A. Williamson, S. Darke, J. Ross & M. Teesson

The effect of cocaine use on short term outcomes for heroin dependence

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THE EFFECT OF COCAINE USE ON SHORT TERM OUTCOMES FOR HEROIN DEPENDENCE

Anna Williamson, Shane Darke, Joanne Ross & Maree Teesson

National Drug and Alcohol Research Centre
University of NSW Sydney, Australia

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EXECUTIVE SUMMARY

Introduction

Cocaine use among heroin users in NSW rose dramatically during the 'heroin drought' of 2001. A recent study (Williamson et al., 2003) demonstrated that heroin users who also used cocaine were a more 'at risk' group. As such, they displayed higher current levels of social dysfunction, drug use, needle-risk taking behaviour and criminality. It was unknown what effect the different clinical profile of heroin users who also use cocaine would have on short-term treatment outcome for heroin dependence. Moreover, it was unclear whether heroin users who also use cocaine were an inherently more dysfunctional group, or whether instead, it was cocaine use *per se* exacerbating dysfunction.

The current study was conducted as part of the Australian Treatment Outcome Study (ATOS). ATOS is the first large scale longitudinal study of treatment outcome for heroin dependence to be conducted in Australia. The aims of the current study were: to determine the effect of cocaine use on the short-term outcomes of treatment for heroin dependence in NSW; to examine the relationship between cocaine use and dysfunction among heroin users.

Results

Prevalence

At baseline, approximately 40% of the ATOS sample had used cocaine in the month prior to interview (CU), but only half as many (19%) reported cocaine use in the month prior to 3 month follow-up. The average frequency of last month cocaine use amongst current cocaine users did not change at three months. While 35% of CU continued to use cocaine at follow up, nearly 10% of those who did not report current cocaine use at baseline had commenced cocaine use during the follow up period. Having reported recent cocaine use at baseline and not enrolling in treatment at baseline were the strongest predictors of cocaine use at three months.

Treatment

Cocaine use at baseline did not appear to be significantly related to short-term treatment retention in the ATOS sample. At three months, CU and non-cocaine users (NCU) were equally likely to have completed their index detoxification or residential rehabilitation program and to still be enrolled in their index maintenance pharmacotherapy. CU and NCU also received similar average methadone and buprenorphine doses during the first three months of their index treatment.

Social functioning

At both baseline and follow up, CU displayed a greater level of dysfunction than NCU, being more likely to report being homeless and gaining the majority of their income from criminal activity and less likely to report current employment. Comparisons within groups on the basis of current cocaine use revealed social functioning to decrease during periods of cocaine use and increase subsequent to cessation of such use.

Drug use

CU continued to display more extensive polydrug use and higher levels of heroin use and dependence at three months. As was the case with social functioning, drug use behaviour appeared to be strongly influenced by cocaine use, with current cocaine users using more drug types and meeting criteria for more heroin dependence symptoms than those not currently using cocaine, irrespective of baseline cocaine use status.

Risk-taking

At three months CU remained more likely than NCU to report injecting a drug in the month prior to follow up and to report daily injection. Needle sharing at three months was also more common among CU than NCU. All needle risk-taking behaviours were seen to decrease substantially upon cessation of cocaine use and increase with the initiation of such use.

Crime

While reported levels of criminal activity in the sample decreased substantially at three months, the higher prevalence of criminal involvement in the CU group noted at baseline was maintained. Current cocaine use was shown to be a key predictor of criminal activity in the sample, with those who reported cocaine use at three months being more likely to report recent criminal activity than those who did not, irrespective of baseline cocaine use status.

Physical and mental health

As at baseline, self-reported general physical health did not vary as a function of cocaine use. As would be expected due to their greater frequency of injection however, CU were more likely to report an injection related health problem at three months. In keeping with this, current cocaine users from both groups were more likely to have recently suffered an injection related health problem than those who did not report cocaine use at follow up. General mental health and rates of current major depression did not appear to be effected by cocaine use at either baseline or three months.

Conclusion

Cocaine use had halved amongst the sample at follow up but frequency of use among those using cocaine at three months remained unchanged. Retention in treatment was not significantly affected by cocaine use at baseline however, short-term outcomes were poorer among CU. Comparisons within groups on the basis of three month cocaine use status revealed that decreased performance on outcome measures was associated with the commencement and/or continuation of cocaine use, while cessation of cocaine use resulted in significant improvements on these measures. Thus, in the short-term, cocaine use appears to exacerbate dysfunction, rather than serving as a marker for a more dysfunctional group of individuals. The relationship between cocaine use among heroin dependent individuals and outcome will be explored further at 12 and 24 months post-treatment entry.

1.0 INTRODUCTION

Cocaine use among heroin users in Australia has traditionally occurred at low levels (Hall et al., 1991). Throughout the mid 1990's however, cocaine use was seen to gradually increase amongst heroin users in Sydney (Hando et al., 1997) before surging in 1998 (Darke et al., 2002). In 2001, with the advent of the 'heroin drought', cocaine use among heroin users in Sydney dramatically increased again (Darke et al., 2002). This rise in cocaine use among heroin users in Sydney is a cause for concern as, in addition to it's cardiotoxic effects, cocaine has been demonstrated to adversely effect many bodily systems (Lange and Hillis, 2001) and is linked to greater needle risk-taking behaviour (Grella et al., 1995, Hudgins et al., 1995, Joe and Simpson, 1995), increased injection-related health problems (Kaye et al., 2000) and criminality (Grella et al., 1995, Kaye et al., 2000).

A recent investigation by Williamson et al (2003), conducted as a part of the Australian Treatment Outcome Study (ATOS), found that a large proportion (39%) of heroin users entering treatment for their heroin dependence in NSW (and users not currently enrolled in treatment) were current cocaine injectors. In keeping with international research (Bux et al., 1995, Chaisson et al., 1989, Hudgins et al., 1995, Kosten et al., 1988), Sydney 'cocaine users' (CU) were found to be a more 'at risk' group. Cocaine use was associated with decreased social functioning (higher levels of homelessness, unemployment and criminality), a greater degree of heroin dependence and more extensive recent polydrug use. In addition, cocaine users were found to engage in higher frequency injecting and to be more likely to report recent borrowing and lending of needles. It was not possible to discern from this study whether cocaine use itself was responsible for the greater dysfunction seen amongst CU, or whether those heroin users who took up cocaine use were an inherently more chaotic group than 'non-cocaine users' (NCU).

The correlates of cocaine use among heroin users in Sydney are an important clinical issue worthy of examination due to the large range of serious health problems associated with cocaine use. Recent research suggess non-fatal cocaine overdoses are common amongst cocaine injectors in Sydney (Kaye and Darke, 2003) and that 146 cocaine-related fatalities occurred in NSW alone from 1993-2002 (Darke et al., 2003). Indeed, cocaine, in

contrast to heroin, is associated with numerous cardiovascular and cerebrovascular complications such as coronary artery disease, myocardial infarction, stroke and seizures (Mittleman et al., 1999, Vasica and Tennant, 2002, Williams et al., 1998). Cocaine use also results in adverse effects to almost all other areas of the body, and is responsible for harms such as bowel infarction, respiratory collapse and hyperthermia (Blum, 1984, Crandall et al., 2002, Platt, 1997). Cocaine use is also associated with a range of mental health problems such as psychosis, depression and anxiety (Garlow et al., 2003, Torrens et al., 1991, Van Beek et al., 2001).

While it appears clear that concurrent heroin and cocaine use results in a greater degree of drug-related harm than heroin use alone, it is unclear what effect such co-use would have on the efficacy of traditional treatments for heroin dependence. No Australian studies have examined this issue, and research conducted in the United States and Spain, where this drug use pattern is more deeply entrenched, has been confined almost exclusively to methadone maintenance programs (Bux et al., 1995, Condelli et al., 1991, Esteban et al., 2003, Greenfield et al., 1996, Grella et al., 1995, Grella et al., 1997, Hartel et al., 1995, Kirdorf and Stitzer, 1993, Kolar et al., 1990, Magura et al., 1998, Magura et al., 1991). The results of such studies have been inconsistent, however it appears that cocaine use on treatment entry is related to poorer treatment outcome (Bux et al., 1995, Condelli et al., 1991).

The current study was conducted as part of the NSW component of ATOS, the first large-scale longitudinal study of treatment entrants for heroin dependence in Australia. The impact of cocaine use on short-term outcomes of treatment for heroin dependence (Methadone/buprenorphine maintenance, detoxification and Residential Rehabilitation/Therapeutic Communities) was examined in NSW, where the phenomena of cocaine use among heroin users primarily occurred. The relationship between cocaine use and psychosocial dysfunction in heroin users will also be explored by examining the effect of both commencing and ceasing cocaine use.

2.1 Study aims

The specific aims of the present study were as follows:

1. To determine the effect of cocaine use on outcomes of treatment for heroin dependence three months post-treatment entry;
2. To examine the relationship between cocaine use and psychosocial dysfunction among heroin users in NSW.

2.0 METHODS

2.1 The ATOS (NSW) sample

Baseline data were collected between February 2001 and August 2002 as part of the New South Wales (NSW) component of ATOS. For a more detailed description of sample recruitment and the baseline questionnaire see (Ross et al., 2002). ATOS is a 12 month longitudinal study of entrants to treatment for heroin dependence, recruited from randomly selected treatment agencies, and a comparison group of non-treatment heroin users. Subjects were recruited from 19 agencies treating heroin dependence in the greater Sydney region, randomly selected from within treatment modality and stratified by regional health area. The agencies comprised ten methadone/ buprenorphine maintenance (MT) agencies, four drug free residential rehabilitation agencies (RR) and nine detoxification facilities (DTX). Four agencies provided both maintenance and detoxification services. In addition, a comparison group of heroin users not currently in treatment (NT) were recruited from needle exchange programs in the regional health areas from which treatment entrants were recruited.

Eligibility criteria were: i) no treatment for heroin dependence in the preceding month, ii) no imprisonment in the preceding month, iii) agreed to give contact details for follow-up interviews, iv.) had a good understanding of English, and v) were 18 years or older. A total of 694 clients entering treatment were eligible for inclusion in ATOS, of these 535 (77%) were enrolled in the study.

The NT group consisted of 80 heroin using individuals not currently in any form of treatment. Of the 221 individuals eligible for inclusion in ATOS as part of the non-treatment group, 80 participated. The participation rate among those eligible for the study was therefore 36.2%.

The total sample was thus 615 heroin users. All subjects were paid A$20 for completing the baseline interview, which took approximately 1 hour to complete. A brief description of the baseline interview is provided below. The conduct of this study was independently reviewed and approved by the ethics committees of the University of New

South Wales and each of the Area Health Boards responsible for the clinics included in the study.

2.2 Baseline interview

Subjects were administered a structured interview on entry to the study. Sections addressed:

2.2.1 Demographic characteristics

Age, gender, Aboriginal/Torres Strait Islander status, country of birth, level of school and tertiary education attained, main source of income in the preceding month, number of children under own care, usual form of accommodation, prison history, and if so longest period of incarceration and the length and recency of last imprisonment.

2.2.2 Treatment and drug use history

Lifetime history of treatment for heroin dependence was established. Participants were asked which drugs they had ever used, which ones they had ever injected, and which they had injected in the preceding six months. The number of days each drug was used in the preceding 6 months was also recorded. Drug use in the preceding month was assessed using the Opiate Treatment Index (OTI; (Darke et al., 1992b). Questions regarding lifetime history of non-fatal heroin overdose were based on earlier work conducted by the authors (Darke et al., 1996b). The injecting sub-scale of the HIV Risk-Taking Behaviour Scale (HRBS), a component of the OTI, was used to measure current injection related risk behaviour (Darke et al., 1992b).

2.2.3 Health

The Short Form-12 (SF-12), a standardised, internationally used measure of health status (Ware et al., 1996), measured general health. The 12 items on the SF-12 are summarised in two weighted summary scales, and generate a mental health and a physical health score. Lower scores are indicative of more severe disability. The injection-related sub-scale of the OTI health scale was used to assess injection-related health problems (Darke et al, 1992).

2.2.4 Criminal activity

Using the criminality scale of the OTI (Darke et al, 1992), participants were asked how frequently they had committed any property crime, dealing, fraud and/or violent crime in the preceding month.

2.2.5 Psychopathology

The Short Form-12 (SF-12) (Ware et al, 1996), measured general psychological health. Past month diagnoses of DSM-IV Major Depression were assessed using the version of the Composite International Diagnostic Interview (CIDI) used in the National Survey of Mental Health and Wellbeing (NSMHWB; (Andrews et al., 1999). DSM-IV diagnoses of Post Traumatic Stress Disorder (PTSD) were obtained using the NSMHWB version of the CIDI (Andrews et al, 1999). A modified version of the Diagnostic Interview Schedule (Robbins et al., 1981) was used to obtain DSM-IV diagnoses of antisocial personality disorder (ASPD). Participants were screened for potential ICD-10 diagnoses of Borderline Personality Disorder (BPD) using the NSMHWB version of the CIDI (Andrews et al, 1999).

2.2.6 Locator information

To facilitate follow-up at 3 and 12 months the following information was sought at baseline: full legal name, nicknames/street names, other surnames that had been used, height, distinguishing physical features, current address, name of person whose address this was, participant's phone number/s, where they expect to be living in 12 months time, name of a doctor or community health centre that would know how to reach the participant, the first person they would contact if arrested, where they would go if they

could no longer stay at their current address, places where they spend time, where messages could be left for them, and the contact details of at least two friends, relatives or associates who could be contacted if needed to assist in locating the participant for follow-up.

2.3 Structured interview at three month follow-up

Three months after the baseline interview extensive efforts were made to recontact and re-interview all individuals who had participated in the baseline interview. If respondents were no longer at the same address as when they were enrolled in the study extensive locator information, including the names and addresses of at least three contact persons such as parents, siblings or best friends (see section above) was available. Multiple efforts were made to contact these persons. Once contacted, the purpose of the ongoing study was (re) explained to study participants and they were invited to participate in the follow-up interview at a time and location of their convenience.

The three month interview was an abbreviated form of the baseline interview but questioning was restricted to events and behaviours that occurred in the intervening period between baseline and follow-up interviews. It included questions on the following topics:

2.3.1 Treatment and drug use history

Participants were asked how many times they had commenced the various treatment options for heroin dependence since the baseline interview and how recently they had attended each type of treatment. Drug use in the preceding month was assessed using the OTI. Questions concerning heroin overdose history since baseline paralleled the questioning at baseline (see above) but were restricted to events occurring in the three months between interviews. The injecting sub-scale of the HRBS was used to measure current injection related risk behaviour.

2.3.2 Health

The SF-12 was administered to participants. The injection-related sub-scale of the OTI health scale was used to assess injection-related health problems.

2.3.3 Criminal activity

Criminal involvement in the past month was assessed using the criminality scale of the OTI.

2.3.4 Psychopathology

The SF-12 was used to gain a general measure of psychological health at 3 months. Current major depression was assessed using the Composite International Diagnostic Interview (CIDI).

2.3.5 Locator information

To facilitate follow-up at 12 months, the locator information obtained at baseline (see above) was checked for accuracy and, where appropriate, updated.

2.4 Statistical analyses

T-tests were used for continuous variables. Where data were highly skewed medians are reported and Mann-Whitney U tests performed. Chi squared analyses were conducted in order to examine group differences involving dichotomous categorical variables. All analyses were conducted using SPSS for Windows, version 11.0 (SPSS Inc, 2003).

3.0 RESULTS

3.1 The ATOS sample at three months

A total of 549 individuals were re-interviewed at three month follow-up, representing 89% of the sample enrolled at baseline. In order to determine factors associated with retention in the cohort at 3 months, a logistic regression was conducted. Variables entered into the model included index group, age, sex, previous treatment history, number of heroin use days in the month preceding baseline interview, suicide history, Major Depression at baseline, PTSD, presence/absence of a personality disorder and cocaine use at baseline. The overall model was significant (χ^2=22.4, df=12, p<.05). Cocaine use at baseline was not related to being successfully followed up at 3 months. Importantly, there was only a slight difference between the treatment and non-treatment modalities in terms of sample retention. While participants in the RR group were more likely to be retained than those in the NT group (91% v 83%, OR=2.50, 95% CI: 1.03-6.10), this was not the case for the MT (92% v 83%, OR=2.21, 95% CI: 1.00-4.89) and DTX groups (88% v 83%, OR=1.62, 95% CI: 0.77-3.39). Gender was the only other factor associated with being followed up at 3 months, with males being slightly less likely to be retained than females (87% v 95%, OR=0.34, 95% CI: 0.17-0.69).

3.2 Prevalence of cocaine use

At baseline, almost all subjects (91%) had a lifetime history of cocaine use (Table 1). Approximately 40% had used cocaine in the month prior to baseline interview (CU), but only half as many (19%) reported cocaine use in the month prior to 3 month follow-up. I A McNemar test found this reduction to be significant (p<.001). In order to determine the effect of treatment on cocaine use status at three months a logistic regression was conducted. Factors entered into the equation were age, sex, cocaine use status at baseline and treatment status at baseline. After backward stepwise elimination, the final model consisted of both cocaine use and treatment status at baseline. The model was significant ($\chi^2$64.33, df=2, p<.001) with those who reported cocaine use at baseline (35% vs 9%, OR=5.12, 95% C.I.= 3.18 - 8.23) being more likely to have used cocaine at follow up and those who entered treatment at baseline being less likely (17% vs 38%, OR=0.46, 95% C.I.=0.26 – 0.83). In order to establish whether the *type* of treatment entered at baseline affected cocaine use at three months, a backward

stepwise logistic regression was conducted. Variables included in the equation were age, sex, cocaine use status at baseline and treatment entered at baseline (MMT, DTX, RR or NT). After extraneous variables were eliminated, the model contained cocaine use status at baseline and treatment entered at baseline and was significant (χ^2=77.16, df=2, p<.001). Again, those who reported cocaine use at baseline were found to be significantly more likely to report cocaine use at three months (35% vs 9%, OR=5.33, 95% C.I.=3.28 – 8.68). Type of treatment entered at baseline was also found to be a significant predictor of cocaine use at three months. Those who entered MT (17% vs 38%, OR = 0.57, 95% C.I. = 0.29 – 1.13), DTX (22% vs 38%, OR =0.60, 95% C.I.=0.31 – 1.16) and particularly RR (7% vs 38%, OR = 0.17, 95% C.I. = 0.07 – 0.41) were all less likely than those not entering treatment at baseline to report cocaine use at three months.

Table 1. Cocaine use patterns among the ATOS NSW participants followed up at 3 months

	Males (n=352) %	**Females (n=197) %**	**Total (n=549) %**	**Comparisons**
Ever used	92	89	91	Not significant
Previous month (baseline)	41	35	39	Not significant
Previous month (3 months)	20	17	19	Not significant

While the proportion of subjects using cocaine decreased markedly from baseline to 3 months, frequency of cocaine use was similar. High frequency use was common at both points with approximately a third of cocaine users reporting daily or more frequent use (33% vs 35%) (Figure 1). At 3 month follow up, 65% of CU reported no cocaine use in the month prior to interview (Figure 2), while 15% reported at least daily use. Nine

percent of NCU reported cocaine use in the month prior to follow up and of these the majority (56%) reported using less than once per week on average.

Figure 1. Frequency of cocaine use among the ATOS NSW sample at baseline and 3 month follow up

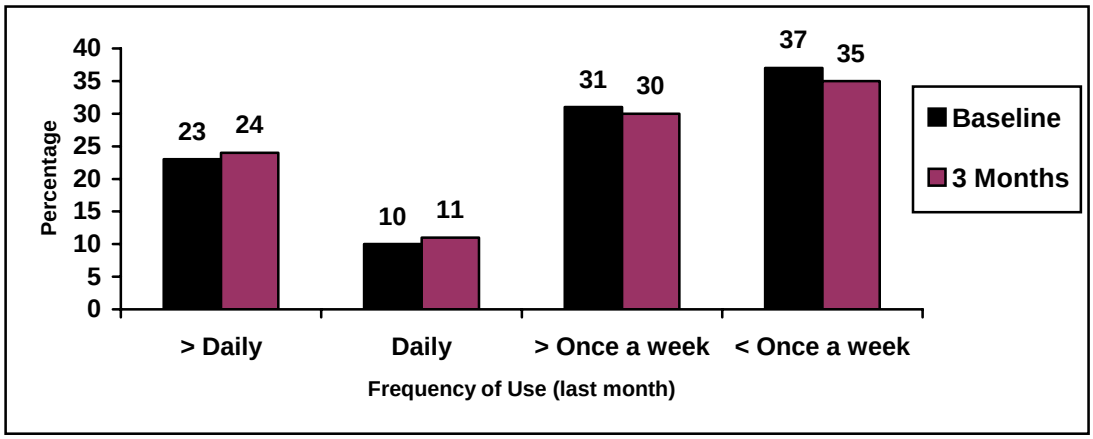
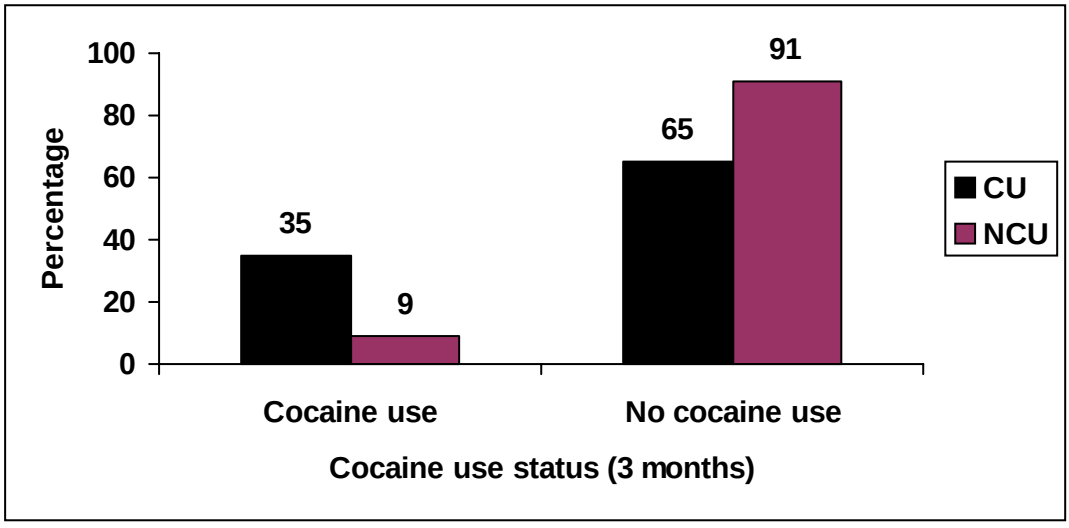


Figure 2. Cocaine use status of baseline CU and NCU at three months



3.3 Comparisons of CU and NCU

3.3.1 Comparative demographic characteristics

The baseline demographics for the entire sample are presented in (Williamson, Darke, Ross & Teesson, 2003). Among those followed up at 3 months, CU and NCU did not differ in terms of age, sex or education level achieved (Table 2). CU were more likely to report a prison history than NCU (46% vs 37%). CU and NCU were equally likely to have previously enrolled in a drug treatment program (93% vs 89%), but differences were found in relation to index treatment entered. CU were less likely to be enrolled in a maintenance pharmacotherapy (23% vs 39%) and significantly more likely to be not currently enrolled in, or seeking, treatment (20% vs 8%) at the time of baseline interview.

Table 2. Comparative Demographic characteristics of CU and NCU

	CU (n=212)	**NCU (n=337)**	**Comparisons**
Age (Yrs)	29	29	Not significant
Male (%)	68	62	Not significant
Education (Yrs)	10	10	Not significant
Prison history (%)	46	37	$\chi^2_{1df}=5.19$, $p<.05$
Previous Treatment (%)	89	88	Not significant
Index treatment (%):			
Methadone/Buprenorphine	24	40*	$\chi^2_{1df}=14.11$, $p<.001$
Detoxification	36	30	Not significant
Residential rehabilitation	21	23	Not significant
No treatment	19	7*	$\chi 2_{1df}=18.81$, $p<.001$

3.3.2 Treatment

CU and NCU did not differ in terms of their retention in index treatment. At 3 months, 59% of CU and 65% of NCU remained in their index maintenance program while approximately one third of all participants either remained in, or had completed, their index RR program (22% vs 38%). Similarly, over half of both groups completed their index detoxification program (57% vs 56%) and over a third their index RR program (33% vs 38%). No significant differences were found in terms of number of days in treatment in either maintenance (77.00 vs 74.22), or short (18.33 vs 18.10) or longer term (55.44 vs 74.34) RR. There were also no differences found in terms of most common methadone (50.72mg vs 56.47mg) or buprenorphine (15.14mg vs 11.80mg) dose between groups.

At follow up, over two thirds of both groups were engaged in some type of treatment for their heroin dependence. The largest proportion were enrolled in a maintenance pharmacotherapy (32.2% vs 40.7%), while over 10% were enrolled in RR (12.8 vs 10.1) and a small number were interviewed while enrolled in a detoxification program (2.8% vs 1.8%).

Table 3. Treatment (index and current) of CU and NCU

	CU (n=212)	NCU (n=337)	Comparisons
Still in index treatment:			
Methadone/Buprenorphine	59	65	Not significant
Detoxification	N/A	N/A	N/A
Residential rehabilitation*	22	38	Not significant
Completed treatment:			
Methadone/Buprenorphine	N/A	N/A	N/A
Detox	57	56	Not significant
Residential Rehabilitation**	33	38	Not significant
Days in index treatment:			
Methadone/Buprenorphine	77.0	74.2	Not significant
Residential Rehabilitation			
-28 day program	18.3	18.1	Not significant
-longer program	55.4	74.3	Not significant
Most common MT dose(mg)	50.7	56.5	Not significant
Most common Bup dose(mg)	15.1	11.8	Not significant
Current treatment – includes ongoing index treatment(%):			
Methadone/Buprenorphine	32.2	40.7	Not significant
Detox	2.8	1.8	Not significant
Residential Rehabilitation	14.2	13.1	Not significant
Other	12.8	10.1	Not significant
None	37.9	34.4	Not significant

** Two of the four residential rehabilitation programs involved in ATOS offer 28 day programs, thus treatment retention at 3 months was impossible. These figures refer to the proportion of participants recruited from programs that run for at least 3 months who were still in treatment at follow-up.*

***These figures are based on the proportion of those who had completed their 28-day Residential Rehabilitation program.*

3.3.3 Social functioning

At baseline, CU presented as a less socially functional group than NCU (described in detail in Williamson et al, 2003). At three months, large reductions in the proportion of the sample reporting being homeless and gaining the majority of their income through criminal activity were observed (Table 4). Despite this however, the same pattern of results were observed as at baseline, with CU continuing to display lower levels of employment (12% vs 20%, $\chi 2_{1df}$=5.61, p<.05), and higher levels of criminal activity (9% vs 4%, $\chi 2_{1df}$=6.32, p<.05) and homelessness (5% vs 1%, 6.37, p<.05) than NCU.

Table 4. Social functioning of CU and NCU at baseline and three months

	BASELINE		**3 MONTH**	
	CU (n=211) %	**NCU (n=337) %**	**CU (n=211) %**	**NCU (n=337) %**
Income:				
Wage	12	22*	12	20*
Govt	41	50*	70	70
Criminal activity	31	16*	9	4*
Homeless	13	5*	5	1*

* Indicates a significant difference between groups

3.3.4 Drug use

The lifetime drug use history of CU and NCU did not differ (described in detail in Williamson et al, 2003). The recent drug use behaviour of the two groups however, differed at both baseline and follow up (although a substantial reduction was seen across the sample in all drug use measures) (Table 5).

At three months, CU continued to report more extensive recent polydrug use (3.7 vs 3.2, t_{254}=2.42, p<.05) and met criteria for a greater number of heroin dependence symptoms

(4.4 vs 3.8, t_{254}=2.42, p<.05) than did NCU. The median number of heroin shots per day had decreased markedly across the sample at three months, with a greater reduction seen amongst the NCU group (U=29631, p<.001).

Table 5. Recent drug use of CU and NCU

	BASELINE		**3 MONTH**	
	CU (n=211)	**NCU (n=337)**	**CU (n=211)**	**NCU (n=337)**
Drug classes (month)- cocaine included	5.81	4.29*	3.7	3.2*
Heroin dependence symptoms	5.69	5.42	4.4	3.8*
Heroin shots per day (med)	3	3	1	0*

* Indicates a significant difference between groups

As noted above, at baseline and follow up CU engaged in a more extensive array of polydrug use than did NCU (Table 6). At three months, half of the sample reported having been abstinent from heroin use in the month prior to interview and polydrug use had also reduced substantially. CU were more likely than NCU to have continued to use heroin during this period (57% vs 46%, χ^2 1df=6.18, P<.05) as well as, not surprisingly, being more likely to have used cocaine (35% vs 9%, χ^2 1df=59.28, P<.001).

Table 6. Prevalence of drug use (last month)

	BASELINE		3 MONTHS	
Drug Class	**CU (n=212) %**	**NCU (n=337) %**	**CU (n=212) %**	**NCU (n=337) %**
Heroin	99	99	57	46
Other Opiates	37	26	19	17
Cocaine	100	0	35	9
Amphetamines	38	24	18	17
Hallucinogens	15	6	19	15
Benzodiazepines	49	47	6	4
Antidepressants	11	16	29	27
Alcohol	57	51	14	17
Cannabis	72	65	44	44
Inhalants	3	0.5	1	0.5
Tobacco	97	95	95	92

3.3.5 Risk-taking behaviour

In keeping with the high rates of heroin abstinence in the sample at 3 months, a large reduction was seen in injecting frequency. While the majority of NCU reported no injections in the month prior to follow up, significantly less CU had ceased injecting (51.9% vs 36.0%, χ^2 1df=13.23, p<.001) (Table 7). When baseline non-injectors (ie those who had never injected) were removed from the analysis, CU were still more likely than NCU to have continued injecting at follow up (35.6% vs 45.9%, $\chi^2$1df=5.40, p<.05). CU were also more likely than NCU to report injecting at least once per day in the month preceding follow up (24% vs 15%, $\chi^2$1df=7.519, p<.01).

Needle risk taking behaviour was reported at high rates throughout the sample at baseline. At three months, a large reduction in needle risk-taking was observed. CU were still more likely than NCU to report needle lending in the past month (13% vs 6%, χ^2 1df= 9.64, P<.01) but there was no difference in the proportion of each group reporting borrowing in that month(7% vs 4%). Across the sample, needles were generally only borrowed from one other person.

Table 7. Risk-taking behaviour

	BASELINE		3 MONTHS	
	CU (n=212) %	**NCU (n=337) %**	**CU (n=212) %**	**NCU (n=337) %**
Injection (mth)	4	14*	36	52*
Injection more than daily	91	71*	24	15*
Borrowed needle (mth)	24	15*	7	4
Number of people borrowed from (mth):				
None	76	85	93	96
One	21	13	5	4
Two or more	3	2	2	0
Lent needle (mth)	33	25*	13	6*

*Indicates a significant difference between groups

3.3.6 Criminal activity

CU were significantly more likely than NCU to report criminal involvement in the month prior to interview at baseline (65% vs 46%, $\chi 2_{1df}=16.83$, $p<.001$) and follow up (35% vs 22%, $\chi^2 1df=11.89$, $P<.01$). At 3 months large reductions in reports of criminal involvement were found amongst both groups (Table 8), the only type of crime CU were significantly more likely to report involvement in at follow up was property crime (24% vs 15%, χ^2 1df=6.32, $p<.05$).

Table 8. Criminal involvement (last month)

	BASELINE		3 MONTH	
	CU (n=212) %	NCU (n=337) %	CU (n=212) %	NCU (n=337) %
Property Crime	37	14*	24	15*
Dealing	25	6*	12	8
Fraud	11	5*	9	4
Violent Crime	6	3	5	3
Any Crime	65	46*	35	22*

* Indicates a significant difference between groups

3.3.7 Physical health

At both baseline and three months CU and NCU scored slightly below average on the SF-12 physical health scale compared the general population (Table 9). At three months, the levels of injection-related health problems had reduced markedly across the sample. At this time CU were more likely to report an injection-related health problem than were NCU (39% vs 28%, $\chi^2$1df=8.20, p<.01). A larger proportion of CU than NCU reported an abscess or infection (7% vs 3%, $\chi^2$1df=6.10, P<.05), scarring or bruising (31% vs 22%, $\chi^2$1df=4.99, P<.05) and difficulty injecting (23% vs 15%, $\chi^2$1df=5.53, P<.05) in the past month.

Table 9. Physical health

	BASELINE		3 MONTH	
	CU (n=212) %	**NCU (n=337) %**	**CU (n=212) %**	**NCU (n=337) %**
SF 12 physical health score	44	44	48	48
Injection related health problems (mth)				
Overdose	13	7*	3	2
Abscesses/infections	9	11	7	3*
Dirty hit	17	23	5	5
Scarring/Bruising	65	59	31	22*
Difficulty Injecting	40	40	23	15*
Any injection related health problem	79	74	39	28*

* Indicates a significant difference between groups

3.3.8 Mental health

At baseline, high levels of psychological distress were evident across the sample. ASPD, PTSD and BPD were all found to occur at rates far exceeding that of the general population (Andrews et al., 1999). SF-12 psychological health scores were 2 standard deviations below the mean (indicating extremely poor mental health), half the sample qualified for a diagnosis of current major depression and 5% had attempted suicide in the preceding month (Table 10). At follow-up, while remaining below population averages, large improvements in psychological well-being were evident throughout the sample. SF-12 psychological scores now fell one standard deviation below the mean on average, and approximately 10% of the sample qualified for current major depression. No differences in mental health emerged between CU and NCU at either baseline or follow-up.

Table 10. Mental health

	BASELINE		3 MONTH	
	CU (n=212) %	NCU (n=337) %	CU (n=212) %	NCU (n=337) %
SF 12 psychological health	32	31	38	41
Major Depression (%)	21	28	13	11
Suicide (1 month) (%)	4	5	5	5
Recurrent thoughts of death (%)	30	29	15	11

3.4 Comparisons of baseline CU by three month cocaine use status

In order to determine the effects of cessation from cocaine use, baseline CU were divided into two groups and compared at three months. Those baseline CU who reported having continued to use cocaine in the month prior to three month follow-up (n=75, referred to as CCU, continuing cocaine users) were compared to those CU who reported abstinence from cocaine during this period (n=137, referred to as NCCU, non-continuing cocaine users).

3.4.1 Social functioning

At three months, those who had continued to use cocaine showed lower levels of social functioning than those who had ceased cocaine use (Table 11). CCU were significantly more likely to report having gained the majority of their income through criminal activity (22% vs 3%) as well as to report being homeless in the month prior to interview (11% vs 2%).

Table 11. Social functioning of CCU and NCCU at three month follow up

	CCU (n=75) %	NCCU (n=137) %	Comparisons
Income:			
Wage	8	14	Not significant
Govt	62	75	Not significant
Criminal activity	22	3	χ^2_{1df}=19.59, p<.001
Homeless	11	2	χ^2_{1df}=7.23, p<.05

3.4.2 Drug use

In the month prior to 3 month interview CCU engaged in significantly more polydrug use than did NCCU, even when cocaine was excluded from the analysis (4.10 vs 2.95). CCU also met criteria for a larger number of heroin dependence symptoms (3.34 vs 1.78) and reported a higher median number of heroin shots per day (1 vs 0) (Table 12).

Table 12. Recent drug use of CCU and NCCU

	CCU (n=75)	NCCU (n=137)	Comparisons
Drug classes (month)- cocaine not included	4.10	2.95	t_{171}=-5.18, p<.001
Heroin dependence symptoms	3.34	1.78	t_{209}=-4.40, p<.001
Heroin shots per day (med)	1	0	U=2661, p<.001

CCU were significantly more likely than NCCU to have continued to use heroin at follow-up (84% vs 33%) (Table 13). A higher proportion of CCU than NCCU also reported benzodiazepine (45% vs 21%), cannabis (64% vs 43%) and inhalant (4% vs 0%) use in the month preceding interview.

Table 13. Prevalence and frequency of drug use (last month)

Drug Class	**CCU (n=75) %**	**NCCU (n=137) %**	**Comparisons**
Heroin	84	33	χ^2_{1df}=32.57, p<.001
Other Opiates	23	16	Not significant
Amphetamines	26	16	Not significant
Hallucinogens	10	4	Not significant
Benzodiazepines	45	21	χ^2_{1df}=12.71, p<.001
Antidepressants	12	15	Not significant
Alcohol	46	43	Not significant
Cannabis	64	43	χ^2_{1df}=8.04, p<.01
Inhalants	4	0	χ^2_{1df}=5.63, p<.05
Tobacco	99	93	Not significant

3.4.3 Risk-taking behaviour

Significantly more CCU reported having injected a drug in the month prior to the three month follow up interview than NCCU (97% vs 46%) (Table 14). In keeping with this, 51% of CCU reported injecting daily or more often in the past month as compared to only 10% of NCCU. CCU and NCCU were equally likely to report borrowing a needle during this period (8% vs 6%), however a significantly larger proportion of CCU reported needle lending (22% vs 9%).

Table 14. Risk-taking behaviour

	CCU (n=75) %	**NCCU (n=137) %**	**Comparisons**
Injection (mth)	97	46	$\chi^2_{1df}=54.89$, $p<.001$
Injecting daily or more often (mth)	51	10	$\chi^2_{1df}=45.94$, $p<.001$
Borrowed needle (mth)	8	6	Not significant
Lent needle (mth)	22	9	$\chi^2_{1df}=6.91$, $p<.05$

3.4.4 Criminal activity

Criminal involvement in the month prior to interview was reported by the majority (58%) of CCU and nearly a quarter (23%) of NCCU. CCU were more likely than NCCU to report having been involved in both property crime (39% vs 15%) and drug dealing (23% vs 7%) during this time. Fraud and violent crime were less common, with rates being similar among CCU and NCCU (Table 15).

Table 15. Criminal involvement (last month)

	CCU (n=75) %	NCCU (n=137) %	Comparisons
Property Crime	39	15	χ^2_{1df}=15.13, p<.001
Dealing	23	7	χ^2_{1df}=11.97, p<.001
Fraud	10	8	Not significant
Violent Crime	7	4	Not significant
Any Crime	58	23	χ^2_{1df}=26.56, p<.000

3.4.5 Physical health

At follow up, differences emerged between CCU and NCCU in relation to their physical health (Table 16). CCU scored significantly lower than NCCU on the SF-12 (46 vs 49) indicating worse general health. CCU were also more likely than NCCU to report injection-related health problems (64% vs 26%). Both scarring/bruising (47% vs 22%) and difficulty injecting (35% vs 16%) were more commonly reported by CCU than NCCU.

Table 16. Physical health

	CCU (n=75) %	NCCU (n=137) %	Comparisons
SF 12 physical health score	46	49	t_{207}=2.11, p<.05
Injection related health problems (mth)			
Overdose	4	3	Not significant
Abscesses/infections	7	7	Not significant
Dirty hit	5	4	Not significant
Scarring/Bruising	47	22	χ^2_{1df}=14.54, p<.000
Difficulty Injecting	35	16	χ^2_{1df}=9.95, p<.01
Any injection related health problem	64	26	χ^2_{1df}=27.92, p<.000

3.4.6 Mental health

The mental health of CCU and NCCU did not differ at follow up (Table 17). Both groups scored one standard deviation below the mean on the SF-12 psychological scale indicating psychological distress. Over 10% of both groups met criteria for current major depression and similar proportions reported recurrent thoughts of death.

Table 17. Mental health

	CCU (n=75) %	NCCU (n=137) %	Comparisons
SF 12 psychological health	38	40	Not significant
Major Depression (%)	11	15	Not significant
Suicide (1 month) (%)	3	2	Not significant
Recurrent thoughts of death (%)	14	12	Not significant

3.5 Comparisons between NCU on the basis of 3 month cocaine use

In order to examine the effects of commencing cocaine use, NCU were divided into two groups on the basis of their cocaine use at three months. Those baseline NCU who reported cocaine use in the month prior to follow-up (n=30, referred to as NCU-C) were compared to those NCU who did not report cocaine use at follow-up (n=307, referred to as NCU-N).

3.5.1 Social functioning

NCU-C and NCU-N were equally likely to have gained the majority of their income through paid employment or government benefits in the month prior to follow up (Table 18). A higher proportion of NCU-C than NCU-N reported gaining the majority of their income from criminal activity (17% vs 3%). Homelessness was uncommon among both groups (3% vs 1%).

Table 18. Social functioning

	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
Income:			
Wage	17	20	Not significant
Govt	53	72	Not significant
Criminal activity	17	3	χ^2_{1df}=12.95, p<.01
Homeless	3	1	Not significant

3.5.2 Drug use

NCU-C and NCU-N differed at follow up in relation to their current drug use (Table 19). NCU-C reported having used significantly more classes of drugs in the month prior to follow-up (4 vs 3) even when cocaine was excluded from the analysis. In addition, NCU-C displayed a greater number of heroin dependence symptoms (3 vs 1) and used a higher median number of heroin shots per day (0.4 vs 0).

Table 19. Recent drug use of NCU-C and NCU-N

	NCU-C (n=30)	NCU-N (n=307)	Comparisons
Drug classes (month) (mean)- cocaine excluded	4.0	3.	t_{335}=3.26, p<.001
Heroin dependence symptoms (mean)	3.3	1.5	t_{335}=4.38, p<.001
Heroin shots per day (med)	0.4	0	U=2489, p<.001

The proportion of NCU-C and NCU-N reporting having used each drug class is presented in Table 20. NCU-C were significantly more likely to have continued using heroin at follow up (80% vs 43%). NCU-C were also more likely to report hallucinogen (17% vs 2%), benzodiazepine (48% vs 25%) and cannabis (70% vs 46%) use in the month prior to follow up interview.

Table 20. Prevalence of drug use (last month)

Drug Class	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
Heroin	80	43	χ^2_{1df}=14.78, p<.000
Other Opiates	23	16	Not significant
Amphetamines	13	15	Not significant
Hallucinogens	17	2	χ^2_{1df}=16.47, p<.01
Benzodiazepines	48	25	χ^2_{1df}=6.22, p<.05
Antidepressants	13	18	Not significant
Alcohol	43	44	Not significant
Cannabis	70	46	χ^2_{1df}=6.34, p<.05
Inhalants	0	1	Not significant
Tobacco	97	92	Not significant

3.5.3 Risk-taking behaviour

Over half of NCU-N had ceased injecting in the month prior to follow up as compared to less than a quarter of NCU-C (Table 21). In keeping with this, 30% of NCU-C reported injecting daily or more often in the past month as compared to 13% of NCU-N. NCU-C were also more likely than NCU-N to report having engaged in both needle borrowing (13% vs 3%) and lending (17% vs 5%) in the past month.

Table 21. Risk-taking behaviour

	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
Injection (mth)	77	45	χ^2_{1df}=10.79, p<.001
Injecting daily or more often (mth)	30	13	χ^2_{1df}=5.99, p<.05
Borrowed needle (mth)	13	3	χ^2_{1df}=7.97, p<.05
Lent needle (mth)	17	5	χ^2_{1df}=7.53, p<.05

3.5.4 Criminal activity

NCU-C were significantly more likely than NCU-N to report some type of criminal involvement in the month prior to 3 month interview (50% vs 19%) (Table 22). Property crime (33% vs 13%), dealing (30% vs 6%) and fraud (17% vs 3%) were all reported at higher rates by the NCU-C group. Reports of involvement in violent crime were rare in both groups (3% vs 3%).

Table 22. Criminal involvement (last month)

	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
Property Crime	33	13	χ^2_{1df}=8.49, p<.01
Dealing	30	6	χ^2_{1df}=20.34, p<.000
Fraud	17	3	χ^2_{1df}=11.56, p<.01
Violent Crime	3	3	Not significant
Any Crime	50	19	χ^2_{1df}=15.58, p<.000

3.5.5 Physical health

The general physical health of both groups was slightly below average (Table 23). NCU-C were more likely than NCU-N to have experienced some type of injection-related health problem in the prior month (53% vs 25%). Scarring/bruising was the only specific injection-related health problem NCU-C were significantly more likely to report at follow up (43% vs 20%).

Table 23. Physical health

	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
SF 12 physical health score	46	49	Not significant
Injection related health problems (mth)			
Overdose	7	2	Not significant
Abscesses/infections	0	3	Not significant
Dirty hit	3	5	Not significant
Scarring/Bruising	43	20	χ^2_{1df}=8.46, p<.01
Difficulty Injecting	20	14	Not significant
Any injection related health problem	53	25	χ^2_{1df}=10.92, p<.01

3.5.6 Mental health

The mental health of NCU-C and NCU-N was similar at follow up (Table 24). Both groups evidenced psychological distress scoring approximately one standard deviation below the mean on the SF-12 psychological scale. Over 10% of both groups met criteria for current major depression with a slightly larger proportion reporting recurrent thoughts of death.

Table 24. Mental health

	NCU-C (n=30) %	NCU-N (n=307) %	Comparisons
SF 12 psychological health	37	41	Not significant
Major Depression (%)	10	11	Not significant
Suicide (1 month) (%)	3	1	Not significant
Recurrent thoughts of death (%)	20	10	Not significant

4.0 DISCUSSION

4.1 Major findings

Recent cocaine use decreased dramatically (39% vs 19%) at three months, but frequency of use did not change amongst those who continued using. While 35% of CU continued their cocaine use at three months, one in ten NCU had actually commenced cocaine use at this time. In keeping with this, logistic regressions revealed cocaine use at baseline to be the biggest predictor of such use at three months. Treatment status at baseline was also found to predict cocaine use at three months, with those who entered MT, DTX and particularly RR being less likely to report cocaine use at follow up than the NT group.

Cocaine use at baseline was not associated with short-term differences in treatment retention in either maintenance pharmacotherapies or residential rehabilitation, nor was it linked to the likelihood of subjects having completed their index inpatient detoxification program. Baseline cocaine use was also unrelated to average methadone or buprenorphine dose received during the first three months of index treatment.

CU continued to display higher levels of social dysfunction, criminality and drug use at follow up (although the sample as a whole had improved on these measures) and were less likely to be abstinent from heroin. At follow up, baseline CU were more likely to report an injection related health problem in the last month with abscesses/infections, scarring/bruising and difficulty injecting all being more common among this group.

It appears that cocaine use itself is responsible for the greater level of dysfunction seen among heroin users who also use cocaine, not that individuals who use cocaine tend to be a more inherently dysfunctional group. Baseline CU who had continued to use cocaine at follow up (CCU) displayed significantly greater levels of dysfunction and drug related harms at three months than NCCU (whose profile was comparable to that of NCU-N at follow up). In keeping with this, those who had not used cocaine at baseline, but had commenced doing so at follow up (NCU-C), had substantially poorer three month outcomes than those who had not begun cocaine use during the follow up period. Taken together these results suggest that a significant decline in functioning is associated

with the commencement of cocaine use, but that this decline is reversed when cocaine use ceases.

4.2 Cocaine use patterns

The proportion of subjects who reported cocaine use in the last month halved from baseline to three month follow up. While two thirds of CU had ceased cocaine use at three months, those who continued using did so at the same frequency as at baseline, with approximately one third continuing to use cocaine daily or more often. Nine percent of NCU had commenced cocaine use at three months and of these the majority reported using less than weekly. Logistic regressions revealed CU status at baseline to be the most significant predictor of cocaine use at three months. Treatment status at baseline was also found to predict cocaine use at follow up. Entrants to all three treatment modalities were less likely to report cocaine use at three months than the NT group, with entrance to residential rehabilitation being a particularly strong predictor of abstinence from cocaine.

While it is clear that some of the reduction in cocaine use observed in the ATOS sample is due to the effects of treatment, changes in Sydney's drug market over the study period must also be considered when interpreting these results. The findings of the Illicit Drug Reporting System (IDRS) suggest that the availability of cocaine in Sydney has fluctuated in recent years (Darke et al., 2002). In 2001, when recruitment for the ATOS project began, cocaine was readily available and widely used, whereas by the following year (when approximately half of the three month interviews were conducted) cocaine was reportedly harder to obtain and of a lesser quality (Roxburgh et al., 2003). Thus, the effects of fluctuations in the availability of cocaine must also be taken into account when interpreting these results.

4.3 Treatment

As the increase in cocaine use among Sydney's heroin users was a relatively recent phenomena when study recruitment began, it was unknown what effect such co-use would have on treatment for heroin dependence or how well-equipped existing services in NSW were to deal with this client group. No differences were found between CU and

NCU in terms of their retention in index treatment at three months. The majority of both groups were still enrolled in their index maintenance program, approximately half of both groups completed their index detoxification program and no difference was found in relation to length of stay in residential rehabilitation programs. In keeping with this, there was no difference between groups in relation to the mean number of days spent in any type of treatment or mean methadone or buprenorphine dose. At three months, two thirds of both groups were engaged in some type of treatment for their heroin dependence with no differences between groups in relation to current treatment type. These findings suggest that existing treatment services are equally well able to retain CU and NCU. As retention in treatment is one of the major predictors of successful outcome for heroin dependence (Condelli and Hubbard, 1994, Gossop et al., 1999, Hubbard et al., 1997, Sanchez-Carbonell et al., 1988, Simpson et al., 1982) these results are encouraging.

4.4 Social functioning

While the sample as a whole evidenced improved levels of social functioning at three months, the relatively lower levels noted among CU at baseline were maintained. Indeed, despite the large number of CU who had ceased their cocaine use at three months, this group continued to report lower levels of employment and a greater tendency to rely on criminal activity for their main source of income. CU also remained more likely to report homelessness in the month prior to three month interview.

In order to determine whether the decreased level of functioning noted amongst CU at both points was a *function* of their cocaine use, or whether, cocaine use at baseline merely served as a marker for a more dysfunctional group, CU and NCU were compared within groups on the basis of their 3 month cocaine use status. The pattern of results observed suggest that the commencement of cocaine use results in a significant decline in levels of functioning, manifested in increased levels of homelessness and reliance on criminal activity to generate income, while cessation of cocaine use results in a corresponding increase in functionality. This pattern has also been observed in overseas research (Kosten et al., 1988). Thus, it appears that the decreased levels of functioning observed

among CU at baseline were indicative of the effects of cocaine use, and not that heroin users who also use cocaine are a self-selected group of more dysfunctional individuals.

4.5 Drug use

Substantial reductions in measures of drug use were also seen across the sample, however CU continued to display higher levels of drug use than NCU at three months. At follow up, CU reported more extensive recent polydrug use than NCU with the larger proportion of this group who reported continuing heroin and cocaine accounting for the majority of this difference. That more CU had continued their heroin use at follow up is also reflected in the higher number of heroin injections per day in this group and the greater number of heroin dependence symptoms they recorded. It would appear then, that in terms of perhaps the most basic measure of outcome, heroin use at follow up, CU have not fared as well as NCU despite the fact that the two groups did not differ in relation to treatment retention, or in likelihood of treatment enrolment at follow up interview. This suggests that while CU may be equally likely as NCU to stay in treatment, their short term outcomes are not as good.

As was the case with social functioning, patterns of drug use appeared to be strongly influenced by current cocaine using status. Thus, the vast majority of CU and NCU who reported cocaine use at three months had continued to use heroin during this time, and moreover, displayed higher levels of heroin dependence than those who did not report cocaine use. In contrast to this, those who reported cocaine use at baseline but had ceased such use by three months showed marked reductions in heroin use and dependence. Cocaine users also reported more extensive polydrug use. It is noteworthy that both groups of current cocaine users were significantly more likely to report benzodiazepine use than non-cocaine users. Concurrent heroin and cocaine use (Coffin et al., 2003, Tardiff et al., 1996), and concurrent heroin and benzodiazepine (Darke et al., 1996a) use have both been linked to increased likelihood of heroin overdose. Hence, the drug use patterns associated with cocaine use at follow up appear to place cocaine users at especially high risk of heroin overdose. At baseline, a significantly higher proportion of CU than NCU reported having experienced a heroin overdose in the past month. This

difference was no longer evident at three months with rates of last month overdose having decreased dramatically throughout the sample.

4.6 Risk-taking behaviour

The reduction in injection frequency noted in the sample at three months is consistent with the high levels of heroin abstinence reported. A third of CU had not used any drugs intravenously in the month prior to follow up as compared to over half of NCU, this reflects the differing levels of heroin abstinence between the two groups. CU were also more likely than NCU to report daily or more frequent injection.

Needle risk taking behaviour among the sample had decreased greatly at three months. CU were no more likely to report borrowing a needle at follow up but were still more likely to report having lent a needle to someone else. Arguably self reported needle lending is a more sensitive measure of needle risk taking behaviour than self reported needle borrowing (as questions on lending are less likely to generate demand characterics). In light of this, and their greater frequency of injection, it appears that at three months CU remain a more 'at risk' group in relation to both vascular damage and blood borne virus exposure.

Comparisons within groups on the basis of current cocaine use revealed current use to be associated with substantially more needle risk-taking behaviour, while ending cocaine use resulted in reductions in such behaviour. Cocaine users in both groups were more likely than non-cocaine users to report injecting in the month prior to follow up and to report daily injection. Needle sharing was also more common among current cocaine users but was seen to decrease substantially upon cessation of cocaine use. This pattern is consistent with both overseas and local research that has found intravenous cocaine use to be associated with high frequency, chaotic injecting (relative to heroin use) and a greater incidence of needle risk-taking behaviour (Bux et al., 1995, Chaisson et al., 1989, Darke et al., 1992a, Van Beek et al., 2001). Hence, it appears that injection frequency and needle risk-taking behaviour increase greatly with the commencement of cocaine use (and decrease when cocaine use ceases) placing individuals who use cocaine at a far greater risk of experiencing the harms associated with such behaviour.

4.7 Criminal activity

Rates of criminal involvement had halved over the follow up period. This reduction in crime may be partially explained by the high levels of heroin abstinence observed across the sample reducing the individuals' need to commit acquisitive crimes in order to fund their drug habit. CU continued to be more likely to report some criminal activity at follow up. The larger proportion of CU still involved in criminal activity at follow up reflects the greater number still using heroin and other drugs.

Criminal involvement at three months was strongly linked to current cocaine use. Indeed, the majority of current cocaine users reported some criminal activity in the month prior to follow up, with rates more than double those of individuals who were not current cocaine users. Those who had used cocaine at baseline but had not continued to use cocaine at follow up showed large decreases in criminal involvement, suggesting a strong link between cocaine use and crime. The greater levels of criminal activity seen amongst current cocaine users are consistent with the pattern of greater levels of drug use, dysfunction and risk-taking that appear to characterise current cocaine users. High levels of criminal involvement and legal problems have often been noted in overseas research examining the correlates of concurrent heroin and cocaine use (Grella et al., 1995, Kaye et al., 2000).

4.8 Physical and mental health

At baseline the general and injection related health of CU and NCU did not differ. At follow up the general health of the sample had changed little, but the prevalence of injection related health problems had reduced from three quarters to one third of the sample. At follow up, CU were more likely to report an injection related health problem, reflecting the greater number of this group who had continued to inject and the larger proportion who were engaged in daily or more frequent injection. Abscesses/infections, scarring or bruising and difficulty injecting were all reported at higher rates by current cocaine users reflecting some of the increased harms associated with greater injection frequency and the frenetic injecting associated with cocaine use.

Physical health was seen to vary at three months as a function of current cocaine use status. Those who had continued their cocaine use reported significantly lower levels of general health as measured by the SF-12 and were more likely to report an injection-related health problem in the last month than those who had ceased cocaine use at follow up. The general health of those who had commenced cocaine use at follow up did not differ significantly from that of those who had not used cocaine over the study period, perhaps suggesting that the effects of cocaine use on general physical health are not immediately obvious to the individual. Injection related health problems were, however, more common among cocaine use commencers at follow up. The higher prevalence of injection-related health problems among current cocaine users at follow up is in keeping with their formerly noted greater levels of drug use and higher injection frequency. It is also consistent with the body of local and overseas literature which has found injection-related health problems to be a harm commonly associated with intravenous cocaine use (Kaye et al., 2000, Kaye et al., 2001, Van Beek et al., 2001). The lower levels of general physical health noted amongst CCU as compared to NCCU may be indicative of the speed with which individuals' general health appears to improve upon cessation of cocaine use. Baseline cocaine users who had ceased such use by 3 months evidenced greater improvements in physical health than those who had maintained their cocaine use.

In contrast to general physical health, the general mental health of the sample had improved greatly over the follow-up period, and the prevalence of current major depression had decreased markedly. As at baseline, no differences were found between CU and NCU in relation to general psychological health, depression or suicidality. In keeping with this, there were no within group differences in relation to these measures on the basis of current cocaine use. The results of this study do not suggest current cocaine use to have an obviously deleterious effect on the already diminished, by population standards (Andrews et al., 1999), general psychological well-being of heroin dependent individuals. However, it must be noted that mental health problems such as psychosis are not captured by this study. Thus, while cocaine use may not have a clear, additative, adverse effect on depression and suicidality amongst this group, it may adversely affect the psychological well-being of users in different ways.

4.9 Conclusion

Cocaine use had halved amongst the sample at follow up but frequency of use among those using cocaine at three months remained unchanged. Retention in treatment was not significantly affected by cocaine use at baseline however, short-term outcomes were poorer among CU. Indeed, CU remained a more 'at risk' group, displaying lower levels of psychological functioning and higher levels of drug use, risk-taking behaviour, crime and injection-related health problems. Comparisons within groups on the basis of three month cocaine use status revealed that decreased performance on these outcomes was associated with the commencement and/or continuation of cocaine use, while cessation of cocaine use resulted in significant improvements on these measures. Thus, in the short-term at least, cocaine use appears to exacerbate dysfunction, rather than serving as a marker for a more dysfunctional group of individuals. The relationship between cocaine use among heroin dependent individuals and outcome will be explored further at 12 and 24 months post-treatment entry.

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