

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

**A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600**

**THE EFFECTS OF COCAINE:
A CORRELATION STUDY OF THE SIGNS AND SYMPTOMS
OF COCAINE ABUSE IN MALES**

**A THESIS
PRESENTED TO THE SCHOOL OF KINESIOLOGY
LAKEHEAD UNIVERSITY
IN PARTIAL FULFILMENT FOR THE DEGREE
MSc IN APPLIED SPORT SCIENCE AND COACHING**

**BY
CHRIS BULLEY ©**

1994/95



National Library
of Canada

Bibliothèque nationale
du Canada

Acquisitions and
Bibliographic Services

Acquisitions et
services bibliographiques

395 Wellington Street
Ottawa ON K1A 0N4
Canada

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-33347-7

Canada

Table Of Contents

	Page
Abstract	i
Acknowledgments	ii
<u>Chapter 1</u>	
Introduction	4
Purpose of the study	4
Subpurpose	4
Significance of the study	4
Statement of hypothesis	4
Limitations	5
Delimitations	5
<u>Chapter 2</u>	
Review of literature	6
Initiation into drug use	6
History of cocaine use	7
What is cocaine?	8
Different forms of cocaine	8
The effects of cocaine	10
Cardiac complications	10
Neurological changes	10
A) Dopamine	10
B) Norepinephrine	11
C) Serotonin	11
Psychological alterations	12

Eating disorders	13
Seizures	13
Sexual performance and behavioural changes	14
Additional Complications	15
Cocaine and athletics	15

Chapter 3

Methods	19
Subjects	19
Statistical evaluation	20

Chapter 4

Results	21
----------------	----

Chapter 5

Discussion	38
-------------------	----

Chapter 6

Recommendations for future study	43
References	44

Appendices

A: Cocaine abuse in Canada and the United States	49
B: Cocaine history questionnaire	51
C: Letter of introduction	53
D: Common myths about cocaine	54
E: Cardiac conditions	56
F: Clinical Tool	58

List of Tables and Figures

Title	Page
Table 1: National Collegiate Athletic Association Observations of Cocaine Use in Athletes	16
Figure 1: Age of The Subjects	22
Figure 2: Ethnic Background of Subjects	22
Figure 3: Employment Status of The Subjects	23
Figure 4: Subjects Annual Gross Salary In Dollars	23
Figure 5: Subjects Means of Supporting Cocaine Habit	24
Figure 6: Amount of Money Subject Spent Per Month On Cocaine	24
Figure 7: Subjects View on Addiction To Cocaine	25
Figure 8: Subjects View on The Addictiveness Of Cocaine	25
Table 2: Common Signs and Symptoms of Cocaine Addiction	26
Table 3: Snorting Cocaine In Relation To The Signs and Symptoms of Cocaine Addiction	27
Table 4: Free basing Cocaine in Relation To The Signs and Symptoms of Cocaine Addiction	28
Table 5: Smoking Crack in Relation To The Signs and Symptoms of Cocaine Addiction	29
Table 6: Intravenous Injection in Relation To The Signs and Symptoms of Cocaine Addiction	30
Table 7: Heroin Use in Relation To The Signs and Symptoms of Cocaine Addiction	31
Table 8: Alcohol Use in Relation To The Signs and Symptoms of Cocaine Addiction	32
Table 9: Marijuana Use in Relation To The Signs and Symptoms of	

Cocaine Addiction	33
Table 10: Other drugs Used With Cocaine in Relation To The Signs and Symptoms of Cocaine Addiction	34
Table 11: Frequency of Cocaine Use in Relation To The Signs and Symptoms of Cocaine Addiction	35
Table 12: Length of Cocaine Use in Relation To The Signs and Symptoms of Cocaine Addiction	36
Table 13: Dosage Per Use of Cocaine in Relation To The Signs and Symptoms of Cocaine Addiction	37

Abstract

The purpose of this study was to determine the self reported signs and symptoms of cocaine abuse in relation to dosage, length of use, method of introduction, other drugs used with cocaine, and frequency of use. Males between the ages of 16 and 40 who were already enrolled in a rehabilitation program in Ontario were used as subjects. The data demonstrated 16 common signs and symptoms of cocaine use and an additional 12 signs and symptoms that could be used to characterize a subject's habit. The epidemiological data demonstrated that Caucasian, unemployed, poorly educated males predominantly between 26-30 are the largest group of cocaine users. The data also raised new questions regarding a subject's thoughts toward addiction and the addictive properties of cocaine.

Acknowledgments

Sincere thanks is given to Dr. Ian Newhouse, Dr. Norm Lavoie, Dr. John Jamieson and Mrs. Linda James for their assistance in the preparation of this document. Furthermore, thanks are extended to the Addiction Research Foundation at St. Joseph's Hospital in Thunder Bay, Mrs Karen Dahl and Mrs. Sharon Mulligan of the Smith Clinic in Thunder Bay, Mr. Michael McCrimmon, Coordinator of the Toronto Human Immunodeficiency Virus Addiction Centre, Mrs. Marianne Walsh, Coordinator of the Saint Thomas Addiction Rehabilitation Unit and Sister Mae Kierns, Coordinator of the St. Joseph=s Hospital in Elliot Lake for their cooperation, assistance, and participation in this study. Lastly, special thanks to all the subjects for their participation in this study.

Chapter 1

Introduction

Purpose of the study

The purpose of this study was to recognize cocaine use based on a tool developed from the relationship between the signs and symptoms of cocaine use and the dosage, method of introduction (snorting, freebasing, smoking crack, or intravenous injection), length and frequency of cocaine use.

Subpurpose

To gather epidemiological data regarding the use of cocaine in Ontario.

Significance of the study

The information gathered from this study will act as a precursor in the development of a diagnostic tool, and patient profile, to be used in the clinical (or non clinical) recognition of the signs and symptoms of cocaine use with respect to dosage, length of use, frequency of use, and method of introduction. Once fully developed the diagnostic tool could be utilized by family, employers, coaches, and trainers to recognize the common characteristics of a cocaine abuser. The epidemiological data including: age, ethnic background, occupation, salary, method of use, expense of habit, and the user viewpoints as to addictive properties of cocaine could be used to determine the extent and social stratification of cocaine abuse in Ontario.

Statement of hypothesis

Increased frequency of the signs and symptoms of cocaine abuse with respect to an increase in dosage, frequency of use, and length of use were expected. There was also an expected relationship between method of introduction and related signs and symptoms (intranasal cocaine use could produce nasal complications). Strong relationships between related signs (i.e.

visual and auditory hallucinations) were also expected. Large variations in the epidemiological data were anticipated.

Limitations

The study was limited by the ability of the subjects to accurately complete the questionnaires. Errors by coordinators within the clinics regarding selection of patients to complete the questionnaires was also outside the researcher's control. The inadequacy of literature regarding the signs and symptoms limited the accuracy of the questionnaire.

Delimitations

The study was delimited to males between the ages of 16 and 40 who resided in Ontario. Only those males who were involved in rehabilitation programs were asked to participate. The only substance to be examined was cocaine. The only variables that were analysed were those contained in the questionnaire.

Chapter 2

Review of literature

Initiation into drug use

The use of illicit drugs worldwide is steadily rising with drugs like heroin, marijuana and cocaine seen frequently in the hands of young people (Bell and Doege, 1987). Children are using drugs at an earlier age (11-13) and are progressing to more powerful drugs more quickly, i.e., from marijuana to heroin or cocaine (Gropper, 1991). Gray, (1993) found a high prevalence of marijuana use by grade 7 and 8 students and furthermore, 68% of young adults, 31% of youths, and 20% of older adults have reported using marijuana. Furthermore, before a child enters grade 12 he/she has a 50% chance of using marijuana and a 70% chance of using marijuana before he/she graduates from college or university.

Gender also plays a significant role in that males have a higher incidence of drug use, act as carriers of information, and pressure other potential users (Penning and Barnes, 1980). Peer pressure and the prevalence of use by peers seem to be the two main precursors to initiation into marijuana use. While peer pressure may be the main reason for beginning use of drugs, continued use depends on the effects felt by the user. Users who reported having gotten Astoned@ or Ahigh@ during the first experience with marijuana, and users who felt the adverse effects were not serious, were most likely to continue use of marijuana (Bailey, Flewelling and Rachal, 1992).

Heroin use has risen steadily since 1954 when there were approximately 4000 heroin addicts in Canada, a number that jumped to 18,000 by 1980. A study by Gibbons, Brown, Greene and DuPont (1981) found that rates of first time heroin use and heroin overdose are greatest during the summer months among those individuals who were not employed and not in school. Gibbons., et al (1981) also determined another major factor in the formula of drug initiation is if the new user knows the person they are getting the heroin from. Of new users 73% knew the

person giving them the heroin and 36% had known the initiators since childhood. Long standing friendships appear to be a major factor in the initiation into heroin use.

To summarize, peer pressure, gender, time of year, the effects felt by the user and the interpretation of the severity of those effects, have a direct bearing on whether or not the individual will start and continue to use drugs. Furthermore, the progression to more potent drugs seems to be determined by the mental and physiological parameters of the individual. The drug user may seek a greater high or his/her body may become immune to the effects of the less potent drugs and the only way to achieve the high is to switch to more powerful drugs. Regardless of why or when an individual uses and continues to use drugs, the problem of drug addiction must be addressed.

History of cocaine use

Recent literature indicates that humans have been using cocaine for the last 5000 years. Chewing of the coca leaves was the first method of introduction used by farmers to heighten awareness and strength (Spivey and Euerle, 1990). Incan civilizations were strong advocates of cocaine, using the drug to stave off thirst and hunger as well as elevating strength. The Spanish, Vespucci and de Leon, revisited South America around 1850 and returned to Spain with the "divine leaves," as described by the natives thus initiating the spread of cocaine to Europe (Erickson, Adalf, Murray and Smart, 1987).

In 1855 Friedrich Gaedcke, a German chemist, isolated the alkaloid from the coca leaf, which is known as cocaine. Cocaine was prescribed to treat alcoholism, syphilis, asthma, hysteria and nervous exhaustion in 1884 by Dr. Sigmund Freud. Furthermore, Dr. William Halstead popularized the use of cocaine as an anaesthetic. Unfortunately, both Freud and Halstead discovered the dark side of cocaine by becoming addicted to the substance after self administration. Perhaps the most ironic use of cocaine was to treat opiate addiction by doctors in the late 19th century (Lee, Mohammadi and Dixon, 1991).

Between 1900 and 1906 cocaine was used in a variety of medications and the "Pure Food and Drug Act" of 1906 stated that all substances containing cocaine had to list the ingredients on the package. This law forced the manufacturer of Coca Cola to list cocaine as an ingredient (Spivey and Euerle, 1990). The widespread use and effects of cocaine suddenly became undesirable in the public eye and growing concern led to the "Harrison Narcotics Act" of 1914 which declared cocaine an illegal substance (Erickson et al., 1987). In the 20th century cocaine ranks as the third most common addictive drug with alcohol and marijuana being the top two respectively (Miller, Gold and Millman, 1989). Detailed information regarding use of cocaine in Canada and the United States is provided in Appendix A.

What is cocaine?

Cocaine (Benzoylmethylecgonine) is an alkaloid that is removed from the coca plant (*Erythroxylon coca*) via a simplistic yet effective procedure (Lombardo, 1986). The leaves of the coca plant are left in the sun to dry, then soaked in kerosene or gasoline and trampled in huge vats for hours. The cocaine drips out the bottom of the vats and is dried to a form a mucky paste. The paste is chemically cleaned with hydrochloric acid then separated using another bombardment of chemicals. Pure cocaine is then dried by a salt crystal and is ready for street use. Before the cocaine is sold it will be "cut" or mixed with other substances to increase profits. Substances typically used in the cutting of cocaine are: strychnine, milk sugar, dextrose, baby laxatives, decongestants, caffeine, local anaesthetics or amphetamines (Erickson and Alexander, 1989). Before use, the cocaine will be manipulated once again to the preference of the user as to the desired method of introduction.

Different forms of cocaine

There are four ways that cocaine can be introduced into the body: snorting, intravenous injection, free basing and smoking (crack). Regardless of the form, cocaine's street names

include: "coke," "C," "snow," "blow," "the lady," "toot" and "the Mercedes of drugs" just to name a few (Spence, 1990).

Snorting cocaine is the most common form of cocaine use and is accomplished by inhalation of a line of cocaine, typically 10-12 grams. Through this method the effects are experienced in approximately 2 minutes and last for 20-30 minutes.

A second popular method of use is combining cocaine with water and injecting the cocaine into the veins. The effects are immediate (15 seconds) and last 15-20 minutes. This is referred to as intravenous injection (IV) of cocaine. Heroin is sometimes combined with cocaine in I.V use and is termed "speed balling" and has even greater repercussions than cocaine use alone (Spence, 1990).

The spread of the Acquired-Immunodeficiency Syndrome (AIDS) has been directly connected with IV drug use and needle sharing, adding to the repercussions of IV cocaine use (Garner, 1988).

The third method of administration is free basing. Cocaine is mixed with ether to form a paste and then the paste is burnt within a pipe containing rum. The user inhales the vapour and in seconds feels the effects which last 10-15 minutes depending on the dosage (Spence, 1990). Ether is a highly volatile and flammable substance and accidental burns are frequently seen with free basing.

The last method of cocaine use is the smoking of crack. One pellet of crack cocaine is worth 8 to 10 dollars, making the drug available to the lower socioeconomic classes and even school children. Crack, named after the sound it makes when it is burnt, resembles small pebbles and is smoked using a pipe. The effects are instant and last from 10-20 minutes depending on the size of the rock (Spence, 1990). The method of use has a direct bearing on the acute effects of cocaine, however, the chronic effects of cocaine are similar and will be discussed in detail.

The effects of cocaine: cardiac complications

Sudden cardiac death is just one of the several cardiac complications attributed to acute and chronic use of cocaine. Myocardial infarction, coronary artery thrombosis, cardiac arrhythmias, myocardial ischemia, myocarditis, (Bunn and Giannini, 1992), left ventricular dysfunction, and left ventricular hypertrophy (Bertolet et al., 1990) are all serious heart complications associated with cocaine abuse. A detailed explanation of each condition is provided in Appendix E.

Neurological changes

Auditory and visual hallucinations are experienced with the use of cocaine and are the result of neurological changes initiated by cocaine. The neurotransmitters that are predominantly affected are dopamine, norepinephrine and serotonin (Stedman, 1987).

A) Dopamine

Dopamine is involved directly with the "reward centre" - the limbic portion of the brain responsible for emotions (Stedman, 1987). The introduction of cocaine blocks the re-uptake of dopamine into the presynaptic nerve terminal. The re-uptake is responsible for termination of the action of dopamine (Miller et al., 1989), and therefore the reward centre is uninhibited. The lack of inhibition results in euphoria and hallucinations which are both auditory and visual (Spivey and Euerle, 1990). Once the effects of cocaine wear off, dopamine receptors are available for the re-uptake of dopamine. There is, however, a large amount of dopamine in the synapse and massive re-uptake causes the reward centre to "crash" below normal levels resulting in depression. The drop below normal levels provides a basis for the increased desire of repeated use. The user wants to avoid the "crash" and the result is repeated administration leading to addiction (Smith, 1986).

Dopamine also plays a major role in the corpus striatum, the portion of the brain responsible for smooth movement. Cocaine causes the degeneration of the dopamine pathways

projecting into the corpus striatum resulting in tremors, decreased motor activity, and rigidity, all of which interfere with movement (Spivey and Euerle, 1990).

Within the hypothalamus there are also dopamine receptor pathways. The dopamine pathways project into the pituitary gland and when altered by cocaine affect the release of prolactin. Prolactin release is enhanced resulting in lactation, menstrual irregularity, and decreased sexual function (Spivey and Euerle, 1990). The effects of cocaine on dopamine are well documented and the results of dopamine interference can cause severe complications. However, further study is warranted to fully understand the effect cocaine has on dopamine.

B) Norepinephrine

Present in the adrenal medulla, norepinephrine is responsible for blood vessel constriction, heart activity, inhibition of motility through the gastrointestinal tract, and pupil dilation (Guyton, 1991). Cocaine inhibits the re-uptake of norepinephrine at the presynaptic knob accentuating the actions of norepinephrine (Spivey and Euerle, 1990). This causes an increase in heart rate and vasoconstriction. Increases in heart rate and vasoconstriction may induce cardiac tachycardia, arrhythmias, and possible death from cardiac arrest due to ischemia, as outlined in the beginning of this chapter. The effects of cocaine on norepinephrine also subside with discontinuation of use (Brown et al., 1992).

C) Serotonin

The third neurotransmitter affected by the use of cocaine is serotonin. Serotonin is responsible in part for vasoconstriction and smooth muscle stimulation (Stedman, 1987). Serotonin is also utilized in the modification of behavioural functions, aggression (Yudofsky, Silver and Hales, 1993), memory, pain receptor excitation, and sleep (Guyton, 1991). All of these systems are negatively affected by decreased levels of serotonin as a result of cocaine intoxication.

Unlike dopamine and noradrenaline, serotonin is inhibited by cocaine. Since serotonin modulates emotions like aggression decreases in serotonin can lead to highly volatile behaviour. The amount of serotonin is decreased by inhibition of its originating chemical. Furthermore, cocaine blocks the re-uptake of serotonin thus further depleting the system (Spivey and Euerle, 1990).

Psychological alterations

Changes in the psychological aspects of an individual's personality, with respect to cocaine use, are dependant on length of use and dosage (Spence, 1990). The psychological aspects of personality change are most evident during the crash phase of cocaine use. During the first phase of the crash, lasting hours to days, symptoms such as intense depression, fatigue, and insomnia are evident. The second phase of the crash may last weeks to months and is characterized by moodiness, anxiety, decreased energy, suspiciousness, and sleep disturbances (Miller et al., 1989).

The reactions of the body to cocaine use seem positive to the abuser but in fact are negative. Feelings of increased strength, increased confidence, and increased productivity are commonly described by cocaine users. However, this is a fallacy. Cocaine does not increase physical performance, but rather inhibits performance. Furthermore, the effects of cocaine last only 20-40 minutes while the crash may last hours to months (Spence, 1990). This may lead to repeated use of cocaine to maintain the delusion of superiority leading to addiction and severe medical problems.

The changes in a person's personality after the effects of cocaine have withdrawn are quite noticeable. Disrupting the actions of dopamine and serotonin, as already discussed, leads to increased aggression and fighting (Yudofsky et al., 1993). The desire for more cocaine and the expense of cocaine lead to theft from family and friends and problems at work. Poor concentration, paranoia, anxiety, hallucinations, confusion, depression, denial, lying, and argumentativeness are all psychological changes associated with cocaine abuse (Spence, 1990).

Eating disorders

Anorexia nervosa and bulimia have been linked to substance abuse (Jonas, Gold, Sweeney and Pottash, 1987). There are several mechanisms that affect eating disorders in association with cocaine. Cocaine is an appetite suppressant but increases the metabolism of lipids. While the user's appetite is suppressed, the increased fat metabolism presents severe nutritional problems (Guyton, 1991). Another aspect of eating disorders is the craving for cocaine over food. The desire for cocaine overrides the craving for food which may lead to malnutrition and vitamin deficiencies (Spence, 1990).

Jonas et al., (1987), reported that the behaviours seen in eating disorders are similar to substance abuse disorders. Questioning of bulimics uncovered a tendency to attribute binge eating with drug use while anorexic users stated that cocaine has compounded their anorexia. The high prevalence of both bulimia and anorexia among drug abusers was revealed by a study by Jonas et al., (1987) which found a 22% incidence of bulimia (above the norm) and a 7% incidence of anorexia nervosa among drug addicts. Perhaps the most profound finding of the study was a high prevalence of bulimia among men. The study concluded that there is an association between cocaine abuse and eating disorders, and that a high percentage of individuals abusing cocaine may suffer from anorexia nervosa or bulimia (Jonas et al., 1987).

Seizures

Kramer, Locke, Ogunyemi and Nelson (1990) reported that 1.4 - 2.8% of cocaine users experience seizures as a result of cocaine use. Kramer et al., (1990), also noted that the seizures were focal or generalized tonic-clonic seizures which could lead to hyperthermia, cardiovascular collapse, or ventricular fibrillation. A focal seizure is characterized by: momentary amnesia, rage, anxiety, discomfort, fear, incoherent speech, or mumbling. A tonic-clonic seizure results in spasmodic muscular contraction which could result in the person biting or swallowing the tongue possibly leading to cyanosis and death (Guyton, 1991).

Although the exact mechanism causing seizures in cocaine abusers is not known, dosage has been directly linked to seizure onset (Brown et al., 1992). Additional research is still needed concerning the interval between use of the drug and onset of the seizures. The majority of seizures occur very soon after cocaine use, but the interval could be several hours. Nonetheless, it has been demonstrated that seizures occur in first time users and in infants whose care givers were smoking free base cocaine (Mueller et al., 1990).

Cocaine administered on a daily basis has exhibited the ability to lower the seizure threshold in animals (Kramer et al., 1990). The concentration of cocaine, however, was less at the end of the study than at the start when no convulsions were seen, indicating a lowering of the seizure threshold. This process is termed "kindling" and is the result of repeated stimulation to one area of the brain to a point where seizures are experienced with lower doses of cocaine (Spivey and Euerle, 1990). Typically, cocaine users must increase the dosage to retain the desired effects of the drug. Since the seizure threshold is decreased with use, the repeated user is at even greater risk of having a cocaine induced seizure.

Sexual performance and behavioural changes

Intravenous drug use has contributed to the AIDS epidemic in both Canada and the United States. Needles are often shared among cocaine users and sex is often used as a method of payment for cocaine. One infected needle could possibly lead to the infection of dozens of people due to the sexual promiscuity and sexual compulsiveness often associated with cocaine abuse (Mackler and O'Brien, 1990). Judgement is affected by cocaine and often sex is engaged while under the influence of cocaine. Furthermore, unprotected sex is often practised complicating the problem of Human Immunodeficiency Virus (HIV) transmission (Garner, 1988).

In low doses, cocaine enhances libido and retards ejaculation, resulting in prolonged sexual activity. Conversely, larger doses of cocaine can cause sexual dysfunction, spontaneous orgasm, and eventually a decrease in sex drive (Miller et al., 1989). Injection of cocaine into the testicles, shaft of the penis, uterus, and intraurethrally have been attempted to increase sex drive.

Repercussions of these activities include, impotence, priapism (abnormal erection of the penis), and uteral infections (Mackler and O'Brien, 1992). The negative effects of cocaine on sex drive and function outweigh any inconsequential positive effects that may be experienced.

Additional complications

Several conditions which may appear as a result of cocaine abuse include perforation of the nasal septum, hepatitis, meningitis, phlebitis, pulmonary embolisms, bacterial endocarditis, as well as others (Spence, 1990). Dental conditions such as flattened cuspal inclines, temporo- mandibular joint pain, gingival lacerations, and myofascial pain are all associated with cocaine use (Lee et al., 1991). Cocaine use has also been associated with interference of short term memory storage (Manschreck et al., 1990) and embolic stroke (Sauer, 1991). Further research within these areas continues

Cocaine and athletics

Cocaine use is a social problem ignored and hidden behind closed doors until an individual in a high profile position is caught experimenting with cocaine. Myths of increased performance, strength, and improved reflexes draw the professional athlete toward the use of cocaine (Scher, 1992).

The National Collegiate Athletic Association (NCAA) has carried out several studies to determine the use of illegal and legal drugs. Results show that there is no difference in use between male and female athletes (Bell and Doege, 1987). Depending on the sport, use of cocaine rises as high as 25% and as low as 1%. Actual statistics of a survey comparing use in 1985 and 1989, are shown in Table 2, page 16, (Anderson, Albrecht, McKeag, Hough and McGrew, 1991). Unfortunately, this literature search revealed no statistics regarding professional sport because the use isn't reported.

As previously stated, athletes use cocaine because they are led to believe that it will enhance their performance, Appendix E demonstrates the myths of cocaine. Cocaine provides

the illusion of increased performance but actually has a hindering effect. As a central nervous system stimulator cocaine heightens peripheral reflexes to a point where normal synchronized, coordinated function is impaired (Lombardo, 1986).

Table 1

National Collegiate Athletic Association Observations of Cocaine Use In Athletes

	Males				
	Baseball	Football	Basketball	Tennis	Track and Field
1985	23%	20%	16%	10%	25%
1989	6%	7%	2%	2%	2%

	Females				
	Basketball	Softball	Swimming	Tennis	Track and Field
1985	12%	16%	19%	11%	9%
1989	2%	5%	7%	5%	1%

(Anderson, Albrecht, McKeag, Hough and McGrew, 1991)

Coupled with poor performance is the masking of fatigue. The masking of fatigue allows the athlete to continue to perform while doing substantial damage to their body which leads to severe pain when cocaine's effects wear off. Cocaine can cause dysfunction of the thermoregulatory system causing hyperthermia. An athlete's body temperature rises during exercise putting the athlete at risk of hyperthermia in situations where hyperthermia would not normally be a factor (Brown et al., 1992)..

Physiologists are constantly investigating how to increase the energy (glycogen) stores so that athletes can perform better and for longer durations. Conlee, Barnett, Kelly and Ho Han, (1991) demonstrated that cocaine combined with exercise caused a decrease in glycogen stores below the levels seen in muscle not treated with cocaine. This translates into a diminished capacity to do work. The athlete on cocaine will deplete his/her energy stores faster than the athlete not using cocaine. Obviously, depletion of energy stores is the opposite reaction an athlete wants.

The most important factor to be looked at, with respect to athletics and cocaine, is the effect on the heart. During exercise, heart rate and blood pressure are elevated (McArdle, Katch and Katch, 1991). Cocaine use has been shown to increase heart rate and blood pressure to a critical point (Cantwell and Rose, 1986). A combination of exercise and cocaine use could elevate heart rate and blood pressure to a point of sudden cardiac death or cardiac arrest. The heart and arteries simply cannot stand the extreme pressure and the result can be cardiac failure or rupture of a blood vessel. Vasoconstriction is another factor resulting from cocaine ingestion and this further compounds the problem (Coniglio, 1990)

In the heart increases in left ventricular mass and posterior wall thickness increases have been attributed to the use of cocaine, and left ventricular dysfunction has also been linked to cocaine use. Athletics will increase the thickness of the heart wall naturally and within safe limits, (Guyton, 1991). Cocaine increases the synthesis of cardiac tissue and in combination with exercise thickens the ventricle wall beyond safe limits. Studies have proven that increased

ventricular thickness has been associated with an increased risk of cardiovascular events and mortality (Brickner et al., 1991).

Arrhythmia, tachycardia, and ventricular fibrillation can be exaggerated or amplified when combining cocaine and exercise. Furthermore, the inhibition of sodium channels and shortened refractory period associated with cocaine abuse also negatively affects athletic performance (Conlee et al., 1990).

As discussed the effects of cocaine last between 15 and 40 minutes, depending on the method of introduction and dosage. Thus to maintain the illusion of performance enhancement the athlete must take cocaine during the event, again and again. Conversely, if the athlete cannot take more cocaine during the event, and the effects wear off, a "crash" could set in resulting in depression and a severe decrease in performance.

As a trainer or coach, there are signals to look for, to detect a player that is using cocaine. Snorting is the most popular method chosen by athletes (Scher, 1992), and results in swollen congested blood vessels 1-2 cm from the tip of the nose (Spence, 1990). Ulcers and perforations of the nasal septum may also be evident. Additional conditions like hyperactivity, talkativeness, dilated pupils, discipline problems, missed curfews, financial debt, absenteeism, and a decline in performance are commonly found with cocaine users (Tennant, 1984).

Chapter 3

Methods

Methods

Utilizing existing literature regarding the effects and epidemiology of cocaine abuse, a questionnaire (Appendix B) was developed and distributed to four substance abuse centres across Ontario. Coordinators of rehabilitation clinics were contacted (at the annual conference) prior to the final copy of the questionnaire being mailed to obtain any feedback the clinic coordinators had regarding the content of the questionnaire and to determine the number of questionnaires they would require. Of the two hundred clinics surveyed the following five programs wished to participate in the study: The Addiction Research Foundation at St. Joseph's Hospital in Thunder Bay (In and Out patient programs), the Toronto HIV Addiction Centre, the Saint Thomas Addiction Rehabilitation Unit, and St. Joseph's Hospital in Elliot Lake. The questionnaires were mailed out to the clinics, completed, and returned for analysis.

Accompanying the questionnaires was a letter of introduction (Appendix C) explaining the questionnaire and procedures to both the patient and staff member. The letter also served as a letter of consent. Both Lakehead University and the Port Arthur General Hospital ethics committees were approached and approved the study.

To ensure patient confidentiality, names and addresses were excluded from the study. The patient's file was used to ensure that the information required in part A of the questionnaire (completed by a staff member, not the patient) was accurate.

Subjects

Male patients between the ages of 16 and 40 with a known history of cocaine use were the target group for this study. Six hundred questionnaires were sent to the clinics and 134 subjects completed the questionnaire a 22.4% response rate.

Statistical evaluation

Utilizing the Statistical Package for the Social Sciences (SPSS) computer software the data was analysed using Chi squared statistical techniques. Each sign or symptom was individually examined in relation to the variables: frequency of use, length of use, method of introduction, other substances used with cocaine, and dosage per use. The data exhibited the existence of a relationship between the individual sign or symptom and the aforementioned variables. Once a relationship was established between the sign or symptom and the variable, all of the results were examined to determine if two signs/symptoms were common to different variables. For example, was one sign or symptom found significant in relation to all of the variables.

The epidemiological data (age, ethnic background, employment, salary, money spent per month on cocaine, employment status, and other means of support) were analysed using descriptive statistics including, mean, median, frequency, and histograms.

Chapter 4

Results

Results

The demographic information gathered in the study is summarized in Figures 1 to 8. The demographics of the subjects involved in the study were as follows: average age range was 26-30, 68% were Caucasian, 62% were unemployed, 35% used theft as a method of supporting their habit, the average annual salary was less than \$30,000/year, and, 54% of those surveyed had only a high school education.

Table 2 depicts signs and symptoms that were found in greater than 50% of the subjects in relation to all of the variables. There was a large recess in the frequency of the signs and symptoms and 50% was arbitrarily chosen as the cut off because it was the mid point of the gap. The common signs and symptoms are as follows: craving for more cocaine, anxiety, guilt, paranoia, tremors, and lying.

The signs and symptoms that were found to be significant (.05 level) in relation to the associated parameters (dosage, frequency of use, method of introduction, length of use, and other drugs used with cocaine) are outlined in tables 3 through 13. The tables include the sign or symptom that was found to be significant, the percentages of the positive responses given by the subjects and (under the heading "P"). The probability level at which the sign or symptom is significant is .05. The signs and symptoms the Chi-squared test deemed as significant could be used in detailing the characteristics of the subjects habit because they were found in relation to specific signs or symptoms.

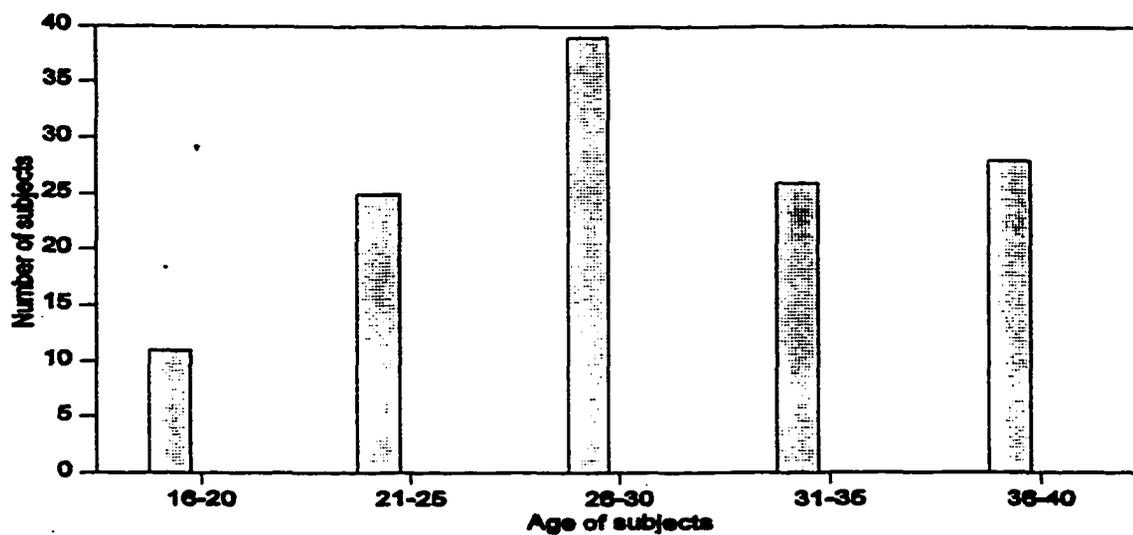


Figure 1. Age of the subjects

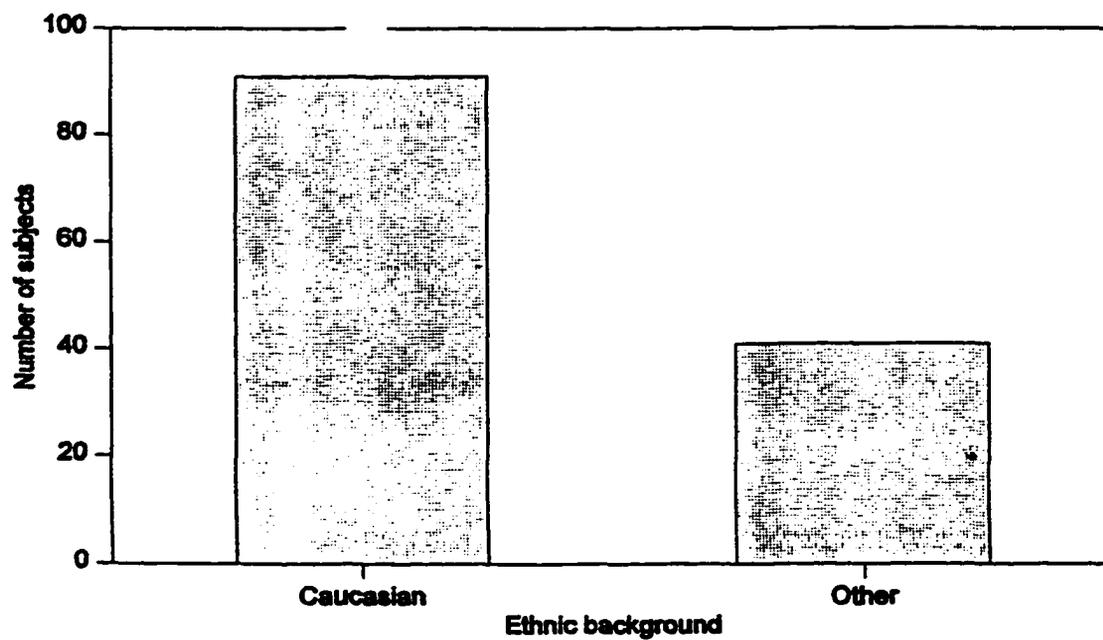




Figure 3. Employment Status Of The Subjects

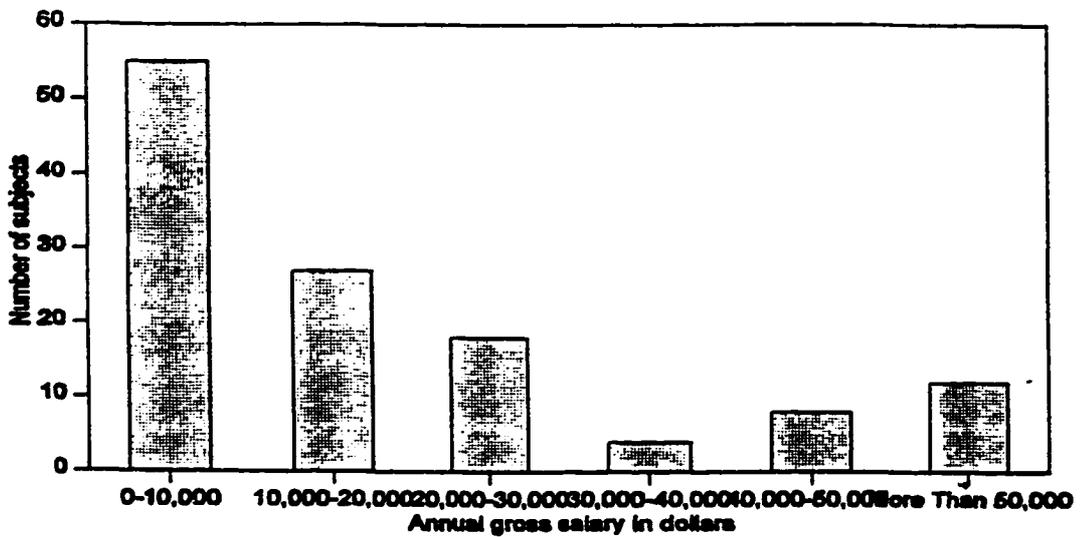


Figure 4. Annual Gross Salary In Dollars

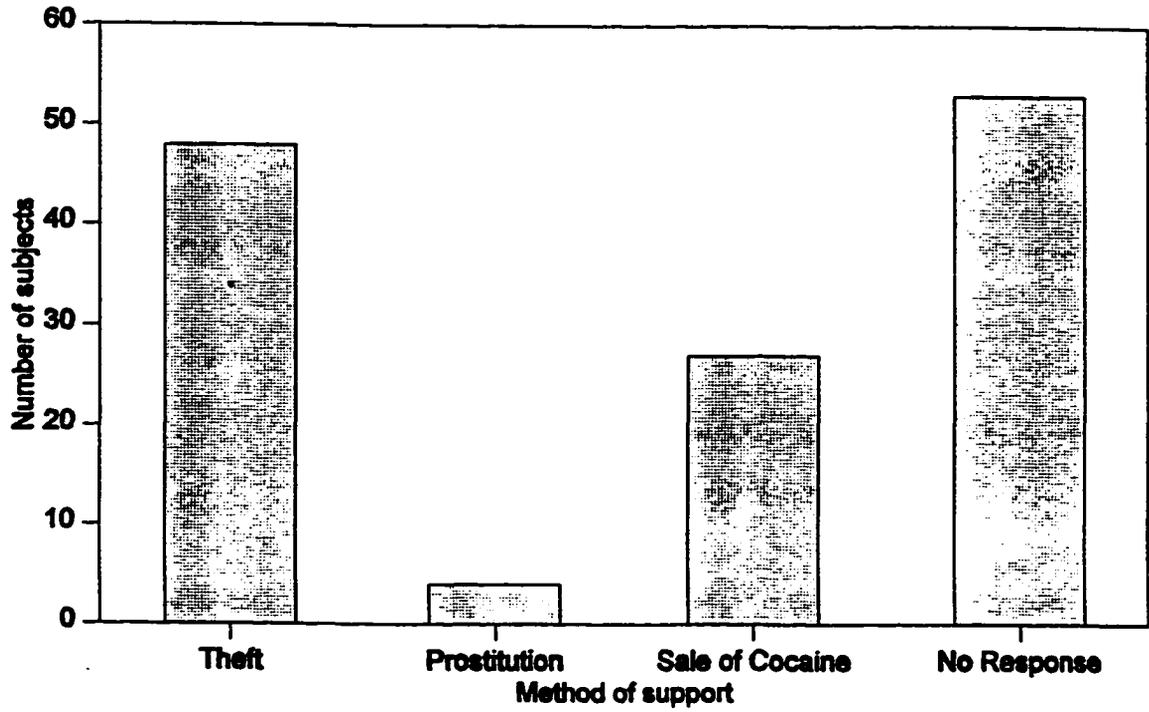


Figure 5. Subjects Means Of Supporting Cocaine Habit

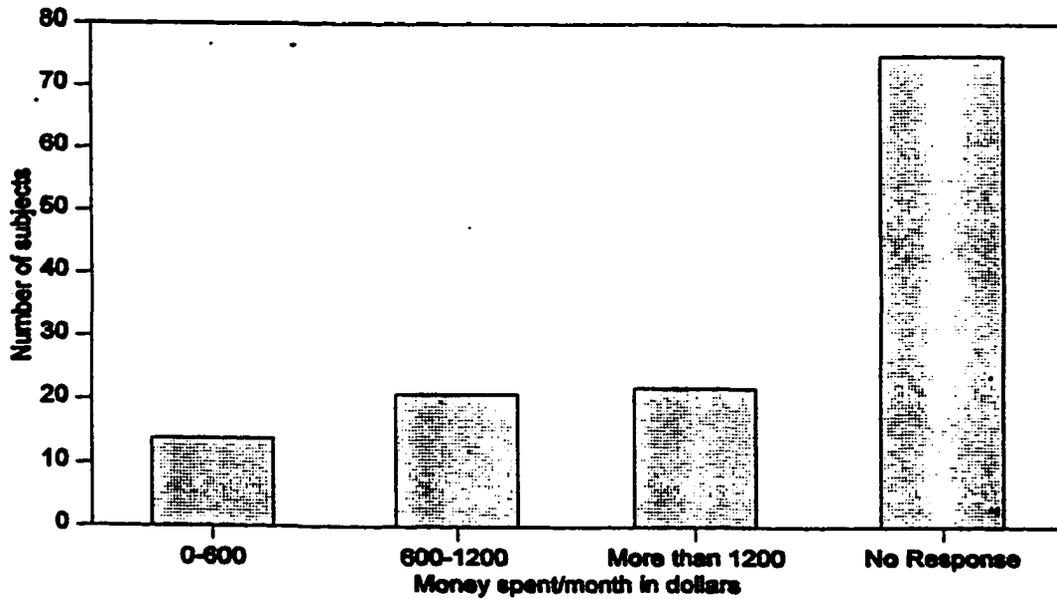


Figure 6. Amount of money subjects spent per month on cocaine

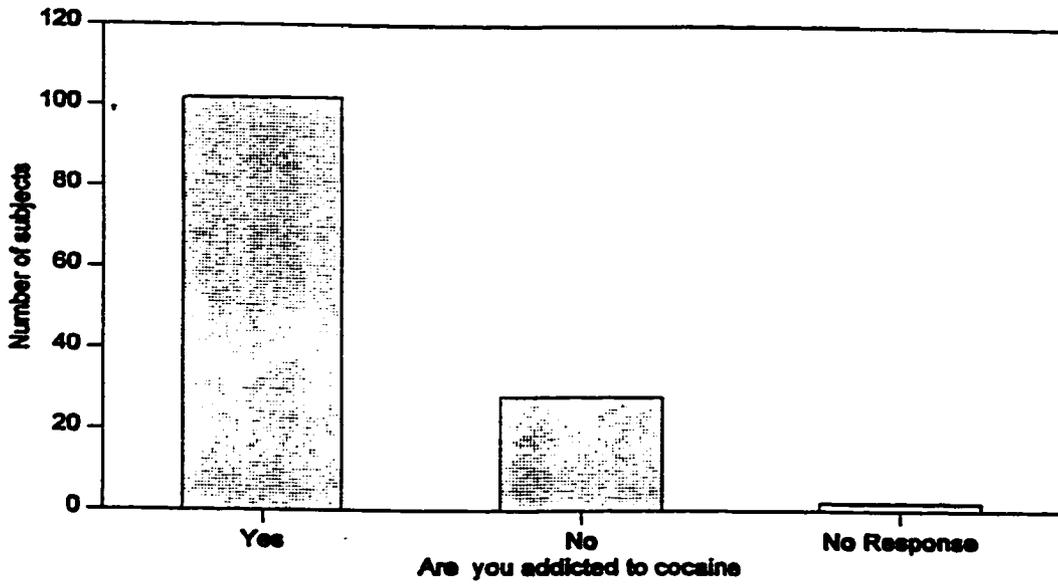


Figure 7. Subjects view on addiction to cocaine

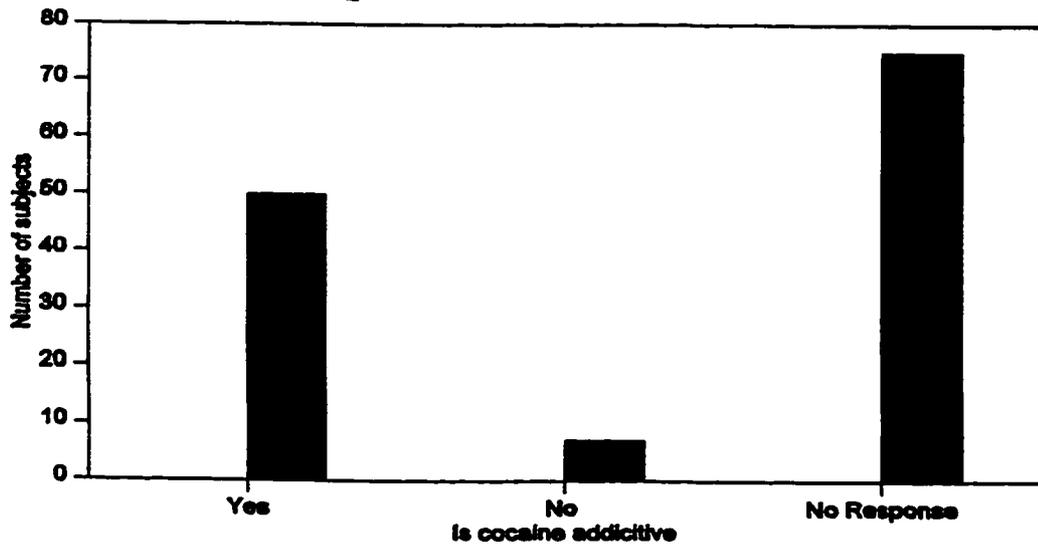


Figure 8. Subjects view on the addictiveness of cocaine

Table 2**Common signs and symptoms of cocaine addiction**

Sign or symptom experienced by a majority of the subjects	Average percentage of subjects experiencing the sign or symptom
Paranoia	83%
Craving for more cocaine	82%
Guilt	77%
Anxiety	71%
Lying	68%
Tremors	60%

Note -Signs and symptoms with an average percentage greater than 50% in relation to all of the signs and symptoms were considered common

Table 3
Snorting cocaine in relation to the signs and symptoms of cocaine addiction

Symptoms found to be significant in relation to snorting cocaine	% That snorted cocaine	% That didn't snort cocaine	P
Auditory hallucinations	24.3	42.3	.006
Increased energy	21.5	50.0	.003
Increased alertness	13.0	38.5	.005
Depression	28.9	80.7	.000
Fuzzy vision	8.9	26.9	.009
Dry mouth	15.9	50.0	.000
Impotence	11.2	30.7	.012
Decreased appetite	23.4	50.0	.007
Twitching	17.8	42.3	.007
Confusion	20.5	50.0	.002
Lying	59.8	92.3	.001
Nausea	10.2	26.9	.026
Restlessness	26.1	61.5	.015
Weight loss	21.5	57.7	.000
Physical exhaustion	27.1	53.8	.008
Mental exhaustion	17.7	50.0	.000
Buzzing in the ear	8.4	30.7	.002
Dry throat	9.4	34.6	.000
Fast heart rate	27.1	53.8	.008

Table 4**Free basing cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to free basing cocaine	% That free base cocaine	% That didn't free base cocaine	P
Auditory hallucinations	44.0	24.0	.045
Increased energy	48.0	22.2	.008
Increased alertness	44.0	13.7	.000
Irritability	72.0	40.7	.004
Fuzzy vision	36.0	14.8	.000
Dry mouth	44.0	17.6	.004
Cold sweats	60.0	34.2	.017
Decreased appetite	60.0	21.3	.000
Twitching	44.0	17.6	.004
Tremors	40.0	65.7	.017
Confusion	48.0	21.3	.006
Lying	88.0	61.1	.010
Weight loss	68.0	19.4	.000
Physical exhaustion	52.0	38.5	.019
Mental exhaustion	48.0	18.5	.001
Buzzing in the ear	32.0	8.3	.001
Dry throat	28.0	11.1	.029
Fast heart rate	52.0	27.8	.019
Spontaneous ejaculation	24.0	7.4	.014

Table 5**Smoking crack cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to smoking crack cocaine	% That smoked crack cocaine	% That didn't smoke crack cocaine	P
Auditory hallucinations	44.5	21.6	.009
Depression	55.6	32.9	.017
Constipation	25.0	4.1	.000
Impotence	33.3	8.2	.000
Decreased appetite	44.5	22.7	.013
Confusion	44.5	19.6	.003
Lying	88.9	57.8	.000
Nausea	27.8	8.2	.003
Weight loss	61.1	16.5	.000
Unable to relax	72.2	48.5	.014
Buzzing in the ear	25.0	8.2	.010
Head aches	36.1	6.1	.001
Spontaneous ejaculation	22.2	6.1	.007
Guilt	66.7	83.5	.034
Fast heart rate	55.6	23.7	.000

Table 6**Intravenous injection of cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to intravenous injection	% That intravenously inject cocaine	% That didn't intravenously inject cocaine	P
Auditory hallucinations	34.3	25.7	.034
Increased alertness	34.3	12.9	.005
Irritability	65.6	40.6	.013
Fuzzy vision	31.3	5.9	.000
Dry mouth	40.6	16.8	.005
Decreased appetite	43.8	23.7	.029
Twitching	34.7	18.8	.056
Confusion	40.7	21.8	.034
Nausea	25.0	9.9	.029
Weight loss	43.8	23.8	.029
Physical exhaustion	46.9	27.7	.043
Mental exhaustion	40.6	18.8	.011
Unable to relax	71.9	49.5	.026
Buzzing in the ear	28.1	7.9	.002
Dry throat	31.2	8.9	.001
Fast heart rate	53.1	25.7	.003

Table 7**Heroin use combined with cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to the use of heroin with cocaine	% That used heroin and cocaine	% That didn't use heroin and cocaine	P
Weight loss	54.5	23.4	.003
Unable to relax	72.7	51.4	.055

Table 8**Alcohol use combined with cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to alcohol use with cocaine	% That use alcohol with cocaine	% That didn't use alcohol with cocaine	P
Feeling of superiority	60.7	28.6	.006
Increased alertness	15.2	33.4	.047
Depression	32.1	76.2	.000
Irritability	42.9	66.7	.044
Paranoia	85.7	57.1	.002
Fuzzy vision	8.9	28.6	.011
Dry mouth	17.9	47.6	.002
Constipation	7.1	23.8	.018
Impotence	10.7	38.1	.001
Increased sexual performance	8.0	23.8	.030
Decreased appetite	23.2	57.1	.001
Tremors	67.9	23.8	.000
Confusion	20.5	57.1	.004
Nausea	6.8	26.7	.001
Weight loss	22.3	61.9	.000
Mental exhaustion	18.8	52.4	.009
Buzzing in the ear	8.0	38.1	.000
Lights in vision	11.6	28.6	.041
Dry throat	10.7	33.4	.006
Head aches	15.1	30.1	.013
Fast heart rate	26.8	61.9	.001
Guilt	83.9	52.3	.001

Table 9**Marijuana use combined with cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to the use of marijuana with cocaine	% That used marijuana and cocaine	% That didn't use marijuana and cocaine	P
Dry mouth	18.6	53.4	.002
Restlessness	37.3	66.7	.029
Weight loss	24.6	60.0	.004
Mental exhaustion	21.2	46.7	.029
Dry throat	11.9	33.4	.025

Table 10**Other drugs used with cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to other drugs used with cocaine	% That used other drugs and cocaine	% That didn't use other drugs and cocaine	P
Visual hallucinations	56.9	31.1	.004
Feeling of superiority	69.3	28.9	.000
Increased alertness	12.5	28.9	.020
Increased sex drive	9.0	31.1	.001
Anxiety	73.9	51.2	.008
Paranoia	89.8	64.5	.000
Insomnia	64.8	40.0	.006
Fuzzy vision	7.9	20.0	.043
Dry mouth	13.6	66.9	.000
Constipation	4.5	20.0	.004
Impotence	10.2	24.5	.029
Craving for more cocaine	89.8	66.7	.001
Increased sexual performance	5.7	20.0	.010
Decreased appetite	18.2	48.9	.000
Twitching	17.1	33.4	.033
Tremors	72.8	37.8	.000
Confusion	17.0	44.5	.000
Nausea	6.8	26.7	.001
Weight loss	19.3	46.7	.000
Mental exhaustion	18.2	35.6	.026
Buzzing in the ear	6.8	24.5	.003
Lights in vision	9.1	24.5	.016
Head aches	13.6	28.9	.033
Fast heart rate	22.8	51.1	.000
Guilt	87.5	62.2	.000

Table 11**Frequency of cocaine use in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant In relation to the frequency of use of cocaine	% That used cocaine less than 15 times/month	% That used cocaine more than 15 times/month	P
Auditory hallucinations	17.5	51.3	.000
Feeling of superiority	62.7	39.0	.023
Depression	37.3	58.5	.042
Dry Mouth	21.6	46.3	.011
Paranoia	66.7	92.7	.002
Migraine head aches	5.9	26.9	.005
Constipation	5.9	24.4	.011
Impotence	9.8	31.7	.004
Decreased appetite	21.6	63.4	.000
Twitching	13.7	46.3	.000
Tremors	56.9	31.7	.016
Confusion	17.6	58.6	.000
Lying	54.9	85.7	.001
Nausea	5.8	31.7	.001
Weight loss	15.7	68.3	.000
Physical exhaustion	29.4	63.4	.001
Mental exhaustion	11.7	56.1	.000
Buzzing in the ear	5.8	34.7	.000
Lights in vision	11.7	31.7	.018
Dry throat	7.8	36.6	.000
Head aches	11.7	41.5	.001
Fast heart rate	21.6	70.8	.000
Spontaneous ejaculation	7.8	24.4	.028

Table 12**Length of cocaine use in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in relation to length of use of cocaine	% That have used cocaine for less than 2 years	% That have used cocaine for more than 2 years	P
Increased strength	47.0	12.9	.008
Increased sex drive	58.8	22.6	.012
Depression	23.5	58.1	.021
Anxiety	29.4	61.3	.034
Irritability	23.5	54.8	.036
Insomnia	11.8	41.9	.011
Increased sexual performance	47.0	6.5	.000
Weight loss	23.5	58.1	.021
Physical exhaustion	23.5	48.4	.043
Unable to relax	29.4	61.3	.034
Head aches	5.9	41.9	.002

Table 13**Dosage per use of cocaine in relation to the signs and symptoms of cocaine addiction**

Symptoms found to be significant in Relation to dosage of cocaine/use	% Using less than 15 grams of cocaine/use	% Using more than 15 grams of cocaine/use	P
Auditory hallucinations	23.4	55.6	.023
Feeling of superiority	23.4	55.6	.023
Irritability	30.0	66.7	.013
Paranoia	60.0	94.5	.009
Insomnia	23.4	44.5	.023
Constipation	6.7	33.4	.016
Impotence	13.4	44.5	.015
Craving for more cocaine	56.7	83.3	.011
Decreased appetite	40.0	83.3	.003
Tremors	6.7	33.4	.016
Confusion	36.7	66.7	.043
Aggressive or violent behaviour	33.4	61.1	.003
Nausea	13.4	38.9	.041
Weight loss	16.7	94.5	.000
Physical exhaustion	26.7	61.1	.018
Buzzing in the ear	10.0	44.5	.005
Dry throat	10.0	38.9	.017
Anxiety	40.0	66.7	.013
Guilt	40.0	55.6	.043
Lying	46.7	83.4	.001
Fast heart rate	56.7	72.2	.036

Chapter 5

Discussion

Discussion

When deciphering the epidemiological data several important facts surface. Drugs are typically associated with the poor, dirty, poorly educated, societal misfits (Miller et al., 1989). Cocaine has somewhat of a different reputation in that it is believed to be the drug of the rich and elite (Tennant, 1984). While it is probable that the rich and elite would seek private help for their problem and not frequent the public clinics questioned in this study, the epidemiological data suggests that the individuals using cocaine are not of the higher sociological echelons. In this study 68% of the subjects were Caucasian, 53.70% have only high school education, 62.51% are unemployed and 84.51% earn less than \$30,000/year. These statistics demonstrate that the impoverished, unemployed, and, uneducated are also using cocaine.

Table 2 demonstrates 6 signs and symptoms that were experienced by greater than 50% of the subjects. The following signs and symptoms were common among addicts: craving for more cocaine, paranoia, anxiety, guilt, tremors and lying. With regard to the clinical tool these 6 signs or symptoms should be investigated in part A of the examination.

Cocaine addiction is both a chemical and psychological addiction due to the effects on the reward centre of the brain as outlined by Spivey and Euerle, (1990). The fear of entering the crash phase of cocaine withdrawal could explain repeated use, which might explain why 82% of the subjects stated that they had cravings for more cocaine, fearing the consequences related to cocaine withdrawal.

Anxiety, paranoia, and guilt (71%, 83% and 77% respectively) were also common signs and symptoms, indicative of the mental turmoil suffered by cocaine addicts. Interestingly, guilt was found less in those addicts who had been using cocaine for less than 2 years. This suggests that possibly the individual has learned to cope with the guilt or simply doesn't feel remorse toward the addiction as seen in users who have used cocaine for more than 2 years. Also, the

instance of paranoia increased as length of use, dosage, and frequency of use increased. The clinical implications of increased paranoia with regard to increased frequency, dosage, and length of use are notable - the more experienced heavy user may suffer from higher degrees of paranoia than the recreational user. Trapped in a cycle the cocaine addict appears to deal with the guilt associated with his habit but becomes increasingly paranoid regarding his habit.

The incidence of lying was 68%. In relation to paranoia, guilt and anxiety, lying is the addict's method of attempting to hide his habit. The incidence of lying increases noticeably as frequency, length, and dosage increases. From a clinical or non-clinical standpoint, the degree of lying could indicate the severity of the addiction and a chronological estimation of use. Drug addicts in general lie to hide their habit due to the legalities involved. Again the problem is cyclical in that as the individual becomes accustomed to the drug he must use more to achieve the same effects thus driving the incidence of lying upward.

The incidence of tremors, experienced by 60% of the subjects, has particular application in athletics. As a central nervous system stimulator, cocaine can cause twitching or spastic muscle contractions (Guyton, 1991).

Tables 3 through 6 examine the method of introduction of cocaine. Tables 3, 4 and 6 depict snorting, freebasing and intravenous injection respectively and are virtually identical. That is to say, the subjects reported the same signs and symptoms when using one of the three aforementioned methods of introduction. The signs and symptoms reported are as follows: auditory hallucinations, increased alertness, irritability, fuzzy vision, dry mouth, decreased appetite, twitching, confusion, weight loss, physical exhaustion, mental exhaustion, buzzing in the ear, dry throat and fast heart rate. Although the methods of introduction are different the reasoning as to why the subjects experienced the same signs and symptoms is difficult to explain due to the lack of research. Nonetheless, all of the methods of introduction did not display the same signs and symptoms.

The subjects who were smoking crack cocaine displayed different signs and symptoms. Depression, constipation, impotence, confusion, nausea, head aches, and, spontaneous ejaculation

were all reported by the subjects that smoked cocaine. This is revealing because one would assume that all methods of introduction would elicit the same signs and symptoms yet the results here do not support that assumption. A physiological explanation to the difference between smoking crack and the other methods of introduction is at this point only speculation.

While the individual physiological effects of cocaine are primarily understood there is no absolute method of determining how the drug will affect each individual. There are simply too many variables in an individual's physiology and habit.

The signs and symptoms reported by the subjects when combining cocaine with heroin (Table 7), alcohol (Table 8), marijuana (Table 9), and, other drugs (Table 10), are sporadic. The results in table 7 and 9 support the fact that cocaine addicts crave nothing but cocaine and will do anything to attain the high felt when using cocaine (Spence, 1990). This might explain why the subjects reported so few signs and symptoms in relation to use of heroin and marijuana. Furthermore, Table 8 augments the findings of Gibbons, et al (1981) in that most people experiment with drugs while drinking alcohol. The signs and symptoms that were reported by the subjects who were combining alcohol with cocaine are similar to the signs and symptoms that were reported with respect to the other parameters, with one exception. The only new sign or symptom that was reported as a result of combining alcohol with cocaine was lights in vision. It is unclear if the lights in the vision are the result of the cocaine or the result of the alcohol. Nonetheless, the fact remains that this was the only additional sign or symptom reported by the subjects. This may indicate that the effects of the cocaine override the effects of the alcohol.

The signs and symptoms in Table 2, as already discussed, were experienced by at least 50% of the subjects and summarization of tables 3 through 10 reveal an additional 10 signs and symptoms that the subjects experienced repeatedly. The 10 signs and symptoms are: auditory hallucinations, dry throat, dry mouth, buzzing in the ear, fast heart rate, weight loss, decreased appetite, mental exhaustion, physical exhaustion, and, confusion. These 10 signs and symptoms in combination to the additional 6 common signs and symptoms make up part A of the questionnaire (Appendix F) and should be investigated in all instances where cocaine use is a possibility. Part B

of the questionnaire will conform to the signs and symptoms that could be used to characterize the subjects habit regarding frequency, length of use, and, dosage.

With respect to frequency of use there are some interesting findings. Depression, migraine headaches, constipation, impotence, lights in the vision, head aches were all significant with respect to frequency of use. All of the signs and symptoms were higher in incidence as the frequency of use rose above 15 sessions per week. However, feelings of superiority were related to those who were using cocaine less than 15 times/month. Also tremors were more evident in those individuals who used cocaine less than 15 times/month. These results demonstrate that tremors and feelings of superiority may indicate that a person is using cocaine less than 15 times/month.

With regards to length of use, increased sex drive, feelings of increased strength and increased sexual performance were demonstrated by addicts that had been using cocaine for less than 2 years. However, the perception of increased strength, increased sex drive and sexual performance dropped off dramatically when the addicts had been using cocaine for more than 2 years. Depression, irritability, insomnia, anxiety, weight loss, head aches and the inability to relax were other signs and symptoms indicated in relation to length of use. All of these symptoms were increased in incidence when the addict had been using cocaine for more than 2 years. From a diagnostic perspective the increased strength, sex drive and performance are all important in categorizing the addict with respect to length of use. In practical application this information could be used to estimate how long a person had been using cocaine.

The last of the parameters to be probed was dosage. Addicts who used more than 15 grams of cocaine in a session reported higher incidences of violent behaviour versus those using less than 15 grams/session. Paranoia, craving for more cocaine, decreased appetite, confusion and an accelerated heart rate were all signs and symptoms predominant in addicts using less than 15 grams/session. All the other signs and symptoms (all of which have already been mentioned) were dominant in those who used more than 15 grams/session. Interestingly, the greatest number of addicts use 0-5 grams of cocaine/session.

Hypothetically, if an individual demonstrated a multitude of signs and symptoms, the information from this study, the clinical tool, could indicate the characteristics of the person's habit from the visible signs and symptoms. Inversely, if the subject describes his habit (how, how much, how often, how long, and with what other substances) the signs and symptoms could possibly be determined.

The final portion of the survey was a double question regarding the addict's reflection toward the addictiveness of cocaine. The data demonstrated that 76% of the subjects thought they were addicted to cocaine. When asked if they thought cocaine was an addictive drug only 37.3% agreed while 56.0% of the participants did not answer the question. Why an individual would think that they are addicted to a drug but chose not to answer a question regarding the addictive qualities of the drug is interesting. Unfortunately discussion is beyond the scope of this paper. The purpose of this experiment was to determine the relationship between the method of introduction, dosage, length and frequency of use to be used in the development of a clinical tool. The clinical tool is included as Appendix F.

Chapter 6

Recommendations for further study

Recommendations

There are several possibilities for further study utilizing the information from this study. The first possible avenue would be to duplicate the study with a larger subject pool to verify the results of the present study. Second, the study could be duplicated using female subjects and examining any differences that may occur. Third, the clinical tool developed from this study could be interveened into an existing rehabilitation program and its accuracy and validity could be investigated. Fourth, the study could be duplicated using another type of questionnaire to determine if the same signs and symptoms are found to be significant. Fifth, additional questions could be asked from the existing data base regarding age in relation to ethnic background or education. Several additional studies and statistical evaluations could be examined from the data gathered in this study. Lastly, the question of why addicts appear to think that they are addicted to cocaine but don't seem to think cocaine is addictive is another avenue that should be explored.

References

Alcoholism and Drug Addiction Research Foundation, (1992). Canadian Profile: Alcohol and Other Drugs. Annual Source Book. 26-32.

Anderson, W. Albrecht, R. McKeag, D. Hough, D and McGrew, C. (1991). A National Survey of Alcohol and Drug Use By College Athletes. The Physician and Sports Medicine. 19(2), 91-104.

Bailey, S. Flewelling, R and Rachal, V. (1992). Predicting Continued Use of Marijuana Among Adolescents: The Relative Influence of Drug-specific and Social Context Factors. Journal of Health and Social Behaviour. 33, 51-66.

Bell, J and Doege, T. (1987). Athletes' Use and Abuse of Drugs. Physician and Sports Medicine. 15(3), 99-108.

Bertolet, B. Freund, G. Martin, C. Perchalski, D. Williams, C and Pepine, C. (1990). Unrecognized Left Ventricular Dysfunction in an Apparently Healthy Cocaine Abuse Population. Clinical Cardiology. 13, 323-328.

Brickner, E. Willard, J. Eichhorn, E. Black, J and Grayburn, P. (1991). Circulation. 84(3), 1130-1134.

Brown, E. Prager, J. Lee, H and Ramsey, R. (1992). CNS Complications of Cocaine Abuse: Prevalence, Pathophysiology and Neuroradiology. American Journal of Radiology. 159, 137-147.

- Bunn, W and Giannini, J. (1992). Cardiovascular Complications of Cocaine Abuse. American Family Physician. 46,(3), 769-772.
- Cantwell, J and Rose, F. (1986). Cocaine and Cardiovascular Events. The Physician and Sports Medicine. 14,(11), 77-82.
- Coniglio, K. (1990). Cocaine-Induced Acute Myocardial Infarction. Critical Care Nurse. 11,(2), 16-22.
- Conlee, R. Barnet, D. Kelly, P and Ho Han, D. (1991). Effects of Cocaine on Plasma Catecholamine and Muscle Glycogen Concentrations During Exercise in the Rat. The American Physiological Society. 1323-1327.
- Erickson, R. Adlaf, E. Smart, R and Canale, M. (1987). Drug use Among Ontario Adults, 1977-1991. Addiction Research Foundations of Canada. 41-44
- Erickson, P and Alexander, B. (1989) Cocaine and Addictive Liability. Addiction Research Foundation of Thunder Bay.
- Fisher and Yates (1990). Statistical tables for Biological, Agricultural and Medical Research, Longman group Ltd, London.
- Gantenberg, N and Hageman, G. (1991) Cocaine-Enhanced Arrhythmogenesis: Neural and Nonneural Mechanisms. Canadian Journal of Physiological Pharmacology. 70, 240-245.
- Garner, G. (1988). AIDS Update: Recommendations For Preventing Transmission Of HIV In Health Care Settings. Canadian Medical Association Journal. 138, 213-219.

- Gibbons, C. Brown, B. Greene, M and DuPont, R. (1981). Initiation into Heroin Use. The International Journal of Addictions, 16(5), 935-939.
- Gold, M. Dakis, C. Pottash, C. Extein, A and Washton, A. (1986). Cocaine Update: From Bench to Bedside. Controversies in Alcoholism and Substance Abuse. 35-57.
- Gray, N. (1993). The Relationship of Cigarette Smoking and Other Substance Use Among College Students. Journal of Drug
- Gropper, M. (1991). The Many Faces of Cocaine: The Importance of Psychosocial Assessment in Diagnosing and Treating Cocaine Abuse. Social Work in Health Care. 16,(2), 97-111.
- Guyton, A. (1991). Textbook of Medical Physiology. W. B. Saunders Company, U. S.
- Jonas, J. Gold, M. Sweeny, D and Pottash, A. (1987). Eating Disorders and Cocaine Abuse: A Survey of 259 Cocaine Abusers. Journal of Clinical Psychiatry. 48,(2), 47-50.
- Kramer, L. Locke, G. Ogunyemi, A and Nelson, L. (1990). Cocaine Related Seizures in Adults. American Journal of Drug and Alcohol Abuse. 16, 309-317.
- Lee, C. Mohammadi, H and Dixon, R. (1991). Medical and Dental Implications of Cocaine Abuse. Current Therapy. 49, 290-293.
- Lombardo, J. (1986). Stimulants and Athletic Performance (Part 2): Cocaine and Nicotine. The Physician and Sports Medicine. 14,(12), 85-89.

- Mackler, S. and O'Brien, C. (1991). Cocaine Abuse. Advances in Internal Medicine. 37, 21-35.
- Manschreck, T. Schneyer, M. Weinstein, C. Laughery, J. Rosenthal, J. Celda, T and Berner, J. (1990). Free base Cocaine and Memory. Comprehensive Psychiatry. 31,(4), 369-375.
- McArdle, W. Katch, F and Katch, V. (1991) Exercise Physiology. Lea and Frieberg, Philadelphia.
- Miller, N. Gold, M and Millman, R. (1989). Cocaine. American Family Physician. 39,(2), 115-120.
- Mueller, P. Benowitz, N. and Olson, K. (1990). Cocaine. Emergency Aspects of Drug Abuse. 8,(3), 481-493.
- Orser, B. (1988). Thrombocytopenia and Cocaine Abuse. Journal of the American Association of Nurse Anaesthetists. 56, 510-514.
- Palumbo, J. Gold, M and Pottash. (1991). Cocaine: Epidemiology. Library of Congress Cataloguing - in - Publication Data. Marcel Dekker, Inc. United States.
- Penning, E and Barnes, G. (1980). Adolescent Marijuana Use. Health and Welfare Canada.
- Sauer, C. (1991). Recurrent Embolic Stroke and Cocaine Related Cardiomyopathy. Stroke. 22,(9), 1203-1205.

- Scher, J. (1992). Death of a Goon. Sports Illustrated. Aug, 32-34.
- Smith, D. (1986). Cocaine-Alcohol Abuse: Epidemiological, Diagnostic and Treatment Considerations. Journal of Psychoactive Drugs. 18,(2), 117-126.
- Spence, W. (1990). Cocaine the Unforseen Dangers. Health Edco: Spence Research Inc. 2-15.
- Spivey, W and Euerle, B. (1990). Necrologic Complications of Cocaine Abuse. Annals of Emergency Medicine. Dec. 1422/95 - 1427/100.
- Stedman. (1987). Webster's New World Medical Dictionary. Prentice Hall, U.S.A.
- Tennant, F. (1984). Dealing with Cocaine Abuse by Athletes. Sports Medicine Digest. 6,(11).
- Wilke, W. (1990). Recognition and Treatment of Cocaine Abuse. Cleveland Journal of Medicine. 57,(7), 595-596.
- Yates, R. Fulton, A. Gabel, J and Brass, C. (1989). Personality Risk Factors for Cocaine Abuse. American Journal of Public Health. 79,(7), 891-892.
- Yudofsky, S. Silver, J and Hales, R. (1993). Cocaine and Aggressive Behaviour: Neurobiological and Clinical Perspectives. Bulletin of the Menninger Clinic. 57,(2), 218-226.

Appendix A

Cocaine abuse in Canada and the United States

Statistics regarding the use of cocaine are surprisingly high and although the use declines for periods overall use continues to rise regardless of the proven counter indications. Each day 5000 people (U.S) will experience cocaine for the first time (Coniglio, 1990). The literature is full of statements regarding the widespread use of cocaine in the U.S.

"30-40 million Americans have experience with cocaine (Brown, Prager, Lee and Ramsey," 1992).

"cocaine related overdoses have doubled since 1981," (Smith, 1986).

"Since the introduction of crack in 1984 there has been another epidemic of cocaine use," (Spivey and Euerle, 1990)

"Cocaine related deaths have risen 200% and the number of people admitted to hospital treatment programs for cocaine abuse has risen 500% since 1976," (Gold, Dackis, Extein and Washton, 1986).

Statistics regarding the use of cocaine in Canada and Ontario are parallel, Appendix A. The statistics illustrate that the use of cocaine is a problem that needs to be addressed. The question that has risen is who is using cocaine. Demographically cocaine users were characterized as young, white, middle class males with higher than average incomes. However, the introduction of crack has made cocaine available to all social strata not just the wealthy (Lee et al., 1991).

"Children as young as 10 years of age are making up to \$500 per week selling crack," (Palumbo, Gold and Pottash, 1991).

"Sixteen percent of children between the ages of 9 and 12 have already been approached

to sell drugs and by the age of 14, 5% of teenagers have used cocaine (Palumbo et al., 1991)."

".. 36% of medical students from 13 schools reported cocaine use, 17% within the part year and 7% within the last month (Palumbo et al., 1991)."

The fact that children are using and selling cocaine is difficult to fathom. Women often barter for cocaine using sex as payment and literally become the slaves of crack dealers.

Additionally, the data regarding the amount of cocaine brought into Canada and the U.S is equally astonishing. There is an estimated 30-50 tons of cocaine transported into the U.S every year, a street value of 55 billion dollars (Palumbo et al., 1991). Clearly, these statistics and statements depict the epidemic of cocaine abuse in Canada and the U.S. This epidemic has led to a growing information library discussing the effects of cocaine.

Appendix B
Cocaine History Questionnaire

Place an "X" in the appropriate space provided in response to the question.

Part A: Epidemiological Data

Age	Ethnic Background	Employment Status
16-20 ()	Caucasian ()	Blue collar ()
21-25 ()	African America ()	White collar ()
26-30 ()	Oriental ()	Self employed ()
31-35 ()	Hispanic ()	Unemployed ()
36-40 ()	American Indian ()	Welfare ()
	East Indian ()	Student ()
	European ()	
	Other ()	

Educational Background	Method of use	Other Drugs used with cocaine
Public school ()	Snorting ()	Heroin ()
Grade School ()	Intravenous ()	Marijuana ()
High school ()	Free basing ()	Alcohol ()
College ()	Smoking ()	Other ()
Trade school ()		

Annual Gross Salary in \$	Other means of support
00,000 - 10,000 ()	Theft ()
10,001 - 20,000 ()	Prostitution ()
20,001 - 30,000 ()	Sale of cocaine ()
30,001 - 40,000 ()	
40,001 - 50,000 ()	Length of use
50,001 - 60,000 ()	Less than 6 months ()
60,001 - 70,000 ()	More than 1 year ()
70,001 - 80,000 ()	More than 2 years ()
80,001 - 90,000 ()	More than 3 years ()
90,001 - above ()	More than 5 years ()
	More than 10 years ()

Money spent/month on cocaine in \$	Frequency of use	Dosage/use in grams	
000 - 200 ()	801 - 1000 ()	1-5 times/month ()	0-5 ()
201 - 400 ()	1001 - 1200 ()	6-10 times/month ()	5-10 ()
401 - 600 ()	1201 - 1400 ()	11-15 times/month ()	10-15 ()
601 - 800 ()	1401 - above ()	16-20 times/month ()	15-20 ()
		more than 20 times ()	20-25 ()
			25-greater ()

Part B: Signs and Symptoms

Signs and symptoms associated with cocaine use.

Visual hallucinations	()	Increased sexual performance	()
Auditory hallucinations	()	Decreased appetite	()
Feelings of superiority	()	Twitching	()
Increased energy	()	Tremors	()
Increased alertness	()	Confusion	()
Increased strength	()	Lying	()
Increased productivity	()	Aggression or Violence	()
Increased sex drive	()	Nausea	()
Depression	()	Restlessness	()
Anxiety	()	Weight loss	()
Irritability	()	Physical exhaustion	()
Paranoia	()	Mental exhaustion	()
Denial	()	Unable to relax	()
Insomnia	()	Buzzing in ear	()
Fuzzy vision	()	Lights in vision	()
Dry mouth	()	Dry throat	()
Sore or bleeding nose	()	Head aches	()
Migraine head aches	()	Fast heart rate	()
Constipation	()	Stealing	()
Cold sweats	()	Fever	()
Impotence	()	Spontaneous ejaculation	()
Craving for more cocaine	()	Guilt	()

Do you consider yourself a cocaine addict? Y() N()
 Do you consider cocaine an addictive drug? Y() N()

Appendix C

Letter of Introduction

March, 1994

Chris Bulley H.B.P.E, CATAcc.
Department of Physical Education and Athletics
Lakehead University,
955 Oliver Road.
Thunder Bay, Ontario.
P7B 5E1

Dear Sir or Madame

In association with Lakehead University and Mrs Linda James, coordinator of the Smith Clinic of St Josephs Hospital in Thunder Bay, I am preparing a Masters thesis entitled The Effects of Cocaine: A Correlational Study of the Signs and Symptoms of Cocaine Abuse in Males. The purpose of the study is to investigate the relationship between dosage, method of introduction (snorting, Free basing, smoking crack and intravenous injection) frequency of use and the signs and symptoms of cocaine abuse. Secondly, the implications of cocaine abuse and athletics will be discussed.

Data from the questionnaire will be used in the development of a diagnostic tool for cocaine abuse recognition and in the development of a cocaine abuser profile. The questionnaire does not require your name, address or signature to ensure your anonymity. The questionnaire is simple and should take you no more than ten minutes to complete, instructions are included. Participation in the study is completely voluntary and you may withdraw at any time, however, there are no personal risks to you as a participant.

The results of the study will be made available to the facility you are associated with and in the Chancellor Patterson Library at Lakehead University. I look forward to your participation in this research project and thank you for your time.

Sincerely

Chris Bulley

Appendix D

Common myths about cocaine

Cocaine is unlike most other illegal drugs because the effects are not yet thoroughly understood. Medical professionals can make educated guesses as to the effects of cocaine but people are individual so the effects vary. Fortunately there is enough research to rebut some of the common myths concerning cocaine. The 10 most common myths according to Spence (1990) are outlined below:

- 1) Cocaine is harmless if snorted. False, cocaine is a killer and can cause respiratory collapse or heart failure no matter how it is taken.
- 2) Cocaine is nonaddictive. False, the effects on the brain create uncontrollable desire for more of the drug.
- 3) Cocaine is not as bad as heroin. False, it is just as addictive as heroin if not more so.
- 4) Cocaine addicts recover faster than heroin addicts. False, heroin can be treated with methadone, a counteragent hasn't yet been found for cocaine.
- 5) Cocaine increases performance and productivity. False, cocaine gives the illusion of increased performance and provides a false sense of confidence.
- 6) Cocaine increases sex drive. False, research shows that 60% of abusers are sexually dysfunctional.
- 7) Cocaine can act as a form of birth control. False, cocaine will alter the menstrual cycle but it will not suggest infertility.
- 8) Cocaine is good for weight control. False, cocaine can result in malnutrition and vitamin deficiencies.
- 9) Cocaine is a cure for depression. False, the dysphoria following cocaine use will drive the individual further into depression.
- 10) Cocaine is expensive. False, crack pellets cost about \$10 (Spence, 1990).

These myths are common among cocaine users and are responsible for recruitment. Myth number 5 is the most often misinterpreted. Cocaine produces a euphoric effect that the individual believes they are more productive or effective when the opposite is the reality. Unfortunately, the euphoria is stronger than the reality and cocaine users tend to omit the truth, excuse reality, and use cocaine regardless.

Appendix E

Cardiac Conditions

Myocardial infarction is a sudden decrease in oxygen supply to the myocardium (middle layer of the heart consisting of cardiac muscle) causing spasm (Stedman, 1987). Myocardial infarction can lead to cardiac arrest or sudden death (Cantwell and Rose, 1986). The decreased availability (myocardial ischemia) of oxygen is due to an increased myocardial demand for oxygen due to increased heart rate and blood pressure. The rapid rise in blood pressure and heart rate has also attributed to spontaneous rupture of the ascending aorta (Brickner, Willard, Eichhorn, Black and Grayburn, 1991). Vasospasm and coronary artery narrowing, as seen in cocaine using populations, are other major contributing factors to myocardial ischemia and eventual myocardial infarction which could lead to death (Bunn and Giannini, 1992).

Coronary artery thrombosis is the formation of a blood clot within a coronary artery (Stedman, 1987). The thrombosis can develop spontaneously at a point of vasospasm (Cantwell and Rose, 1986) or platelet aggregation. Platelet aggregation is the clustering of platelets and is evident in cocaine abuse, however, the exact mechanism is unknown (Coniglio, 1990). Conversely, cocaine has also been shown to cause thrombocytopenia, a decrease in platelet numbers (Orser, 1988). A decrease in platelet count has serious implications with blood clotting abilities putting the subject at further risk when dealing with bleeding. A study by Coniglio (1990) also exhibited that platelet levels will return to normal after termination of drug use in approximately 6 weeks.

Cardiac arrhythmia refers to irregular rhythm of the heart (Stedman, 1987). Common arrhythmias reported in cocaine use are: atrial tachycardia and fibrillation, accelerated idioventricular rhythm and ventricle tachycardia (Mueler, Benowitz and Olson, 1990). Arrhythmia associated with cocaine could also be linked to the effects of cocaine on sodium (Na^{++}) calcium (Ca^{++}) and potassium (K^{+}) channels. Cocaine has been shown to block fast Na^{++} channels (Gantenburg and Hageman, 1991), by binding to the voltage sensitive Na^{++} channel thus decreasing the amount of Na^{++} influx. The disruption of Na^{++} effects the repolarization K^{+} of

channels thus interfering with cardiac rhythm. Sodium influx is also related to depolarization and the reduction of Na^{++} ions. This interference prevents the initiation of an action potential resulting in abnormal heart rhythm and possibly cardiac arrest (Mackler and O'Brien, 1991).

Cocaine has also been the cause of a shortened ventricular refractory period which also contributes to the possibility of cardiac arrhythmia (Brickner et al., 1991). Regardless of the mechanism, cardiac arrhythmia is a serious and possibly fatal consequence of cocaine use. Myocarditis refers to inflamed state that occurs within the muscle of the heart as a result of intense catecholamine stimulation. Contraction band necrosis (irreversible destruction) and focal myocardial necrosis (death of myocardial tissue from the centre out) are results of increased catecholamine stimulation (Cantwell and Rose, 1986).

Conditions regarding the left ventricle include hypertrophy and dysfunction. Dysfunction is associated with tachycardia and cardiomyopathic ischemia. Hypertrophy has been seen in a number of cocaine users through autopsy. Brickner et al., (1991) noted "marked left ventricle hypertrophy in several cocaine abuse patients none of whom had any medical condition known to cause left ventricular hypertrophy." The results of the study undertaken by Brickner et al., (1991) found significant increases in left ventricle mass index (cocaine abuser 103 ± 24 g/m² compared to a control group 77 ± 14 g/m²) and posterior wall thickness (1.12 ± 0.17 cm cocaine user vs 1.01 ± 0.13 cm control group). Explanations as to the mechanism behind hypertrophy of the heart follows three main thoughts. First, animal studies suggest that alpha-adrenergic stimulation elicits myofibril protein synthesis and increase the production of cardiac muscle tissue above normal levels. Alpha-adrenergic receptors are stimulated by cocaine. Second, norepinephrine secretion is enhanced and has been shown to increase left ventricular mass in canine experiments although the mechanism is still under inquiry. Thirdly, the subsequent increase in blood pressure and heart rate as a result of cocaine ingestion would facilitate left ventricular mass increases (Brickner et al., 1991). Once again regardless of the mechanism the fact that left ventricular mass is indeed increased when using cocaine is demonstrated.

Appendix F

Clinical Tool

Common Signs and Symptoms of Cocaine Use

Sign or Symptom	Notes
Paranoia	() _____
Guilt	() _____
Craving for more cocaine	() _____
Decreased appetite	() _____
Weight loss	() _____
Fast heart rate	() _____
Dry throat	() _____
Dry Mouth	() _____
Buzzing in the ear	() _____
Auditory hallucinations	() _____
Tremors	() _____
Confusion	() _____
Lying	() _____
Physical exhaustion	() _____
Mental exhaustion	() _____
Nausea	() _____
Anxiety	() _____

Additional Signs and Symptoms of Cocaine Use

Sign or Symptom	Notes
Increased energy	() _____
Increased alertness	() _____
Irritability	() _____
Fuzzy vision	() _____
Cold sweats	() _____
Spontaneous ejaculation	() _____
Depression	() _____
Impotence	() _____
Lights in vision	() _____
Head aches	() _____
Insomnia	() _____
Feelings of superiority	() _____

Symptoms related to frequency of use less than 15 times/month

Feeling or superiority () _____
Tremors () _____

Symptoms related to length of use less than 2 years

Increased sex drive () _____
Increased sexual performance () _____
Increased strength () _____

****these drop of in significance in addicts that have been using for more than 2 years****

Symptoms related to length of use greater than 2 years

Depression () _____
Irritability () _____
Insomnia () _____
Weight loss () _____
Anxiety () _____
Inability to relax () _____
Head Aches () _____

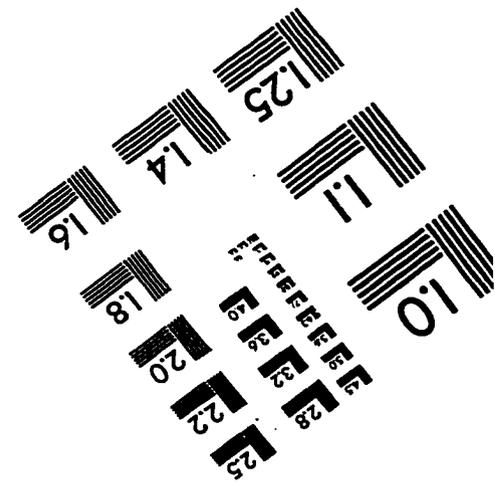
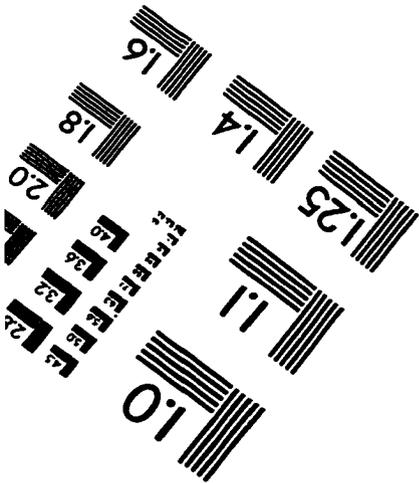
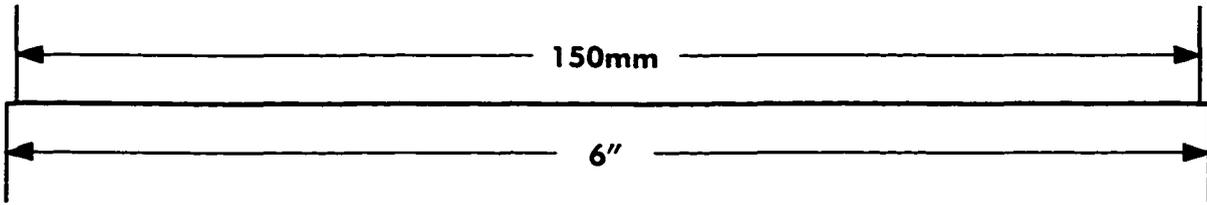
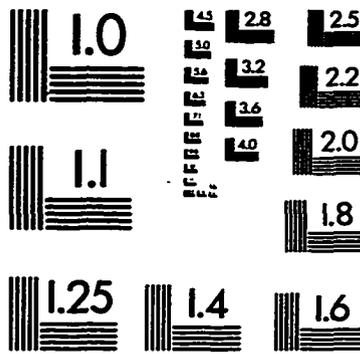
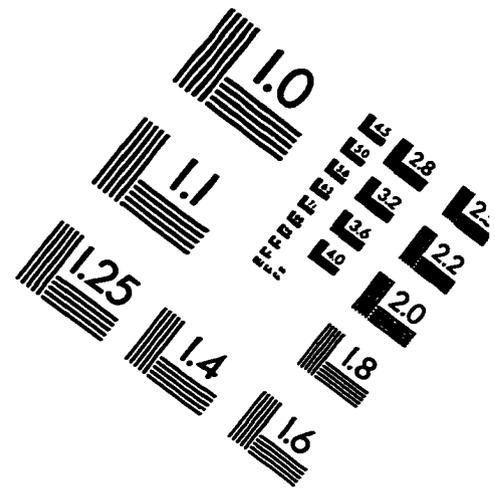
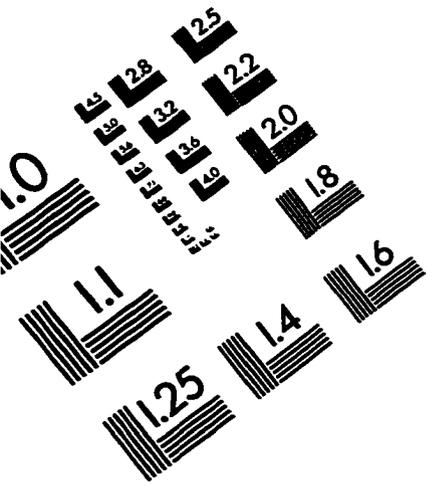
Symptoms related to dosages above 15 grams/session

Aggressive or violent behaviour () _____

Symptoms related to dosages below 15 grams/session

Paranoia () _____
Craving for more cocaine () _____
Decreased appetite () _____
Confusion () _____
Accelerated heart rate () _____

IMAGE EVALUATION TEST TARGET (QA-3)



APPLIED IMAGE, Inc
 1653 East Main Street
 Rochester, NY 14609 USA
 Phone: 716/482-0300
 Fax: 716/288-5989

© 1993, Applied Image, Inc., All Rights Reserved