills found in decedents, changing policies for how many prescription refills are allocated to individuals may help in taking unused medications off the shelves of potential substance users. Another way to prevent prescription medications from being abused or sold on the streets would be to have a place for people to return unused medications so that they can be properly destroyed.

As the literature suggests, ethanol alone represented the most common substance found in all four modes of death (Inaba & Cohen, 2004). However, the data analyzed did not take into consideration that decomposing bodies emit a certain percentage of ethanol after death. This may bias the results and could be a reason for the high numbers of ethanol found in the decedents (O'Neal & Poklis, 1996). Further research as to how much ethanol is common in decomposing bodies could be beneficial to future projects related to death and postmortem toxicology screenings.

Owing to the high representation of ethanol found among decedents in Clark County, programs such as Mothers Against Drunk Driving (MADD), the Nevada National Guard Counterdrug Taskforce and Drug Abuse Resistant Education (DARE) need to be aware

of how many adolescents are dying with ethanol in their bodies. These anti-drug programs can potentially help in further educating adolescents about the importance of abstinence from drugs and alcohol. Mass Media such as advertisements on the radio and television, as well as in newspapers and magazines can help in informing the public of the alarming statistics related to ethanol and death.

Of all decedents who died of homicide-related deaths, 3.6% of them had both benzoylecgonine (a metabolite of cocaine) and ethanol in their toxicology results. The combination of these two substances can form cocaethylene. As mentioned in the literature review, the presence of cocaethylene can lead to more violent behavior than cocaine or ethanol alone (Inaba & Cohen, 2004). This explains why those who had both benzoylecgonine and ethanol in their toxicology screenings died as a result of homicide.

Alcohol and Motor Vehicle Fatalities

Consistent with the literature, alcohol was the most prevalent substance found in motor vehicle fatalities (Kelly et al., 2004). The next most common substances found in motor vehicle accidents were cannabinoids and stimulants. From the data, it is obvious that there is not only a high correlation between alcohol and motor vehicle fatalities, but there is also a significant relationship between alcohol and all modes of death, weather it be natural-related causes or those that resulted from homicides. Analyses suggested that one out of every four motor vehicle fatalities in Clark County involved alcohol. Law makers should therefore consider implementing harsher sentences on those who drive under the influence. Public health professionals such as university educators, counselors and physicians need to educate the public, especially those who are most vulnerable (i.e.

teenagers and college-age individuals) about the deleterious effects alcohol can have on one's life.

Assistance from restaurants and bars can also help in avoidance of drunk drivers being on the streets. Phone numbers of taxi services posted on signs within these facilities may help those who are intoxicated to take a cab home after a night of drinking. Also, volunteer programs designed to drive intoxicated individuals home during peak drinking hours could also be beneficial in avoiding fatalities related to ethanol abuse.

Cannabinoids should also be screened for once someone is brought to jail after being charged with drunk driving. If such drugs are found upon testing, harsher sentences should be given. This could also be implemented against people who are found with other drugs such as stimulants, opioids and depressants.

Prevalence of Drugs Found in Age, Gender and Ethnicity

Age

Of all substances, ethanol and cannabinoids were most prevalent in the toxicology screening of teenagers. This suggests that anti-drug programs such a DARE and MADD need to be not only aware of these statistics, but also need to address people within this age group. Individuals within such age categories may be more susceptible to peer-pressure and rebellious behavior and therefore attention needs to be focused upon teenagers in order to help prevent drug-related fatalities (Gottfredson & Koper, 1996).

Gender

Of all decedents, there was a higher prevalence of all substances found in males. Owing to the fact that males often engage in more rebellious and risky behaviors than

females, the findings of more drug substances in males, is not surprising (Gottfredson & Koper, 1996). However, females were more likely to have prescription medications including antidepressants, depressants and opioid and morphine derivatives than males. When looking at male decedents, there was a higher prevalence of ethanol, cannabinoids and stimulants than in females. Programs such as DARE, MADD and the National Guard Counterdrug Taskforce could design classes which focus on preventing males and females from becoming substance abusers with drugs they are more susceptible in using. The fact that teenagers (aged 12-17) were more likely to have ethanol and cannabinoids in their toxicology screenings also suggests that the anti-drug programs may have failed in reaching these individuals. This indicates that anti-drug programs should consider changing their programs in order to better address adolescents and substance abuse.

Ethnicity

Caucasians represented the majority of all decedents. Of all African Americans, Asians and Hispanics, ethanol was the most prevalent substance found, while opioids and morphine derivative were most commonly found in Caucasians. Statistically, it was found that Caucasians were most likely to have substances such as prescription medications in their toxicology screenings, while African Americans and Hispanics were more likely to have substances such as Stimulants and Cannabinoids in their toxicology screenings upon death. Thus, as hypothesized, there is a difference in substance abuse among ethnicity. Owing to these facts, courses or programs designed for specific cultures or ethnicities could help educate those who are at risk for drug-related mortality. According to the US Census Bureau, nearly a quarter of Nevada's population in 2005 consisted of Hispanics (US Census Bureau, 2005). There is a potential language barrier

among this group of individuals. Coordinating programs that are designed for those who are not proficient with the English language could be beneficial in educating not only Hispanics, but also other ethnicities and cultures about drug-related mortalities.

Accidents, Homicides and Children

As hypothesized, accident and homicide-related deaths were the top two leading causes of death among toddlers (aged 1-4) and those in childhood years (aged 5-11). It is important that parents and law enforcement personnel in Clark County, Nevada are aware of the alarming statistics among homicides and accident-related deaths in children. Parents need to be more cautious when leaving their children unattended for any period of time, and lawmakers should consider changing the policies that are enforced against parents with any kind of domestic violence history. This can help prevent those who are unsuitable for parenthood to either put their children up for adoption or even find help in treating their problems. Such alternatives can furthermore prevent children from the risks of domestic violence and homicide. Also, implementing higher fines or jail sentences against parents who are caught driving recklessly with children could also help in preventing accidents among children. Educating and informing day care facilities and pre-school workers about the signs of child abuse can also help in preventing homicides among young children. Posting phone numbers of domestic violence hotlines such as S.A.F.E. House or Safe Nest within child day care facilities for circumstances where abuse is suspected may also help in addressing violence against children who are vulnerable. Children should also be aware of what abuse is and know how to approach a teacher or nanny if they are being abused by their parents. Lectures in elementary schools

or pre-schools could educate younger children about the difference between a spanking and an unnecessary beating.

Prescription Drugs and Mortality

Prescription drugs (including antidepressants, depressants and opioid and morphine derivatives) represented the majority of substances found in all decedents. Whether or not these drugs led do the demise of the decedents, there is obviously a significant association among prescription drugs and death. Future research considering policy changes could potentially help prevent the abuse of prescription drugs. Education, intervention and monitoring of prescription drugs are a few prevention strategies, which could be useful in order to control the "epidemic" of prescription drugs. Illicit abuse of prescription drugs can lead to precarious events such as crime, homicide, suicide and death resulting from accidental overdoses. Informing the public about the statistics when it comes to deaths related to prescription drug abuse is important in the prevention of serious public health issues. Substituting commonly abused prescription drugs such as methadone for buprenorphine also may help in preventing potential problems with pharmacotherapeutic drugs (Jones, 2004). Knowing the statistics relating to the abuse of prescription drugs will furthermore help encourage public health workers to target high-risk groups for prevention and treatment programs.

Ethanol represented the majority of substances found within the elderly (aged 65+) followed by opioid and morphine derivatives and depressants. Owing to the fact that prescription medications and depressants were among the top three most common substances found in decedents, it is obvious that prescription medications are a problem

among the elderly (aged 65+). Not only can these drugs be misused and abused, but they may also lead to death if not taken as directed. Because the elderly (aged 65+) are closer to death and suffering from more ailments than the rest of the population, they may be more susceptible to taking a few extra depressants in order to end their lives too soon. Physicians need to be aware of the fact that there is a significant statistical correlation between elderly (aged 65+) death and prescription medications. Thus, future research should look at changing policies related to the possibility of over-prescribing medications to the elderly (aged 65+).

Research Limitations

The lack of all concentrations of drug substances prevented pharmacokinetic models from being considered. However, alcohol, cocaine and heroin were all quantified and could be of use for further studies to examine concentrations of drugs found within decedents.

At the time the data were collected, some of the causes of death were pending or undetermined. A separate study could be conducted with these data to see if there are associations between undetermined deaths and drugs. As mentioned earlier, ethanol is common in decomposing bodies. Further research, which would take into consideration the exact amounts of ethanol in decomposing bodies released upon death, could also be examined in future studies.

Although ethanol and motor vehicle fatalities were examined in this study, it was not noted whether or not the decedent was the driver of the car, or a passenger who happened to be intoxicated at the time of death. Therefore, future research could examine if it was

indeed ethanol which led to the motor vehicle fatality and provide a more accurate study relating to motor vehicle deaths and ethanol.

Examining the environment of each decedent could have also been beneficial to this study. This can furthermore help in determining the relationship of manners of death and the different substances detected in particular demographic areas of Clark County.

Another limitation is that some of the decedents may have been visiting an area in Clark County at the time of their death. Although they may have actually lived in another state or county, they were examined at the Clark County, Coroner's office. Furthermore, this may bias the results. Therefore looking into the deaths of people who were residents of only Clark County may provide a more accurate study when examining associations of drugs and death.

CHAPTER 7

SUMMARY

This project demonstrated that drugs, whether they be prescription medications, over-the counter medications, or illicit substances, may not always be directly associated with deaths in Clark County, but that there is a significant relationship among drug use and death. Previous research and studies have supported these findings; however, after analyzing the data of prescription medications and ethanol in different modes of death, it is obvious that there is a problem with drug use leading to death, which needs to be addressed.

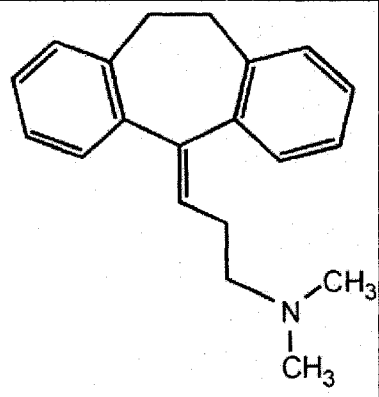
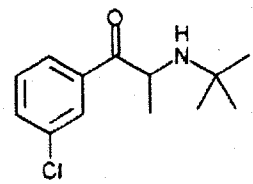
This study was the first report of drug-related mortalities conducted in Clark County, Nevada. It is important to inform the public of the associations between ethnicity, age, gender and toxicological findings in different modes of death. Furthermore, examining the years prior to 2005 should also be conducted in order to analyze potential trends in drug-related mortality.

The public needs to not only be aware of the facts related to drugs and death, but action also needs to be taken in order to prevent drug-related mortality. Further research should look at changing policies, laws and education practices in order to help decrease the prevalence of drugs found in not only postmortem decedents, but also help prevent abuse in those who are living. The findings from this research complimented previous studies related to drug use, and also showed statistics about death and mortality that have

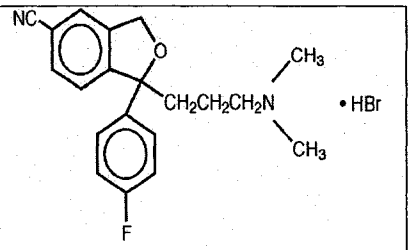
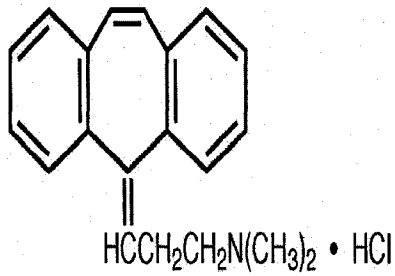
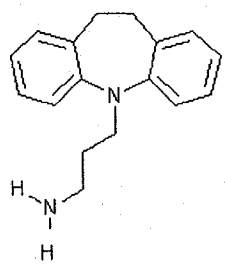
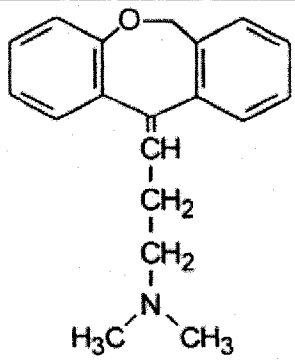
not been studied to this date. It is important that research continues to be done in regards to mortality and drugs in order to address substance abuse and help prevent unfortunate circumstances from occurring within Clark County, Nevada.

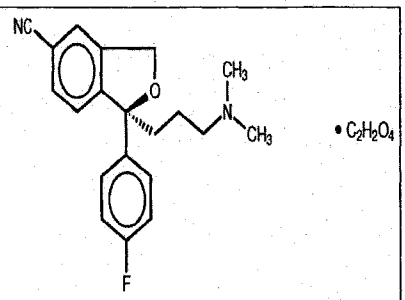
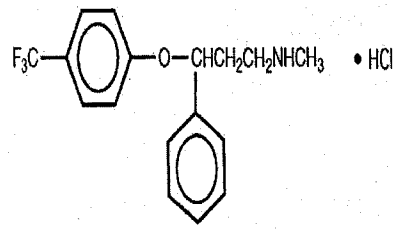
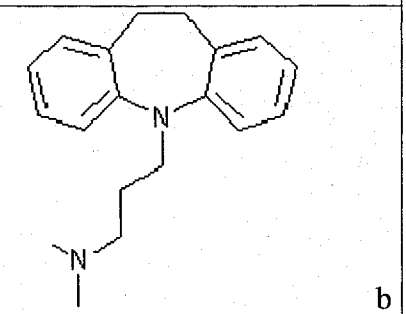
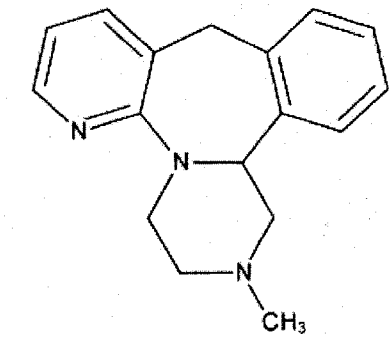
APPENDIX I

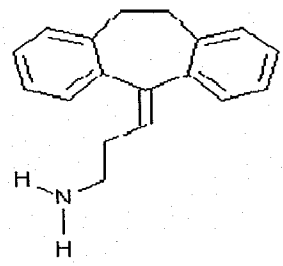
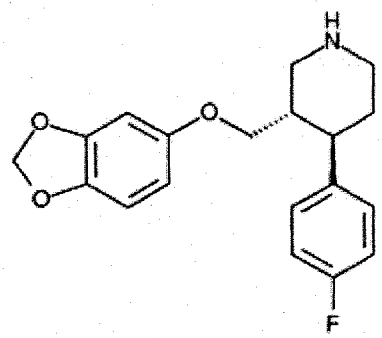
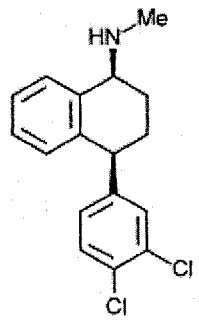
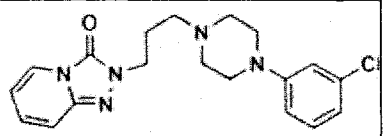
ANTIDEPRESSANTS

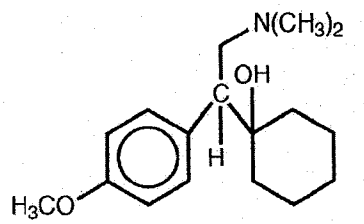
Common/"street"/ BRAND NAME	CHEMICAL NAME	[1]STRUCTURE
Amitriptyline, ELAVIL®, TRYPTANOL®, ENDEP®, TRYPTIZOL®	3-(10,11-dihydro-5H-dibenzo[a,d] cycloheptene-5-ylidene)-N, N-dimethyl-1-propanamine	 b
Bupropion, WELLBUTRIN®	(±)-1-(3-chlorophenyl)-2-[(1,1-dimethylethyl)amino]-1-propanone	 b

[1] a-PDR (Physicians Desk Reference); b-www.emolecules.com

Citalopram, CELEXA®	(±)-1-(3-dimethylaminopropyl)-1-(4-fluorophenyl)-1,3-dihydroisobenzofuran-5-carbonitrile, HBr	 a
Cyclobenzaprine, FLEXERIL®	3-(5 *H* -dibenzo[*a,d*] cyclohepten-5-ylidene)-*N* , *N* -dimethyl-1-propanamine hydrochloride	 a
Desipramine, NORPRAMIN®, PERTOFRANE®	Desipramine	 b
Doxepin, APONAL®	11-(3-(Dimethylamino) propylidene)-6H-dibenz(b,e)oxepine	 b

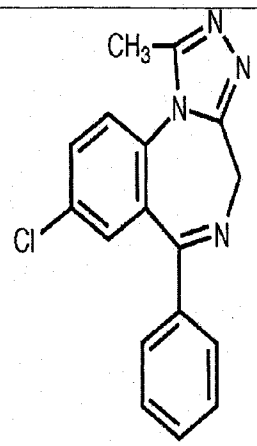
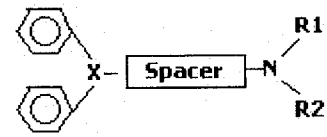
Escitalopram, LEXAPRO®	S-(+)-1-[3-(dimethyl-amino)propyl]-1-(p - fluorophenyl)-5-phthalancarbonitrile oxalate	 a
Fluoxetine, PROZAC®	(±)-N-methyl-3-phenyl-3-[((alpha),(alpha),(alpha)-trifluoro- p - tolyl)oxy]propylamine hydrochloride	 a
Imipramine, ANTIDEPRIN®, JANIMINE®, TOFRANIL®	Impramine Hydrochloride	 b
Mirtazapine, REMERON®	1,2,3,4,10,14b-hexahydro-2-methylpyrazino[2,1-a] pyrido [2,3-c] benzazepine	 b

Nortriptyline, AVENTYL®, PAMELOR®	3-(10,11-dihydro-5H-dibenzo[a,d] cyclohepten-5-ylidene)- N-methyl-1-propanamine	 b
Paroxetine, PAXIL CR®	(3S-trans)-3-((1,3-Benzodioxol-5-yloxy)methyl)- 4-(4-fluorophenyl)-piperidine hydrochloride	 b
Sertraline, ZOLOFT®	(1S-cis)-4-(3,4-dichlorophenyl)-1,2,3,4-tetrahydro-N-methyl-1-naphthalenamine hydrochloride	 b
Trazodone, DESYREL®	8-[3-[4-(3-chlorophenyl)piperazin -1-yl]propyl]-6,8,9-triazabicyclo[4.3.0] nona-2,4,9-trien-7-one	 b

Venlafaxine, EFFEXOR®	(R/S)-1-[2-(dimethylamino)-1-(4-methoxyphenyl)ethyl] cyclohexanol hydrochloride	 a

APPENDIX II

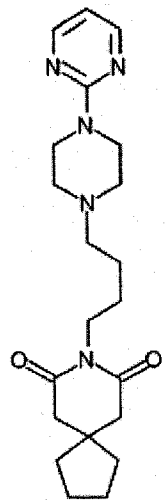
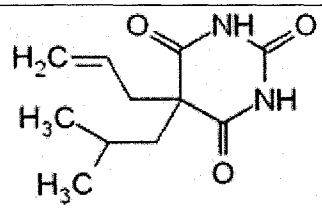
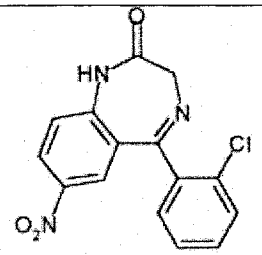
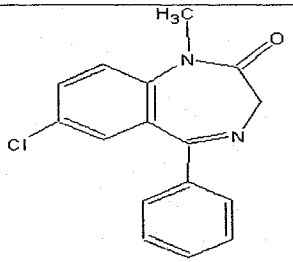
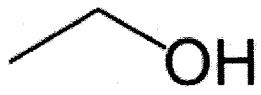
DEPRESSANTS

Common/"street"/ BRAND NAME	CHEMICAL NAME	*STRUCTURE
[1]Alprazolam, XANAX XR®	8-chloro-1-methyl-6-phenyl-4 *H-s* – triazolo [4,3-(alpha)] [1,4] benzodiazepine	 a
[2]Antihistamine	H_1-receptor Antagonists	 b

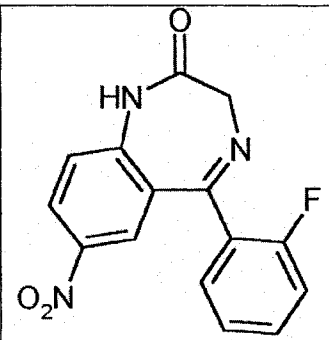
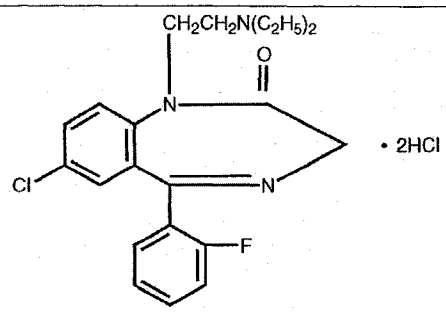
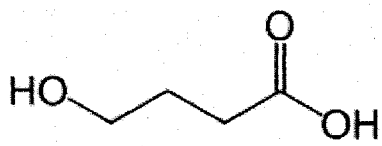
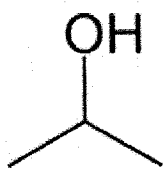
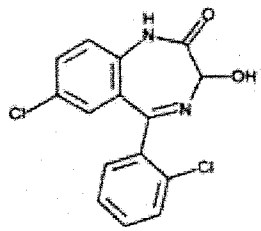
* a-PDR (Physicians Desk Reference); b-www.emolecules.com

[1] Benzodiazepine Class

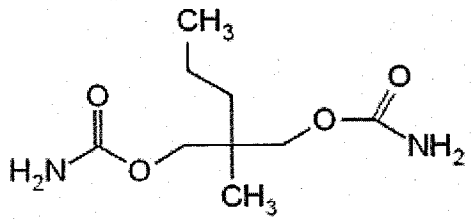
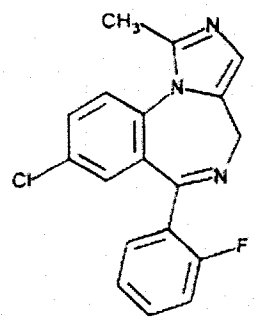
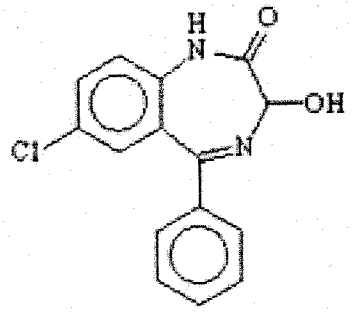
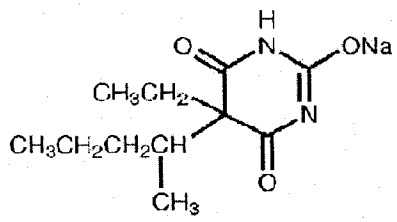
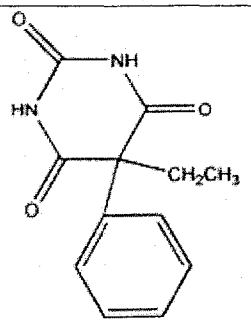
[2] Diphenhydramine

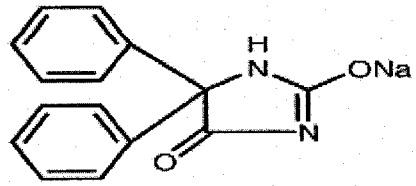
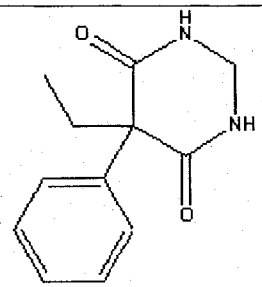
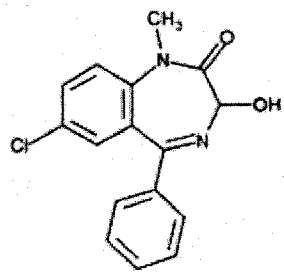
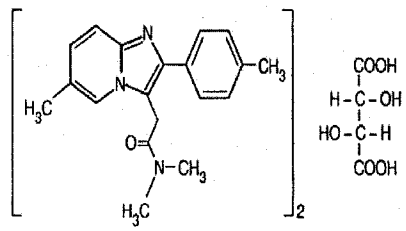
Buspirone, BUSPAR®	N/A	 b
Butalbital, AXOCET®, BUCET®, BUPAP®	5-(2-methylpropyl)-5-(2-propenyl)-2,4,6(1H,3H,5H)-pyrimidinetrione	 b
Clonazepam, KLONOPIN®	6-(2-chlorophenyl)-9-nitro-2,5-diazabicyclo [5.4.0] undeca-5,8,10,12-tetraen-3-one	 a
[2]Diazepam, VALIUM®, SEDUXEN®, APOZEPAM®	7-chloro-1-methyl-5-phenyl-1,3-dihydro-2H-1,4-benzodiazepin-2-one	 a
Ethanol	Ethyl alcohol	 b

[2] Benzodiazepine Class

Flunitrazepam, ROHYPNOL®, "forget-me pill," "Mexican Valium," "R2," "roofies"	6-(2-fluorophenyl)-2-methyl-9-nitro-2,5-diazabicyclo [5.4.0] undeca-5,8,10,12-tetraen-3-one	 b
Flurazepam, DALMANE®	7-chloro-1-[2-(diethylamino)ethyl]-5-(*o* -fluorophenyl)-1,3-dihydro-2 *H* – 1,4-benzodiazepin-2-one di hydrochloride	 a
Gamma-Hydroxybutyrate, "GHB", Fantasy, G, Juice, Liquid Ecstasy, & Gamma-OH, XYREM®	4-Hydroxybutanoic acid	 b
Isopropanol	Isopropyl alcohol	 b
[1]Lorazepam, ATIVAN®	9-chloro-6-(2-chlorophenyl)-4-hydroxy-2,5-diazabicyclo[5.4.0] undeca-5,8,10,12-tetraen-3-one	 b

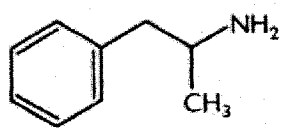
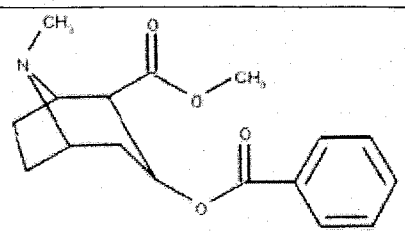
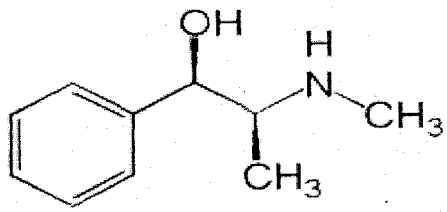
[1] Benzodiazepine Class

Meprobamate, MILTOWN®	[2-(carbamoyloxy methyl)-2-methyl-pentyl] carbamate	 b
Midazolam, VERSED®, HYPNOVEL®, DORMICUM®	8-chloro-6-(2-fluorophenyl)-1-methyl-4H-Imidazo(1,5-a) (1,4) benzodiazepine	 b
Oxazepam, ALEPAM®, MURELAX®, SERAX®, SEREPAX®, SERESTA®	9-chloro-4-hydroxy-6-phenyl-2,5-diazabicyclo [5.4.0] undeca-5;8,10,12-tetraen-3-one	 b
Pentobarbital, NEMBUTAL®	5-ethyl-5-(1-methylbutyl) barbiturate	 a
[1]Phenobarbital, LUMINAL®	5-ethyl-5-phenyl-1,3-diazinane-2,4,6-trione	 b

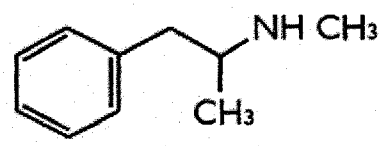
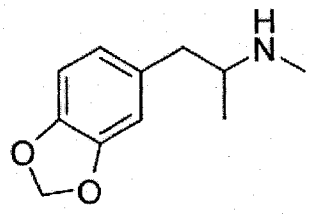
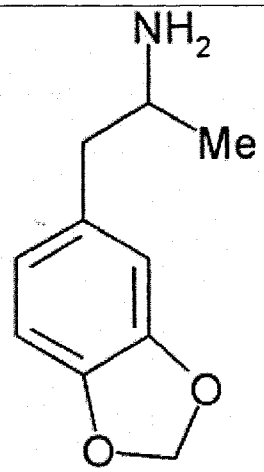
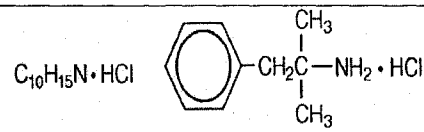
Phenytoin, DILANTIN®	5,5-diphenyl-2,4-imidazolidinedione	 a
Primidone, MYSOLINE®	5-ethyl-5-phenyl-1,3-diazinane-4,6-dione	 b
Temazepam, RESTORIL®	7-Chloro-1,3-dihydro-3-hydroxy-1-methyl-5-phenyl-1,4-benzodiazepin-2-one	 b
Zolpidem , AMBIEN®	N,N,6-trimethyl-2-p-tolylimidazo[1,2-a] pyridine-3-acetamide L-(+)-tartrate (2:1)	 a

APPENDIX III

STIMULANTS

Common/"street" /BRAND NAME	CHEMICAL NAME	***STRUCTURE
*Amphetamine, BIPHETAMINE® "speed," "bennies," "black beauties," "uppers," "crosses"	1-phenylpropan-2-amine	 b
*Cocaine, COCAINE HYDROCHLORIDE® "crack," "coke" **Benzoylecgonie	[1R-(exo,exo)]-3-(Benzoyloxy)-8-methyl-8-azabicyclo [3.2.1]octane-2-carboxylic acid methyl ester	 b
Ephedrine	(1*R*,2*S*)-2-methylamino-1-phenylpropan-1-ol	 b

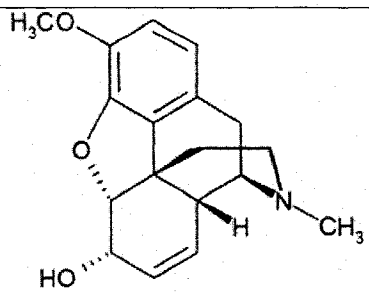
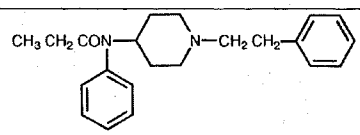
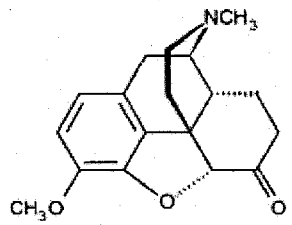
*"street name" taken from NIDA
**Cocaine metabolite
*** a-PDR (Physicians Desk Reference); b-www.emolecules.com

*Methamphetamine, DESOXYN®, "crystal," "crank," "ice," "meth," "speed"	(S)-N-methyl-1-phenyl-propan-2-amine	 b
*Methylenedioxymethamphetamine ,MDMA, "ecstacy", "E", "XTC", "X", "Adam"	1-(benzo[d][1,3]dioxol-5-yl)-N-methylpropan-2-amine	 b
Methylenedioxyamphetamine, MDA	3,4-methylene dioxyamphetamine	 c
Phentermine, ADIPREX-P®, OBENIX®, OBY-TRIM®	(alpha),(alpha)-Dimethyl phenethylamine hydrochloride	 a

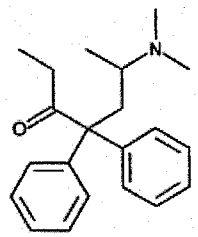
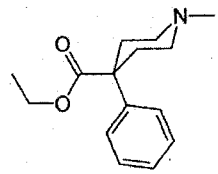
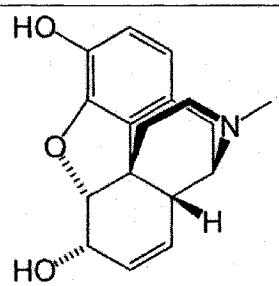
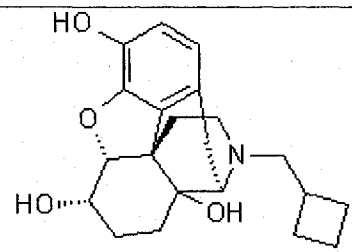
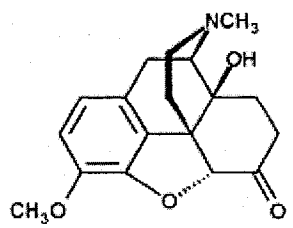
*"street names" taken from NIDA

APPENDIX IV

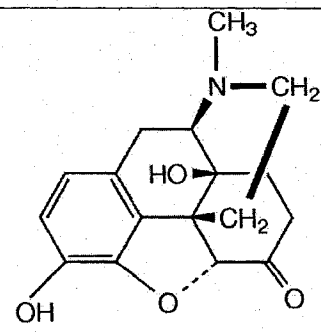
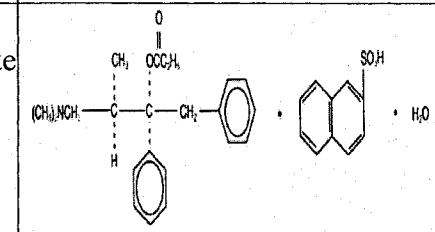
OPIOIDS AND MORPHINE DERIVATIVES

Common/"street"/ BRAND NAME	CHEMICAL NAME	*STRUCTURE
**Codeine, ROBITUSSIN A-C®, "cody," "Captain Cody"	7,8-didehydro-4,5-epoxy-3-methoxy-17-methylmorphinan-6-ol	 a
Fentanyl, DURAGESIC®	N-Phenyl-N-(1-(2-phenylethyl) 4-piperidinyl) propanamide	 a
**Hydrocodone, VICODIN®, ANEXIA®, LORCET®, LORTAB®, "vike," "Watson-387"	4,5a-Epoxy-3-methoxy-17-methylmorphinan-6-one tartrate (1:1) hydrate (2:5)	 a

* a-PDR (Physicians Desk Reference); b-www.emolecules.com
** Street names taken from NIDA

Methadone, DOLOPHINE®	6-(dimethylamino)-4,4-diphenyl-3-heptanone	 b
Meperidine/Pethidine, ALGIL®, DEMEROL®	Ethyl-1-methyl-4-phenylpiperidine-4-carboxylate	 b
**Morphine, ROXANOL®, "M," "Miss Emma," "monkey" ***Heroin	7,8-didehydro-4,5-epoxy-17-methylmorphinan-3,6-diol	 a
Nalbuphine, NUBAIN®	(-)-17-(cyclobutylmethyl)-4, 5alpha-epoxymorphinan-3,6alpha,14-triol hydrochloride	 a
Opiates (morphine, codeine)	See morphine/codeine	See morphine/codeine
**Oxycodone, OXYCONTIN® "Oxy," "O.C.," "killer"	4, 5-epoxy-14-hydroxy-3-methoxy-17-methylmorphinan-one	 a

*a-PDR (Physician's Desk Reference); b-www.emolecules.com

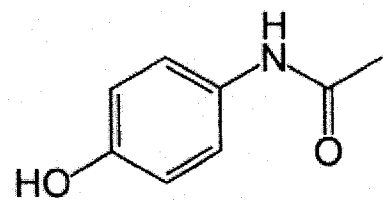
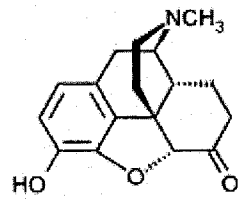
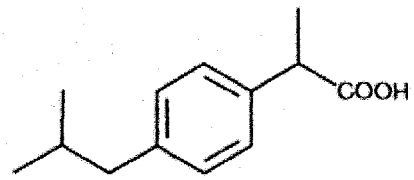
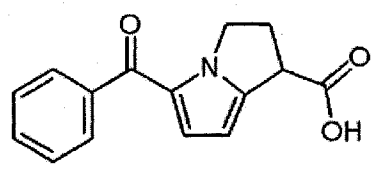
Oxymorphone, NUMORPHAN®	4.5α-Epoxy-3, 14-dihydroxy-17-methylmorphinan	 a
Propoxyphene	Ethyl-1-methyl-4-phenylpiperidine-4-carboxylate	 b

** Street names taken from NIDA

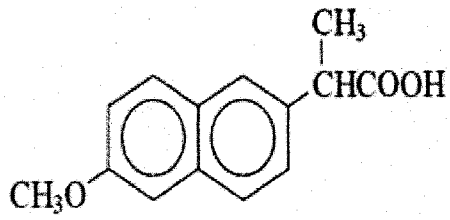
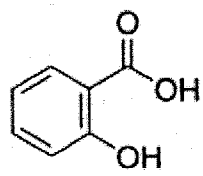
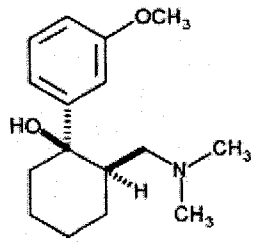
*** Narcotic derived from Morphine (6-Monoacetylmorphine-metabolite of heroin)

APPENDIX V

ANALGESICS

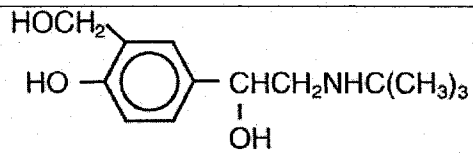
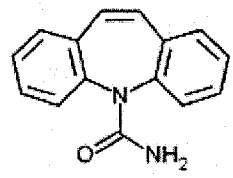
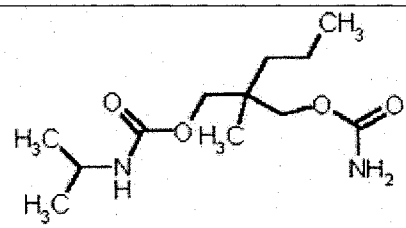
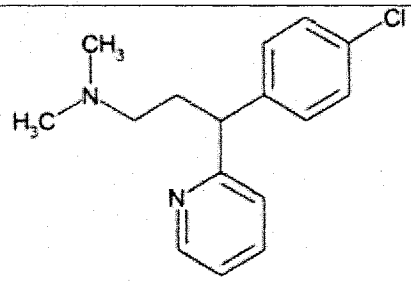
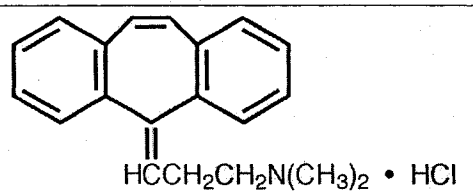
Common/"street"/BRAND NAME	CHEMICAL NAME	*STRUCTURE
Acetaminophen/Paracetamol, TYLENOL®, MIDOL®	N-(4-hydroxyphenyl) acetamide	 b
Hydromorphone, DILAUDID®	4,5-α-epoxy-3-hydroxy17-methyl-morphinan-6-one	 a
Ibuprofen, ACT3®,ADVIL®, BRUFEN®, NUPRIN®	2-[4-(2-methylpropyl) phenyl]propanoic acid	 a
Ketorlac, TORADOL®	(±)-5-benzoyl-2,3-dihydro-1H-pyrrolizine-1-carboxylic acid, 2-amino-2-(hydroxymethyl)-1,3-propanediol	 a

* a-PDR (Physician's Desk Reference); b-www.emolecules.com

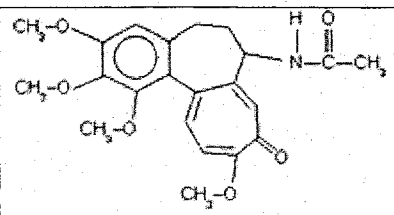
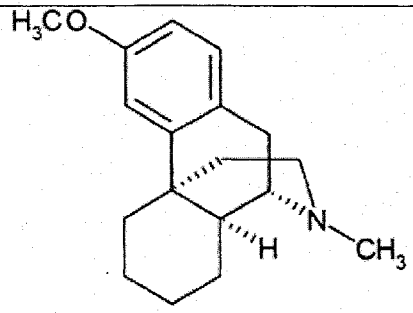
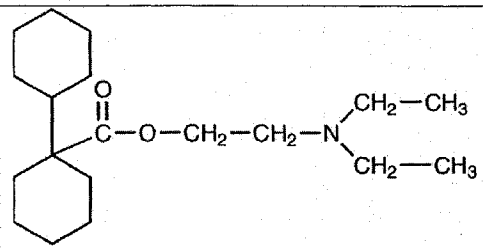
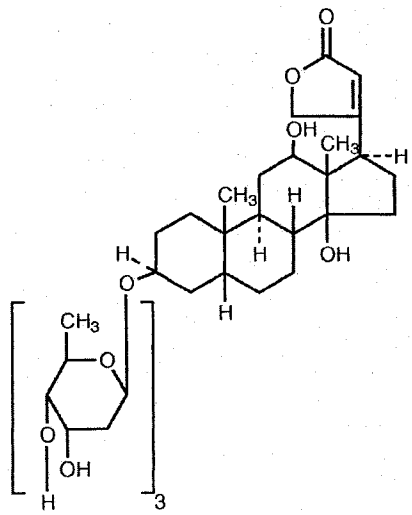
Naproxen	(S)-6-methoxy-α-methyl-2-naphthaleneacetic acid	 a
Salicylate/Salicylic acid	2-hydroxybenzoic acid	 b
Tramadol, ULTRAM®	*rac*-(1*R*,2*R*)-2-(dimethylamino methyl)-1-(3-methoxyphenyl)-cyclohexanol	 b

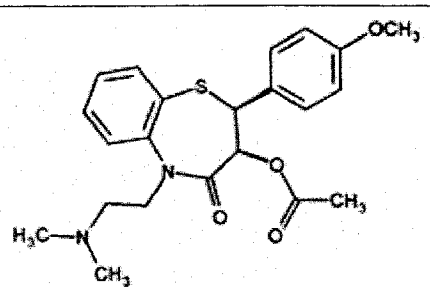
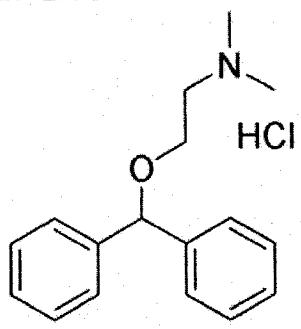
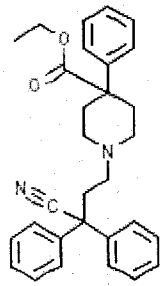
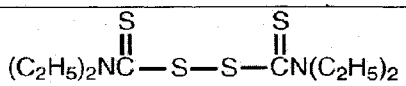
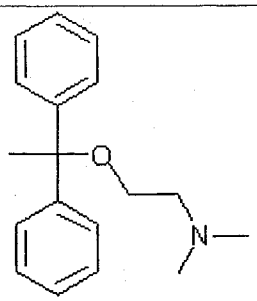
APPENDIX VI

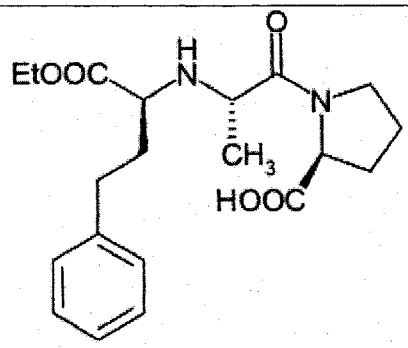
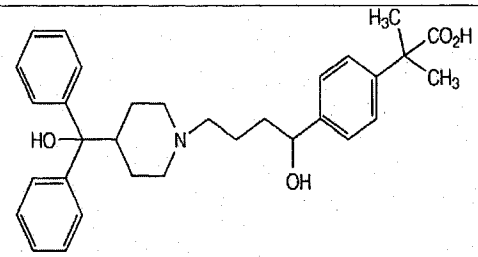
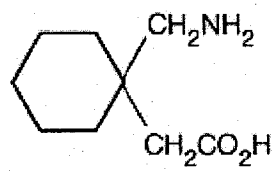
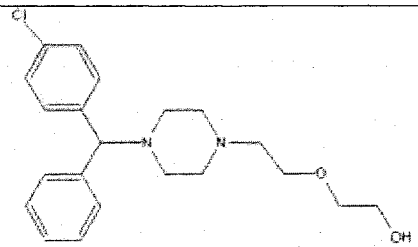
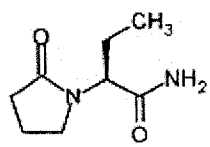
OTC/PRESCRIPTION MEDICATIONS

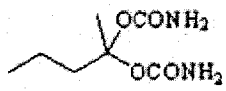
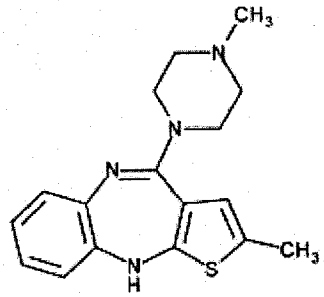
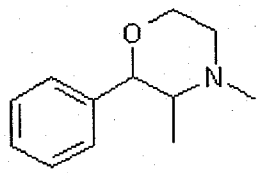
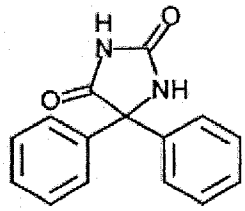
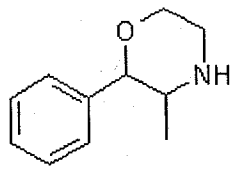
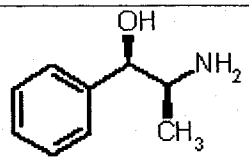
Common/"street"/ BRAND NAME	CHEMICAL NAME	*STRUCTURE
Albuterol, PROVENTIL®	(alpha) [1] -[(*tert* -butylamino) methyl]-4-hydroxy- *m* -xylene-(alpha), (alpha)'-diol)	 a
**Carbamazepine, CARBATROL®	5H-dibenz(b,f) azepine-5-carboxamide	 a
Carisoprodol, SOMA®	N-isopropyl-2-methyl-2-propyl-1,3-propanediol dicarbamate	 b
Chlorphenamine, Chlor-Trimeton®	(3RS)-3-(4-chlorophenyl)-N,N-dimethyl-3-(pyridin-2-yl)propan-1-amine	 b
Clyclobenzaprine HCL, FLEXERIL®	3-(5 *H* -dibenzo[*a,d*] cycloheptен-5-ylidene) *N* , *N* -dimethyl-1-propanamine hydrochloride	 a

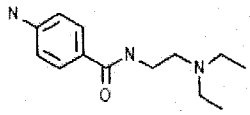
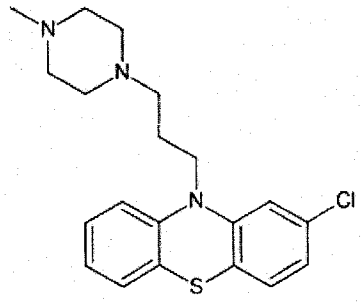
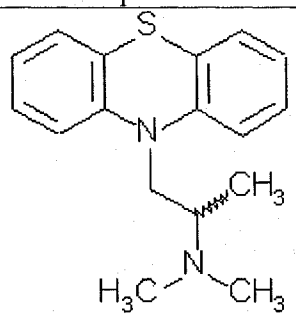
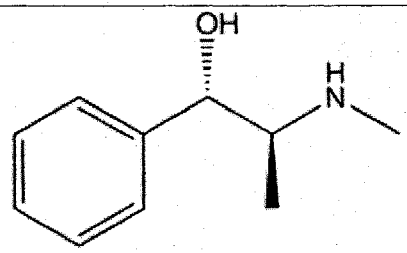
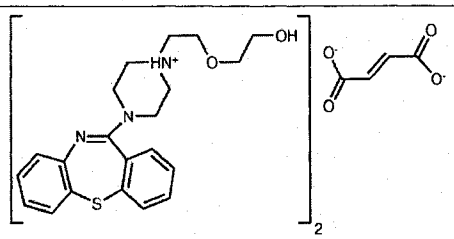
* a-PDR (Physician's Desk Reference); b-www.emolecules.com
** 10-Hydroxycarbazepine-metabolite of carbamazepine

Colchicine, COLCHICINE®	N-((7S)-5,6,7,9-tetrahydro-1,2,3,10-tetramethoxy-oxobenzo(a) heptalen-7-yl)-acetamide	 b
Dextromethorphan, DM®, DXM®	D-(+)-3-methoxy-17-methyl-(9α,13α,14α)-morphinan	 a
Dicyclomine, BENTYL®	[bicyclohexyl]-1-carboxylic acid, 2-(diethylamino) ethylester	 a
Digoxin, DIGITEK®	3-((O-2,6-dideoxy-β-D-ribo-hexopyranosyl-(1-4)-O-2,6-dideoxy-β-D-ribo-hexopyranosyl-(1-4)-2,6-dideoxy-β-D-ribo-hexopyranosyl) oxy)-12,14-dihydroxy-,(3β,5β,12β)-card-20(22)-enolide	 a

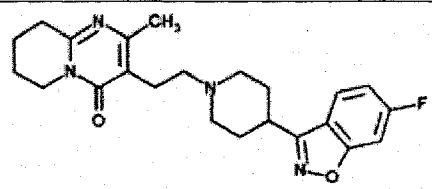
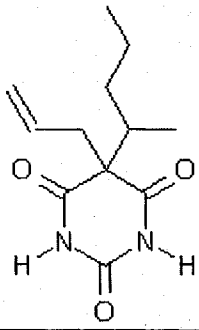
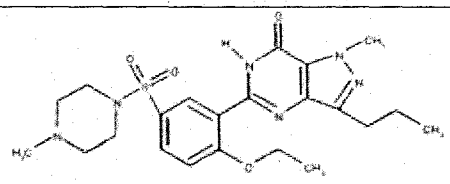
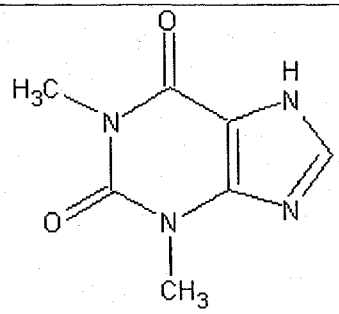
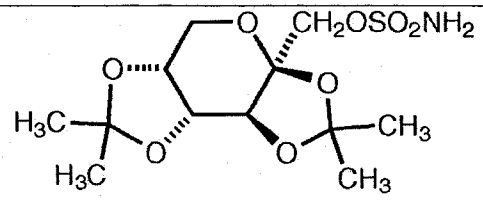
Diltiazem, CARDIZEM®	[2-(2-dimethyl aminoethyl)-5-(4-methoxyphenyl) -3-oxo-6-thia-2-azabicyclo [5.4.0]undeca-7,9, 11-trien-4-yl]ethanoate	 a
Diphenhydramine, BENADRYL®	2-(Diphenyl methoxy) – N,N-dimethyl ethylamine hydrochloride	 b
Diphenoxylate, Lomotil®	ethyl 1-(3-cyano-3,3-diphenyl-propyl)- 4-phenyl-piperidine-4-carboxylate	 c
Disulfiram, ANTABUSE®	Bis(diethylthio carbamoyl) disulfide	 a
Doxylamine, UNISOM® NIGHTTIME SLEEP AID	N/A	 b

Enalapril, RENITEC®, VASOTEC®	(S)-1-[N-[1-(ethoxycarbonyl)-3-phenylpropyl] -l-alanyl]-l-proline	 b
Fexofenadine, ALLEGRA®	(±)-4-[1-hydroxy-4-[4-(hydroxy diphenylmethyl)-1-piperidinyl]-butyl]-(alpha), (alpha)-dimethyl benzeneacetic acid	 a
Gabapentin, NEURONTIN®	1-(aminomethyl)-cyclohexane acetic acid	 a
Hydroxyzine, ATARAX®, UCERAX®, SERECID®	1-(p-chlorobenzhydryl) 4-[2-(2 hydroxyethoxy)-ethyl] piperazine	 b
Levetiracetam, KEPPRA®	(-)-(S)-α-ethyl-2-oxo-1-pyrrolidine acetamide	 b
Lithium, ESKALITH®	Li	N/A

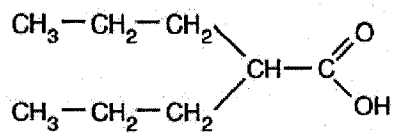
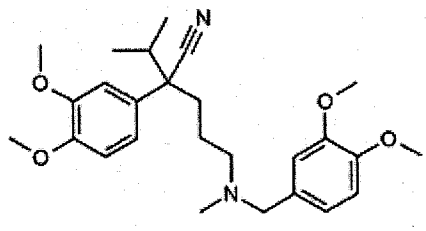
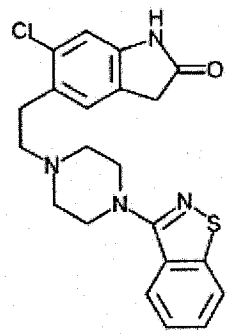
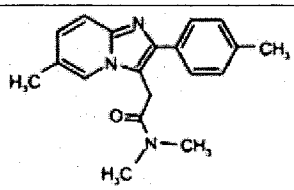
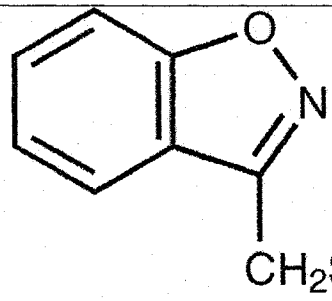
Meprobamate, MILTOWN®	[2-(carbamoyl oxy methyl)-2-methyl-pentyl] carbamate	 b
Methocarbamol, ROBAXIN®, ROBAXACET®, ROBAX PLATINUM®	[2-hydroxy-3-(2-[2methoxy phenoxy)-propyl] aminoformate	N/A
Olanzapine, ZYPREXA®, SYMBYAX®	2-methyl-4-(4-methyl-1-piperazinyl)-10H-thieno [2,3-b][1,5] benzodiazepine	 b
Phendimetrazine, BONTRIL®	3,4-Dimethyl-2-phenyl-morpholine	 b
Pheneytoin, DILANTIN®	5,5-diphenyl-2,4-imidazolidine dione	 b
Phenmetrazine, PRELUDIN®	3-methyl-2-pheny lmorpholine	 b
Phenylpropanolamine	2-amino-1-pheny-1-propanol	 b

*Procainamide, PRONESTYL®, PROCAN®, PROCANBID®	4-amino-N- (2-diethyl aminoethyl) benzamide	 structure taken from: http://redpoll.pharmacy.ualberta.ca/ drugbank/index.html
Prochlorperazine, COMPAZINE®, BUCCASTEM®, STEMETIL®	2-chloro-10- [3-(4-methyl-1- piperazinyl) propyl]- 10H-phenothiazine (Z) -2-butenedioate	 structure taken from: http://bibleocean.com/OmniDefinition/ Prochlorperazine
Promethazine, PHENERGAN®	N, N,alpha-trimethyl- 10H-phenothiazine- 10-ethanamine (9CI)	 b
*Pseudoephedrine, SUDAFED®	(1*S*,2*S*)-2- methylamino- 1-phenylpropan- 1-ol	 a
Quetiapine, SEROQUEL®	2-[2-(4-dibenzo [*b,f*] [1,4]thiazepin- 11-yl-1-piperazinyl) ethoxy]-ethanol fumarate (2:1) (salt)	 a

* N-Acetylprocainamide-metabolite of Procainamide
* Norpseudoephedrine-pseudoephedrine metabolite

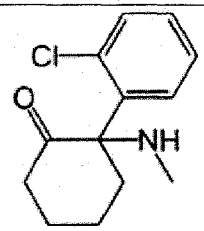
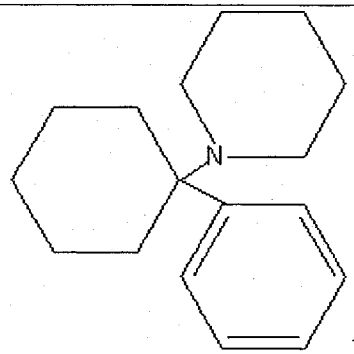
Risperidone **RISPERDAL®	4-[2-[4-(6-fluorobenzo [d]isoxazol-3-yl)-1-piperidyl]ethyl]-3-methyl-2,6-diazabicyclo [4.4.0]deca-1,3-dien-5-one	 a
Secobarbital, SECONAL®	5-(1-methylbutyl)-5-prop-2-enyl-hexahydro pyrimidine-2,4,6-trione	 b
Sildenafil, VIAGRA®	1-[4-ethoxy-3-(6,7-dihydro-1-methyl-7-oxo-3-propyl-1*H*-pyrazolo[4,3-*d*]pyrimidin-5-yl) phenylsulfonyl]-4-methyl piperazine citrate	 a
Theophylline THEO-DUR®, RESPBID®, SLO-BID®	1,3-dimethyl-7H-purine-2,6-dione	 b
Topiramate, TOPAMAX®	2,3:4,5-Di- *O* -isopropylidene-(beta)-D-fructopyranose sulfamate	 a

** 9-Hydroxyrisperidone-metabolite of risperidone

Valproic Acid, DEPAKENE®	2-propyl pentanoic acid	 a
Verapamil, ISOPTIN®, VERELAN®, CALAN®	2-(3,4-dimethoxy phenyl)-5-[2-(3,4-dimethoxy phenyl)ethyl-methyl-amino] -2-(1-methy lethyl) pentanenitrile	 b
Ziprasidone, GEODON®	5-[2-[4-(1,2-benzisothiazol-3-yl)-1-piperazinyl] ethyl] 6-chloro-1,3-dihydro-2 – indol-2-one	 b
Zolpidem, AMBIEM®	N,N,6-trimethyl-2-(4-methylphenyl)-imidazo(1,2-a)pyridine 3-acetamide	 b
Zonisamide, ZONEGRAN®	1,2-benzisoxazole-3-methane sulfonamide	 a

APPENDIX VII

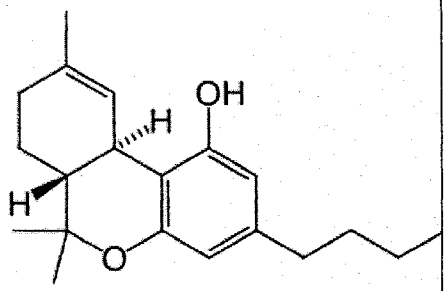
DISOCIATIVE ANESTHETICS

Common/"street"/BRAND NAME	CHEMICAL NAME	*STRUCTURE
**Ketamine, KETANEST®, KETASET®, and KETALAR®, "Special K," "K," "Vitamin K," "Cat Valium"	2-(2-chlorophenyl)-2-(methylamino)-cyclohexanone	 b
Phencyclidine, "PCP", "Angel Dust", "sherm"	Phencyclidine	 b

* b-www.emolecules.com
** "street names" taken from NIDA

APPENDIX VIII

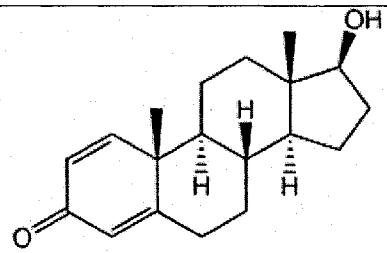
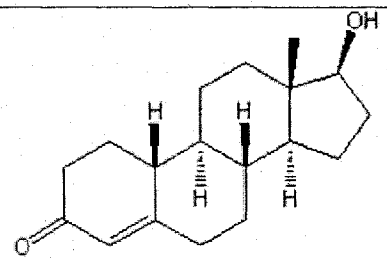
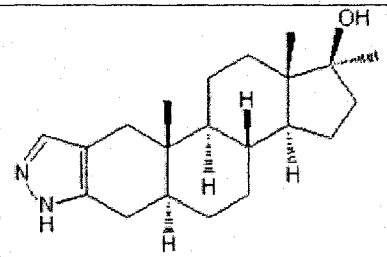
CANNABINOIDS

Common/"street"/BRAND NAME	CHEMICAL NAME	*STRUCTURE
**Cannibis, "hash," "chronic," MARINOL®	Delta-9-tetrahydrocannabinol	 b

* b-www.emolecules.com
** "street names" taken from NIDA

APPENDIX IX

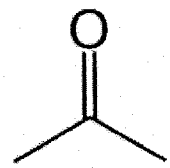
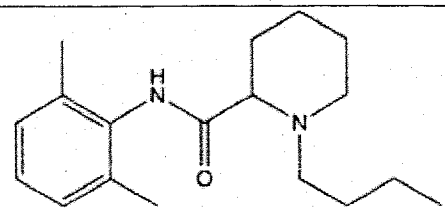
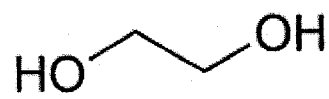
ANABOLIC STEROIDS

Common/"street"/BRAND NAME	CHEMICAL NAME	*STRUCTURE
Boldenone,EQUIPOISE®, GANABOL®, EQUIGAN®	1,4-androstadieene-3-one,17β-ol	 b
Nandrolone, DECA-DURABOLIN®	17β-Hydroxyestra-4-en-3-one	 b
Stanozolol,WINSTROL®	17β-Hydroxy-17-methyl-5α-androstano[3,2-c] pyrazole	 b

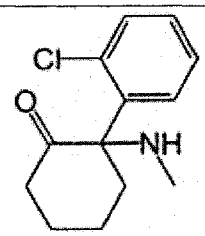
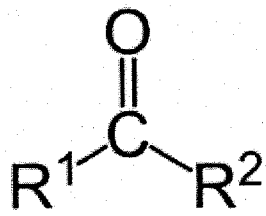
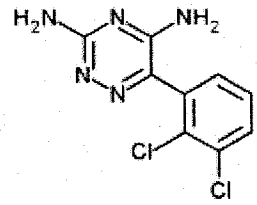
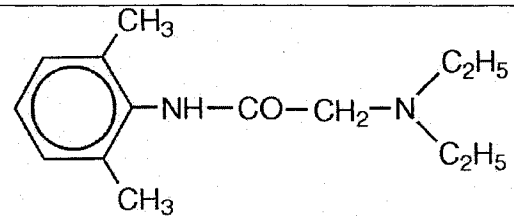
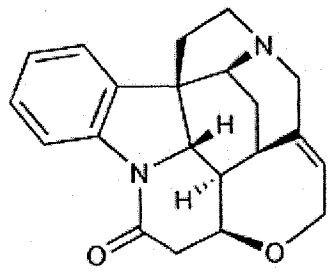
* b-www.emolecules.com

APPENDIX X

OTHER COMPOUNDS

COMMON/"street"/ BRAND NAME	CHEMICAL NAME	*STRUCTURE
Acetone	β-ketopropane, Dimethyl ketone	 b
Arsenic	Arsenic	**As**
Bupivacaine, MARCAIN®, MARCAINE®, SENSORCAINE®	1-butyl-*N*-(2,6-dimethylphenyl) piperidine-2-carboxamide	 b
Carbon Monoxide	Carbon Monoxide	CO
Carboxyhemoglobin	N/A	COHb
Cyanide	hydrogen cyanide, cyanogen chloride, sodium cyanide, potassium cyanide	HCN, CNCl, NaCN, KCN
Ethylene Glycol	Ethane-1,2-diol	 b

* b-www.emolecules.com

Ketamine, KETANEST®, KETASET®, KETALAR®	2-(2-chlorophenyl)-2-(methylamino)-cyclohexanone	 b
Ketones	Ketone group	 b
Lamotrigine, LAMICTAL®	3,5-diamino-6-(2,3-dichlorophenyl)-as-triazine	 b
Lead	N/A	Pb
Lidocaine, LIGNOCAINE®	acetamide, 2-(diethylamino)-N-(2,6-dimethylphenyl)	 b
Mercury	N/A	Hg
Strychnine	Strychnos nux-vomica	 b

b-www.emolecules.com

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