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Patterns of sustained heroin abstinence amongst long-term, dependent heroin users: 36 months findings from the Australian Treatment Outcome Study (ATOS)

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Abstract

Aims: To determine patterns of past month, 12 month and sustained 36 month heroin abstinence.

Methods: As part of a longitudinal cohort study, 429 heroin users re-interviewed at 36 month follow-up for the Australian Treatment Outcome Study (ATOS).

Results: The proportion who had sustained heroin abstinence since baseline declined from 14% at 12 months to 8% at 36 months. The proportion who reported abstinence over the preceding 12 months, however, increased significantly from 14% at 12 months to 40% at 36 months. There were no significant gender differences in the proportions reporting sustained 36 month abstinence. Females, however, were significantly more likely to have maintained abstinence over the 12 months preceding 36 month follow-up. Independent predictors of sustained abstinence over 36 months were fewer treatment episodes since baseline, not committing crime at baseline and higher levels of global psychological distress.

Conclusions: Despite a decline in the proportion who had maintained complete heroin abstinence over 36 months, there were substantial increases in 12 month abstinence patterns. The results illustrate the importance of stable treatment retention.

1. Introduction

While it is beyond question that enrolment in the major treatment modalities for heroin dependence is associated with large reductions in heroin and other drug use (Darke, Williamson, Ross & Teesson, 2006; Flynn, Joe, Broome, Simpson & Brown, 2003; Gossop, Marsden, Stewart & Treacy, 2002; Hubbard, Craddock, Flynn, Anderson & Etheridge, 1997; Teesson et al, 2006), the maintenance of abstinence is more problematic (Hser, Hoffman, Grella & Anglin, 2001; Sheehan, Oppenheimer & Taylor, 1993; Darke et al, 2005). In the longest follow-up of heroin users conducted to date Hser et al (2001) reported that, in a cohort now aged in their late 50s, 21% were still active users and only 47% had maintained abstinence for more than five years.

The optimum outcome for the treatment of heroin dependence is sustained abstinence from heroin. Reductions in heroin use, and abstinence in particular, are beneficial in reducing the physical, psychological and social harms associated with heroin use. Such reductions are associated with lower levels of polydrug use, crime, needle sharing, overdose, psychopathology, suicide and improved physical health (Darke et al, 2006; Gossop et al, 2002; Hubbard et al, 1997; Teesson et al, 2006). Relapse, however, is critically important, as the period following relapse carries a particularly high risk for overdose due to reduced opioid tolerance. Indeed, recent forensic studies suggest that a significant proportion of fatal heroin overdose cases were abstinent in the period immediately prior to death (Darke, Hall, Kaye, Ross, & Duflo, 2002; Fugelsstad et al, 2003; Tagliaro, Debattisti, Smith & Marigo, 1998).

Despite the importance of sustained abstinence, few outcome studies have reported on

patterns of abstinence (Darke et al, 2005; Hser et al, 2001; Sheehan et al, 1993). Point prevalence data typically indicate high levels of current abstinence at follow-up after treatment (e.g. Gossop et al, 2002; Hubbard et al, 1997; Teesson et al, 2006). Those reporting current abstinence at different follow-up points, however, may not be the same people. The Australian Treatment Outcome Study (ATOS), for instance, reported that half of the cohort were abstinent at 3 month follow-up (Ross et al, in press) and 60% at 12 months (Teesson et al, 2006). Only 14%, however, maintained heroin abstinence over the initial 12 month period (Darke et al, 2005). Treatment exposure was strongly related to abstinence. Those who achieved abstinence for 12 months received more days of treatment, enrolled in fewer different treatment episodes, and were less likely to have had previous treatment for opioid dependence.

A number of important questions arise in relation to sustained abstinence. What are the long-term patterns of heroin abstinence? Do these initial “successes” maintain their abstinence? Do others achieve long-term abstinence? What factors are associated with the maintenance of sustained abstinence? Such questions are of direct clinical import in reducing both the morbidity and mortality associated with heroin use. The current study aimed to examine heroin abstinence patterns over the course of 36 months amongst entrants to the three main treatment modalities, methadone/buprenorphine maintenance (MT), drug free residential rehabilitation (RR) and detoxification (DTX), as well as a group not in treatment (NT). Specifically, the study aimed to:

1. Determine the proportion who maintained heroin abstinence from baseline interview until 36 month follow-up;
2. Determine patterns of current and long-term heroin abstinence at 36 months; and

3. Determine treatment and individual characteristics associated with the maintenance of sustained heroin abstinence.

2. Methods

2.1 Procedure

The data were collected from the New South Wales component of the Australian Treatment Outcome Study (ATOS). Baseline interviews were conducted between February 2001 and August 2002. ATOS is a longitudinal study of entrants to treatment for heroin dependence, recruited from randomly selected treatment agencies delivering MT, RR or DTX. Subjects were recruited from 19 agencies treating heroin dependence in the greater Sydney region, randomly selected from within treatment modality. In addition, a group of NT heroin users were recruited from needle and syringe programmes. Participants were interviewed at baseline, 3, 12, 24 and 36 months. 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) aged 18 years or over, and v) fluent in English. Ethics approvals were obtained from the University of New South Wales, and all relevant area health services.

ATOS relies on self reported drug use. Hair sampling, however, was conducted at the 3 months follow-up interview on 61 randomly selected participants (approximately 10% of the baseline sample) as a bio-marker for heroin use over the month preceding interview. The overall agreement between self-reported heroin use and the presence of hair morphine was 75% ($\kappa=0.49$). In 15% of cases heroin use was reported, but morphine not detected, and in 10% recent heroin use denied but morphine detected.

Due to logistical constraints, no hair sampling was conducted at other times throughout follow-up.

2.2 Structured Interview

At baseline, participants were administered a structured interview that addressed demographics, treatment history, drug use, criminal behaviours, health and psychopathology. Drug use, needle risk-taking, injection-related health problems and criminal behaviours over the month preceding interview were measured using the Opiate Treatment Index (OTI) (Darke, Hall, Heather, Wodak, & Ward, 1992). General mental and physical health were measured using the Short-Form 12 (SF12), in which lower scores indicate poorer health (Ware, Kosinski & Keller, 1996). DSM-IV diagnoses of opioid dependence, current Major Depression, and ICD-10 diagnoses of Borderline Personality Disorder (BPD) were obtained using the Composite International Diagnostic Interview (CIDI) (World Health Organization, 1993). Diagnoses of Antisocial Personality Disorder (ASPD) were obtained from the Diagnostic Interview Schedule, modified to obtain DSM-IV diagnoses (Robins, Helzer, Croughan & Ratcliff, 1981).

Follow-up interviews were abbreviated forms of the baseline interview. Participants were asked how many times they had commenced treatment, in any modality, for heroin dependence since the most recent interview, and the time spent in each treatment episode. Current drug use, needle risk-taking, injection-related health problems and criminal behaviours were measured by the OTI. The SF12 was re-administered to obtain a measure of general mental and physical health, and DSM-IV diagnoses of current Major Depression were obtained using the CIDI.

2.3 Statistical analyses

Where distributions were highly skewed, medians were reported and Mann Whitney U tests conducted. For categorical variables, odds ratios (OR) and 95% confidence intervals (CI) were calculated. Cochran's Q test was used to examine differences in proportions across follow-up. The McNemar test for paired proportions was used to examine differences in proportions between baseline and 36 month follow-up, and paired t-tests were used to examine differences in levels of continuous variables. In order to determine independent predictors of sustained abstinence over follow-up, a standard logistic regression was employed. In order to determine the best fitting regression model, backwards elimination of non-contributory variables was employed, in which non-contributory variables are successively removed from each iteration (Agresti, 2002). The Hosmer-Lemeshow statistic was used to determine goodness of fit. All analyses were conducted using SPSS for Windows, Release 14.0 (SPSS, 2005).

3. Results

3.1 Cohort characteristics

The cohort followed-up at 36 months consisted of 429 current heroin users (70% of the original cohort). A further 36 (6%) were incarcerated and 13 (2%) were known to be deceased. Follow-up interview rates for earlier points were: 3mths (89%), 12mths (80%), 24mths (76%). The mean age at baseline was 29.5yrs (SD 8.0, range 18-53), and 65% were male. The cohort had completed a mean of 10.1yrs of school education (SD 1.7, range 2-12), 29% had completed a trade/technical course, and 7% a university degree. Criminal behaviours in the preceding month were reported by 54%, and 36% had a prison history. The main sources of income were: social security

allowances (47%), criminal activity (22%) and wage/salary (18%). Fourteen percent had children in their care (males 7%, females 26%: OR 4.48, CI 2.51-8.06).

The mean age of first intoxication from any substance was 13.7yrs (SD 3.3, range 5-34), with alcohol (56%) and cannabis (40%) the most common substances. The median age of first heroin use was 18.0yrs (range 9-43yrs) and median length of heroin use career at entry was 7.0yrs (range <1-35yrs).

There were no differences between cohort members interviewed at 36 months and others in major baseline characteristics: age (29.5 v 28.7yrs), percent male (65 v 69%), previous treatment enrolment (85 v 90%), daily heroin use (78 v 84%), number of drug classes other than heroin used (3.9 v 3.8), criminal involvement (54 v 56%) or SF12 mental health scores (31.4 v 32.3).

3.2 Treatment history and drug use at 36 months

At 36 month follow-up, 53% were enrolled in a drug treatment programme, and all but three had received treatment (Table 1). There was widespread exposure across treatment modalities, and multiple treatment episodes were common. Females were more likely to be currently enrolled in treatment and to have enrolled in a MT programme over follow-up, but were less likely to have enrolled in a DTX programme. They had also been enrolled in treatment for significantly more days than males, but there was no gender difference in the number of treatment episodes commenced.

Daily heroin use had declined dramatically from baseline to 36 months ($\chi^2=265.3$,

$p < .001$), as had the number of drug classes other than heroin used in the month preceding interview ($t_{428} = 22.9$, $p < .001$) (Table 1). At all points, the most commonly used drugs other than heroin were: tobacco (baseline: 96%, 12mths: 91%, 24mths: 91%, 36mths: 90%), alcohol (51%, 46%, 51%, 50%), cannabis (69%, 45%, 46%, 46%) and benzodiazepines (50%, 22%, 22%, 24%).

Table 1 about here

3.3 Heroin abstinence

At each follow-up point, approximately two thirds of the cohort reported current (past month) heroin abstinence (Table 2). Whilst the proportion reporting current abstinence remained stable, the proportion who reported abstinence over the preceding 12 months increased significantly. Thus, the proportion of those reporting past month abstinence who had been abstinent for at least 12 months increased from a minority to a majority: 12 mths (22%), 24mths (49%), 36 mths (61%). The proportion who had maintained continuous heroin abstinence since baseline, however, declined significantly across follow-up. All those who reported 36 month sustained abstinence had tested negative for morphine in the hair analyses conducted at 3 months.

Overall, at 36 months 40% had been abstinent for the preceding 12 months, 25% for the preceding 24 months and 8% for the entire 36 months.

Table 2 about here

There were no significant gender differences in the proportions reporting past month heroin abstinence or sustained 36 month abstinence. Females, however, were significantly more likely to have maintained abstinence over both the preceding 12 (OR 1.63, CI 1.02-2.29) and 24 months (32 v 22%, OR 1.70, CI 1.08-2.69).

3.4 Sustained abstinence and treatment

Those who sustained 36 month heroin abstinence were less likely to have had previous treatment for opioid dependence at baseline (Table 3). There were significant differences between 36 month sustained abstinence rates amongst the four baseline treatment groups: MT (10%), RR (15%), DTX (4%), NT (0%) ($\chi^2=13.9$, $p<.01$). Compared to the baseline NT comparison group, none of whom achieved 36 month sustained abstinence, sustained abstinence was significantly more common amongst the MT ($\chi^2=4.6$, $p<.05$) and RR ($\chi^2=7.1$, $p<.01$) groups, but not the DTX group ($p>.15$).

There was no significant difference between those who sustained 36 month heroin abstinence and others in the number of treatment days received over that period (Table 3). Those who sustained abstinence, however, had enrolled in fewer treatment episodes and were less likely to have had multiple enrolments.

Table 3 about here

3.5 Sustained abstinence and individual factors

There were no differences between those who sustained 36 month abstinence and

others in heroin use career, baseline opioid dependence symptoms or the number of drugs other than heroin being used at baseline (Table 3). The continuously abstinent were, however, less likely to have been using heroin daily and to have been committing crime. There were no differences in Major Depression, BPD or ASPD, but the continuously abstinent had significantly lower baseline SF12 global mental health scores (indicating higher levels of psychological distress).

3.6 Independent predictors of sustained 36 month abstinence

In order to determine independent predictors of sustained 36 month abstinence, a series of logistic regressions with backwards elimination were conducted. Variables entered into the initial model were the standard demographic controls of age and sex, treatment exposure prior to ATOS, number of treatment days over 36 months, number of treatment episodes over 36 months, baseline heroin use, baseline illegal activities, and baseline SF12 mental health score. The final model was significant and had a good fit (Table 4). Independent predictors of sustained abstinence were fewer treatment episodes, not committing crime at baseline and lower SF12 mental health scores.

Table 4 about here

4. Discussion

The current study provides novel data on long-term abstinence patterns, and the predictors of sustained abstinence, amongst entrants to the three major treatment

modalities for heroin dependence. There was encouraging evidence for the prognosis of long-term heroin users, and for the role of treatment in producing sustained abstinence from heroin. While the proportion who maintained heroin abstinence declined over the three years of follow-up, nearly one in ten had maintained continuous abstinence. Given the drug use and treatment histories of the cohort, this is certainly a respectable figure. More importantly, however, there was a trend towards increased levels of past year abstinence across the follow-up period. Thus, whilst the proportion reporting past month abstinence at any particular annual follow-up point remained stable, this masked a long-term trend towards stable abstinence.

As at 12 months (Darke et al, 2005), fewer treatment enrolments were strongly associated with sustained abstinence. On the whole, long-term retention in as few treatment episodes as possible appears to offer the strongest chance of success. The study clearly indicates the importance of stable treatment in producing long-term abstinence. Compared to the NT group, none of whom sustained abstinence, significantly higher proportions of entrants to the long-term treatment modalities (MT, RR) achieved abstinence. This was not the case for those who entered DTX at baseline.

There were, however, notable differences between 12 and 36 months in the treatment experience of those who sustained abstinence across these periods. At 12 months, those who sustained abstinence had received significantly more treatment days than the non-abstinent (Darke et al, 2005). By 36 months, however, this difference had vanished. Moreover, the abstinent were significantly *less* likely to be currently enrolled in treatment. In fact, two thirds of the abstinent were not enrolled in

treatment at 36 months. It would appear that this group had successfully emerged from a longer, more stable treatment experience in the first year of follow-up, having made long-term changes to their drug use which they were able to maintain.

While there were no gender difference in continuous 36 month abstinence, females were more likely to have maintained abstinence over the both the 12 and 24 months preceding 36 month follow-up. In interpreting these findings, there were three main differences between males and females. Firstly, females were more likely to be currently enrolled in treatment at 36 months. Secondly, they had received substantially more treatment over follow-up. Finally, they were substantially more likely to have children under their care. While the more extensive treatment exposure may explain the trends in abstinence, it is possible that these factors are related, with dependent children providing a strong motivation for treatment success.

Who, then, maintained abstinence for the entire 36 months? They were not distinguishable from the non-abstinent by baseline heroin use career or dependence symptoms. There were, however, some notable differences. Firstly, those who maintained abstinence were less likely to have had previous treatment enrolment, a finding that has been noted previously (Darke et al, 2005; Hser, Grella, Hsieh, Anglin & Brown, 1999). It has been suggested that a history of previous treatment may well be a marker for more severe drug problems (Hser et al, 1999). They were also less likely to be using heroin daily and to be committing crime at treatment in-take. Overall, these patterns suggest a less severe drug involvement profile at treatment in-take, despite their long-term heroin use histories.

Those who maintained abstinence did, however, report more severe psychological distress when entering treatment. This stands in contrast to the 12 month results from this cohort (Darke et al, 2005), where there were no differences in baseline psychological distress between those who maintained abstinence over the initial 12 months and others. Psychological distress, however, has been an inconsistent predictor of opioid treatment outcome. While some longitudinal studies report an association with poorer outcomes (Joe, Grella, Hsieh, Anglin & Brown, 1999; Kosten, Rounsaville & Kleber, 1986; Simpson & Marsh, 1986), others report no association, particularly in relation to continued drug use (Ball & Ross, 1991; Cacciola, Alterman, Rutherford, McKay & Mulvaney, 2001; Darke et al, 2005; Rounsaville, Kosten, Weissman, & Kleber, 1986). The current results indicate that the factors that predict short-term outcome may not be the identical to those that predict long-term outcome. It is possible that the higher levels of distress amongst the abstinent in this study were a motivator to seek long-term changes in behaviour. Certainly the current results suggest that psychological distress should not automatically be seen as a marker for poor outcome.

In interpreting these results, some caveats need to be borne in mind. Firstly, the study is based upon self-report, and biomarkers were only collected at 3 month follow-up. As such, caution needs to be exercised in interpreting reported drug use rates. Hair analyses at 3 months, however, showed respectable concordance with self reported heroin use, and most discordance was from reported use *not* being detected. Self-reported use also varied widely across drug classes, as has been seen amongst the cohort at 3, 12 and 24 months (Darke et al, 2006; Ross et al, in press; Teesson et al, 2006), with no obvious global “halo effect”. Secondly, as in all longitudinal studies,

there was loss to follow-up. While some caution must always be exercised, it should be noted that there were no major differences between those interviewed and those lost to follow-up in demographic, drug use or previous treatment variables.

In summary, despite a decline in the proportion of this cohort of long-term heroin users who maintained complete heroin abstinence from baseline, there were substantial increases in 12 month abstinence patterns across follow-up. The fact that a large proportion of those who maintained their abstinence were no longer in treatment underlines the possibility of achieving long-term change and moving on from treatment. The results are encouraging for the long-term efficacy of treatment for opioid dependence, and illustrate the importance of stable treatment.

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Table 1
Treatment exposure and drug use at 36 months

	Males (n=278)	Females (n=151)	All (n=429)	Gender comparisons
Currently in treatment (%)	49	62	53	OR 1.70, CI 1.14-2.54*
Any treatment (%)	99	100	99	ns
<i>Treatment exposure over 36mths (%)</i>				
MT	71	80	74	OR 1.67, CI 1.03-2.63
RR	41	32	38	ns
DTX	57	39	51	OR 0.48, CI 0.33-0.73
Total days enrolled in treatment (mdn)	371.5	583.5	428.5	U=16,591, p<.001
No. treatment episodes (mdn)	3	3	3	ns
<i>Drug use (past mth)</i>				
<u>Daily heroin use (%)</u>				
Baseline	78	78	78	ns
36 mths	14	12	14	ns
<u>No. other drug classes used</u>				
Baseline	3.8	4.1	3.9	ns
36 mths	1.8	1.8	1.8	ns

* Reference group=Males

Table 2

Current and sustained heroin abstinence across 36 months

Abstinence	Follow-up point			Analyses
	12 months %	24 months %	36 months %	
<i>All (n=429)</i>				
Preceding month	64	67	66	ns
Preceding 12 mths	14	33	40	$Q_2=102.4, p<.001$
Sustained 36 mths	14	11	8	$Q_2=35.6, p<.001$
<i>Males (n=278)</i>				
Preceding month	62	63	64	ns
Preceding 12 mths	13	29	37	$Q_2=51.9, p<.001$
Sustained 36 mths	13	9	7	$Q_2=24.1, p<.001$
<i>Females (n=151)</i>				
Preceding month	68	73	70	ns
Preceding 12 mths	16	39	47	$Q_2=51.6, p<.001$
Sustained 36 mths	16	13	10	$Q_2=12.0, p<.01$

ns=not significant

Table 3

Treatment and other factors associated with sustained 36 month heroin abstinence

Variable	Abstinent 36 mths (n=35)	Heroin use (n=393)	Comparisons
<i>Demographics</i>			
Age	30.2	29.5	ns
Sex (% male)	57	66	ns
<i>Treatment</i>			
Treatment exposure prior to ATOS (%)	80	91	OR 0.40, CI 0.16-0.99
Current treatment (%)			
Not in treatment	63	45	OR 0.49, CI 0.24-0.99#
MT	29	50	
RR	0	1	
DTX	0	0	
Other	6	3	
Total treatment days (36 mths)	470.2	511.9	ns
No. treatment episodes (36 mths) (mdn)	2	3	U=3614.5, p<.001
Multiple treatment episodes (%)	60	86	OR 0.23, CI 0.11-0.49
<i>Drug use</i>			
Heroin use career (yrs) (mdn)	8	7	ns
Heroin dependence symptoms (mdn)	6	6	ns
Daily heroin use (%)	60	80	OR 0.39, CI 0.19-0.79
No. drug classes used	4.0	3.5	ns
<i>Crime</i>			
Any illegal activities (%)	34	56	OR 0.41, CI 0.28-0.85
<i>Psychopathology</i>			
SF 12 (mental health)	26.8	31.8	t ₄₂₇ =2.7, p<.01
Major Depression (%)	26	24	ns
BPD (%)	37	44	ns
ASPD (%)	74	69	ns

*Referent group=heroin use; ns=not significant

#Treatment vs not in treatment

Table 4

Logistic regression predicting sustained heroin abstinence over 36 months

Variable	OR	CI	P value
Treatment episodes	0.58	0.44-0.75	p<.001
Baseline crime	0.42	0.20-0.91	p<.05
SF12 mental health score (baseline)	0.94	0.90-0.98	p<.001

Model diagnostics: $\chi^2_3=40.2$, p<.001, Hosmer-Lemshow $\chi^2_8=5.1$, p>.7