AN EXAMINATION OF COCAINE DEPENDENCE AMONG INJECTING AND NON-INJECTING COCAINE USERS IN SYDNEY.

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EXECUTIVE SUMMARY

A recent study of cocaine use in Sydney found that there were significant proportions of both injecting and non-injecting cocaine users that exceeded the proposed diagnostic cut-off score for cocaine dependence on the Severity of Dependence Scale (SDS), and that level of dependence was the most influential mediator in the relationship between the use and associated harms of cocaine. Irrespective of the route of administration, dependence was associated with poorer physical and psychological health.

The current study aimed to further investigate the cocaine dependence syndrome by examining the prevalence, correlates, symptoms, and diagnosis of dependence among both injectors and non-injectors of cocaine. This study also endeavoured to ascertain the SDS cut-off score that best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence. The final aim of the current study was to extend upon previous research and determine the prevalence and nature of cocaine-induced physical and psychological health problems.

A sample of 96 injecting cocaine users and 46 non-injecting cocaine users were interviewed about their frequency and methods of cocaine use, as well as about any physical and/or psychological problems that they attributed to such use. Subjects were administered two different measures of dependence; the Composite International Diagnostic Interview (CIDI) and the SDS.

Cocaine dependence was highly prevalent among ICU, with almost half (47%) of cocaine injectors qualifying for a DSM-IV diagnosis of dependence. Among NICU, cocaine dependence was of a lower, but still significant, prevalence, with over one-fifth (22%) of subjects qualifying for a diagnosis of dependence.

Cocaine-dependent ICU were more likely to have experienced cocaine-induced physical (76% vs 43%) and psychological (80% vs 39%) problems in the previous 12 months than non-dependent ICU. Similarly, greater proportions of cocaine-dependent NICU reported physical (90% vs 44%) and psychological (100% vs 42%) problems than non-dependent NICU. Route of administration was not found to be a significant predictor of cocaine dependence. Frequency of use over the preceding six months was the only factor that was independently associated with dependence.

There was a high prevalence of cocaine-related problems among ICU and NICU, with more than half of each group reporting that they had experienced physical (ICU-58%; NICU-54%) and/or psychological (ICU-58%; NICU-54%) problems in the preceding 12 months. Among ICU, the most common physical problems were palpitations, headaches, and sleep problems. Among NICU, the most common physical problems were numbness/tingling, nasal problems, and sleep problems. The most common psychological problems among both ICU and NICU were paranoia, mood swings, and agitation. Route of administration did not appear to play a role in the likelihood of having experienced such problems.

The SDS was found to be an accurate diagnostic tool to measure the presence or absence of cocaine dependence. A score of 3 on the SDS was revealed by ROC analysis to be the cut-off point which best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence.

In summary, this study revealed that cocaine is a drug with the potential to cause dependence, as well as a number of physical and psychological problems, among a broad spectrum of users with various patterns and methods of use. Cocaine dependence among injecting and non-injecting users

was of a level sufficient to cause concern and warrant further research. While subjects who had used cocaine more frequently were more likely to be cocaine-dependent, a diagnosis of dependence was not contingent on a high frequency of use. Thus, the potential for irregular, as well as regular, users of cocaine to develop cocaine dependence should be recognized and factored into the development of harm minimization or treatment strategies. It is concluded that the use of cocaine should be treated as an issue of serious concern and remain a focus of future research.

INTRODUCTION

The accumulated findings of research conducted since the mid 1990's (Hando et al., 1997; Kaye et al., 2000; Malcolm et al., 1996; McKetin et al., 1999) have provided evidence for a progressive increase in the use of cocaine among injecting drug users (IDU) in Sydney. The prevalence of recent (i.e. in the previous six months) cocaine use among Sydney IDU surveyed for the Illicit Drug Reporting System (IDRS) rose from 41% in 1996 to 67% in 1999 (McKetin et al., 2000). Injecting cocaine use has been associated with higher levels of injecting frequency, HIV risk behaviours and seroprevalence, as well as a greater number of injection-related problems such as vascular damage, abscesses, and infections (Chaisson et al., 1989; Darke et al., 1992a; Kaye et al., 2000; McKetin et al., 1999; Schoenbaum et al., 1989; Torrens et al., 1991).

A recent study conducted by Kaye et al. (2000) revealed significant proportions of both injecting (34%) and non-injecting (17%) cocaine users to be dependent on the drug, as measured by the Severity of Dependence Scale (SDS) (Gossop et al., 1995). While injecting cocaine use was associated with greater overall harm to the user than non-injecting use, dependence was found to be the most influential mediator in the relationship between the use and associated harms of cocaine. Irrespective of the route of administration, dependence was associated with poorer physical and psychological health.

The current study aimed to further investigate the cocaine dependence syndrome by examining the prevalence, correlates, and diagnosis of dependence among both injectors and non-injectors of cocaine. Given the prevalence of dependence and cocaine-related harms among non-injecting cocaine users revealed by Kaye et al. (2000), an examination of the cocaine-dependence syndrome in a non-injecting, as well as an injecting, group of

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cocaine users was warranted. In addition to providing information about the prevalence and correlates of cocaine dependence within each group, the role of route of administration was able to be investigated.

The prevalence of dependence was measured by applying the DSM-IV (American Psychiatric Association, 1994) criteria for substance dependence. While the DSM-IV defined construct of substance dependence is regarded as the "gold standard", the SDS has also proven to be a valid and reliable measure of dependence (Gossop et al., 1995; Gossop et al., 1997). Early research into amphetamine dependence (Hando & Hall, 1993) suggested that a score greater than 4 on the SDS is indicative of amphetamine dependence, a finding later validated by Topp and Mattick (1997). While Kaye et al. (2000) used such a score to indicate cocaine dependence, an appropriate diagnostic cut-off point on the SDS for cocaine dependence has yet to be statistically determined. As such, the present study aimed to ascertain the SDS cut-off score that best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence.

The final aim of the current study was to extend upon the work of Kaye et al. (2000) and determine the prevalence and nature of cocaine-induced physical and psychological health problems in the context of both lifetime and recent experience.

1.1 Study Aims

The specific aims of the present study were as follows:
1. To determine the prevalence and correlates of cocaine dependence among injecting and non-injecting cocaine users in Sydney;
2. To investigate the role of route of administration in cocaine dependence;
3. To determine an appropriate cut-off score for a diagnosis of cocaine

dependence on the SDS;

4. To examine the prevalence and nature of cocaine-induced physical and psychological health problems.

2.0 METHOD

2.1 Procedure

All subjects were volunteers who were paid A$30 for their participation in the study. Recruitment took place from June 2000 to August 2000, via advertisements placed in treatment agencies, needle and syringe programs, music magazines, and by word of mouth. Subjects comprised a sub-sample of those surveyed for the IDRS (Darke et al., 2001), which was conducted in conjunction with the present study. The IDRS involved two phases of recruitment: 1. recruitment of regular (i.e. at least monthly) injectors of heroin, cocaine, or amphetamine, and 2. recruitment of regular ecstasy users.

Subjects contacted the researchers, either by telephone or in person, and were screened for eligibility for inclusion in the present study. To be eligible for the study subjects must have used cocaine at least once during the six months preceding interview. Interviews were conducted by one of the research team and took between 30 and 45 minutes to complete.

All subjects were guaranteed, both at the time of screening and interview, that any information they provided would remain strictly anonymous and confidential.

2.2 Structured interview

2.2.1 <u>Demographic characteristics</u>

Demographic details included: age, gender, level of secondary and tertiary education, employment status, drug treatment history, and prison history.

2.2.2 Drug use history

Drug use history was obtained by asking subjects which drug classes they had ever used, which ones they had ever injected, and which ones they had injected in the preceding six months. The number of days on which they had used each drug class during the previous six months was also obtained. Where applicable, further questions about the age at which subjects first injected a drug, the type of drug first injected, the frequency of recent injecting, and the subjects' main drug of choice were also asked.

2.2.3 Cocaine use patterns

Information on patterns of cocaine use was obtained by asking subjects about initial and recent (i.e. last 6 months) routes of cocaine administration. Subjects were also asked about the frequency of their cocaine use in the last 6 and 12 months.

2.2.4 Cocaine dependence

Cocaine dependence was measured using the Composite International Diagnostic Interview (CIDI) (Core Version 2.1, World Health Organisation, 1997), an instrument which operationalises the DSM-IV diagnostic criteria for substance dependence. In order to obtain a *current* CIDI diagnosis of substance dependence, i.e. present at some stage during the preceding 12 months, respondents needed to qualify for three or more of seven symptoms, each of which reflect drug use patterns or associated problems in the previous 12 months.

Subjects were also administered the SDS - a 5-item scale that measures psychological dependence over the preceding 12 months. Scores range from 0-15, with higher scores indicating a greater degree of dependence on the drug in question.

2.2.5 <u>Physical and psychological problems associated with cocaine use</u>

Subjects were asked whether or not they had ever experienced physical and/or psychological problems that they directly associated with their use of cocaine. They were also asked whether or not they had experienced such problems in the previous 12 months.

2.2.6 <u>Crime</u>

The Opiate Treatment Index (OTI) Criminality Scale (Darke et al., 1992b) was administered to subjects. This scale measures property crime, drug dealing, fraud, and violent crime committed during the month preceding interview. Scores on this scale range from 0-16, with higher scores indicating a greater degree of criminal involvement. Subjects were also asked whether or not they had been arrested during the previous 12 months and, if they had been arrested, what they were arrested for.

2.3 Analyses

For continuous variables t-tests were employed. Categorical variables were analysed using chi-square. Where distributions were highly skewed, medians were reported. In order to determine the variables that were independently associated with dependence, a logistic regression analysis was conducted using the backward stepwise method of elimination. A Receiver Operating Characteristic (ROC) analysis was conducted in order to determine an appropriate cut-off point on the SDS for cocaine dependence. All analyses were conducted using SPSS for Windows, Version 9 (SPSS Inc, 1999).

3.0 RESULTS

3.1 Sample characteristics

The sample consisted of 142 illicit drug users who, in accordance with the aforementioned inclusion criteria, had used cocaine at least once in the six months preceding interview. Those subjects who had injected cocaine during the previous six months (n=96) were classified as injecting cocaine users (ICU), while those who had used, but not injected, cocaine during this period (n=46) were classified as non-injecting cocaine users (NICU).

The mean age of the sample was 27.9 years (SD 7.3, range 16-50 yrs), with 66% being male. The mean length of school education was 10.0 years (SD 1.93, range 0-12 yrs), with 26% having completed a trade or technical course and 13% having completed a university course. Nearly two-thirds (60%) of the sample were unemployed at the time of interview, with 14% in full-time employment, 13% in part-time/casual employment, and 8% engaged in sex work. Almost one-quarter (23%) of the sample were in treatment for drug dependence at the time of interview and had been so for a median of 7 months (range 1-144 mths). The majority of those in treatment (31/32) were enrolled in a methadone maintenance program. Nearly half of the sample (48%) had a prison history and 42% had been arrested in the previous 12 months.

3.2 Comparisons of ICU and NICU

3.2.1 <u>Demographic characteristics</u>

The demographic characteristics of the ICU and NICU groups are presented in Table 1.

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Table 1: Demographic characteristics of ICU and NICU

Variable	ICU (N=96)	NICU (N=46)
Age (mean yrs) (range)	29.3 (16-50)	25.0 * (18-39)
% Male	65	67
Education (mean yrs) (range)	9.4 (0-12)	11.5 * (10-12)
% Unemployed	76	26 *
% Prison history	69	4 *
% In drug treatment	33	0 *

* Significant difference exists between groups

As Table 1 illustrates, ICU were significantly older (t_{124}=3.90, p<.001; 95%CI= 2.12, 6.49) and had less education than NICU (t_{140}=-9.08, p<.001; 95%CI= -2.59, -1.66). ICU were also more likely to be unemployed (χ^2=32.30, p<.001), currently enrolled in drug treatment (χ^2=19.79, p<.001), and to have a prison history (χ^2=51.69, p<.001) than NICU. Consistent with the higher rates of previous incarceration, OTI crime totals were significantly higher for ICU than for NICU (2.4 vs 1.0, t_{134}=4.52, p<.001; 95%CI= 0.77, 1.97), indicating a greater degree of criminality among ICU in the preceding month.

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3.2.2 <u>Drug use history</u>

The majority of ICU nominated heroin (77%) or cocaine (16%) as their primary drug of choice. Ecstasy was the most popular drug of choice among NICU (39%), closely followed by cannabis (30%).

Cocaine was used on a significantly greater number of median days by ICU than by NICU in the preceding six months (12 vs 4, U=1309.5, p<.001), as well as on a greater range of days (ICU: 1-180; NICU 1-90). Fourteen percent of ICU had used cocaine at least once a day in the previous 12 months, whereas no NICU had used cocaine this frequently (χ^2 =6.86, p<.01). The usual route of cocaine administration in the last 12 months was injection for nearly all ICU (95%) and intranasal (snorting) for the majority of NICU (87%).

The median number of days on which heroin (180 vs 0, U=289.5, p<.001), and benzodiazepines (6 vs 0, U=1324.5, p<.001) had been used in the previous six months was significantly higher for ICU than for NICU. The median number of days on which ecstasy (0 vs 14.5, U=357.0, p<.001), amphetamine (0 vs 5.5, U=1500, p<.01) and cannabis (48 vs 140, U=1741.5, p<.05) were used during this period, however, was significantly lower for ICU than for NICU.

The mean number of drug classes ever used (9.5 vs 9.0) did not significantly differ between ICU and NICU, nor did the mean number of drug classes used in the last six months (6.6 vs 7.0) (Table 2). Not surprisingly, ICU had injected significantly more drug classes than NICU in their lifetime (4.0 vs 0.6, t_{140}=14.39, p<.001; 95%CI=2.91, 3.83), and in the last six months (2.8 vs 0.3, t_{122}=17.27, p<.001; 95%CI=2.27, 2.86). In addition to cocaine, the most popular psychoactive drugs used among ICU in the previous six months were heroin, cannabis and benzodiazepines. Among NICU, alcohol, ecstasy, and

Table 2: Drug use histories of ICU and NICU

Variable	ICU (N=96)		NICU (N=46)	
	%EVER	%6 MTHS	%EVER	%6 MTHS
Cocaine	100	100	100	100
Heroin	98	93	39	24
Methadone	79	54	4	0
Other opiates	41	24	22	4
Amphetamines	89	48	100	76
Hallucinogens	66	5	91	37
Ecstasy	48	21	98	96
Benzodiazepines	82	67	63	41
Alcohol	97	54	100	98
Cannabis	98	75	98	89
Anti-depressants	21	12	28	13
Inhalants	35	7	80	43
Tobacco	100	97	80	74
Mean no. of drug classes used	9.5	6.6	9.0	7.0
Mean no. of drug classes injected	4.0	2.8	0.6	0.3

* Significant difference exists between groups

cannabis were the most commonly used psychoactive drugs apart from cocaine (Table 2).

3.3 Physical and psychological problems associated with cocaine use

ICU and NICU did not significantly differ in terms of the proportion of subjects who reported having ever experienced physical problems due to their

cocaine use (60% vs 57%). Nor did they differ in terms of the proportion that had experienced such problems in the previous 12 months (58% vs 54%). (Table 3). As Table 3 illustrates, among ICU the most common physical problems occurring in the last 12 months were heart palpitations (35%), headaches (31%), and sleep disturbances (30%). Among NICU, the most common physical problems occurring in the last 12 months were numbness/tingling (30%), nasal bleeding/congestion (26%), and sleep disturbances (22%).

The proportions of ICU and NICU that had ever experienced psychological problems did not significantly differ (63% vs 67%). Similarly, there was no significant difference between the proportions that had experienced such problems in the previous 12 months (58% vs 54%). The most common psychological problems experienced in the previous 12 months were the same for both ICU and NICU: paranoia, mood swings, and agitation (Table 3). Among ICU, however, paranoia was reported by the highest proportion of subjects (33%), whereas among NICU the most prevalent problem was mood swings (35%).

3.4 Cocaine dependence

3.4.1 Prevalence of cocaine dependence

Almost half (47%) of the ICU group, and over 1 in 5 NICU (22%), qualified for a DSM-IV diagnosis of cocaine dependence, the difference between these proportions being statistically significant (χ^2=8.28, p<.01) (Table 4).

Among ICU, the most prevalent DSM-IV symptoms were tolerance, taking cocaine in larger amounts or for longer than intended, and continued use despite physical and/or psychological problems caused or exacerbated by cocaine use (Table 4). This was also the case for those ICU who qualified for a

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diagnosis of dependence. Among NICU, the most prevalent DSM-IV symptoms were withdrawal, tolerance, taking cocaine in larger amounts or for longer than intended, and continued use despite physical and/or psychological problems caused or exacerbated by cocaine use. These were also the most prevalent symptoms among those NICU who qualified for a diagnosis of dependence.

Table 3: Physical and psychological problems associated with cocaine use

Variable	ICU (N=96) %		NICU (N=46) %	
Ever experienced physical problems	60		57	
Experienced physical problems in last 12 mths	58		54	
Most common physical problems in last 12 mths	Palpitations Headaches Sleep problems	35 31 30	Numbness/tingling Nasal problems Sleep problems	30 26 22
Ever experienced psychological problems	63		67	
Experienced psychological problems in last 12 mths	58		54	
Most common psychological problems in last 12 mths	Paranoia Mood swings Agitation	33 32 32	Mood swings Agitation Paranoia	35 28 22

Table 4: Prevalence of DSM-IV symptoms of current cocaine dependence

Dependence Symptoms	ICU (N=96) %	NICU (N=46) %
1. Tolerance	59	26 *
2. Withdrawal (as evidenced by withdrawal syndrome <u>or</u> drug use to relieve withdrawal symptoms)	37	30
3. Taken in larger quantities/for longer than intended	51	26 *
4. Persistent desire/unsuccessful efforts to cut down	24	7 *
5. Great deal of time spent using/procuring/recovering	33	4 *
6. Neglecting important social/occupational/recreational activities	30	11 *
7. Continued use despite physical and/or psychological problems	56	30 *
Diagnosis of dependence (3 or more of above symptoms)	47	22 *

* Significant difference exists between groups

It should be noted that the majority of ICU (83%), and over a half of NICU (56%), exhibited at least one DSM-IV symptom of cocaine dependence.

3.4.2 <u>Using the SDS as a measure of cocaine dependence</u>

The mean SDS scores of ICU and NICU who received a DSM-IV diagnosis of dependence were compared with those who did not receive such a diagnosis. Dependent ICU scored significantly higher on the SDS than non-dependent

ICU (6.0 vs 0.8, t_{52}=7.64, p<.001). Similarly, dependent NICU had significantly greater mean SDS scores than non-dependent NICU (2.0 vs 0.5, t_{44}=2.28, p<.05).

An ROC analysis was conducted in order to determine the optimal cut-off point on the SDS for cocaine dependence, i.e. that which best strikes a balance between the sensitivity (proportion of true-positives) and specificity (proportion of true-negatives) of the SDS as a diagnostic tool. The ROC curve, depicted in Figure 1, graphically represents the performance of the SDS through the whole range of cut-off points. The area under the ROC curve (AUC) summarises the diagnostic utility of a test. In the case of a test that only discriminates between the presence or absence of a diagnosis at the level of chance, the AUC will be 0.5 and is represented by the diagonal on the ROC graph. The AUC increases as the diagnostic accuracy of the test increases to a maximum of 1.0, which indicates a test with perfect diagnostic utility. Thus, the AUC value of 0.86 in the present ROC analysis suggests that the SDS is a test of high diagnostic utility. This analysis revealed a score of 3 on the SDS to be the cut-off point with the highest chi-square (χ^2 =58.18), and which, thus, best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence. Hence, an SDS score equal to, or greater than, 3 is indicative of cocaine dependence. A list of the sensitivity, specificity and chi-square values for each cut-off point is presented in Table 5.
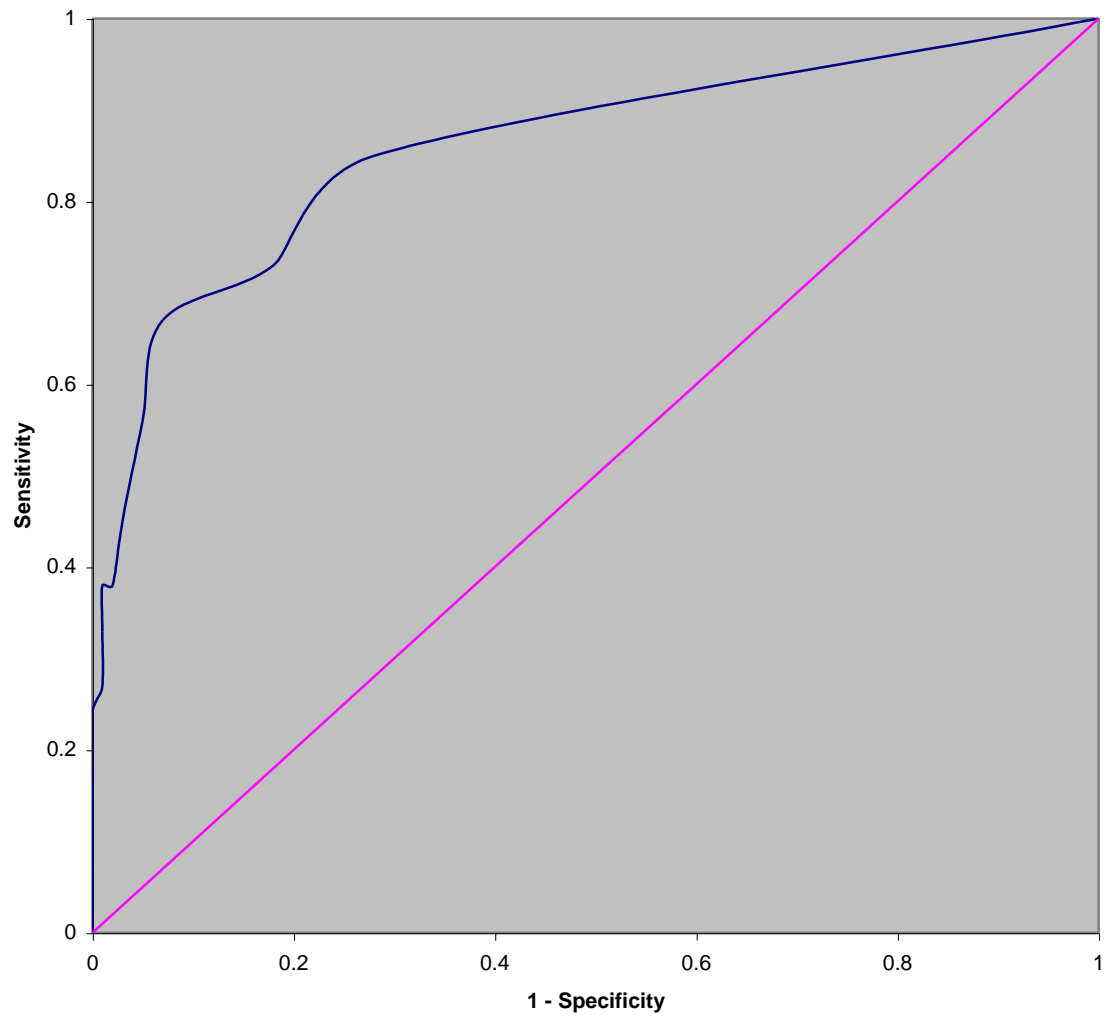
Figure 1. ROC curve calculated for the SDS

Table 5: Sensitivity, specificity, and χ^2 values of the SDS at each successive cut-off point when discriminating between cocaine users with and without DSM-IV dependence

SDS score	Sensitivity (%)	Specificity (%)	χ^2
0	100	0	-
1	85	72	45.14
2	73	82	41.66
3	67	93	58.18
4	56	95	48.62
5	45	97	37.56
6	38	98	31.97
7	38	99	35.30
8	33	99	28.99
9	27	99	23.00
10	24	100	22.64
11	16	100	15.20
12	15	100	13.41
13	7	100	6.51
14	2	100	1.59
15	0	100	-

3.4.3 Comparisons of dependent and non-dependent ICU

Within the ICU sample, a number of comparisons were made between those who were cocaine-dependent, as classified by the CIDI, and those who were not cocaine-dependent. These comparisons are summarised in Table 6.

Dependent ICU were more likely than non-dependent ICU to be female (53% vs 20%, χ^2 =11.89, p<.01) and to have experienced physical (76% vs 43%, χ^2 =10.34, p<.01) and psychological (80% vs 39%, χ^2 =16.36, p<.001) cocaine-related problems in the previous 12 months. Dependent ICU had also used cocaine on a greater number of median days (48 vs 6 days, U=543, p<.001) in the preceding six months than non-dependent ICU.

There were no significant differences between dependent and non-dependent ICU in terms of the mean number of drug classes ever used (9.6 vs 9.5) or

used in the previous six months (6.5 vs 6.6). Nor were there any significant differences between the mean number of drug classes ever injected (3.8 vs 4.1) or injected in the last six months (2.7 vs 2.9).

3.4.4 Comparisons of dependent and non-dependent NICU

Within the NICU sample, comparisons were made between those who were cocaine-dependent, as classified by the CIDI, and those who were not cocaine-dependent. These comparisons are summarised in Table 7.

Dependent NICU were more likely than non-dependent NICU to have experienced physical (90% vs 44%, $\chi^2 = 6.55$, p<.05) and psychological (100% vs 42%, $\chi^2 = 10.73$, p<.01) cocaine-related problems in the previous 12 months. Dependent NICU had used cocaine on twice the number of median days (6 vs 3 days, U=80.5, p<.01) than non-dependent NICU during the preceding six months.

There were no significant differences between dependent and non-dependent NICU in terms of the mean number of drug classes ever used (9.6 vs 8.9) or used in the previous six months (6.9 vs 7.0). Nor were there any significant differences between the mean number of drug classes ever injected (0.4 vs 0.7) or injected in the last six months (0.1 vs 0.3).

Table 6: Comparisons of dependent and non-dependent ICU

Variable	Dependent ICU (n=45)	Non-dependent ICU (n=51)
Age (mean yrs) (range)	28.9 (16-49)	29.7 (16-50)
% Male	47	80 *
Education (mean yrs) (range)	9.0 (0-12)	9.6 (6-12)
% Unemployed	69	82
% In treatment	33	33
% Prison history	78	61
% Arrested last 12 mths	56	57
OTI crime	2.6	2.2
No. of days used cocaine in last 6 mths (med)	48	6 *
Physical problems in last 12 mths	76	43 *
Psychological problems in last 12 mths	80	39 *

* Significant difference exists between groups

Table 7: Comparisons of dependent and non-dependent NICU

Variable	Dependent NICU (n=10)	Non-dependent NICU (n=36)
Age (mean yrs) (range)	23.3 (18-30)	25.5 (18-39)
% Male	80	64
Education (mean yrs) (range)	11.2 (10-12)	11.6 (10-12)
% Unemployed	40	22
% In treatment	0	0
% Prison history	10	3
% Arrested in last 12 mths	20	11
OTI crime	1.5	0.9
No. of days used cocaine in last 6 mths (med)	6	3 *
Physical problems in last 12 mths	90	44 *
Psychological problems in last 12 mths	100	42 *

* Significant difference exists between groups

3.4.5 <u>Predictors of cocaine dependence</u>

In order to determine the factors that were independently associated with a DSM-IV diagnosis of cocaine dependence, a logistic regression was conducted. Variables entered into the model were: age, sex (female=1, male=0), group

(ICU=1, NICU=0), and the number of days on which cocaine had been used in the previous six months. The final model revealed the number of days of cocaine use in the last six months to be the only significant predictor of cocaine dependence (OR=1.03, χ^2 =17.06, p<.001; 95%CI=1.01, 1.04), indicating that, after taking all other factors into account, the odds of being cocaine-dependent increase by 3% for each additional day of cocaine use. The model was significant (χ^2 =31.72, p<.001) and had a good fit (Hosmer-Lemeshow χ^2 =9.89, p=0.27).

4.0 DISCUSSION

4.1 Major findings

Cocaine dependence was highly prevalent among ICU, with almost half of cocaine injectors qualifying for a DSM-IV diagnosis of dependence. Among NICU, cocaine dependence was of a lower, but still significant, prevalence, with over one-fifth of subjects qualifying for a diagnosis of dependence.

Irrespective of route of administration, cocaine-dependent subjects were more likely to have experienced cocaine-induced physical and psychological problems in the previous 12 months than non-dependent subjects. Among ICU, cocaine-dependent subjects were also more likely to be female than non-dependent subjects. Route of administration was not found to be a significant predictor of cocaine dependence. Frequency of use over the preceding six months was the only factor that was independently associated with dependence.

There was a high prevalence of both physical and psychological cocaine-related problems among ICU and NICU, with more than half of each group reporting that they had experienced such problems in the preceding 12 months. While route of administration did not appear to play a role in the likelihood of having experienced either type of problem, dependence, as noted above, was associated with a greater prevalence of such problems.

Finally, the SDS was found to be an accurate diagnostic tool to measure the presence or absence of cocaine dependence. A score of 3 on the SDS was revealed by ROC analysis to be the cut-off point which best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence.

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4.2 Comparisons of ICU and NICU

The current study revealed several differences between the demographic profiles of cocaine users according to their main route of administration. ICU were older, had lower levels of education, and were more likely to be unemployed than NICU. They were also more likely to be enrolled in drug treatment and to have a prison history. These differences have been found in earlier cocaine research (Kaye et al., 2000) and provide further evidence for the existence of two demographically disparate groups of cocaine users in Sydney (Hando et al., 1997).

In accordance with the findings of Kaye et al. (2000), the polydrug use histories of ICU and NICU were similar, indicating that the extent of risk-taking in relation to drug experimentation may be independent from that in relation to the choice of administration route.

Consistent with the higher rates of previous incarceration among ICU, as well as the findings of previous research (Kaye et al., 2000), ICU were found to have been more criminally active than NICU in the month preceding interview. As the onset of crime compared with that of cocaine use was not measured in the current study, it is unclear whether the higher level of recent criminality among ICU was a function of their greater frequency of cocaine use or whether it reflected group differences independent of cocaine use, such as the fact that the ICU group was predominantly comprised of regular heroin users. Alternatively, the recent criminality of ICU may have been a current snapshot of criminal careers that were initiated prior to drug use. Indeed, previous research has demonstrated the high prevalence of crime preceding drug use among IDU (Kaye et al., 1998).

4.3 Prevalence of cocaine dependence

Almost half of ICU, and over 1 in 5 NICU, qualified for a DSM-IV diagnosis of cocaine dependence. While the prevalence of cocaine dependence among both groups is cause for concern, ICU were far more likely to qualify for a diagnosis than NICU. The higher prevalence of dependence among ICU is consistent with previous cocaine, heroin, and amphetamine research demonstrating an association between route of administration and severity of dependence, whereby injecting users showed higher levels of dependence than non-injecting users (Gossop et al., 1992; Kaye et al., 2000; Ross et al., 1994).

In contrast to the current study, Kaye et al. (2000) did not observe any difference between the prevalence of cocaine dependence among ICU and NICU, even though ICU scored higher on the SDS. The conflict between these findings, however, is likely to be due to the different diagnostic measures employed. In the previous study, the SDS was used as a presumptive measure of cocaine dependence. Diagnoses were made using an SDS cut-off point which had previously been used to measure dependence on other drugs, but which had not been validated for the diagnosis of cocaine dependence. In the current study, formal diagnoses of dependence were obtained using DSM-IV, the "gold standard" measure of drug dependence.

Substantial proportions of both ICU and NICU exhibited at least one DSM-IV symptom of cocaine dependence. Although at least three symptoms are required for a diagnosis, this finding suggests that features of the cocaine dependence syndrome were prevalent among both groups.

4.4 Correlates of cocaine dependence

With the exception of a higher proportion of females among dependent than non-dependent ICU, the demographic characteristics, drug use histories, and criminal histories of ICU did not significantly differ according to their dependence status.

Among NICU, no significant effect of gender on dependence status was found. There were also no significant differences between dependent and non-dependent NICU in terms of other demographic characteristics, drug use history, or criminal history.

Although Kaye et al. (2000) did not observe any such relationship, an association between gender and drug dependence has been suggested by other research (Kaye & Darke, 2000; Ross et al., 1995). As in the case of ICU in the current study, these studies found that being female was independently associated with a greater degree of dependence, although it should be noted that the drugs under investigation were heroin, amphetamine and benzodiazepines, rather than cocaine. While such findings would appear to suggest that females are at greater risk of becoming dependent on these drugs, it is possible that the females in question were more willing than males to recognize and report the degree to which their drug use was problematic. However, as the evidence to date is equivocal, more extensive investigations into the differential effects of gender on dependence liability are required before any firm conclusions about these findings can be drawn.

The frequency of cocaine use over the preceding six months was higher among dependent than non-dependent subjects in both the ICU and NICU groups and proved to be the only significant independent predictor of

dependence. Although cocaine-dependent subjects had used cocaine more frequently than non-dependent subjects, the median frequency of use was twice a week among ICU, and once a month among NICU. These findings are at odds with the widely held belief that dependence implies frequent use of a drug and demonstrate that, contrary to this notion, even "recreational" users of cocaine may qualify for a diagnosis of dependence.

The proportions of dependent subjects in both the ICU and NICU groups that had experienced physical and/or psychological problems related to their cocaine use in the last 12 months were approximately twice that of non-dependent subjects. While an association between cocaine dependence and a high prevalence of physical and psychological health problems has been demonstrated by previous research (Kaye et al., 2000), the current study has shown that the experience of such problems may be one of the major features of the cocaine dependence syndrome. Although not a criterion necessary for a diagnosis, the continuation of cocaine use despite experiencing associated health problems was reported by at least eighty percent of cocaine-dependent ICU and NICU.

Overall, these results suggest that the correlates of cocaine dependence pertain mainly to the patterns and consequences of cocaine use *per se*, rather than to the characteristics or drug use career of the user. Moreover, the potential for dependence does not appear to be influenced by either user characteristics or route of administration. Hence, an employed, well-educated, non-injector may be just as likely to become cocaine-dependent as an injector with a lower socio-economic status if the two are using cocaine equally as frequently.

4.5 The SDS as a diagnostic measure of cocaine dependence

The present study revealed the SDS to be a test of high diagnostic utility for the measurement of cocaine dependence. A score of 3 was found to be the cut-off point that best discriminates between the presence or absence of a DSM-IV diagnosis of cocaine dependence. As such, the cut-off point of 5 (i.e. an SDS score of 5 or more) used to diagnose amphetamine dependence (Topp & Mattick, 1997) is not appropriate for the diagnosis of cocaine dependence, being too conservative a criterion and thus underestimating the true prevalence of cocaine dependence.

4.6 Physical and psychological problems associated with cocaine use

Physical and psychological health problems related to cocaine use were common among both ICU and NICU, with over a half of each group reporting that they had experienced such problems in the previous 12 months. The finding that NICU were just as likely as ICU to report both types of problems suggests that non-injecting routes of administration are not without risk of harm to the user.

With respect to physical problems, the route of administration did appear to bear some relation to the nature of the problems experienced. One of the most common types of physical problem reported by NICU, for example, was related to the snorting of cocaine, i.e. sinus/nasal congestion and/or bleeding. Whilst not the most common type of physical problem among ICU, vascular problems were reported by 14% of this group, a substantially greater proportion than that of ICU in previous research (Kaye et al., 2000). An association between injecting cocaine use and vascular damage has been demonstrated by previous research (Kaye et al., 2000; McKetin et al., 1999) and is thought to be due to the higher frequency with which cocaine, relative to other drugs, is injected (Chaisson et al., 1989; Schoenbaum et al., 1989).

While there are certain physical problems unique to the method by which cocaine is administered, there are many others that occur irrespective of the way cocaine is used. The health risks associated with injecting drug use have been well documented (Kaye et al., 2000; Ross et al., 1994; Ross et al., 1997) and the fact that these risks are increased by the higher injecting frequency that is typically associated with the use of cocaine should not be ignored. However, the finding that heart palpitations and numbness/tingling were the problems reported by the highest proportion of ICU and NICU, respectively, indicates that the greater harm associated with injecting cocaine use may be eclipsed by the harm caused by the effects of the drug itself. Moreover, there was no difference between the likelihood of each group having experienced physical problems from cocaine. As such, non-injecting cocaine use may be no less detrimental to the user's health overall than injecting cocaine use.

The suggestion that the harm associated with cocaine use is largely independent of the way in which it is administered is also supported by the lack of difference between the proportions of ICU and NICU that had experienced psychological problems in the previous 12 months. Moreover, the most commonly reported psychological problems were the same among both groups.

While the majority of NICU in the current study had snorted cocaine, other research has shown that the smoking of freebase or "crack" cocaine can also have serious physical and psychological effects, such as cardiovascular problems, seizures, strokes, pulmonary problems, and psychosis (Cornish & O'Brien, 1996; Platt, 1997). These findings, in addition to those of the current study, suggest that there is no "safe" way of using cocaine. Encouraging users, therefore, to change to an alternative route of administration may not only fail to reduce the harm caused by the effects of cocaine itself, but may

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also introduce a new, and perhaps more severe, range of problems related to the adopted method of use.

Given that ICU had used cocaine far more frequently than NICU in the preceding 12 months, yet were no more likely to experience resultant problems, the physical and psychological harms associated with cocaine use do not appear to necessarily be a cumulative effect of repeated use. Even sporadic use may be problematic. Future research, therefore, should take into account the fact that the physical and psychological health of all cocaine users, not just those who are using on a regular basis, may be at risk.

It should be noted that the prevalence of cocaine-related problems, physical and psychological, was substantially greater in the present study than in that conducted by Kaye et al. (2000). Whether this is due to differences in the willingness to report such problems, differences in the amount of cocaine used on each occasion, or to other factors is unclear, as these variables were not measured in either study. It is also possible that the increased prevalence of cocaine-related problems is a function of the length of time that cocaine has been readily available in Sydney. As Kaye et al. (2000) noted, the increase in the use and availability of cocaine in Sydney has only been observed since the mid-1990's. With the increase in the number of people initiating cocaine use, along with the increasingly longer cocaine use careers of established users, it is not surprising that a greater number of problems are now surfacing.

4.7 Summary and conclusions

In summary, this study revealed that cocaine dependence among injecting and non-injecting users is of a level that is sufficient to cause concern and warrant further research. While subjects who had used cocaine more frequently were more likely to be cocaine-dependent, a diagnosis of

dependence was not contingent on a high frequency of use. Thus, the potential for irregular, as well as regular, users of cocaine to develop cocaine dependence should be recognized and factored into the development of harm minimization or treatment strategies.

The study also determined that, in order to diagnose dependence, the most appropriate cut-off point on the SDS is 3, a lower cut-off than that used in the diagnosis of amphetamine dependence. Given that its utility as a diagnostic measure of cocaine dependence was statistically validated, the SDS may be recommended as a brief screening instrument for cocaine dependence.

Finally, the study revealed a high prevalence of both physical and psychological problems associated with the use of cocaine. The likelihood of experiencing such problems was independent of the user's route of administration and frequency of use, although their prevalence was greater among those who were cocaine-dependent. Although the study endeavoured to elucidate the prevalence and nature of the harms associated with cocaine use, further investigation of this subject is warranted.

Overall, the findings of the study have demonstrated that cocaine is a drug with the potential to cause dependence, as well as a number of physical and psychological problems, among a broad spectrum of users with various patterns and methods of use. As such, its use should be treated as an issue of serious concern and remain a focus of future research.

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