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COCAINE USE
RECOMMENDATIONS
IN
TREATMENT AND REHABILITATION

Prepared for Canada's Drug Strategy Division by
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1. Introduction

In Canada, the increasing rates of Hepatitis C, HIV/AIDS and overdose deaths have been associated with cocaine use among people who inject drugs, particularly in Vancouver and other large urban centres. The purpose of this report is to promote the use of effective interventions by providing information on cocaine and its effects, and identifying best practices in treatment and rehabilitation for individuals with cocaine-use problems. Issues of accessibility to treatment for different population groups are not covered in this report, since they are addressed in other Health Canada reports on best practices, for example, *Best Practices – Substance Abuse Treatment and Rehabilitation* (Health Canada, 1999).

Following the introduction, section two of this report describes the historical context of cocaine use in North America, section three reviews available data on the prevalence of cocaine, and section four describes cocaine's short-and long-term effects. Sections five and six review the treatment literature on pharmacological and behavioural treatment interventions, and make recommendations for best practices.

This report is based on a literature review of medical, psychological and sociological journals. Studies referenced in the report were reviewed for methodological rigor. A bibliography of studies of sufficient quality for reference purposes is attached, as well as a brief list of key program resources available through the Web.

For purposes of evaluating response to pharmacotherapy, only studies that used randomized, double-blind procedures were selected. For the evaluation of behavioural treatment, studies that were included used

random assignment and a credible control or comparison treatment procedure. PsycLit and Medline were the primary sources of studies. For both, the search words "cocaine" and "treatment" were entered. The search included all articles to the end of 1997.*

2. Historical Overview of Cocaine Use

Cocaine is obtained from the leaves of the coca plant, which is indigenous to South America. Reports of its use date back to 3000 B.C., and its use by the Incas in Peru was commented on by the 16th century Spanish Conquistadors (Fleming et al., 1990; Warner, 1993). The Conquistadors reported that chewing the coca leaf increased stamina, and reduced hunger and thirst. Chewing the coca leaf was the predominant method for deriving cocaine-related effects, until 1855 when the drug was isolated as an alkaloid by Albert Niemann, who named it "cocaine". Operating in an unregulated environment in the late 19th century in both Canada and the United States, this new drug was adapted for a variety of purposes such as in teas and cigarettes, as a local anaesthetic, and in cough syrups and other remedies. It is perhaps most infamously known as an ingredient in Coca Cola. The large number of cocaine products and the ability of doctors, pharmacists and vendors to provide them to the public are blamed for the creation of a large North American drug-dependent cohort in the late 19th century (Das, 1993; Jonnes, 1995; Smart, 1991; Warner, 1993). In Canada, cocaine was also widely used in the late 19th century, until the introduction of legislation in 1905.

Following the introduction of legislation in North America, cocaine use appeared to be confined to small subcultures for many years. Indeed, Jonnes (1995) argues that use declined most significantly this century in the United

* Note: Some selected references dated after 1997 have been added to this report.

States (and presumably in Canada) around World War II, when the majority of those who had become dependent on cocaine during the 19th century had passed away. However, reports of greater cocaine use surfaced in the 1970s, although cost impeded widespread use until the 1980s, when cocaine became popular once again, particularly with the advent of less costly “crack cocaine” (Das, 1993; Smart, 1991). Although Canadian data are not available, U.S. data strongly suggest that cocaine use is more widespread today than in the 19th century. Examining U.S. cocaine imports from 1900 and comparing them to estimates of cocaine consumption in 1993, Das (1993) found a tenfold increase, yet the U.S. population had only increased about three times. Although its use is most prevalent in North America and Latin America, its use is also increasing in Western Europe and Australia, and is spreading to some African and Asian countries (World Health Organization, 1998).

While specific numbers are not available, historians have generally found that cocaine users in the 19th century do not fit the profile of today’s users (Das, 1993; Jonnes, 1995). There are differences in the gender distribution and social class of chronic users. Females and members of the upper class were more highly represented in the 19th century (Jonnes, 1995). In contrast, people using cocaine today are more likely to be males, and more chronic users originate from lower income groups (McKenzie and Single, 1997).

3. Distribution of Cocaine Use in Canada

This section describes the characteristics of users and the trends in use. Because cocaine is an illicit drug, the number of users can never be determined definitively. Not everyone who uses cocaine will admit use if asked in a survey, or will accurately recall consumption. Not all users will be charged or convicted. However, data are available that give some

idea of the prevalence of cocaine use. Typical indicators include survey data from national and local telephone surveys, school surveys, police-and court-generated data, and treatment studies.

3.1 National Surveys of Adults

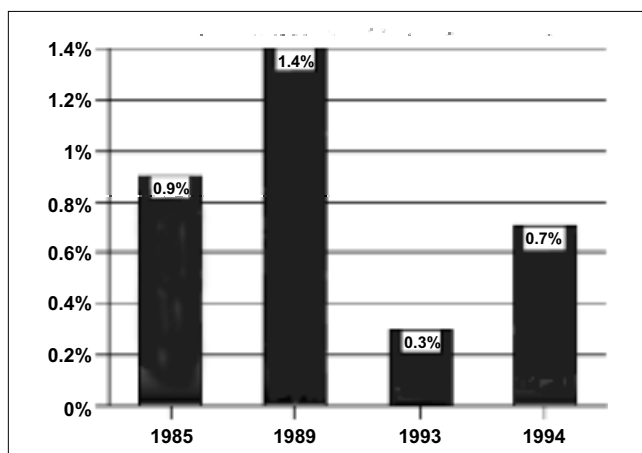
Recent national surveys of Canadians 15 years or older that have included questions on alcohol and other drug use are the 1985 Health Promotion Survey, the 1989 National Alcohol and Drug Survey, the 1990 Health Promotion Survey, the 1993 General Social Survey and the 1994 Canada’s Alcohol and Other Drugs Survey (for a summary, see McKenzie and Single, 1997). National surveys generally poll a representative sample of Canadians (15+ years) from the 10 provinces, but not the Yukon nor the Northwest Territories, and these surveys average an 80 percent response rate. However, it should be remembered that telephone surveys (which are the typical method used) may underestimate the prevalence of cocaine use, because they miss groups that are more likely to use cocaine, such as prison inmates; persons in residential treatment facilities or other institutional facilities; and individuals who are homeless and therefore lack a stable address or telephone. An additional problem is that only a small number of people admit using cocaine (below 1%), and this increases the possibility of sampling error. Other problems common to the interview process include selective responses and memory gaps. Still, the large sample numbers and the diversity of respondents in such surveys ensure a reasonable picture of cocaine use by Canadian adults. Information from these surveys allow examination by demographic characteristics such as age, gender, occupation, marital status and education.

Among Canadians aged 15 and older, survey data indicate that cocaine users tend to be young (20-34 years), single and male. They are also more likely to have completed some

post-secondary education, to describe their occupations as semi-skilled or students, and to be classified in the lowest income bracket. Cocaine users are most likely to be found in cities with larger than 100,000 population in British Columbia and Quebec. Lifetime use of cocaine is also highest among those aged 20-34 years, and men are about twice as likely to report current or lifetime use as women.

National survey data also indicate that self-reported cocaine use in the year prior to the survey dropped slightly from 1985 (0.9% indicated that they had used in the last year) to 1994 (0.7%). Between those years, use appeared to peak in 1989 (1.4%) and reached its lowest rate in 1993 (0.3%). Overall, the data suggest that there has been little change in cocaine use over the past 10 years (Figure 1). Findings are similar in the United States. Based on results from the U.S. National Household Survey on Drug Abuse (NIDA, 1998), in 1996, about 0.8% of the U.S. population 12 years and older were current users, with peak use among those aged 18 to 25 years (2.0%).

Figure 1
Cocaine Use in Canada



Sources: 1985 Health Promotion Survey, 1989 Alcohol & Drug Survey, 1993 General Social Survey, 1994 Canada's Alcohol & Other Drugs Survey

3.2 Women and Cocaine Use

There is a convergence of national and student surveys showing that females are less likely to use cocaine than males. For example, the 1994 Canada's Alcohol and Drugs Survey had 0.5% females reporting cocaine use compared to 0.8% males, meaning men were 60% more likely to use cocaine (McKenzie and Single, 1997).

Other studies have highlighted some differences between male and female cocaine users. For example, Powis et al. (1996) surveyed 558 individuals who use cocaine in a range of community settings in a U.S. city. They found that women tended to be younger, use smaller amounts of cocaine than men, and were less likely to be people who injected drugs. Also, women were less likely to report that they had undertaken treatment. Relationships with males was a substantial influence on cocaine use by women. Most females who inject cocaine were introduced to this practice by cocaine-injecting sexual partners.

3.3 Youth and Cocaine Use

3.3.1 Student Surveys

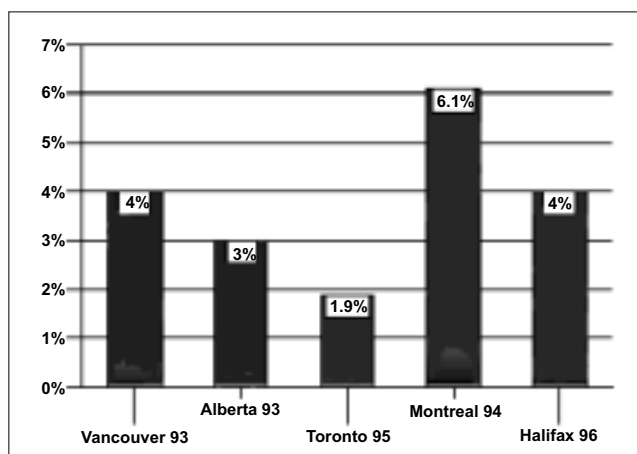
School studies using secondary school student self-reports provide information on cocaine use by young people.

The most comprehensive student surveys have been carried out in Ontario biannually over a 22-year period from 1977 onward. Rates of use were at their peak in 1979, when 5.1% of grade 7 to 13 students reported use in the previous 12 months. This was followed by a steady decline to 1.5% in 1993. Since then use has climbed again, with 4.1% of students reporting use in 1999 (Adlaf et al., 1999) As with adults, males are more likely to report use

than females. Students in grades 11 and 13 reported the highest rate of use (Adlaf et al., 1999). Rates of use of crack among Ontario students remained stable from the mid-eighties, when it made its first appearance, until 1993. At between 1.0% to 1.4% since that time, rates have increased to 2.3% (Adlaf et al., 1999).

Although peak rates of use are somewhat higher among surveys of U.S. high school seniors, they also show a similar decline from a peak of 13.1% in 1985 to 3.1% in 1992, and then a slight increase to 4.9% in 1996. Student surveys done in British Columbia, Alberta, Manitoba and the Atlantic provinces, indicate that rates of use are quite variable across the country. Only British Columbia and Ontario distinguished between cocaine and crack use. Recent surveys show that cocaine use is highest among students in British Columbia (7.8%), followed by Manitoba (5%) and New Brunswick (4.8%). The average for all the Atlantic provinces was 3.4%. (Alberta Alcohol and Drug Commission, 1997; Addictions Foundation of Manitoba, 1995; Health Promotion Institute, 1995; Prince Edward Island, 1996). Information is also available by city from the Canadian Community Epidemiology Network on Drug Use (CCENDU) (Poulin, 1997), which shows that the prevalence of use of crack or cocaine among adolescents was highest in Montreal (6.1%), followed by Halifax (4%) and Vancouver (4%), Alberta (3%), and, finally, Toronto (1.9%). These findings are illustrated in Figure 2.

Figure 2
Student Self-Reported Drug Use
Canada, Various Years



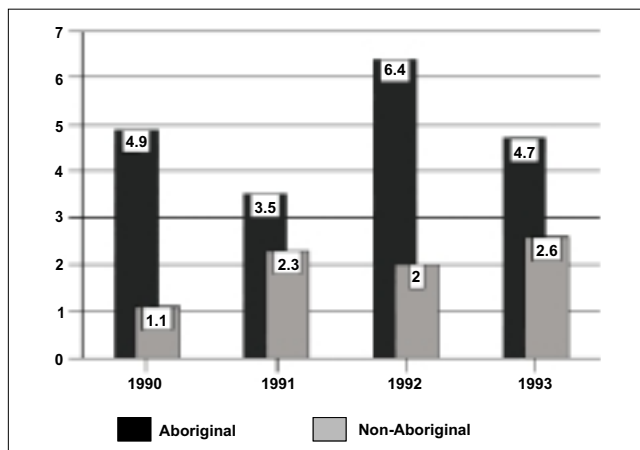
Source: CCENDU, 1997

The most recent CCENDU report (Poulin, Single and Fralick, 1999), includes more recent figures (1997) for only some of the CCENDU sites. In Winnipeg, 5.5% of students who were using drugs other than alcohol, reported past year cocaine use; in Toronto, 3% of students reported cocaine use and 2% crack use; in Fredericton, 5% reported crack or cocaine use.

Comparison of Aboriginal and non-Aboriginal student drug use is provided in a study by Gfellner and Hundleby (1995), who administered self-report questionnaires to Grade 7-12 students in a non-metropolitan Prairie city. Students were surveyed annually from 1990 to 1993. Study findings indicate a greater prevalence of cocaine use among Aboriginal (registered Aboriginals and Métis) youth, compared to Non-Aboriginal students (Figure 3). In 1990, 4.9% of Aboriginal students reported cocaine use, compared to 1.1% of non-Aboriginal students, meaning they were 4.5 times as likely to use cocaine. By 1993, 4.7% of Aboriginal students reported cocaine use, making them only about twice as

likely to use as non-Aboriginal students (2.6%). On the other hand, reported crack use doubled for both Aboriginal and non-Aboriginal students from 1990 to 1993. In 1990, 4.2% of Aboriginal students reported crack use, compared to 8.1% in 1993. Crack-using non-Aboriginal youth totalled 1.8% in 1990, and increased to 3.4% in 1993. However, caution should be exercised in generalizing these findings to other Canadian locales.

Figure 3
Aboriginal and Non-Aboriginal Students' Cocaine Use



Source: Gfellner and Hundleby, 1995

Student surveys often suggest higher rates of cocaine use by adolescents than national surveys of Canadians 15 years of age and older. This may be due to the setting (home versus school) and survey design, which may lead to student under-reporting in national studies (Gfroerer, Wright and Kopstein, 1997). Students may be more comfortable reporting cocaine use in the school than in the home, where their parents may be in the vicinity. The orientation of questions toward students on a school-based survey may also increase truthful reporting. Finally, school surveys include students in grades 8 and 9, while some national surveys do not include those below 15 years of age.

3.3.2 Street Youth

Young people who reside in and around Canada's downtown cores are much more likely to consume large amounts of cocaine and other drugs. According to the 1999 CCENDU (Poulin, Single and Fralick, 1999), 85% of Vancouver street youth report cocaine use, with more than half reporting frequent use. Also, 48% of males and 32% of females reported injection drug use. Rates were somewhat lower in other cities, with 31% of Toronto street youth reporting cocaine use and 31% crack use. In Montreal, the reported use was 32% and 18% for cocaine and crack respectively, and, in Halifax, the figures were 33% and 20% (1991 figures).

The substantial prevalence of cocaine use among street youth is a cause for concern. Use of cocaine can lead to injection drug use, which increases the risk of hepatitis and HIV infection. The expense of drug use also promotes involvement in criminal activities such as drug dealing, theft and prostitution to support regular use (Inciardi et al., 1994).

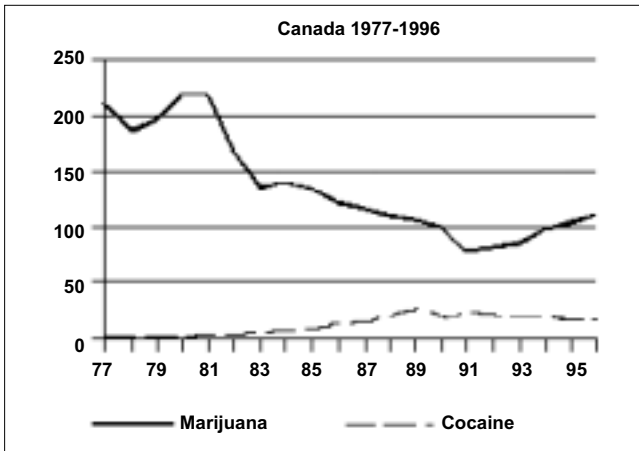
3.4 Official Crime Statistics

Official charges and conviction data, which are available from police forces across Canada, indicate the number of cocaine possession and trafficking offences. Police charges emanate from the *Controlled Drugs and Substances Act* (which replaced the *Narcotic Control Act*) and provide a yearly record of the number of individuals charged with cocaine-related offences. Conviction data, which are generated through the courts, identify the number of individuals found guilty of cocaine offences.

Changes in rates of drug charges from year to year may not always reflect changes in cocaine-use patterns, but instead may depend on resources committed by law-enforcement

agencies to detect users, as well as on the agencies' perception of cocaine's availability and associated problems in their jurisdiction. Convictions represent a smaller number than charges because some charges are withdrawn, plea bargained, or dismissed by the court by "not guilty" findings.

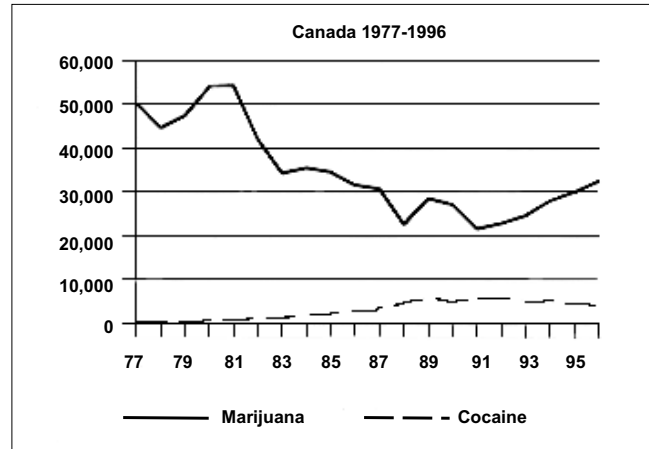
Figure 4
Trends in Cocaine and Marijuana
Offence Rate per 100,000



Source: Canadian Centre for justice Statistics

With these caveats in mind, police data show an upward trend in cocaine possession charges. Increases start in 1977, peak in 1989 and then stabilize in the 1990s. In comparison, cannabis-possession offences declined steadily in the 1980s until the beginning of the 1990s, when they started to increase again (Figure 4). This trend is viewed as representing a move by law-enforcement agencies to target more serious drugs (Wolff and Reingold, 1994).

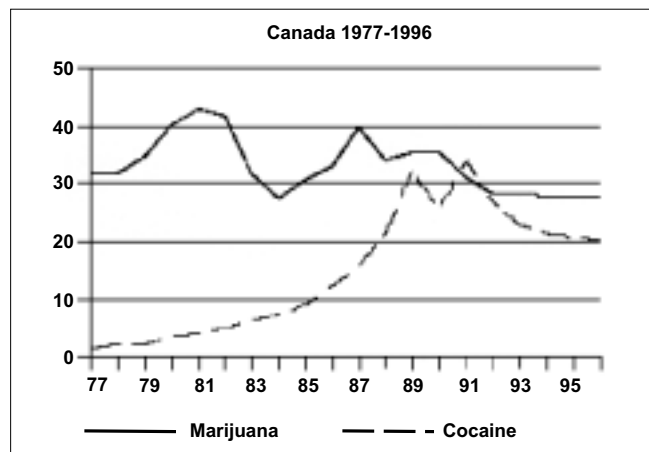
Figure 5
Trends in Cocaine and Marijuana
Possession Offences



Source: Canadian Centre for Justice Statistics

In 1977, cocaine possession made up 1% of all drug-possession incidents, but, by 1996, it had increased to 11%. Conversely, marijuana possession made up 93% of all incidents in 1977, but declined to 80% by 1992.

Figure 6
Trends in Cocaine and Marijuana
Trafficking Rate per 100,000



Source: Canadian Centre for Justice Statistics

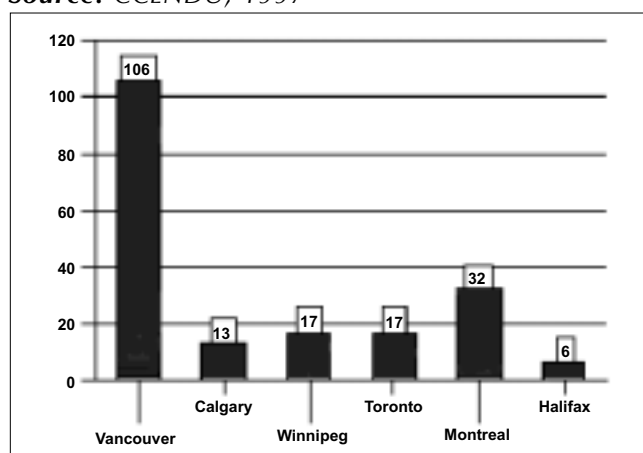
Since 1977, police have also shifted their attention away from possession and directed it toward trafficking and cultivating offences (Figure 6). As a proportion of all drug trafficking offences, cocaine increased almost sevenfold, from 4% in 1977 to 27% in 1996.

3.5 Morbidity and Mortality

Hospital-discharge records provide information on individuals who use cocaine who develop serious health problems as a result of their use. CCENDU (Poulin, 1997; Poulin et al., 1999) provides information on morbidity for large Canadian urban centres (Vancouver, Calgary, Regina, Winnipeg, Toronto, Montreal, Fredericton and Halifax). Vancouver had the highest rate per 100,000 of hospital discharges involving a cocaine-related diagnosis (using the measure of all diagnostic levels, rather than just the most responsible diagnosis) with rates of 106 and 35, in 1995 and 1996 respectively. However, other sites (e.g. Calgary, Winnipeg) showed increased rates between 1995 and 1996. This is shown in Figure 7.

Figure 7
Cocaine-Related Hospital Discharges
Canada 1995

Source: CCENDU, 1997



Cities that are part of the CCENDU project also provided data on deaths that involved cocaine. In 1996, mortality rates for cocaine-related deaths per 100,000 were one or less in Calgary, Toronto, Montreal and Halifax, with Regina and Fredericton reporting a rate of zero. These rates were generally consistent with those for 1995. However, in Vancouver, the rate was 28 in 1996, an increase from in 1995.

3.6 Treatment Agency Admissions

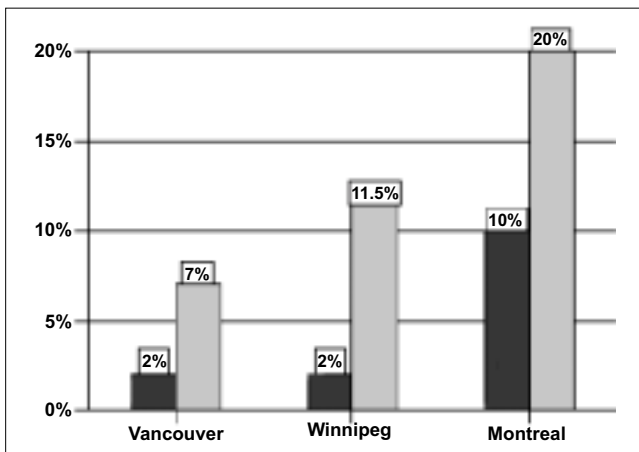
The proportion of people receiving treatment for cocaine use provides information about the number of people experiencing drug-related problems and the availability of services. The first CCENDU report (Poulin, 1997) found that, in spite of the apparently high rates of morbidity and mortality associated with cocaine use in Vancouver, that city reported one of the lowest proportion of individuals in treatment who use cocaine (11%), while Halifax reported the highest (28%). The authors of a study on seroconversion among people who inject drugs observed that as early as 1990 the lack of appropriate treatment services, especially for individuals who use cocaine, was identified as a major barrier for those using British Columbia's needle-exchange programs (Strathdee et al., 1997).

3.7 Cocaine Injection Drug Use, and Hepatitis C and HIV

In Canada, a significant proportion of people who inject drugs are now injecting cocaine, and this appears to increase the risk of HIV seroconversion (Strathdee et al., 1997; Blanchard and Elliot, 1998). Among people who inject drugs in Vancouver, Strathdee et al. (1997) found that cocaine was the main drug injected by 72% of those who were HIV-positive and 62% of those who were HIV-negative. HIV-positive people who inject drugs

were more likely to be established users of injectable drugs, to engage in commercial sex work and to inject with others.

Figure 8
HIV Prevalence Among Injection
Drug Users
 Selected Canadian Cities



Vancouver figures are from 1988-89 and 1996 respectively (Source: Patrick et al. 1997). Winnipeg estimates are from 1990 and 1998 (Jamison and Elliot, 1998). Montreal figures are from 1990 and 1996 (Hankins and Tran, 1996).

High rates of HIV and Hepatitis C infections among people who inject drugs have been reported in other large Canadian urban centres as well (Figure 8). Despite the longstanding availability of needle-exchange programs and street nurse programs, Vancouver now has the highest estimated rate of HIV prevalence among people who inject drugs in North America, followed by Montreal (Canadian Centre on Substance Abuse and Canadian Public Health Association, 1997). The second CCENDU national report identifies high rates of Hepatitis C among people who inject drugs in Vancouver's population, while other CCENDU sites also report concerns regarding Hepatitis B and C rates among their populations of people who inject drugs (Poulin et al., 1999).

The risk of HIV associated with injected drugs is of particular concern for women. For males, injection drug use accounted for 18.5 % of AIDS cases in 1999 compared to 1.1% prior to 1990. For females the increase has been from 7.3 % prior to 1990 to 31.7 % in 1999 (Health Canada, 2000) Similarly, the Strathdee et al. (1997) Vancouver study of 1006 people who inject drugs (353 subjects were women) noted that "subjects testing HIV-positive at baseline were more likely to be women" (Strathdee et al., 1997).

Although there are no definitive answers as to why people who inject cocaine are at greater risk of HIV infection than those using other injectable drugs such as heroin, recent studies have identified a number of risk factors associated with injecting cocaine. Based on initial results from a multi site study, the cocaine working group of the National Institute of Drug Abuse concluded that, overall, cocaine users tend to engage in more HIV-related risk behaviours, including needle sharing and unprotected sex (Compton, Lamb and Fletcher, 1995). In comparison to heroin users, people who inject cocaine are injecting more frequently on a daily basis thus increasing the likelihood of using contaminated needles (Hudgins, McCusker and Stoddard, 1995).

It should also be noted that the risk of infection may be related both to needles and to other paraphernalia. In a study by Shah et al (1996), 85% of infected needles collected from a drug "shooting gallery" had evidence of HIV. This study also found traces of HIV DNA in contaminated water used for rinsing needles, infected cotton swabs and infected "cookers" (spoons or bottle caps for dissolving drugs). The likelihood of infection because of contaminated needles or other paraphernalia is also true for Hepatitis C. HCV (hepatitis C) is transmitted more easily through the blood than HIV. It is also more potent than HIV and is acquired earlier after sharing needles. Compared to HIV, HCV is 10 to 15 times more infectious by the spread of blood (Heintges

and Wands, 1997). This situation is further exacerbated by high prevalence rates of HCV infection among populations that inject drugs; even the occasional sharing of needles and other drug paraphernalia carries an extreme risk.

4. Effects of Cocaine

Cocaine is a powerful stimulant that produces behavioural changes, and affects the neurological, cardiovascular, gastrointestinal and respiratory systems of the body. Cocaine provides two strong pharmacological actions. It is best-known for acting as a stimulant to the central nervous system. Less well-known are its properties as a local anaesthetic. At the level of the central nervous system, cocaine works by blocking the re-uptake of neurotransmitters (dopamine, norepinephrine and serotonin) at the synaptic junctions. This has a strong impact on the pleasure centre of the brain (the limbic system), producing a strong euphoric effect that can result in increased alertness, activity and talkativeness, and a decrease in appetite. As well, a greater sense of well-being may lower anxiety and inhibitions (Volkow et al., 1997; Das, 1993; Fleming et al., 1990; Hall et al., 1990; Warner, 1993).

Many cocaine users are multi drug users (poly drug users), making it difficult to specify cocaine's physical and psychological complications, and to disentangle its effects from those of alcohol, marijuana, other illicit drugs, and the user's lifestyle. Estimation of drug dosages is limited by a lack of reliable reporting, and the fact that cocaine sold on the street may be adulterated with a variety of types and amounts of other substances. Still, this area of cocaine research is growing, and it draws on studies conducted in hospitals and treatment centres, as well as some recent longitudinal studies, which allow a more careful tracking of cocaine's effects over time (Chen et al., 1996; Gorelick, 1992; Warner, 1993).

4.1 Routes of Administration

Cocaine can be "snorted" through the nose, smoked or injected. The duration of the immediate euphoric effects of cocaine depend on the route of administration; smoking or injecting cocaine gives a more immediate high than snorting. However, the faster an effect is achieved, the shorter the duration of the effect; the high from smoking may last 5-10 minutes, while that from snorting may last 15-30 minutes (NIDA, 1998).

4.2 Effects of Short-term Use

At low doses (single doses up to approximately 20 mg), cocaine produces a range of behavioural, neurological, cardiovascular, respiratory and gastrointestinal effects (Brands, Sproule and Marshman, 1998). These include feelings of euphoria, contemplation, anxiety or panic, increased energy, talkativeness, mental alertness, and postponement of the need for sleep and food. Some people report that the drug helps them to perform simple physical and intellectual tasks more quickly. Physical symptoms include increased heart rate, blood pressure and rate of breathing, and a dry mouth.

At higher doses, (several hundred milligrams, or less for more sensitive individuals), the symptoms experienced at lower doses are exaggerated, resulting in intense euphoria followed by agitation, anxiety, flight of ideas, grandiosity or erratic or violent behaviour, and, in some cases, paranoid psychosis. Physical symptoms may include nausea and vomiting, blurred vision, muscle twitches and tremors, elevated blood pressure, fluid in the lungs, chest pain, and other lung damage. The possibility of serious harm or death also increases, and higher dosages have been linked with seizures, strokes and cerebral infarction, heart attack or depression of respiration (Brands, Sproule and Marshman, 1998).

A recent study funded by the National Institute on Drug Abuse (NIDA) found that women were less sensitive to the effects of cocaine than men. The authors of the study (Lukas et al., in press) believe that these gender differences are attributable to differences in the speed at which cocaine is metabolized, and also to barriers created to absorption of cocaine by the presence of more mucous in women's mucous membranes during certain phases of their menstrual cycle. The authors speculate that although women may be less sensitive to the effects, they may need to take more cocaine to experience the same effect as men (NIDA Notes, January/February, 1996).

4.3 Effects of Long-term Use

Long-term chronic cocaine use may result in damage to the tissues of the nose and perforation of the nasal septum among those who snort, lung damage among those who smoke, and increased risk of overdosing, infections and sexually transmitted disease among those who inject. In addition, the chronic user who alternates between "cocaine binges" and crashes is likely to experience dramatic mood swings from agitation and excitability to severe depression, panic attacks, paranoid thinking, violent behaviour, suicidal ideation, cognitive impairment, sleep disorders, eating disorders, sexual dysfunction, kidney problems, and at times visual and auditory hallucinations (Brands, Sproule and Marshman, 1998; Blank-Reid, 1996; Hall et al., 1990; Das, 1993; Di Paola et al., 1997; Gourgoutis and Das, 1994; Mittenberg and Motta, 1993; Rosselli and Ardilla, 1996).

4.4 Onset of Long-term Effects

Complications from cocaine use may take time to manifest themselves. Chen et al. (1996) conducted a longitudinal study of a U.S. high school cohort of 1222, and followed them over a 20-year period after their 1971 graduation from high school. They found that medical complications often did not arise in cocaine

users until they were in their thirties. Over time, however, ongoing cocaine use led to more cardiovascular, neurological and general health problems, as well as negative self-reported health and sick days. Chronic users reported more health problems than less frequent cocaine users. In this study, the authors controlled for socio-demographic characteristics, pre-existing health problems, and the effects of tobacco, alcohol and marijuana. The authors concluded that health problems may not be apparent in individuals who use cocaine during their twenties but, by their thirties, a cumulative effect will become evident, and more health problems will ensue.

4.5 Tolerance and Dependence

Individuals who use cocaine may develop tolerance to the euphoric effects of cocaine, leading some to raise their dose to increase or prolong the effects; some chronic users develop an increased sensitivity to cocaine's adverse effects (Brands, Sproule and Marshman, 1998). On cessation of use regular users experience withdrawal symptoms that are common to withdrawal from other central nervous system stimulants, such as depression, exhaustion, extended sleep and hunger. Regular users also develop a strong psychological dependence on the drug with intense cravings when the drug is not available. Brands, Sproule and Marshman (1998) indicate that the abuse liability of cocaine is the highest of all illicit drugs because of the powerful euphoria and the rapidity with which it is achieved, particularly when the drug is injected or smoked.

Withdrawal from cocaine is believed to fall into three phases. The "crash" period lasts from 9 hours to 4 days. It initially produces agitation, depression, anorexia and high cocaine craving, and later it is associated with fatigue, depression, insomnia, no craving, and finally exhaustion. The middle phase, "withdrawal," lasts from 1 to 10 weeks and swings from initial low anxiety and craving to

high anxiety and cravings in the latter stages. The third and final phase, "extinction," is an indefinite period and features a normal mood but episodic craving, which can be triggered by conditioned cues learned during past cocaine use (Halikas et al., 1993; Hall et al., 1990). However, not all researchers agree on the presence of craving. Flowers and her colleagues (1993) recorded the daily cravings of 15 cocaine-abusing patients who were just admitted to a residential treatment program. Patients reported almost no cravings, generally positive moods, and strong (but not too strong) energy levels. These researchers concluded that cocaine-withdrawal effects were more psychological than physiological. In a somewhat similar fashion, Miller and Gold (1994) found that cocaine-dependent patients reported impulsivity, not craving, as the reason for relapse. They argue that chemical changes in the brain may be present, but a physical craving related to these changes is too small for patients to detect. They suggest that cocaine abuse may be part of a learned behaviour or lifestyle that creates psychological (rather than physical) motivation.

4.6 Lethality

Toxicity of cocaine is a concern raised in cases of cocaine-related "sudden" deaths and instances of heart attack, seizure and stroke (Benowitz, 1992; Biebuyck, 1990; Smart, 1991). A safe maximum dosage of cocaine is considered to be about 200-300 mg. The relation of toxicity to frequency of use or dosage size remains an open question. Sudden deaths attributable to toxicity sometimes involve cases where only small amounts of cocaine (30 mg.) have been consumed (Benowitz, 1992; Biebuyck, 1990; Middleton and Kirkpatrick, 1993). Measurement of dosage in toxic cases is problematic because of individual variation in rate of absorption, metabolism, frequency of use, and type of administration (e.g. intranasal vs. injection). The timing of blood tests in the case of fatalities will also affect estimates (i.e., when

the body was discovered, the time it took for medical personnel to arrive, when the sample was taken). Metabolism continues post-mortem, which also complicates interpretation of cocaine levels (Middleton and Kirkpatrick, 1993). Benowitz (1992) suggests that the profile of overdose deaths has changed. He observes that, in the United States in the 1970's, cocaine was a drug used by a young middle-class group, while now frequent users are from inner city or lower socioeconomic groups who are prone to poor health and more likely to be poly drug users. Cases of cocaine toxicity were rare in the 1970s, but overdose deaths from cocaine are now a major concern, particularly in larger urban centres.

Cocaine-related deaths may also result from using other substances with cocaine. U.S. researchers have found that the human liver combines cocaine and alcohol, and manufactures a third substance called cocethylene, which intensifies cocaine's euphoric effects but may also increase the risk of sudden death (NIDA, 1998). Combining cocaine with other analgesics such as heroin also increases the risk of sudden death.

4.7 Reasons for Using and Quitting, and Perceptions of Effects

The reason for using cocaine may affect self-reported health outcomes, depending on whether cocaine is being used for social or coping reasons. White and Bates (1993) assessed survey results from 1270 young adults and found that respondents who identified coping reasons tended to be heavier users, and to report more negative outcomes. Self-attributed negative outcomes ranged from psychological (became terrified for no reason), dependent (missed out on things, went to school or work high) physical (passed out), or legal and interpersonal (relatives avoided me, been in trouble with police).

Although cocaine can produce a powerful psychological dependence, research also suggests that cocaine users are not oblivious to the health problems related to use. Some users recognize health problems and take action. In a Canadian study, Cheung et al. (1991) found that concern over heart problems, nausea and other negative health aspects of cocaine led to users quitting. In a U.S. study (Waldorf and Murphy, 1995), the authors found that middle-class cocaine dealers often quit because their own use led to health problems.

4.8 Concurrent Cocaine Use and Psychiatric Disorders

Many people with cocaine problems also have serious Axis I mental disorders (Hoffman, et al., 1996) and Axis II personality disorders and psychological disorders (Marlowe, et al., 1997). The latter group is particularly problematic, as they have been shown to do poorly in treatment programs for all types of disorders. In an extensive evaluation of the impact of personality disorders among individuals who use cocaine, Barber et al. (1996) found that 47% of their sample met criteria for one or more personality disorders. Those with personality disorders, (compared to those without this condition), had more additional psychiatric disorders, and were more likely to be involved in criminal activities. The most common Axis II diagnoses were antisocial (20%) and borderline (11%).

In another study, Anthony and Petronis (1993) compared the rates of psychiatric disturbances among individuals who use cocaine to a matched set of young adult non-users and found that, in comparison to the non-users, the individuals who used cocaine were 3.7 times more likely to report panic attacks, 3.2 times more likely to report panic disorders, twice as likely to report that they were depressed, and 11.8 times more likely to report a manic episode. The study was unable to directly link these disturbances with the amount of use or withdrawal, nor did it

carefully assess individual predisposition, lifestyle or poly drug-use questions. The study clearly, however, shows a greater probability of psychiatric disturbances for individuals who use cocaine. Given the sample size and the time period covered, it represents one of the stronger research efforts attempting to quantify differences in psychiatric disturbances between cocaine users and non-users.

It is not always clear, however, to what extent psychiatric disorders are associated with or independent of the use of cocaine. A study of 50 patients hospitalized for cocaine dependence by Weiss and his colleagues (1993) found that the majority of these patients were rated antisocial according to DSM-III-R, and that these diagnoses were present both during drug use and in periods of abstinence. These findings suggest that personality disorders are conditions that exist independently of cocaine use.

Although psychiatric symptoms may be attributable to cocaine use or cessation, the persistence of symptoms associated with the "crash" phase of cessation beyond the first few days (e.g. depression, agitation, psychosis) may indicate the presence of a concurrent psychiatric disorder requiring assessment and treatment.

4.9 Cocaine and Pregnancy

The use of crack cocaine by expectant mothers has been linked to developmental problems for their children. Cocaine rapidly crosses the placenta and has the same pharmacological effects on the fetus as on the mother (Brands, Sproule and Marshman, 1998). Research has found that prenatal exposure is associated with a higher risk of spontaneous abortion, abruptio placentae, premature birth weight, length and head circumference at birth, poor sleep patterns, and long-term behavioural problems (Gingras et al., 1995; Howard et al., 1995; Kenner and D'Apolito, 1997; Mayes et al., 1995; Regalado et al., 1996; Vogel, 1997).

Some recent studies have shown that children exposed to cocaine while their mothers were pregnant are more impulsive and easier to distract than their peers, have poor motor skills and experience language-development delays (Angelilli et al., 1994; Fetters and Tronick, 1996; Kenner and D’Apolito, 1997). These children are more difficult to arouse, but when they are aroused they are more difficult to control. This may be linked to delays in the ability to maintain attention, as well as in the ability to disengage attention (Heffelfinger, Craft and Shyken, 1997). Children with these characteristics will find it hard to learn in the school environment.

Not all researchers, however, agree that cocaine is a significant cause of developmental problems for infants exposed in utero (Kane, Aronson and Zotti, 1997). As observed earlier, poly drug use is common in cocaine-using expectant mothers, and effects observed in newborns may be attributable to use of other substances (e.g. tobacco or alcohol), as well as other factors such as poor prenatal care, inadequate maternal nutrition, poor maternal health, or other factors associated with the mother’s lifestyle.

In their review of the literature, researchers from the Lindesmith Center (1998) argue that the exaggeration of cocaine effects on pregnant women may do more harm than good. The stigma, and even criminalization, of drug use may discourage women from seeking help for drug addiction, and can result in “crack kids” labels being placed on apprehended children, thereby preventing them from becoming adopted. Furthermore, cocaine-exposed children entering the school system may be inaccurately labelled as “learning delayed.” However, rather than trying to disentangle the proportionate effect of cocaine versus cigarettes, alcohol, or living in poverty, the focus should be on addressing

the needs of pregnant cocaine-addicted women and their affected off-spring through appropriate interventions and support.

5. Treatment Approaches

Two types of treatment interventions for cocaine-related problems are described in the following section: pharmacotherapy and behavioural treatment. These interventions pursue a variety of goals. The focus of pharmacotherapy research has been on finding a medication that will block or substantially reduce the effects of cocaine, and also block the severe craving experienced by users. In addition, some studies have focussed on pharmacological treatment for the depression that is associated with withdrawal from cocaine. Such medications may address both the management of withdrawal, as well as longer-term maintenance. Behavioural interventions address the reduction or elimination of attitudes, feelings or behaviours that support or contribute to substance use, and help the individual to develop healthier behaviours and a corresponding healthier lifestyle.

For the evaluation of medications, all articles that used double-blind randomized control procedures were selected as the basis for making best practice statements. In addition, some information is provided on drugs that show potential, but have not yet demonstrated effectiveness in rigorous scientific trials. For the evaluation of behavioural treatment, studies that used random assignment and a credible control or comparison treatment procedure were included.

For each study that was evaluated, the following information (when available) was obtained: a) retention in the treatment program, b) reduction of cocaine usage, c) reduction of cocaine cravings, and d) improvement in medical or psychological status. These categories are consistent with those recommended by the Treatment Protocol Effectiveness Study (Treatment Outcome Working Group, 1996). Most of the pharmacotherapy studies provided information for some or all of these variables. However, the studies evaluating behavioural treatment procedures provided less information.

Some studies involved interventions with subjects who were dependent on other drugs besides cocaine, particularly opioids and alcohol. There is some evidence that people with addictions to more than one drug may not respond as well to treatment compared to those abusing only one substance (e.g. Brown, Seraganian and Tremblay, 1994). This is consistent with the treatment of other disorders.

It is important to note that most of the drug studies also used psychosocial treatment interventions in addition to medication. The purpose of these studies was to determine if the addition of medication improved treatment effectiveness over psycho-social treatment only. In most of these studies, participants in both groups showed improvement, and the addition of medication generally did not improve treatment efficacy.

It should also be noted that, although most studies included both genders (the proportion of women was usually about 25-30%), study results did not usually include analysis of outcome by gender.

5.1 Pharmacotherapy

Cocaine acts by blocking the re-uptake of three neurotransmitters (dopamine, norepinephrine and serotonin) which produces cocaine's acute reinforcing or pleasurable effects. Studies have examined drugs that either block the reinforcing effects of cocaine (antagonists) or share some of the reinforcing effects of cocaine, but have a longer duration of action (agonists or analogs). Other studies have examined the usefulness of drugs that address some of cocaine's side effects such as depression or seizures. Based on their pharmacological properties, four primary classes of drugs have been used to treat cocaine-related problems: antidepressants, dopamine regulators, anti-seizure medications and drugs that are used to maintain opioid users.

5.1.1 Antidepressants

Table 1 reviews studies that used antidepressants to treat cocaine addiction. All of the drugs described in this Table have effects on the serotonergic and norepinephrine neurotransmitter systems. The first six studies used tricyclic antidepressants. The final four used fluoxetine, a selective serotonin re-uptake inhibitor. Antidepressants are thought to be useful for treating cocaine-related problems for two reasons. First, many cocaine users experience features of depression when withdrawing from cocaine. Second, repeated exposure to cocaine can cause prolonged deficits in serotonergic function (Levy et al., 1993). All antidepressants work partly by regulating serotonergic systems.

Table 1
Comparison of Antidepressants and Placebo for Treating Cocaine Addiction

Study	Medicine	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med/Psych Improv. 4	Comments
Nunes et al., 1995	Imipramine	Cocaine	–	?			Poor response for intravenous, freebase users & non-depressed.
Galloway et al., 1994	Imipramine	Cocaine		–	–	–	Study conducted in community setting.
Campbell et al., 1994	Desipramine	Cocaine	–	–			Also evaluated carbamazepine. No evidence for effectiveness.
Carroll et al, 1994 (a & b)	Desipramine	Cocaine		?			Group differences did not persist for medication beyond 6 weeks, improvements due to cognitive behavioural therapy, not medication.
Gawin et al., 1989	Desipramine	Cocaine					Included weekly psychotherapy.
Oliveto et al., 1995	Desipramine	Cocaine/ Opioid					Results are compared to a group receiving fluoxetine.
Covi et al., 1995	Fluoxetine	Cocaine	–	–	–	–	Highest dose (60 mg) of fluoxetine produced poorest outcome.
Batki et al., 1994	Fluoxetine	Cocaine/ Opioid					Reductions found in methadone maintained cocaine dependent subjects only.
Batki et al., 1996	Fluoxetine	Cocaine		–	–	–	Could only compare usage and craving for first 6 weeks.
Washburn et al., 1994	Fluoxetine	Cocaine					

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage – = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

Tricyclic Antidepressants

Several studies have examined the efficacy of tricyclic antidepressants for the treatment of cocaine dependence and associated problems. Galloway et al. (1994) found that **imipramine** was effective in retaining people in treatment when compared to a placebo, but had no effect on cocaine craving or cocaine use. In contrast, Nunes et al. (1995) found that imipramine significantly reduced cravings among nasal cocaine users, but those who injected or freebased showed a very poor response to imipramine. This same study also found that cocaine users who were depressed showed a better response to imipramine than those who were not, indicating the need for careful client assessment when considering the suitability of this type of pharmacotherapy.

Oliveto et al. (1995) found that, similarly to imipramine, **desipramine** was effective in retaining people in treatment, but also had no effect on craving or cocaine use. In this study (Oliveto et al., 1995), subjects were addicted to both heroin and cocaine, and all were being maintained on buprenorphine. Desipramine was more effective than either amantadine or fluoxetine in retaining patients in treatment over a 12-week period. In addition, the desipramine and amantadine groups had a greater number of drug-free days than the fluoxetine group.

Gawin et al. (1989) in a double-blind study compared desipramine with lithium and a placebo. In addition, subjects in all three conditions attended weekly individual outpatient psychotherapy sessions. Over the six-week period of the study, subjects in the

desipramine group were significantly more likely to achieve continuous periods of abstinence, to show reductions in cocaine craving and to have longer retention in treatment than the other two conditions. Carroll et al. (1994) compared behavioural relapse prevention to clinical management, paired with either desipramine or a placebo over a 12-week period. The study found that: subjects in all four groups showed significant improvement over the 12-week period; desipramine was more effective than a placebo in reducing cocaine use over the first six weeks, but these differences did not persist beyond six weeks; and subjects with low-severity cocaine use had significantly longer periods of consecutive abstinence in the desipramine condition than in the placebo condition. This study also involved a 12-month follow-up in which the authors conclude that the efficacy of desipramine did not persist after short-term treatment and that its effects were most apparent in the early stages of treatment.

Another study (Campbell et al., 1994), compared desipramine and carbamazepine (an anticonvulsant), and found that neither was more effective than a placebo in reducing cocaine usage. Finally, a study by Bystritsky et al. (1991) found some evidence that desipramine can be effective in reducing cocaine-induced panic attacks.

The effectiveness of desipramine (and possibly other antidepressants) may be reduced by use of other drugs. Kosten, et al. (1990) compared plasma levels of desipramine in patients who were being treated for depression or cocaine use. Plasma levels were found to be much lower in a subset of cocaine users being maintained on methadone for heroin addiction. The authors suggest that methadone may have affected the metabolism of desipramine, reducing its effectiveness.

Selective Serotonin Re-uptake Inhibitors (SSRIs)

Fluoxetine is a cocaine antagonist that has been one of the more extensively studied drugs because of its role in serotonergic regulation (McCance, 1997). Several studies indicate fluoxetine's utility in reducing the effects of cocaine. Some studies have found that fluoxetine is effective in retaining people in treatment, (Batki et al., 1994; Batki et al., 1996; Washburn et al., 1994). The study by Washburn et al. (1994) also found longer periods of abstinence for subjects using fluoxetine versus a placebo, and Batki et al. (1994) found reduced cocaine use and craving in methadone-maintained cocaine-dependent individuals, but not those with a primary cocaine dependence. However, other studies have found fluoxetine to be less effective in treatment retention than desipramine or amantadine (Oliveto et al., 1995). A study by Covi et al. (1995) found that fluoxetine could be a detriment when used in conjunction with interpersonal counselling. The study found that fluoxetine at 20 mg., 40 mg. or 60 mg. did not add to the improvement produced by counselling, and the 60 mg. doses may have interfered with the effects of counselling.

5.1.2 Dopamine Regulators

There have been very few studies using antidepressants other than the tricyclics or SSRIs. However, some of the "second-generation antidepressants" such as bupropion, which inhibit norepinephrine and dopamine, may be effective in reducing cocaine craving.

The addictive and euphorogenic effects of cocaine result primarily from inhibition of dopamine re-uptake (Rothman, 1990). This inhibition of uptake leads to a rapid accumulation in the synapse resulting in activation of dopamine receptors. Spealman et al. (1992), in their review of non-human research related to cocaine and the dopamine system, have shown that dopamine agonists

produce cocaine-like effects in animals and that dopamine antagonists reduce the response to self-injected cocaine.

Fortunately, some potent dopamine re-uptake blockers have not been reported to produce euphoria or addiction in humans. Based on these observations, dopamine re-uptake inhibitors have been classified into two groups: type 1, which produce euphoria and type 2, which do not (Rothman, 1990). Given that the two types act at the same site (dopamine transport), it has been hypothesized that type 2 blockers may be useful in reducing the euphoric effects of cocaine and, as a result, may decrease cocaine usage. This has led to the evaluation of several dopamine-regulating drugs in the treatment of cocaine usage.

It should be noted that there is some evidence that the effects of dopamine agonists vary depending on the phase of the cocaine-abuse cycle. Phases of the cocaine-abuse cycle include euphoria, crash and craving. Hollander et al. (1990) treated cocaine addicts during different phases of the cycle with

apomorphine, a dopamine agonist. They found that subjects reported less craving during the craving phase than in the crash phase.

Table 2 presents six studies that evaluated medications that operate primarily on the dopamine neurotransmitter system.

Amantadine, an indirect dopamine agonist, has been evaluated in a series of randomized, double-blind studies. The results suggest that amantadine might be useful, especially in the early stages of treatment. Alterman et al. (1992) compared amantadine with a placebo. The subjects received medications for a 10-day period. At the end of the drug trial, subjects receiving amantadine were significantly more likely to be free of cocaine than were those on the placebo. Similar findings were obtained at a one-month follow-up. A more recent study by Handelsman et al. (1995), which evaluated amantadine and a placebo over a longer period of time, did not find differences in cocaine consumption or craving between the two groups. Two possible reasons for the differences in these two studies may be related

Table 2
Comparison of Dopamine Regulators and Placebo

Study	Medicine	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med./Psych Improv. 4	Comments
Eiler et al., 1995	Bromocriptine	Cocaine	–			–	Very high dropout rates.
Stine et al., 1995	Mazindol	Cocaine	–	–	–	–	All participants received group therapy.
Handelsman et al., 1995	Amantadine	Cocaine/ Opioid	?	–	–	–	Participants with high SCL-90 scores improved more on medication.
Alterman et al., 1992	Amantadine	Cocaine	–		–	–	Differences in positive urine samples developed over two weeks.
Giannine et al., 1993	Buspirone	Cocaine		?			Buspirone is a nonbenzodiazepine tranquilizer affecting the dopamine system. The improvement was for withdrawal symptoms.

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage – = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

to subject characteristics and/or longevity of amantadine's effect. For example, Alterman et al. (1992) specifically excluded subjects who were addicted to other substances, whereas the subjects in the Handelsman et al. (1995) study were methadone-maintenance patients. Alternatively, in a brief review of the efficacy of amantadine for treating cocaine withdrawal, Thompson (1992) speculated that "amantadine's effectiveness in maintaining short-term abstinence may decrease with time" (p. 934).

Bromocriptine is another dopamine agonist that acts through stimulation of postsynaptic dopamine receptors, and may reduce craving and withdrawal by reversing the depletion of dopamine resulting from cocaine use. Eiler et al. (1995) compared bromocriptine to a placebo with patients that were only dependent on cocaine. Their results showed that the two treatments did not differ except for a possible advantage for bromocriptine during the first three weeks.

Mazindol, is a dopamine re-uptake inhibitor (cocaine antagonist). One study (Stine et al., 1995) compared mazindol to a placebo over a six-week period. The results showed that the two groups did not differ on any of the primary measures.

5.1.3 Anticonvulsants

Animal research has shown that animals that are given large doses of cocaine experience seizures. With repeated cocaine experiences, there is an increased probability of seizure activity occurring. This has been referred to as "kindling" (Cornish et al., 1995).

Carbamazepine, an anticonvulsant medication, has been found to reduce both seizure activity and cocaine use, in open clinical trials. As a result, several studies have evaluated the use of carbamazepine in cocaine-dependent populations. The major studies using double-blind randomization procedures have not found carbamazepine to be effective in reducing cocaine use or craving, or for retaining patients in treatment programs (Cornish et al., 1995; Kranzler et al., 1995; Montoya et al., 1995). These results are presented in Table 3.

5.1.4 Buprenorphine

Because of the co-morbidity of opioid and cocaine use, several studies have evaluated the relative efficacy of methadone and **buprenorphine** for retaining subjects in treatment programs, and in reducing opioid and cocaine use. Research has shown that buprenorphine attenuates the effects of cocaine on adrenocorticotropin (ACTH) in

Table 3
Comparison of Anticonvulsants and Placebo

Study	Medicine	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med./Psych Improv. 4	Comments
Kranzler et al., 1995	Carbamazepine	Cocaine Males only	–	–	–	–	The majority of participants smoked cocaine.
Montoya et al., 1995	Carbamazepine therapy	Cocaine	–	–	–	–	Participants also had cognitive behaviour.
Cornish et al., 1995	Carbamazepine	Cocaine	–	–	–	–	Carb. group showed better retention during early phase of study.

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage – = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

cocaine-dependent men (Mendelson et al., 1992). Plasma levels of ACTH parallel plasma cocaine levels and self-reported mood states. Strain et al. (1994) compared methadone to buprenorphine for reducing cocaine use in patients that were addicted to both cocaine and heroin. Their results showed that the two drugs were equally effective in retaining subjects and in reducing cocaine-positive urines. Both groups showed about a one-third reduction in cocaine-positive urine samples. Finally, in a very recent report, Eissenberg et al. (1997) have shown that daily injections of buprenorphine are not necessary to maintain cocaine abstinence. These results are shown in Table 4.

therapy (CBT) or 12-step facilitation (TSF)) was effective in reducing both alcohol and cocaine use, and retaining clients in treatment.

5.16 Emerging Pharmacotherapies

There are several new drugs that show potential for treating cocaine addiction. The most promising of these compounds is GBR 12909. Studies have shown that both cocaine and GBR 12909 inhibit the activation of a protein called the dopamine transporter, increasing the levels of dopamine outside the nerve cells. This prolongs dopamine's pleasurable effects. GBR 12909 produces a much smaller dopamine "spike" but maintains levels for a longer period of time. In studies

Table 4
Comparison of Buprenorphine and Methadone

Study	Medicine	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med./Psych Improv. 4	Comments
Strain et al., 1994	Buprenorphine Methadone	Opioid/Coc.	–	–			No differences between drugs for cocaine measure.
Schottenfeld et al., 1997	Buprenorphine Methadone	Opioid/Coc.		–	–	–	The larger the dose of both drugs the greater the retention.

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage – = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

5.1.5 Disulfiram

McCance (1997) notes that many cocaine abusers are also dependent on alcohol, and that alcohol may precipitate cocaine use, because it is used to enhance the euphoric effects of cocaine and to alleviate some of the dysphoric effects. Although McCance (1997) reports that a number of open trials with disulfiram resulted in decreases in both cocaine and alcohol use, its efficacy needs to be confirmed in large, well-controlled trials (McCance, 1997). However, a recent randomized clinical trial (Carroll et al., 1998) concluded that disulfiram in conjunction with outpatient psychotherapy (cognitive behavioral

using monkeys, it was found that the injection of GBR 12909 greatly reduced cocaine self-administration (Stocker, 1997).

Best Practice Guideline #1: The literature does not yet provide sufficient evidence for the efficacy of specific drugs in the treatment of cocaine dependence. However, several antidepressant drugs have shown promise in retaining users in the initial stages of treatment, particularly depressed patients and those who "snort" cocaine. There appears to be some evidence that drugs used in the treatment of opiate or alcohol dependence

may be useful in reducing cocaine use in patients addicted to cocaine and heroin or cocaine and alcohol.

5.2 Behavioural Treatments

As with treatment for other substance-abuse disorders, behavioural treatments have been found to be an effective approach to the treatment of cocaine dependency. A number of behavioural interventions have been found to be particularly effective: Contingency Management, Cognitive Behavioural Therapy (CBT) and broad-based behavioural therapy.

5.2.1. Contingency Management

To date, one of the most effective approaches to treating cocaine dependency has been developed by Stephen Higgins and his colleagues (Higgins et al., 1993; Higgins et al., 1994; Higgins et al., 1995) combining a community reinforcement approach (CRA) with a contingency management component (vouchers). The base CRA program is designed to enhance the client's family relations, and vocational, recreational and social activities, and is provided over a six-month period. Typically, it involves a functional analysis of the client's substance use to identify antecedents and consequences of substance use, so that strategies can be developed to avoid high-risk antecedents and to put in place alternatives to the consequences of cocaine use. As well, the base program includes social, recreational and employment counselling, drug-refusal training, social-skills training and reciprocal relationship counselling.

To this base, a voucher system has been added. Clients receive vouchers (that can be exchanged for various merchandise) when they remain drug-free and in treatment. The vouchers increase in value for cocaine-free urine samples. It should be noted that the therapists for this program were very experienced doctoral-level students. The three studies by Higgins and his colleagues reported

in Table 5, all show that the contingent use of vouchers when combined with other cognitive behavioural interventions, markedly reduces cocaine use and increases the psychological well-being of the participants. In addition, these studies show that the use of these procedures, especially the contingent vouchers, increases retention over alternative treatment conditions, including CRA alone. The literature consistently suggests that the longer people remain in a treatment program the greater is the likelihood that they will decrease cocaine usage. In a recent review of the literature, Higgins (1996) reports on 13 studies using contingency management to reduce cocaine usage. In just over one half of the studies, the participants were on methadone maintenance for opioid addiction in addition to their cocaine dependency. He reports that, in 11 of the 13 studies, there was a reduction in cocaine usage. These studies have been carried out both in inner-city and rural locations.

In some studies, Higgins and his colleagues (Higgins et al., 1994a) incorporated family members or friends into the contingency management component of their behavioural treatment program. Family members were informed of the results of urinalysis, and they provided social reinforcement for a negative-urine screen. Although preliminary results indicated that this was an effective intervention, randomized trials did not support its efficacy (NIDA, 1998).

The National Institute on Drug Abuse in the United States has recently produced a manual incorporating a contingency management approach, which is available in hard copy and on-line: *A Community Reinforcement Plus Vouchers Approach: Treating Cocaine Addiction (1998)*.

**Table 5
Behavioural Treatment**

Study	Treatment	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med./Psych Improv. 4	Comments
Higgins et al., 1993	Contingency Man.	Cocaine					Incentives were contingent on urine free samples.
Higgins et al., 1994	Contingency Man.	Cocaine					Both groups in behavioural program; one group received vouchers.
Higgins et al., 1995	Contingency Man.	Cocaine					One year follow-up of above participants.
Carroll et al., 1991	CBT	Cocaine					More severely dependent did better in CBT.
Carroll et al., 1994 (a & b)	CBT	Cocaine					More severely dependent did better in CBT.
Carroll et al., 1998	CBT & TSF	Cocaine & Alcohol					CBT and TSF more effective than clinical management.
Wells et al.,	CBT and 12 Step	Cocaine		-			CBT and 12 step equally effective in reducing drug use.
Azrin et al., 1994	Behaviour Mod.	Cocaine					Youth showed better results compared to adults.

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage - = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

5.2.2. Cognitive Behavioural Therapy

Another approach that has shown strong evidence of effectiveness for the treatment of substance abuse in general, but also with clients who are cocaine-dependent is Cognitive Behavioural Therapy (CBT). This approach is a short-term (usually 12-16 sessions over 12 weeks) focussed intervention involving somewhat similar components to CRA. As with CRA, it includes a functional analysis of antecedents and consequences to develop strategies to avoid high-risk situations and to identify alternatives to cocaine's reinforcing effects. It also includes a heavy emphasis on the development of coping skills. It may also be delivered as part of a broader range of interventions that could include pharmacotherapy, counselling for adjunctive areas such as family counselling or vocational counselling, or attending a mutual-aid group. Unlike CRA, it does not usually include a voucher component or intervention with the client outside the treatment setting.

Studies of the effectiveness of CBT with cocaine dependent clients have been carried out by Carroll and her colleagues (Carroll, 1991, Carroll et al., 1994a; 1994b; Carroll et al., 1996) and compare CBT to other interventions for clients with different profiles. As Table 5 indicates, CBT (Relapse Prevention) has been found to be more effective in terms of both retention in treatment and reduction in cocaine use when compared to Interpersonal Psychotherapy (Carroll et al., 1991) and to Clinical Management (CM) (Carroll et al., 1994 a, 1994b). In both these studies, there was an interaction effect. Subjects who were more severely dependent on cocaine did better in the CBT condition, while there were no differences in outcome for those less severely dependent. In the CBT/CM study, at the one year follow-up, continued gains in reducing cocaine use were found in the CBT group, but not the CM group (Carroll et al., 1994b). These studies also found that CBT was more effective than CM in retaining depressed

subjects in treatment and was somewhat more effective in reducing cocaine use (Carroll et al., 1994a).

One interesting finding from the series of studies by Carroll and colleagues and also by Wells et al. (1994) is that other “active therapies” using a different theoretical approach may be as effective as cognitive behavioural therapy. Carroll (1998) evaluated the efficacy of CBT in comparison to CM and TSF (12- Steps Facilitation) in a group of subjects that met criteria for both cocaine and alcohol dependence. This study also included the use of disulfiram. The study found that both CBT and TSF were more effective than CM in retaining clients in treatment and reducing cocaine use (as well as alcohol use). Wells et al. (1994), compared skills-training and relapse-prevention techniques based on Marlatt and Gordon (1995) to a recovery support group based on the Twelve Steps of AA, and recovery support group as described in a study by Well et al.(1994). Subjects in both treatment conditions reduced their use of cocaine and other substances (alcohol and marijuana), and there were no significant differences in cocaine outcomes for the two interventions.

It may be, as Carroll et al. (1998) point out, that the more active and directive therapeutic approaches, which also require clients to carry out assignments outside of scheduled sessions, are more powerful than the less demanding and less directive clinical management approach, particularly for more severely dependent clients.

CBT has also been published in manual form by the National Institute on Drug Abuse: *A Cognitive Behavioural Approach: Treating Cocaine Addiction* (1998).

5.2.3. Broad-based Behavioural Therapy

Azrin and his colleagues (1994) have reported similar success using a broad-based behaviour-therapy program. In this study, the three primary treatment procedures were a) stimulus control/competing response training, b) urge control and c) social control/contracting. The control condition produced minimal change in drug use, whereas over 60% of the patients in the behavioural group discontinued drug use. In addition, they were more improved on measures related to work, school and alcohol use.

Best Practice Guideline #2: The literature shows good evidence that behavioural treatment procedures (particularly contingency management and cognitive behavioural therapy) are effective in reducing cocaine use and retaining clients in treatment. Further, other active, directive therapeutic approaches using different theoretical approaches may be as effective as CBT.

5.2.4 Treatment for Women and Pregnant Women

The recent Health Canada report: *Best Practices – Substance Abuse Treatment and Rehabilitation* (Health Canada, 1999) concludes that there is insufficient evidence to support the provision of specific types of interventions for women. However, it also notes that it is important to consider the barriers to treatment and to provide a range of modifications and support services.

Hughes et al. (1994) examined treatment retention among women who were in an 18 month therapeutic community program and were randomly assigned to two conditions. Although both groups received the same therapeutic community program, the experimental group was permitted to bring their children to live with them during treatment. Preliminary results from this study

indicate significantly longer retention in treatment for the experimental group in comparison with the control group.

Pregnant women who use cocaine have benefited from involvement in a therapeutic community. Using a rigorous outcome measure of cocaine-positive urinalysis, Egelko and her colleagues (1996) found that 87.2% of the final three urine samples (prior to discharge) were negative in a perinatal cohort attending a modified day-program therapeutic community. Female participants averaged two months in treatment. Those women who began the program while pregnant did substantially better than those who joined the program postpartum, illustrating the need for early intervention.

Studies have also shown that intervention programs directed at improving parenting skills can have positive effects on infant development, and can help “make up ground” for children born to cocaine-using mothers (Kane et al., 1997; Howard et al., 1995; Zuckerman and Frank, 1994).

6. Other Influences on Treatment Effectiveness

6.1 Client Characteristics

Studies have found that there are many impediments to the treatment of cocaine-related problems (Gorelick, 1992). First, a very large percentage of people who use/abuse cocaine also use/abuse other substances, including alcohol, THC and heroin. This poly drug use is associated with more frequent psychopathology, discontinuation of treatment programs and relapse (Brady, et al., 1995; Brown, Serganian and Tremblay, 1993, 1994; Condelli, Fairbank, Dennis and Rachal, 1991). There is evidence that these groups are particularly resistant to treatment (Leal, Ziedonis and Kostien, 1994). Also, a large number of people either discontinue treatment

or continue to use substances during treatment (Agosti, Nunes and Ocepeck-Welikson, 1996). Agosti et al. (1996) have reported that approximately 55% of people drop out of treatment programs. Those who do discontinue treatment are more likely to be younger, less well-educated, to have begun using substances at an earlier age, and to be from minority groups. In addition, Hoffman et al. (1996) found that those who used cocaine regularly during the 12 months post-treatment were more likely to have attended fewer treatments, to be female, to be less educated, and to have been regular cocaine users prior to entering treatment. The latter, showing that those who used cocaine on a regular basis before treatment were more likely to relapse or discontinue treatment, is supported by a recent study comparing people who had or had not participated in self-help programs prior to seeking treatment. Weiss et al. (1996) reported that a significantly larger proportion of those who had attended self-help programs prior to treatment became abstinent within one month of treatment when compared to those not previously in self-help groups.

There is also evidence that there may be different types of cocaine users. Ball et al. (1995), using two different cluster analytic procedures, identified two subgroups of cocaine users. The Type B cocaine users, which constituted one third of their sample, compared to Type A users, had higher risk factors (e.g. family history and childhood behaviour problems), more antisocial behaviour and more psychiatric problems. These factors may play an important role for the assessment, treatment and prevention of cocaine use.

The above observations highlight the importance of individualized treatment planning and programming.

**Table 6
Enhanced Treatment Programs**

Study	Treatment	Subjects	Reten. 1	Red. Coc. 2	Red. Urges 3	Med./Psych Improv. 4	Comments
Lam et al., 1995	Residential vs. Normal Community	Cocaine					Homeless participants.
Schneider et al., 1996	Day vs. Inpatient	Cocaine	–	?			Day treatment participants relapsed faster.
Richard et al., 1995	Cognitive-Behavioural & Adjunct Therapy	Cocaine		–			Adjunct therapies included acupuncture, medication or biofeedback.
Schumacher et al., 1995	Enhanced vs. Usual Day Care	Cocaine		?			Homeless participants. Group therapy was the primary treatment. Enhanced group met more often halfway house used social learning approach.
Hoffman et al., 1996	Intensive vs. Regular group therapy	Cocaine		?			Intensive group met more often and could include individual and family therapy.
Wells et al., 1994	Relapse prevention vs. 12 step	Cocaine	–	–			Both groups improved.
Rosenblum et al., 1999	High intensity vs. Low intensity CBT	Cocaine		–			High severity users did better in high intensity treatment.

Note: 1. Increased Retention in Program = treatment group improved compared to control group
 2. Reduced Cocaine Usage – = no differences between groups
 3. Reduced Cocaine Craving ? = could not determine if differences occurred
 4. Medical/Psychological Improvement

6.2 Treatment Exposure

The issue of treatment exposure has been examined in a number of studies. The studies reported in Table 6 generally compare a regular program with an enhanced program. The enhanced programs included more frequent contact, e.g. daily rather than once or twice a week and/or a greater variety of treatment components, e.g. individual counselling and family counselling. The study results generally show that clients participating in an “enhanced program” versus the regular program had greater reductions in cocaine use than did the controls. (Richard et al., 1995; Hoffman et al., 1996; Lam et al., 1995; Schumacher et al., 1995; Schneider et al., 1996)

Schumacher and his colleagues (1995) compared an enhanced day-program (state of the art day-treatment model) versus a “usual

care” program (twice weekly individual and group counselling with medical evaluation and referral). At the 12 months follow-up, they found that significant reductions in cocaine and other substance use and homelessness occurred in clients who attended an average of 4.1 days a week versus those who attended an average of less than one day a week. Schumacher et al. note that: “... greater attendance and consequently better outcome is more likely to occur in a program that requires more participation than a program that requires less” (Schumacher et al., 1995).

In a similar study, Hoffman et al. (1996) randomly assigned a sample of cocaine users of (primarily) crack cocaine to one of six different four month treatment conditions: standard group therapy twice a week or group counselling for five days a week using a cognitive behavioural approach with an

emphasis on relapse prevention, and, within these two group treatment conditions, the provision of either no additional services, or individual psychotherapy, or individual psychotherapy plus family therapy. Greater treatment **exposure** was associated with less likelihood of regular use of cocaine, other substances or engaging in criminal behaviour at the 12 month follow-up. However, the study did not find outcome differences based on different treatment **approaches**.

Richard et al. (1995) compared a standard outpatient neurobehavioural group receiving individual treatment only, with a neurobehavioural group that was also receiving an adjunctive treatment involving one of either acupuncture, anti craving medication or biofeedback (brainwave therapy) for cocaine-dependent clients. At the nine month follow-up, it was found that clients receiving adjunct therapy stayed in treatment almost 60 days longer than those in the control group, and they also attended more days of the core neurobehavioural program. Further, retention in treatment significantly improved drug-use outcome as measured by cocaine-specific urinalysis, but the study did not demonstrate additional effects for adjunctive therapies beyond their role in treatment retention.

A very recent study, Rosenblum et al. (1999), found that, in a six month randomized trial of low-intensity versus high-intensity treatment, both groups showed declines in cocaine use, but subjects with more severe levels of cocaine use did better in high-intensity treatment.

Best Practice Guideline #3: Enhanced treatment (greater frequency of contact, more treatment components) is associated with reduced cocaine use at follow-up.

6.3 Treatment Setting

Studies that have compared the efficacy of inpatient/residential versus outpatient treatment programs have produced mixed results (Alterman, O'Brien and Droba, 1996; Hitchcock, Stainback and Roque, 1995; Khalsa et al., 1996; Lam et al., 1995; Schneider, Mittelmeier and Gadish, 1996; Schumacher et al., 1995). Khalsa et al. (1996), for example, found that inpatients who had long-term follow-up improved more than those in other programs. Lam et al. (1995) compared the efficacy of a sheltered residential program with stages of privileges to a community-based treatment program for homeless cocaine-abusing men. Their results showed that, although both groups improved, the residential program produced much higher reductions in cocaine use at the 6, 9 and 21 months follow-ups and greater residential stability at 6 and 9 months in comparison with the control group.

A study by Alterman et al. (1996) found equivalent effects for inpatient and day-patient programs. Similarly, in a comparison of day versus inpatient treatment for cocaine-dependent patients following an initial brief inpatient detox, Schneider et al. (1996), found that there were significant differences in rates of total abstinence in favour of the inpatient group at three months, but these differences had disappeared by six months. The authors conclude that the study results support the use of day treatment as a viable and cost-effective alternative to inpatient treatment for this group. However, it should be noted that the day-treatment group had a higher treatment drop-out rate.

Schneider et al. (1996), in an especially well-designed program, found that, at three months follow-up, the inpatient group had a significantly higher rate of abstinence (63%) compared to those in the day-treatment program (38%).

Finally, it is worth noting the findings from the recent U.S. Drug Abuse Treatment Outcome Study (DATOS) (NIDA, 1998). When four different types of treatment programs were compared (outpatient methadone programs, long-term residential programs, outpatient drug-free programs and short-term inpatient programs), there were substantial reductions in drug use among clients in all types of programs. The primary drug of abuse in these programs was cocaine, and, even in the outpatient methadone programs, 42% of clients abused cocaine. The percentages of clients reporting weekly or more frequent cocaine use prior to treatment was higher in both residential settings (66% and 67%) versus 42% in the outpatient settings. Thus reduction to approximately 20% across all four settings in reported weekly or more frequent cocaine use was more significant for the residential settings than for the outpatient settings.

Best Practice Guideline #4: Consistent with other literature in the substance treatment and rehabilitation field, research continues to support the cost-effectiveness of outpatient/day-treatment versus inpatient treatment. However, some cocaine-dependent clients may require the additional support provided by residential care or inpatient treatment, e.g. clients who are homeless.

6.4 Individual Versus Group Treatment

Many of the effective interventions discussed above have been delivered in an individual counselling format. However, Smokowski and Wodarski (1998) in a recent article on cognitive behavioural treatment for cocaine addiction, identify the group format as an important component of substance-abuse treatment. They note that, apart from the support and reinforcement provided by group members, the group format can also provide group-reward structures for programs that use contingency management.

In conclusion, unlike the conclusions arising from much of the research on using medications to treat cocaine addictions, it appears that behavioural methods are effective. This is especially true for behavioural procedures that provide incentives for cocaine-free urine samples and include cognitive behavioural treatment. Multicomponent programs, that address cocaine use, family and financial issues, and relapse prevention, appear to retain people in programs longer, reduce cocaine usage, and reduce the use of other substances. Finally, provision of continuing care may improve outcome.

7. General Conclusions and Summary of Best Practices

National survey and local school survey data suggest that relatively few Canadians use cocaine and that the rates have been relatively stable in the 1990s. However, surveys do not capture the serious health and social problems that are associated with cocaine use, such as the epidemic of HIV and Hepatitis C infections among people who inject drugs in some of Canada's larger cities. Although it is sometimes difficult to disentangle the harmful effects due to cocaine use from effects that may be due to other substances and lifestyle choices, research indicates that even casual users often report quitting because of perceived health risks.

Research into effective treatment methods have focussed on pharmacotherapy and behavioural interventions. The results of pharmacotherapy research have not yet produced a substitute drug that can play the same role with cocaine as methadone has with heroin. However, there is some evidence that pharmacotherapy may increase treatment retention in the initial stages of treatment. There is evidence that behavioural treatment, either contingency management or cognitive behavioural treatment is effective in retaining clients in treatment and reducing cocaine use.

Best Practice Guideline #1: The literature does not yet provide sufficient evidence for the efficacy of specific drugs in the treatment of cocaine dependence. However, several antidepressant drugs have shown promise in retaining users in the initial stages of treatment, particularly depressed patients and those who “snort” cocaine. There appears to be some evidence that drugs used in the treatment of opiate or alcohol dependence may be useful in reducing cocaine use in patients addicted to cocaine and heroin or cocaine and alcohol.

Best Practice Guideline #2: The literature shows good evidence that behavioural treatment procedures (particularly contingency management and cognitive behavioural therapy) are effective in reducing cocaine use and retaining clients in treatment. Further, other active, directive therapeutic approaches using different theoretical approaches may be as effective as CBT.

Best Practice Guideline #3: Enhanced treatment (greater frequency of contact, a comprehensive recruitment plan with more treatment components) is associated with reduced cocaine use at follow-up.

Best Practice Guideline #4: Consistent with other literature in the substance-abuse field, research continues to support the cost-effectiveness of outpatient/day-treatment versus inpatient treatment. However, some cocaine-dependent clients may require the additional support provided by residential care or inpatient treatment, e.g. clients who are homeless.

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Resources Available On-Line

The following can be downloaded from the National Institute on Drug Abuse (NIDA) Web site:

A Cognitive Behavioural Approach: Treating Cocaine Addiction (1998) Manual 1127 pages.
NCAD #BKD254. Available from National Institute of Drug Abuse.

A Community Reinforcement Plus Vouchers Approach: Treating Cocaine Addiction (1998)
Manual 2 (148 pages). NCADI # BKD255.

Medications Development for the Treatment of Cocaine Dependence: Issues in Clinical Efficacy
Trials (RM 175). (1998). NCADI # M175.