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

# Cocaine use and treatment outcomes for heroin dependence: 12 month outcomes

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# COCAINE USE AND TREATMENT OUTCOMES FOR HEROIN DEPENDENCE: 12 MONTH OUTCOMES

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# EXECUTIVE SUMMARY

## Introduction

Cocaine use among treatment entrants for heroin dependence in NSW became common during the 'heroin drought' of 2001. Recent studies demonstrated that heroin users who also used cocaine were a more 'at risk' group at treatment entry (Williamson et al, 2003) and showed poorer short term outcomes (Williamson et al, 2004). Overall, they displayed higher current levels of social dysfunction, drug use, needle-risk taking behaviour and criminality. It was unknown whether these patterns would persist past the initial stages of treatment, and what effect differing patterns of cocaine use over time would have on outcome.

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 current study was conducted twelve months post treatment entry. The aims of the current study were: to determine the effect of cocaine use on outcomes of treatment for heroin dependence twelve months post-treatment entry; to examine the relationship between cocaine use and dysfunction among heroin users; and to examine the effects of persistence of cocaine use over follow up on outcomes.

## Results

### *Prevalence*

The prevalence of cocaine use in the sample had decreased from 39% at baseline to 10% at twelve months. Frequency of use had also decreased: only ten percent of current users reported using cocaine daily at twelve months, compared to a quarter at baseline. Those who were enrolling in treatment at baseline interview were significantly less likely to report recent cocaine use at twelve months, while current cocaine users at twelve months had spent significantly fewer days in treatment.

### *Treatment*

Baseline cocaine users were significantly less likely to be retained in their index maintenance pharmacotherapy at follow up, but no differences were noted in relation to retention in index detoxification or residential rehabilitation programs. Baseline cocaine users also spent significantly fewer days in treatment over the follow up period. Persistent cocaine use over the study period was associated with treatment instability, with more persistent cocaine use associated with commencing a greater number of treatment episodes.

### *Social functioning*

At baseline, three and twelve months CU consistently displayed a higher level of social dysfunction. At twelve months they remained more likely to report gaining the majority of their income from criminal activity and homelessness was more prevalent amongst this group. The same pattern of results was also observed for current cocaine users at twelve months. The more interview points at which cocaine use was reported, the higher the prevalence of homelessness (12% cocaine use at all points vs 1% no cocaine use).

### *Drug use*

Baseline cocaine use was a significant predictor of continuing heroin use at twelve months (49% vs 37%), and of failure to attain abstinence from heroin over the entire follow up period. Moreover, more persistent cocaine use was associated with higher rates of heroin use at follow up, and with failure to maintain heroin abstinence since baseline. Almost twice the proportion of current cocaine users as non-current users reported heroin use at follow up (78% vs 37%). Baseline cocaine use was not a predictor of more extensive polydrug use at twelve months. Persistent cocaine use over the follow up period, however, predicted higher levels of polydrug use at follow up, as did current cocaine use.

### *Risk-taking*

Baseline and current cocaine use were predictors of needle sharing at twelve months, and the more points cocaine use was reported at, the greater the prevalence of needle sharing.

Injection-related health problems were also predicted by baseline and current cocaine use and increased with increasing persistence of cocaine use (eg 72% of those who used at all points vs 21 % of non-cocaine users).

### *Crime*

By twelve months, baseline cocaine use no longer predicted higher levels of criminal activity. It did, however, predict incarceration over the follow up period. Having reported cocaine use at more interview points was an independent predictor of greater criminal involvement at follow up, and the more points at which cocaine use was reported, the greater the likelihood that the subject had been imprisoned since baseline. Current cocaine users at twelve months were also significantly more likely to have recently engaged in criminal activity (45% vs 22%).

### *Physical and mental health*

Current cocaine users reported poorer general physical health than non-users at twelve months. Baseline cocaine use was not associated with poorer general health outcomes at this time, although baseline cocaine users were more likely to have recently used ambulance or general practitioner services. Injection-related health problems at twelve months were predicted by baseline and current cocaine use and persistence of cocaine use was an independent predictor of injection-related health problems. The general mental health of the sample was not differentiated by baseline cocaine use or persistence of use. At twelve month follow up however, current cocaine users reported poorer general mental well being.

### *Conclusion*

The prevalence and frequency of cocaine use had declined significantly in the sample by twelve months. Despite decreased availability of the drug, however, 10% continued to use cocaine. Any cocaine use over the study period was associated with decreased stability of treatment and poorer outcomes on virtually all outcome measures. *Persistent* cocaine use over the study period, however, appeared particularly detrimental in relation to almost all outcome measures. Cocaine use among clients should evidentially be a cause

for concern amongst treatment providers. Such use is linked to a wide variety of harms and high-risk behaviours, and importantly, to continuing poorer treatment outcome.

# 1.0 INTRODUCTION

In 2001 the prevalence and frequency of cocaine consumption among heroin users in Sydney increased dramatically (Topp, Day, & Degenhardt, 2003). This surge in use followed an earlier increase in 1998 (Darke, Kaye, & Topp, 2002) and was driven by an unprecedented large-scale decrease in the availability of heroin, coupled with an increase in the availability and affordability of cocaine (Topp et al., 2003). Increased cocaine use was a concern due to the potential exposure of users to a range of health and psychological problems over and above those caused by heroin use (Van Beek, Dwyer, & Malcom, 2001). Further, it was unknown what effect, if any, concurrent cocaine use would have on the efficacy of traditional treatments for heroin dependence (Williamson, Darke, Ross, & Teesson, 2003).

The harms associated with cocaine use are many, and involve almost all major bodily systems (Platt, 1997). Cocaine use can result in neurological complications, most notably haemorrhagic and ischaemic strokes (Neiman, Haapaniemi, & Hillbom, 2000). The cardiotoxicity of cocaine is also well documented, with myocardial ischemia and infarction, and arrhythmias being among the problems cocaine use can generate (Lange & Hillis, 2001; Mittleman et al., 1999). Seizures, intestinal infarctions and both renal and respiratory failure have all been found to result from cocaine use (Blum, 1984; Crandall, Vongpatanasin, & Victor, 2002). Severe psychiatric problems such as psychosis and depression have also been implicated (Garlow, Purselle, & D'Orio, 2003; Torrens, San, Peri, & Olle, 1991; Van Beek et al., 2001).

Research conducted in Sydney around 2001 confirmed overseas studies in identifying harms of cocaine use. Cocaine use was found to be associated with decreased social functioning and increased criminality (Kaye, Darke, & McKetin, 2000; Van Beek et al., 2001). Increased injecting and consequently injection-related health problems were also noted, as was a greater degree of polydrug use (Kaye & Darke, 2004; Kaye et al., 2000; Van Beek et al., 2001). In addition, non-fatal cocaine overdoses were found to be common among users in NSW (Kaye & Darke, 2003), and 146 cocaine-related fatalities were identified between 1993 and 2003 (Darke & Kaye, In press).

The Australian Treatment Outcome Study (ATOS), the first large-scale longitudinal study of treatment entrants for heroin dependence in Australia, provided a unique

opportunity to examine the effects of concurrent cocaine use on treatment outcomes for heroin dependence. Recruitment began in 2001, at the beginning of the heroin drought/cocaine wave. Baseline analyses of NSW data showed that cocaine was being used by a large proportion (39%) of treatment entrants for heroin dependence (Williamson et al., 2003). Despite not differing at baseline in terms of drug use history or psychopathology, heroin users who also used cocaine exhibited a greater degree of drug related harm, being more likely to report homelessness, criminality, needle sharing and injection-related health problems. In addition, cocaine users reported a greater degree of heroin use and dependence and more extensive polydrug use.

At three month follow up the prevalence of cocaine use in the ATOS sample had halved (Williamson, Darke, Ross, & Teesson, 2004). While great improvements in most outcome measures were evident across the cohort, baseline cocaine users (CU) displayed poorer outcomes than those who had not reported baseline cocaine use (NCU). No short-term differences were observed in regards to treatment retention, CU however, continued to display the lower levels of social functioning, drug use, needle risk-taking and criminality that characterised them at baseline. By comparing subjects on the basis of their cocaine use over the three month study period, it became evident that it was cocaine use itself that caused the relatively poor outcomes observed among CU, and not that cocaine users were simply a self-selected group of more dysfunctional individuals. Those CU who had ceased cocaine use at three months enjoyed significantly better short term outcomes than those who had continued their cocaine use. Similarly, NCU who had commenced cocaine use showed decreased functioning relative to NCU who had not used cocaine.

These studies represented the first estimate of the prevalence of cocaine use among treatment entrants for heroin dependence in NSW, and of the short term effects of such use on treatment outcomes. It remains unknown, however, what effect such use would have beyond the initial stages of treatment. The current study, conducted as part of the NSW component of ATOS, aimed to examine the impact of cocaine use on medium-term (twelve month) outcomes of treatment for heroin dependence (Methadone/buprenorphine maintenance, detoxification and Residential Rehabilitation/Therapeutic Communities). The relationship between cocaine use and

psychosocial dysfunction in heroin users was also explored by examining the effect of cocaine use patterns across the follow up period.

### *1.1 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 twelve months post-treatment entry;
2. To examine the relationship between cocaine use and psychosocial dysfunction among heroin users in NSW;
3. To examine the effects of differing patterns of cocaine use over the twelve month follow up period on outcomes.

## 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.

The total baseline sample was 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.

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.

## 2.2 Structured interview at 12 month follow-up

The 12 month interview was an abbreviated form of the baseline interview and included questioning on the following topics:

### 2.2.1 Treatment history

Participants were asked how many times they had commenced the various treatment options for heroin dependence, how recently they had attended each type of treatment and the duration of that treatment episode.

### 2.2.2 Drug use history

Drug use in the preceding month was assessed using the Opiate Treatment Index (OTI; Darke et al, 1992).

### 2.2.3 Heroin overdose history

Questions regarding lifetime history of non-fatal heroin overdose were based on earlier work conducted by the authors (Darke et al, 1996).

### 2.2.4 Injection-related risk-taking behaviour

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, 1992).

### 2.2.5 Injection-related health

The injection-related sub-scale of the OTI health scale was used to assess injection-related health problems (Darke et al, 1992).

### 2.2.6 General health

The Short Form-12 (SF-12) is a standardised, internationally used instrument that provides a general measure of health status (Ware et al, 1996). The 12 items on the SF-12 are summarised in two weighted summary scales, and generate a mental health and a physical health score. The SF12 is standardised with a mean score of 50 and a standard deviation of 10. Lower scores are indicative of more severe disability.

### 2.2.7 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.

### 2.2.8 Current Major Depression

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).

## *2.3 Statistical analyses*

For comparisons between two groups, 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. One-way ANOVAs with tukey post hoc comparisons were used for comparisons between three groups. McNemar's tests were used to examine changes across time. In order to determine the factors independently associated with categorical variables at twelve months, logistic regressions were conducted. Variables entered into the equation were age, sex, total number of days in treatment and treatment episodes over the follow up period, cocaine use status and baseline measure of the dependent variable. In order to determine the factors independently associated with continuous variables at follow up, linear regressions were conducted using the same variables. All analyses were conducted using SPSS for Windows, version 11.0 (SPSS Inc, 2003).

# 3.0 RESULTS

## *3.1 Sample characteristics*

A total of 495 (80%) of the cohort were successfully re-interviewed at 12 months: MT (167), DTX (171), RR (104) and NT (53). A further 31 participants (5%) were known to be incarcerated, and 5 were deceased (0.8%). The mean length of follow-up was 369.2 days (SD 56.3, range 310-722). At baseline, the mean age of those successfully followed-up was 29.2 years (SD 7.8, range 18-56), and 65% were male. The sample had completed a mean of 10.1 years of secondary education (SD 1.6, range 2-12), 31% had completed a trade/technical course, and 6% a university degree. Thirty seven percent had a prison history. The main sources of income were: social security allowances (45%), criminal activity (23%) and wage/salary (19%). Ninety percent had been enrolled in treatment for opiate dependence prior to ATOS, with no differences between index groups. Twenty six percent met criteria for current Major Depression, 45% for BPD and 71% for ASPD.

The mean age of first intoxication with any substance was 13.7 years (SD 3.3, range 2-34), and 19.6 years (SD 5.2, range 9-43) for first heroin use. The mean length of heroin use career at baseline was 9.7 years (SD 7.6, range <1-35 years), and the median OTI heroin use score was 2.0 (range 0.0-33.3). Ten percent of participants had used heroin and other drugs exclusively by non-injecting routes of administration in the month

preceding ATOS enrolment. The sample had used a mean of 9.1 (SD 1.7, range 2-11) drug classes in their lives, and 4.8 (SD 1.7, range 2-9) in the month preceding interview.

In order to determine factors associated with retention in the cohort at 12 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 current cocaine use status at baseline. The overall model was significant ($\chi^2_{1df}$=10.54, p<.001). Participants in the treatment groups were more likely to be retained than those in the NT group (82% v 66%, OR 2.42, 95% CI: 1.45-4.05). No other factors were significantly associated with sample retention. Those re-interviewed and those lost to follow-up thus did not differ significantly from each other in terms of age, gender, treatment history, number of heroin use days in the month before baseline, Major Depression, PTSD, and personality disorders.

## *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 (CU), but only 19% reported cocaine use in the month prior to 3 month follow-up. At 12 month follow up, the prevalence of current cocaine use had decreased significantly to approximately 10% ($\chi^2_{1df}$=73.01, p<.001). In order to determine the effect of treatment on cocaine use status at twelve months a logistic regression was conducted. Factors entered into the equation were age, sex, cocaine use status at baseline and treatment status (treatment/non-treatment) at baseline. The final model was significant ($\chi^2_{2df}$=45.33, p<.001), with those who reported using cocaine at baseline being more likely to report cocaine use at twelve months (18% vs 5%, OR=3.49, 95% C.I.=1.78-6.83), and those who entered treatment being less likely (6.8% vs 35.8%, OR=0.17, 95% C.I.=0.85-0.34). Index treatment type was not significantly related to cocaine use at follow up.

**Table 1. Cocaine use patterns among the ATOS NSW participants followed up at 12 months**

| | Males (n=321) % | Females (n=174) % | Total (n=495) % | Comparisons |
|---|---|---|---|---|
| Ever used | 91.6 | 88.9 | 90.7 | Not significant |
| Previous month (baseline) | 41.7 | 35.6 | 39.6 | Not significant |
| Previous month (3 months) | 19.3 | 16.7 | 18.4 | Not significant |
| Previous month (12 months) | 10.0 | 9.8 | 9.9 | Not significant |

While the proportion of subjects using cocaine decreased markedly from baseline to 3 months, frequency of cocaine use was similar. In contrast, twelve month frequency of cocaine use had dropped substantially (Figure 1). At twelve months half of all current cocaine users reporting using less than weekly, as opposed to a third at baseline and three months. Only around ten percent reported more than daily use at twelve months compared to a quarter at baseline and three months. Eighteen percent of baseline CU continued to use cocaine at 12 months, while 5% of NCU had commenced cocaine use at this time (Figure 2).

**Figure 1. Frequency of cocaine use among current users in the ATOS NSW sample at baseline, 3 and 12 month follow up**

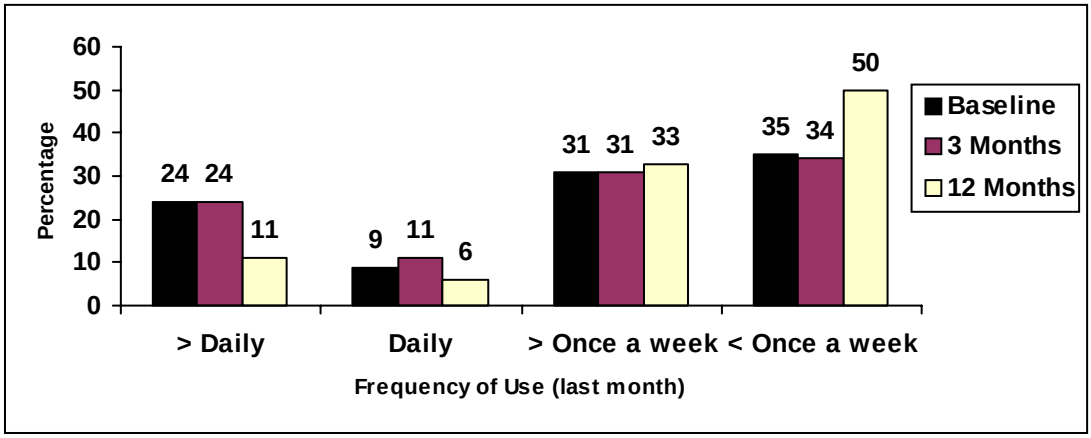
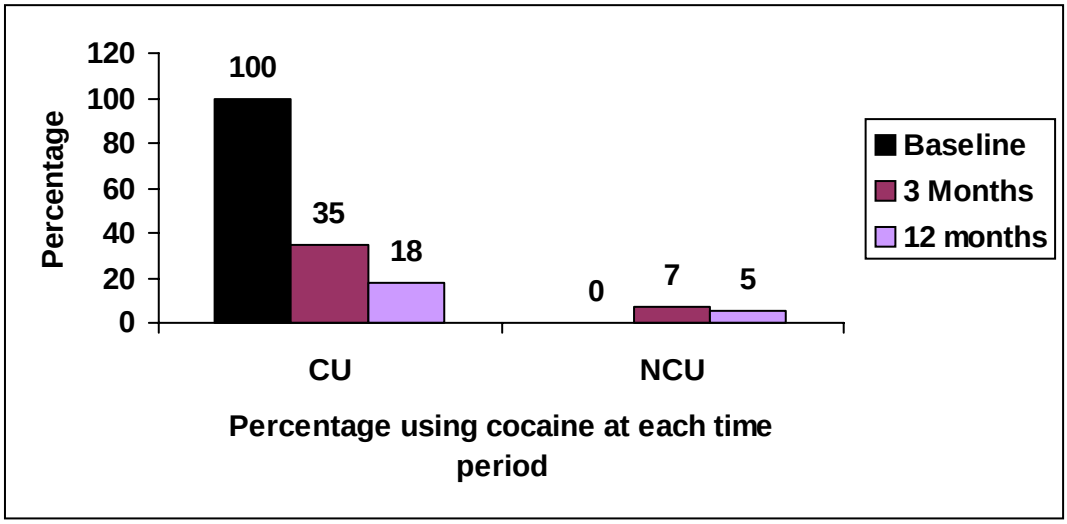



**Figure 2. Cocaine use status of baseline CU and NCU at three and twelve months**




## *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 12 months, CU and NCU did not differ in terms of basic demographics characteristics. CU were more likely, however, to

report a history of incarceration (42.9% vs 32.8%). The majority of both groups had received previous treatment for their heroin dependence (96.9% vs 98.7).

### 3.3.2 Treatment

It was impossible for any participants to remain enrolled in their index DTX program at twelve months, and only one RR involved in the ATOS study offered a program of longer than three months duration. Retention in MT was possible at follow up, and differences emerged between groups in this regard. Significantly less CU than NCU remained in their index maintenance treatment (27.5% vs 49.1%) (Table 2). Moreover, while the two groups did not differ in terms of total days retained in index DTX or RR programs, CU had spent significantly less days on average in their index MT treatment (176.7 vs 233.3). CU and NCU did not differ in terms of mean number of treatment episodes over twelve month follow up (2.7 vs 2.4). However, CU reported significantly fewer days spent in any treatment for their heroin dependence since baseline (153.8 vs 187.0). The majority of both groups were enrolled in some type of treatment at 12 months, with no differences in current treatment type.

**Table 2. Treatment (index and current) of CU and NCU**

| | CU (n=196) | NCU (n=299) | Comparisons |
|---|---|---|---|
| *Still in index treatment:* | | | |
| Methadone/Buprenorphine | 27.5 | 49.1 | $\chi^2_{1df}$=6.82, p<.05 |
| Detoxification | N/A | N/A | N/A |
| Residential rehabilitation | N/A | N/A | N/A |
| *Days in index treatment*: | | | |
| Methadone/Buprenorphine | 176.7 | 233.3 | $t_{165}$=2.46, p<.05 |
| Detox | 5.9 | 6.4 | Not significant |
| Residential Rehabilitation | 54.8 | 70.1 | Not significant |
| Number of treatment episodes (including index) | 2.7 | 2.4 | Not significant |
| Number of days in any treatment over 12 months | 153.8 | 187.0 | $t_{491}$=2.8, p<.01 |
| Currently enrolled in treatment (%) | 62.2 | 57.5 | Not significant |

### 3.3.3 Social functioning

At baseline, CU presented as a less socially functional group than NCU. At twelve months, the proportion of CU gaining the majority of their income from paid employment had increased substantially, equalling than of NCU (Table 3). The proportion of the sample reporting gaining the majority of their income from criminal activity had decreased markedly at follow up, but CU continued to be more likely to do so (6.6% vs 2.3% $\chi^2_{1df}$=5.62, p<.05). Similarly, the proportion reporting homelessness at 12 months was less than half that at baseline, but CU were still more likely to be homeless than NCU (5.1% vs 1.1%, $\chi^2_{1df}$=7.78, p<.01). A logistic regression ($\chi^2_{2df}$=18.46, p<.000, $R^2$=.17) revealed that having used cocaine at baseline (5.1% vs 1.1%, OR=5.67, 95% C.I.=1.51-21.27) and being older (36.54 vs 29.03, OR=1.12, 95% C.I.=1.04-1.20) were independently associated with homelessness at twelve months.

**Table 3. Social functioning (last month)**

| | BASELINE | | 12 MONTH | |
|---|---|---|---|---|
| | CU (n=196) % | NCU (n=299) % | CU (n=196) % | NCU (n=299) % |
| *Income:* | | | | |
| Wage | 12.2 | 21.1* | 22.4 | 23.4 |
| Govt | 40.2 | 49.3* | 65.3 | 66.9 |
| Criminal activity | 47.6 | 29.5* | 6.6 | 2.3* |
| Homeless | 12.8 | 4.3* | 5.1 | 1.1* |

* Indicates a significant difference between groups

### 3.3.4 Drug use

At twelve months a substantial reduction was seen across the cohort in all drug use measures, however the CU group continued to be characterised by heavier drug use (Table 4). Thus, CU reported more extensive recent polydrug use (with cocaine excluded from the analysis) than NCU (3.2 vs 2.9, $t_{493}$=2.14, p<.05). In addition, CU met criteria for a greater number of heroin dependence symptoms than did NCU (1.8 vs 1.2, $t_3$=3.08, p<.01) and reported more heroin use days in last month (6.0 vs 3.7, $t_{354}$=2.9, p<.01).

The factors associated with heroin use at twelve months were examined using logistic regression. The final model was significant ($\chi^2_{2df}$=27.97, p<.000) and accounted for 7% of the variance. Reporting cocaine use at baseline (49.0% vs 36.5%, OR=1.48, 95%C.I.=1.02-2.16), spending less days in treatment since baseline (144.62 vs 194.53, OR=.997, 95%C.I.=.996-.999) and having commenced more treatment episodes (2.74 vs 2.31, OR=1.12, 95%C.I.=1.01-1.23) were independently associated with continuing heroin use at twelve months.

The predictors of more extensive polydrug use (with cocaine excluded from the analysis) at twelve months were examined via linear regression. The model was significant ($F_{6,486}$=9.458, p<.000) and accounted for 9% of the variance. Reporting a higher degree of polydrug use at baseline (β=.30, t=6.51, p<.001) and having spent less days in

treatment since baseline (β=-.001, t=2.48, p<.05) were both associated with engaging in more poly drug use at twelve months.

**Table 4. Drug use (last month)**

| | **BASELINE** | | **12 MONTH** | |
|---|---|---|---|---|
| | **CU (n=196)** | **NCU (n=299)** | **CU (n=196)** | **NCU (n=299)** |
| Drug classes (mth)- cocaine excluded | 4.7 | 4.3* | 3.2 | 2.9* |
| Heroin dependence symptoms | 5.7 | 5.4* | 1.8 | 1.2* |
| Heroin use days (mth) (mean) | 21.5 | 19.7* | 6.0 | 3.7* |

* Indicates a significant difference between groups

At twelve months, half of the sample reported having been heroin abstinent in the month prior to interview (Table 5). CU were more likely than NCU to report having used heroin (49.0% vs 36.5%, $\chi^2_{1df}$=7.66, p<.01), other opiates (13.3% vs 7.7%, $\chi^2$ 1df=4.1, p<.05) and, cocaine (17.9% vs 4.7%, $\chi^2_{1df}$=23.04, p<.001) in the month preceding twelve month follow up.

**Table 5. Prevalence of drug use (last month)**

| | BASELINE | | 12 MONTHS | |
|---|---|---|---|---|
| **Drug Class** | **CU (n=196) %** | **NCU (n=299) %** | **CU (n=196) %** | **NCU (n=299) %** |
| Heroin | 98.5 | 98.7 | 49.0 | 36.5* |
| Other Opiates | 35.7 | 26.8* | 13.3 | 7.7* |
| Cocaine | 100 | 0 | 17.9 | 4.7 |
| Amphetamines | 37.8 | 23.1* | 18.4 | 15.1 |
| Hallucinogens | 14.8 | 6.0* | 6.6 | 5.7 |
| Benzodiazepines | 46.9 | 46.8 | 27.6 | 21.4 |
| Antidepressants | 10.2 | 15.7 | 12.8 | 15.7 |
| Alcohol | 53.6 | 50.2 | 6.6 | 5.7 |
| Cannabis | 73.5 | 63.9* | 50.0 | 46.8 |
| Inhalants | 3.6 | 0.3* | 0.0 | 0.3 |
| Tobacco | 95.9 | 94.3 | 92.9 | 91.0 |

### 3.3.5 Risk-taking behaviour

At baseline, a higher proportion of CU than NCU reported injecting drugs in the month prior to interview, and daily injection was also more common among this group (Table 6). At twelve months, while the majority of the sample reported no injections in the last month, a greater proportion of CU than NCU had injected (56.6% vs 38.1%, $\chi^2_{1df}$=16.35, p<.001). Similarly, more CU than NCU had continued to inject daily on average (21.9% vs 9.4%, $\chi^2_{1df}$= 5.24, p<.001).

Rates of needle sharing had fallen markedly at twelve months, but CU remained more likely to report borrowing and lending needles (13.8% vs 5.4%, $\chi^2_{1df}$=12.34, p<.01).

Predictors of needle sharing at twelve months were examined via logistic regression. The model was significant ($\chi^2_{4df}$=32.10, p<.000) and accounted for 14% of the variance. Having used cocaine (13.8% vs 5.4%, OR=2.18, 95%C.I.=1.12-4.26) or shared needles (14.3% vs 5.8%, OR=2.61, 95%C.I=1.35-5.02) at baseline were both independent predictors of needle sharing at baseline. Further, having spent less days in treatment over the follow up period (114.53 vs 179.44, OR=.995, 95%C.I.=.992-.999) and having commenced more treatment episodes (3.21 vs 2.42, OR=1.19, 95%C.I.=1.04-1.37) were associated with higher rates of needle sharing at twelve months.

**Table 6. Risk-taking behaviour (last month)**

| | **BASELINE** | | **12 MONTHS** | |
|---|---|---|---|---|
| | **CU (n=196) %** | **NCU (n=299) %** | **CU (n=196) %** | **NCU (n=299) %** |
| Injection | 98.5 | 87.3* | 56.6 | 38.1* |
| Injection daily | 90.3 | 70.2* | 21.9 | 9.4* |
| Shared needles | 40.8 | 29.4* | 13.8 | 5.4* |

*Indicates a significant difference between groups

### 3.3.6 Criminal activity

At baseline CU were significantly more likely than NCU to report involvement in all types of crime (with the exception of violent crime), and a higher proportion of this group reported some criminal involvement in the month prior to baseline interview (Table 7). At twelve months, rates of criminal involvement had reduced by more than half, but CU continued to be more involved in property crime than NCU (16.7% vs 9.8%, $\chi^2_{1df}$=6.44, p<.05).

**Table 7. Criminal involvement (last month)**

| | BASELINE | | 12 MONTH | |
|---|---|---|---|---|
| | CU (n=196) % | NCU (n=299) % | CU (n=196) % | NCU (n=299) % |
| Property Crime | 46.7 | 32.4* | 16.7 | 9.8* |
| Dealing | 28.7 | 21.7 | 10.2 | 7.0 |
| Fraud | 20.5 | 12.7* | 4.5 | 4.1 |
| Violent Crime | 8.7 | 6.4 | 1.6 | 1.4 |
| Any Crime | 64.6 | 47.5* | 22.8 | 17.3 |

* Indicates a significant difference between groups

### 3.3.7 Physical health

At baseline CU and NCU scored slightly below the mean on the SF-12 physical health scale (Table 8). By twelve months their mean scores were approximately equal to the population average. Levels of injection-related health problems had fallen substantially across the sample at twelve months. CU were, however, more likely to report an injection-related health problem than were NCU (33.2% vs 21.5%, $\chi^2_{1df}$=8.37, p<.001). Abscesses or infections (7.1% vs 1.7%, $\chi^2_{1df}$=9.60, p<.001) and difficulty injecting (19.4% vs 11.0%, $\chi^2_{1df}$=6.72, p<.05) were more commonly experienced by CU than NCU in the month preceding follow up.

The factors associated with reporting an injection related health problem at twelve months were modelled using logistic regression. The final model was significant ($\chi^2_{3df}$=26.11, p<.000) and accounted for 8% of the variance. The factors independently associated with injection-related problems at twelve months were baseline cocaine use (33.2% vs 21.5%, OR=1.65, 95%C.I.=1.09-2.51), reporting an injection-related health problem at baseline (30.1% vs 14.4%, 2.52, 95%C.I=1.45-4.39) and spending less days in treatment over the follow up period (147.45 vs 183.52, OR=.998, 95%C.I.=.996-1.00).

**Table 8. Physical health (last month)**

| | BASELINE | | 12 MONTH | |
|---|---|---|---|---|
| | **CU (n=196)** | **NCU (n=299)** | **CU (n=196)** | **NCU (n=299)** |
| SF 12 physical health score (mean) | 44.0 | 43.3 | 49.1 | 49.5 |
| *Injection related health problems* (%); | | | | |
| Overdose | 13.3 | 6.4* | 3.6 | 2.0 |
| Abscesses/infections | 8.7 | 11.4 | 7.1 | 1.7* |
| Dirty hit | 15.8 | 21.1 | 3.6 | 3.0 |
| Scarring/Bruising | 66.3 | 60.2 | 19.9 | 18.1 |
| Difficulty Injecting | 39.3 | 39.1 | 19.4 | 11.0* |
| Any injection related health problem | 77.6 | 72.9 | 33.2 | 21.5* |

* Indicates a significant difference between groups

### 3.3.8 Health service utilization

At baseline CU were more likely than NCU to have recently received help from ambulance officers (15.3 vs 7.7, $\chi^2_{1df}$=7.18, p<.05). At twelve months, CU remained more likely to have recently received help from ambulance officers (10.2% vs 3.7%, $\chi^2_{1df}$=8.59, p<.01). At twelve months CU were no more likely than NCU to have been hospitalised, but were more likely to have visited a GP (96.2% vs 47.3%, $\chi^2_{1df}$=6.67, p<.01). As baseline and twelve months, both groups were equally likely to have visited a mental health professional in the last month (Table 9).

**Table 9. Health service utilisation**

| | BASELINE | 12 MONTH | BASELINE | 12 MONTH |
|---|---|---|---|---|
| | CU (n=196) % | NCU (n=299) % | CU (n=196) % | NCU (n=299) % |
| Ambulance | 15.3 | 7.7* | 10.2 | 3.7* |
| Hospital | 11.7 | 6.7 | 8.2 | 6.0 |
| GP | 64.3 | 56.5 | 59.2 | 47.3* |
| Mental health professional | 23.5 | 21.7 | 24.1 | 18.8 |

* Indicates a significant difference between groups

### 3.3.9 Mental health

At baseline, high levels of psychological distress were evident across the sample. 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 twelve months, while remaining below population averages, large improvements in psychological well-being were evident throughout the sample. SF-12 psychological scores fell an average of one standard deviation below the mean, and approximately 10% of the sample met criteria for current major depression. No differences in mental health emerged between CU and NCU at either baseline or follow-up.

**Table 10. Mental health (last month)**

| | BASELINE | | 12 MONTH | |
|---|---|---|---|---|
| | **CU (n=196) %** | **NCU (n=299) %** | **CU (n=196) %** | **NCU (n=299) %** |
| SF 12 psychological health | 31.5 | 31.7 | 40.9 | 42.4 |
| Major Depression (%) | 22.4 | 27.4 | 11.7 | 10.4 |
| Suicide (%) | 4.9 | 5.5 | 1.5 | 0.7 |
| Recurrent thoughts of death (%) | 30.5 | 28.8 | 11.7 | 8.4 |

## 3.4 Comparisons between baseline CU and NCU over the entire 12 month period

In order to establish the effect of baseline cocaine use across the entire 12 month follow up period CU and NCU were compared on four major outcomes: heroin abstinence, imprisonment, heroin overdose and suicide attempts. CU were significantly less likely than NCU to have maintained abstinence from heroin over the twelve month follow up period (8% vs 18%, $\chi^2_{1df}=8.67$, $p<.01$). CU were also more to have been imprisoned over the follow up period (18% vs 11%, $\chi^2_{1df}=4.65$, $p<.05$), and to have experienced a heroin overdose (16% vs 10%, $\chi^2_{1df}=4.81$, $p<.05$). In keeping with the lack of differences found between CU and NCU in terms of measures of mental health, both groups were equally likely to have attempted suicide over the follow up period (Table 11).

**Table 11. Major twelve month outcomes for CU and NCU**

| | CU (N=196) % | NCU (N=299) % |
|---|---|---|
| Continuous abstinence from heroin | 8.2 | 17.5* |
| Incarceration | 17.9 | 11.0* |
| Overdose | 16.3 | 9.7* |
| Suicide attempt | 12.2 | 7.0 |

* Indicates a significant difference between groups

## *3.5 Cocaine use and general polydrug use compared on major 12 month outcomes*

In order to establish the relative importance of baseline cocaine use and baseline polydrug use generally (with cocaine excluded from the analysis) on the major twelve month outcomes a series of logistic regressions were conducted. To examine this issue in relation to maintaining abstinence throughout the twelve month follow up period the variables entered into the equation were age, sex, number of drug classes used in the month prior to baseline interview (with cocaine excluded) and cocaine use (yes/no) at baseline. The final model was significant ($\chi^2_{1df}$=9.21, p<.01). Those who reported using cocaine in the month prior to baseline were less likely to report having been abstinent throughout the 12 month follow period than were those who did not report cocaine use at that time (8% vs 18%, OR=0.42, 95% C.I.=0.23-0.76). Age, sex and general polydrug use were not significantly related to achieving abstinence from heroin throughout the follow up period.

Cocaine use at baseline and general polydrug use were then compared on their ability to predict imprisonment over the twelve month follow up period. Variables entered into the equation were age, sex, baseline cocaine use and polydrug use generally (with cocaine excluded from the analysis). The final model was significant ($\chi^2_{3df}$=16.28, p<.001). Those imprisoned since baseline were more likely to be younger (27.75 vs 29.46, β=0.96, t=1.68, p<.05), male (17% vs 8%, OR=2.46, 95% C.I.=1.01-2.87) and a cocaine user at

baseline (18% vs 11%, OR=1.7, 95% C.I.=1.01-2.87). General polydrug use at baseline and gender were unrelated to imprisonment over the follow up period.

The relationship between cocaine use, polydrug use and overdose was then examined. Age, sex, baseline cocaine use and general polydrug use (with cocaine excluded from the analysis) were entered into the equation. The final model was significant ($\chi^2_{1df}$=18.15, p<.001). Polydrug use was the only variable found to be significantly independently related to having overdosed (5.15 vs 4.33, OR=1.42, 95% C.I.=1.19-1.69).

In order to determine the relationship between cocaine use, polydrug use and having attempted suicide since baseline, a final logistic regression was conducted. Age, sex, baseline cocaine use and general polydrug (with cocaine excluded from the analysis) were entered into the equation. The final model was significant ($\chi^2_{1df}$=12.24, p<.001). A greater degree of polydrug use at baseline was associated with an increased risk of suicide attempt over the follow up period (5.22 vs 4.36, OR=1.44, p<.001).

## *3.6 Comparisons at twelve months on the basis of current cocaine use status*

In order to examine the harms associated with current cocaine use at twelve months those who reported cocaine use in the last month were compared to non-cocaine users (Table 12). At twelve months, current cocaine users were significantly more likely than non-users to nominate criminal activity as their primary source of income (16.3% vs 2.7%) and to report current involvement in criminal activity (44.9% 22.0%). CU12 were also more likely to report having been homeless in the past month (8.2% vs 2.0%).

Current cocaine users were significantly more likely to have used heroin in the month prior to twelve month interview (77.6% vs 37.4%) and met criteria for a greater number of heroin dependence symptoms (3.08 vs 1.28). CU12 had also used a greater number of drug classes in the preceding month (4.06 vs 2.89), even with cocaine excluded from the analysis

Needle sharing (18.4% vs 7.6%) and injection-related health problems (66.3% vs 22.0%) were both more commonly reported by current cocaine users. In keeping with this, current users were in significantly poorer general physical health than were non-users

(45.9 vs 49.7), with SF-12 scores nearly a standard deviation lower. The general mental health of cocaine users was also significantly worse than that of non-users (38.24 vs 42.17), with both groups scoring far below population norms.

**Table 12. Twelve month outcomes for CU12 and NCU12 (last month)**

| | **CU12 (N=49)** | **NCU12 (N=446)** | **COMPARISONS** |
|---|---|---|---|
| *Income ((%):* | | | |
| Wage | 20.4 | 23.3 | Not significant |
| Govt | 57.1 | 67.3 | Not significant |
| Criminal activity | 16.3 | 2.7 | $\chi^2_{1df}$=21.17, p<.001 |
| Homeless (%) | 8.2 | 2.0 | $\chi^2_{1df}$=6.52, p<.05 |
| Criminally active (%) | 44.9 | 22.0 | $\chi^2_{1df}$=12.63, p<.001 |
| Heroin use (%) | 77.6 | 37.4 | $\chi^2_{1df}$=29.27, p<.001 |
| Heroin dependence symptoms (mean) | 3.08 | 1.28 | $t_{493}$=5.49, p<.001 |
| Drug classes – coke not included (mean) | 4.06 | 2.89 | $t_{493}$=4.84, p<.001 |
| Needle sharing (%) | 18.4 | 7.6 | $\chi^2_{1df}$=6.43, p<.05 |
| Injection-related health problems (%) | 66.3 | 22.0 | $\chi^2_{1df}$=38.91, p<.001 |
| SF 12 physical health (mean) | 45.92 | 49.70 | $t_{493}$=2.58, p<.05 |
| SF 12 mental health (mean) | 38.24 | 42.17 | $t_{491}$=2.09, p<.05 |

## *3.7 Comparisons on the basis of cocaine use over the 12 month follow up period*

In order to explore the effects of persistence of cocaine use across the follow up period the cohort was stratified into four groups: those who did not report cocaine use at any point (n=269), those who reported use at one point (n=141), two points (n=60) or all three points (n=25). Univariate analyses were conducted to determine the relationship of persistence of cocaine use to major outcomes. In order to determine whether persistence

of cocaine use remained significant after taking into account the effects of other variables, a series of regressions were conducted. For each analysis, unless otherwise stated, variables included in the model were age, sex, total treatment days, total treatment episodes, cocaine use group and a baseline measure of the dependent variable.

### 3.7.1 Treatment retention

The number of days spent in treatment over the follow up period differed as a function of number of interview points at which cocaine use was reported, with more frequent cocaine use associated with fewer treatment days ($F_{3,489}$=3.70, p<.01). To determine whether persistence of cocaine use was still related to treatment retention once other factors had been taken into account, a linear regression was conducted controlling for age, sex, and cocaine group. The model was significant ($F_{3,489}$=7.51, p<.001). Even after other factors were controlled for, number of cocaine use episodes remained a significant predictor of treatment dose since baseline (β=-1318, t=-2.01, p<.05). Male gender was also associated with fewer days in treatment (β=-45.93, t=-3.80, p<.001).

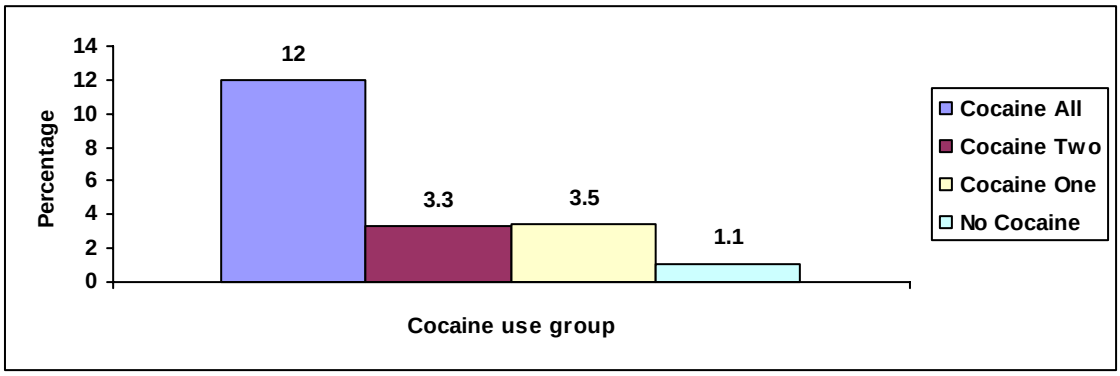
Persistent cocaine use was associated with commencing a greater number of treatment episodes over the follow up period ($F_{3,491}$=2.23, p<.05). Another linear regression was conducted controlling for age, sex, treatment status at baseline and cocaine group. The model was significant ($F_{4,490}$=7.54 p<.001). After taking into account other factors, cocaine use remained a predictor of treatment stability. Those who reported cocaine use at more interview points commenced a greater number of treatment episodes over the follow up period (β=.25, t=2.58, p<.01), while the non treatment group commenced fewer treatment episodes than did the treatment group (β=-1.39, t=-5.05, p<.001).

### 3.7.2 Social functioning

Cocaine use across the study period was not related to employment status at twelve months ($\chi^2_{3df}$=3.81, p=.30). The proportion of the cohort who were homeless at twelve months, however, differed according to persistence of cocaine use, with more persistent use associated with a higher prevalence of homelessness ($\chi^2_{3df}$=11.58, p<.01). Thus, 12% of those who used cocaine use at all points were homeless at twelve months, as compared to just 1% of non-cocaine users (Figure 3). The logistic regression predicting homelessness at twelve months was significant ($\chi^2_{3df}$=19.81, p<.000). After controlling

for other factors, having used cocaine at more data points (OR=2.03, 95% C.I.=1.21-3.41) remained an independent predictor of homelessness at twelve months, as was older age (OR=1.12, 95% C.I.=1.05-1.20).

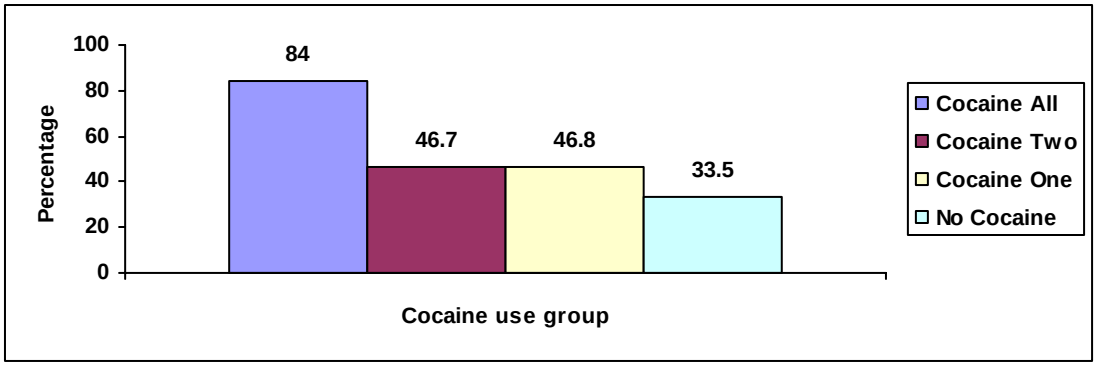
**Figure 3. Prevalence of homelessness at twelve months as a function of cocaine use across the study period**




### 3.7.3 Drug use

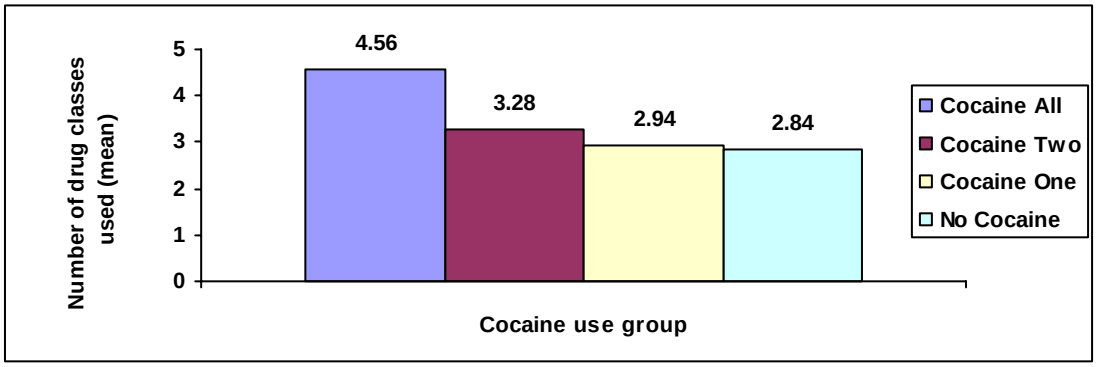
Persistent cocaine use was associated with a higher prevalence of heroin use at twelve months ($\chi^2_{3df}$=28.08, p<.001), with 84% of those who reported cocaine use at all points reporting heroin use at twelve months compared to 33.5% of non-cocaine users (Figure 4). The logistic regression for heroin use at twelve months was significant ($\chi^2_{3df}$=42.34, p<.000). After taking into account the effects of other variables, persistent cocaine use remained a significant predictor of heroin use at twelve months (OR=1.59, 95% C.I.=1.28-1.97). Less time spent in treatment over the follow up period (OR=.997, 95% C.I.=.996-.999) and commencing more treatment episodes (OR=1.12, 95% C.I.=1.01-1.24) also predicted heroin use at twelve months.

**Figure 4. Heroin use at twelve months as a function of cocaine use across the study period**




Persistent cocaine use was associated with more extensive polydrug use (with cocaine excluded) at twelve months ($F_{3.491}$=9.51, p<.000) (Figure 5). In order to establish whether this effect was maintained after taking into account the effects of other variables, a linear regression was conducted. The model was significant ($F_{8,484}$=10.70, p<.000). Persistent cocaine use remained an independent predictor of more extensive polydrug use at follow up (β=0.29, t=3.6, p<.000). Spending fewer days in treatment (β=-.001, t=-2.32, p<.05) and more extensive baseline polydrug use (with cocaine not included) (β=.29, t=6.37, p<.000) were also predictors of greater polydrug use at twelve months.

**Figure 5. Polydrug use at twelve months as a function of cocaine use across the study period**



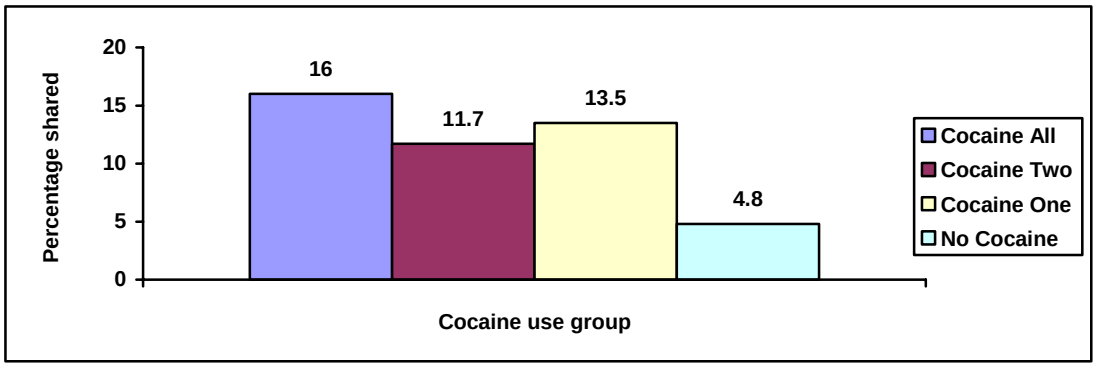

*NB cocaine not included in this analyses

### 3.7.4 Needle risk taking and injection-related health

Recent needle sharing was more common amongst persistent cocaine users at twelve months ($\chi^2_{3df}$=11.47, p<.01). Thus 16% of those who had used cocaine at all points

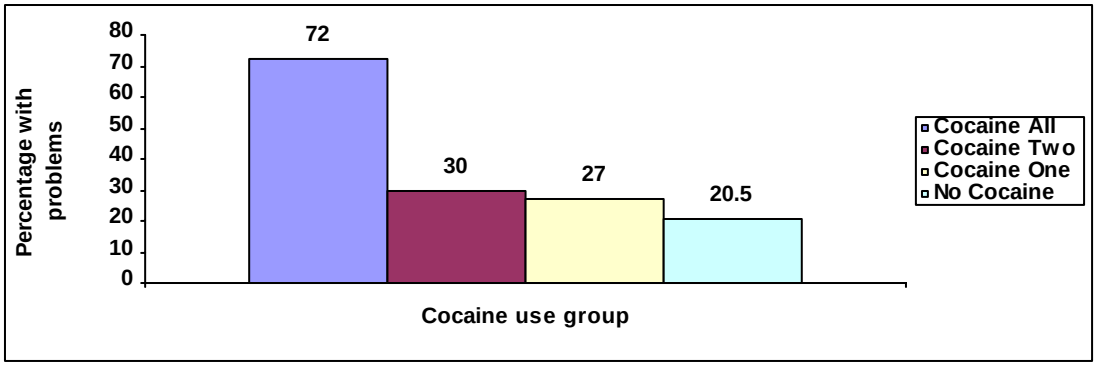
reported needle sharing at follow up, as compared to just 4.8% of non-cocaine users (Figure 6). The logistic regression for needle sharing was significant ($\chi^2$4df=31.23, p<.000). After taking into account other factors, persistent cocaine use remained a significant predictor of needle sharing at twelve months (OR=1.46, 95% C.I.=1.04-2.05). Commencing more treatment episodes (OR=1.20, 95% C.I.=1.05-1.38), spending fewer days in treatment (OR=.995, 95% C.I.=.992-.999) and baseline needle sharing (OR=2.64, 95%C.I.=1.37-5.08) were also associated with needle sharing at twelve months.

**Figure 6. Needle sharing at twelve months as a function of cocaine use across the study period**




More persistent cocaine use was associated with a higher prevalence of injection-related health problems at twelve months ($\chi^2_{3df}$=32.15, p<.000). Seventy two percent of those who reported cocaine use at all points reported an injection-related health problem at twelve months, compared to 20.5% of non-cocaine users (Figure 7). In order to determine whether this relationship endured after the effects of other variables were considered, a logistic regression was conducted. The final model was significant ($\chi^2_{3df}$=38.83, p<.000). Persistent cocaine use remained predictive of injection-related health problems at 12 months (OR=1.64, 95% C.I.=1.31-2.05) as did having had baseline injection-related health problems (OR=2.57, 95% C.I.=1.47-4.50).

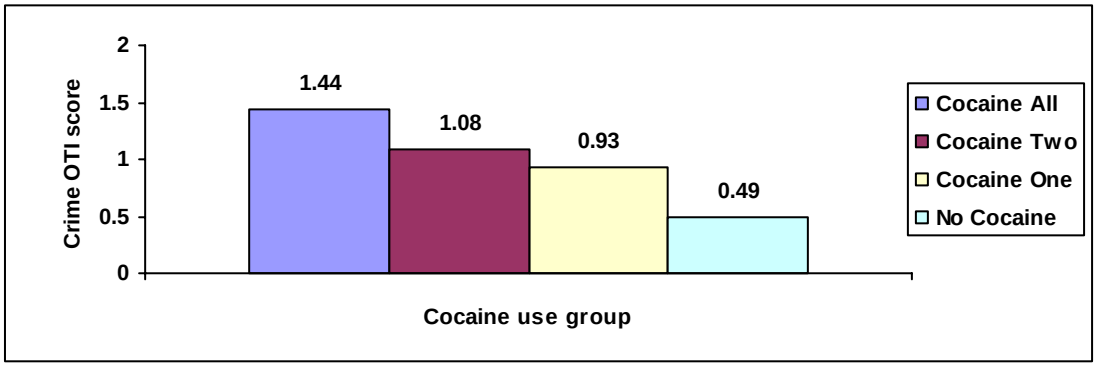
**Figure 7. Prevalence of injection-related health problems at twelve months as a function of cocaine use across the study period**




### 3.7.5 Crime

More persistent cocaine use was associated with higher levels of criminal involvement at twelve months ($F_{3,491}$=5.16, p<.01) (Figure 8). The linear regression for criminal activity was significant ($F_{6,485}$=15.29, p<.000). After taking into account the effects of other variables, having used cocaine at more interview points remained associated with higher crime OTI scores at twelve months (β=.07, t=2.47, p<.05). Those who had spent fewer days in treatment (β=-.001, t=-2.73, p<.01), had commenced more treatment episodes (β=.04, t=2.60, p<.05) and who reported a higher frequency of baseline crime (β=.17, t=6.35, p<.001) also reported higher levels of crime at follow up.

**Figure 8. OTI crime score (mean) at twelve months as a function of cocaine use across the study period**



### 3.7.6 Physical and mental health

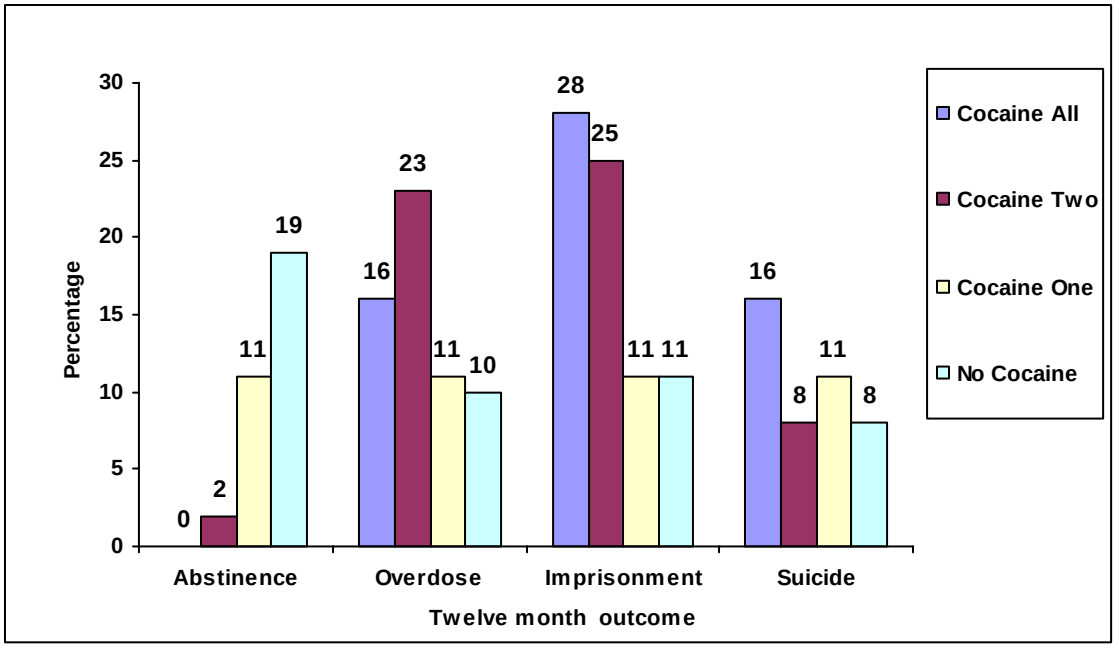
Persistence of cocaine use was not related to general physical health at twelve months ($F_{3,489}$=2.18, p=.90). General mental health at follow up was also unrelated to persistence of cocaine use ($F_{3,489}$=.99, p=.39).

### 3.7.7 Twelve month outcomes

In order to establish the effect of persistence of cocaine use across the entire twelve month follow up period, the cohort were compared on four major outcomes: heroin abstinence, imprisonment, heroin overdose and suicide attempts. Persistent cocaine use was associated with a decreased likelihood of having maintained abstinence from heroin since baseline ($\chi^2_{3df}$=18.26, p<.001) (Figure 9). The logistic regression for heroin abstinence was significant ($\chi^2_{3df}$=40.43, p<.000). After taking into account the effect of other variables, persistent cocaine use remained significantly associated with a lower likelihood of having achieved twelve month heroin abstinence (OR=.43, 95% C.I.=.28-.68). Those who had commenced more treatment episodes (OR=0.70, 95% C.I.=.55-.88) were also less likely to have maintained abstinence.

Persistent cocaine use was associated with greater likelihood of having suffered a heroin overdose over the follow up period ($\chi^2_{3df}$=8.47, p<.05) (Figure 9). The logistic regression for heroin overdose since baseline was significant ($\chi^2_{3df}$=61.01, p<.000). After taking into account the effects of other variables cocaine use was not a predictor of overdose since baseline. Having commenced more treatment episodes (OR=1.58, 95%C.I=1.37-1.81) and spending fewer days in treatment (OR=.996, 95%C.I.=0.994-0.999) were independently associated with heroin overdose over follow up period.

**Figure 9. Twelve month outcomes as a function of cocaine use across the study period**




Those who had used cocaine at more interview points were significantly more likely to have been imprisoned since baseline ($\chi^2_{3df}$=12.91, p<.01) (Figure 9). In order to determine whether this relationship was maintained after the effects of other variables were taken into account a logistic regression was conducted. The final model was significant ($\chi^2_{6df}$=58.64, p<.000). Persistent cocaine use remained an independent predictor of imprisonment since baseline (OR=1.41, 95% C.I.=1.06-1.90). Being younger (OR=.93, 95% C.I.=.89-.97), having commenced more treatment episodes (OR=1.16, 95% C.I.=1.02-1.32) and having a prison history prior to study entry (OR=5.55, 95% C.I.=3.02-10.20) were all also independently associated with having being imprisoned. Persistence of cocaine use was not a predictor of suicide attempt since baseline ($\chi^2_{3df}$=2.43, p=0.49).

# 4.0 DISCUSSION

## *4.1 Major findings*

The prevalence of cocaine use in the cohort had decreased from 39% at baseline to 10% at twelve months. Cocaine use at twelve months was associated with both cocaine use at baseline, and not having entered treatment at baseline. Frequency of cocaine use had also decreased, only ten percent of current users reported using cocaine daily at twelve months, compared to a quarter at baseline.

Baseline cocaine users were less likely to be retained in treatment over the twelve month follow up period. CU had received less treatment overall since baseline. While the sample had improved greatly on all outcome measures at twelve months, CU continued to display the poorer social functioning, higher levels of drug use and dependence and elevated needle risk taking behaviour that characterised them at baseline. Over the follow up period CU were less likely to maintain abstinence from heroin, and where more likely to be imprisoned and to experience a heroin overdose. Cocaine use at baseline specifically, as distinct from polydrug use generally, was found to be significantly associated with both failure to achieve abstinence over the follow up period, and post-baseline imprisonment. As at baseline and three months, those who reported current cocaine use at twelve months showed poorer outcomes than those not currently using cocaine across all outcome domains.

When subjects were compared on the basis of cocaine use patterns over the study period, cocaine use was shown to be a significant factor in almost all outcome measures. *Any* cocaine use was seen to be harmful, yet it was also clear that *persistence* matters. A clear pattern emerged for almost all outcome variables whereby for each additional interview point cocaine use was reported, twelve month outcome was significantly poorer.

## *4.2 Cocaine use patterns*

The prevalence of current cocaine use amongst the cohort halved from baseline to three months, and halved again at twelve months. Nearly one in five baseline cocaine users however, had continued to use cocaine at twelve months, while 5% of non cocaine users

had commenced use. Between baseline and three months the frequency of cocaine use among active users in the sample did not change. At twelve months however, both the prevalence and frequency of cocaine use had decreased significantly.

In examining the changing cocaine use patterns, several factors must be taken into account. The strongest predictor of cocaine use at twelve months was cocaine use at baseline. Entering treatment at baseline however, was also associated with decreased likelihood of cocaine use at this time. Indeed, MMT, DTX and RR participants were all less likely than the NT group to report cocaine use at twelve months. When viewed within the context of the significant overall decrease in drug use and related behaviours in the sample, the decline in cocaine use may be seen to be in part, attributable to the effects of treatment. This interpretation is encouraging, especially given that large scale concomitant use of heroin and cocaine was a relatively new phenomenon facing treatment providers in NSW when the study began. Further, MT at least, is specifically focused on heroin use and would thus not necessarily be expected to effect cocaine use. However, the beneficial effects of methadone in reducing cocaine use, possibly because of it's general stabilising effects, have been noted elsewhere (Magura, Siddiqi, Freeman, & Lipton, 1991; Shaffer & La Salvia, 1992).

While the substantial role of treatment in reducing cocaine use must be recognised, the changing state of NSWs' cocaine market should also be considered. The availability of cocaine was at its highest ever level when study recruitment began in 2001, but had reduced dramatically by the end of 2003, when twelve month follow ups were completed (Roxburgh, Degenhardt, Breen, & Barker, 2003). Thus, while acknowledging the strong role of treatment, some of the decrease in cocaine use noted amongst the ATOS sample must be attributed to the lessened availability and quality of cocaine in Sydney.

## *4.3 CU and NCU at 12 months*

Despite the large-scale changes in cocaine use patterns over the study period, baseline cocaine use status continued to be strongly related to twelve month outcomes. Thus, while the sample as a whole evidenced great improvements in all areas, CU displayed the poorer treatment outcomes and greater degree of drug-related harm noted in other studies (Bux, Lamb, & Iguchi, 1995; Condelli, Fairbank, Dennis, & Rachal, 1991).

There were no differences between CU and NCU in relation to treatment retention at three months (Williamson et al., 2004). By twelve months however, this was no longer the case. While both groups commenced more than one treatment episode for heroin dependence over the follow up period, CU had significantly fewer treatment days overall. This lack of treatment stability among heroin users who also use cocaine has been observed elsewhere (Perez de los Cobos, Trujols, Ribalta, & Casas, 1997) and highlights the more chaotic nature of the CU group. This is a worrying finding as retention in treatment has been consistently demonstrated to be one of the best predictors of outcome (Alemi, Stephens, Llorens, & Orris, 1995; Brewer, Catalano, Haggerty, Gainey, & Fleming, 1998; Condelli & Hubbard, 1994).

At both baseline and three months CU were a less socially functional group than were NCU. They reported higher levels of homelessness, and financial reliance on criminal activity than NCU, as well as lower levels of employment (Williamson et al., 2004). The same pattern was observed at twelve months despite the fact that only 20% of CU were still using cocaine at this time, and that their frequency of use had decreased. This finding is consistent with that of Kosten et al (1988), who found that the increased dysfunction noted among heroin users who also used cocaine persisted for six months after their frequency of cocaine use had decreased.

The relatively poor treatment outcome of the CU group at twelve months was most evident in relation to drug use variables. CU recorded higher levels of heroin use and dependence at follow up as well as more extensive polydrug use. This continuing high level of drug use was coupled with frequent injection, relative to NCU, placing CU at increased risk of vascular damage and reflected in their higher frequency of injection-related health problems. Importantly, needle sharing was also significantly more common amongst CU than NCU. CU thus remained at a greater risk of both transaction and transmission of blood borne viruses at twelve months.

While, the general physical health of the cohort had improved greatly at twelve months, the injection related health of CU remained significantly worse than that of NCU. CU were also more likely to have received assistance from an ambulance at twelve months, and to have visited a GP. While the greater proportion of CU visiting GPs may be

partially explained by prescription-seeking, it is possible that at least some of this difference is attributable to health problems, including injection-related health problems. At twelve months the mental health of both CU and NCU had improved, while remaining below average. Both groups continued to report similar levels of general mental wellbeing and were equally likely to have visited a mental health professional.

It is evident that cocaine use at baseline was associated with poorer outcomes at twelve months, in almost all domains. Baseline cocaine use was an independent predictor of worse twelve month outcomes in relation to homelessness, heroin use, needle sharing and injection-related health problems. When variables were examined that covered the entire period, the effects of baseline cocaine use were equally apparent. CU were less likely to have remained abstinent from heroin since baseline and were more likely to have experienced a heroin overdose. Consistent with their higher levels of crime at all follow up points, CU were also more likely to have been imprisoned. Baseline cocaine use specifically, as opposed to polydrug use in general, was found to be independently associated with the lower levels heroin abstinence and higher levels of imprisonment noted amongst CU.

## *4.4 The effects of current cocaine use*

Despite largely being an in treatment sample at twelve months, with reduced frequency of cocaine use, current cocaine users displayed poorer outcomes than non-users across all domains. Thus, as at baseline (Williamson et al, 2003) and three months (Williamson et al, 2004), current cocaine use was seen to have a strong, detrimental effect on drug use and drug-related problems. In keeping with overseas studies, current use was linked to higher levels of psychosocial dysfunction (Kosten et al, 1988) and criminal activity (Grella et al, 1995). Current cocaine use was also associated with poorer treatment outcome for heroin dependence ie, higher levels of continuing use and dependence (Bux, 1995; Condelli, 1991; Perez de los Cobos, 1997). Consistent with earlier findings (Williamson et al, 2003; Williamson et al, 2004), current cocaine users also engaged in a greater degree of polydrug use than did non-users. As polydrug use has been shown to be a risk factor for both suicide attempts (Darke, Ross, Lynskey, & Teesson, 2004) and heroin overdose (Darke, Williamson, Ross, & Teesson, submitted) in this cohort, such use clearly places twelve month cocaine users at increased risk of premature death.

The link between cocaine use and needle risk-taking, noted in both overseas and local studies, was also evident amongst this cohort (Des Jarlais et al., 1989; Grella, Anglin, & Wugalter, 1995; Joe & Simpson, 1995; Van Beek et al., 2001); Darke et al, 1992). The elevated rates of needle sharing noted among current cocaine users at twelve months makes this group particularly vulnerable to blood borne virus infection. Indeed, HIV seroprevalence is commonly linked to cocaine injection in overseas studies, due to the high rates of needle sharing amongst users (Chassion et al, 1989, De Jarlais et al, 1989, Haberman et al, 1993, Torrens et al, 1991).

Current cocaine users also reported poorer general physical health and more injection-related health problems than non users. Injection–related health problems are commonly found to be more prevalent amongst cocaine users due to the high frequency injection that typifies cocaine use (Van Beek, 2001; Platt, 2001). Current cocaine users also displayed significantly poorer general mental health than non-users a finding consistent with other research (Garlow et al., 2003; Torrens et al., 1991). Taken together, these results suggest that even while in treatment, current cocaine users require extra attention and resources to aid in overcoming their greater physical and emotional problems, and reducing the level of drug-related harm they are exposed to.

## *4.5 Persistence of cocaine use*

While an overall decline in cocaine use was observed across the study period, individual cocaine use patterns varied widely. Approximately half of the cohort did not report cocaine use at any data point, with the remainder reporting having used at one (29%), two (12%) or at all three (5%) points. The question as to wether *persistence* of cocaine use mattered was examined by comparing occasional users to those who had used at all, or no, points.

In general, as reflected by baseline cocaine users and current users, it was clear that even *some* cocaine use had significant deleterious effects on twelve months outcomes, however, it appeared that this effect increased with increased number of cocaine use points. Regressions revealed that cocaine use across the study period was an independent predictor of most major outcomes, with a higher number of cocaine use points equating

to poorer outcome. Thus, increasingly persistent cocaine use led to increasingly substandard outcomes in such key areas as treatment stability, homelessness, heroin use, polydrug use, needle sharing, injection-related health problems and criminal activity. Further, persistent cocaine use predicted failure to maintain heroin abstinence since baseline and incarceration since study entry. It is clear that risk increases with more persistent cocaine use. Evidently the additive effects of cocaine use over time are substantially greater than those garnered by occasional use and must be considered when treating heroin users who also use cocaine.

## *4.5 Conclusions*

The prevalence and frequency of cocaine use had declined significantly in the sample at twelve months. Despite decreased availability of the drug, however, 10% continued to use cocaine. Any cocaine use over the study period was associated with decreased stability of treatment and poorer outcomes on virtually all outcome measures. *Persistent* cocaine use over the study period, however, appeared particularly detrimental in relation to almost all outcome measures. Cocaine use among clients should evidentially be a cause for concern amongst treatment providers and may warrant being specifically targeted during treatment. Such use is linked to a wide variety of harms and high-risk behaviours, and importantly, to continuing poorer treatment outcome.

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