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Health services use and treatment costs over 12 months among heroin users:

Findings from the Australian Treatment
Outcome Study (ATOS)

NDARC Technical Report No. 203

HEALTH SERVICES USE AND TREATMENT
COSTS OVER 12 MONTHS AMONG HEROIN
USERS:
FINDINGS FROM THE AUSTRALIAN
TREATMENT OUTCOME STUDY (ATOS)

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EXECUTIVE SUMMARY

Introduction

Heroin use results in a significant social burden. In addition to the wider social impact, heroin use represents a serious public health concern creating many challenges for policy makers and treatment providers alike. This health burden comes at some cost; heroin dependence accounts for a significant proportion of the total burden of disease and injury related to illicit drugs in Australia. Despite this, there is little information on either the use of health care services generally, or more specifically the use of drug treatment services over extended periods of time, by heroin users in Australia.

This report documents economic costs of treatment for heroin and other health services using data from the Australian Treatment Outcome Study. The aims of this report are to:

1. Determine patterns of treatment for heroin dependence and other health services use among heroin users
2. Determine the costs of treatment and other health services use.

This current report presents 12 month cost data from New South Wales, South Australia and Victoria.

Method

Seven hundred and forty five individuals entering treatment and 80 heroin users not seeking treatment were recruited into the study and interviewed by trained research staff using a structured questionnaire. A total of 649 individuals, who were followed up at 12 months and for whom there was complete resource use information are included in the report. Data was collected on all treatment experiences (type, and number of days of treatment) over the 12-month follow-up, use of other health care services, as well as their heroin and other drug use, mental health and criminal activity. Treatment and other health services use were costed using a set of standard prices.

Results

Index treatment

- The costs of index treatments over the 12-month follow-up period totalled \$1,894,861 for the 649 subjects. On average the index treatment costs were \$2,920 per person with an average of 83 days in treatment or an average cost per day of \$35 (range \$10 to \$203).

Non-index treatments

- In addition to the index treatment, the sample received other drug treatments during the 12 months. The total cost of this other drug treatment was \$2,120,283 with a mean of \$3,267. Seventy percent of the sample reported at least one episode of non-index treatment during the 12 months with 41.6% of the sample having some form of maintenance therapy, 19.6% residential rehabilitation and 25.6% detoxification with clear differences across the original treatment groups.

Total treatment (combining index and non-index treatment)

- The total treatment (index and non-index) costs at 12 months were \$4,015,363 for the 649 individuals, with a mean of \$6,187. Overall, the mean length of stay was 179.5 days over an average of 2.6 episodes of care.
- As is common in health care expenditures, the distribution of the total costs is skewed, with 25% of individuals accounting for only 6% of the costs, and 25% of individuals accounting for 60% of total treatment expenditures.

Other health system utilisation and costs

- The expenditure for the whole sample on non-treatment health services use (HSU) for one month at baseline was \$252,862 and for one month at 12 months was \$298,843, an 18% increase. The mean expenditures increased in all groups except for the residential rehabilitation group where the mean expenditures declined from \$777

at baseline to \$473 at 12 months. Hospital/ambulance expenditure accounted for more than half the expenditures at both baseline and the 12-month follow-up, at 57.8% and 63.6% respectively.

- As with the treatment expenditures, a small proportion of the ATOS cohort incurred the majority of the HSU expenditures. At baseline, 19% of individuals consumed no HSU resources, while 15% of the group consumed 74% of the resources. A similar pattern is seen at the 12-month follow-up interview, where 23% reported no additional use of health care services, and 79% of the resources were used by 14% of individuals.

Conclusion

It is beneficial to consider what the \$6,187 of drug treatment purchased. There was, on average, 15.3 more heroin free days per month at twelve months, a 76% improvement. There was a 55% improvement in rates of abstinence and a 52% decrease in the numbers who committed a crime in the previous month. In this study, the cost savings related to decrease in crime were not estimated, however results from NTORS in the UK determined that the cost of crime decreased by 50% in two in two years post treatment compared to the year prior to treatment. This suggests that the purchase of the drug treatment provides substantial benefit to society in terms of decrease in heroin use, both in terms of abstinence and harm reduction and a decrease in crime.

1. INTRODUCTION

Heroin use results in a significant social burden. Several international studies such as the Drug Abuse Report Program (DARP), Treatment Outcome Prospective Study (TOPS), Drug Abuse Treatment Outcome Study (DATOS) and National Treatment Outcome Research Study (NTORS) (Simpson et al., 1997, Hubbard et al., 1989, Gossop et al., 1997, Gossop et al., 1998, Gossop et al., 2000, Gossop et al., 2003, Godfrey et al., 2004, Simpson and Sells, 1982) have examined treatment use and outcomes in the United States and the United Kingdom. When the costs of treatment in these and other studies were compared to the social benefits gained from treatment, including decreased crime costs, the findings were unvarying, that is, treatment is cost beneficial from the societal perspective (Harwood et al., 1988, Gerstein et al., 1994, Godfrey et al., 2004, Gossop et al., 1998, Flynn et al., 1999, Cartwright, 2000).

Heroin use is a serious public health concern that creates many challenges for policy makers and treatment providers alike. The general health of heroin users has long been recognised to be poor (Ryan and White, 1996, Cherubin and Sapira, 1967, Webster et al., 1977). In addition to overall poor health, heroin users also have specific health problems related to overdose, blood-borne viruses, injection-induced vascular damage (Degenhardt, 2001, Warner-Smith et al., 2001, Morrison et al., 1997, Crofts and Aitkin, 1997) and high rates of depression and other psychopathology (Brienza et al., 2000, Brooner et al., 1997, Croughan et al., 1982, Darke and Ross, 1997, Khantazin and Treece, 1985, Kosten and Rounsaville, 1988, Rounsaville et al., 1982). Heroin users also engage in frequent poly drug use (Darke and Ross, 1997, Kidorf et al., 1998) including prescription pharmaceutical products (Ross et al., 1996, Darke et al., 2003) which often leads to frequent visits to multiple doctors (ie. doctor shopping) (Adair et al., 1996).

This health burden comes at some cost; heroin dependence accounts for a significant proportion of the total burden of disease and injury related to illicit drugs in Australia (Mathers et al., 1999) with estimates that 23% of the burden of heroin is due to health

care costs (Mark et al., 2001). In the US, French et al. (2000) reports that injecting and chronic drug users consumed approximately US \$1000/year more in health care costs than the general population when inpatient, outpatient and emergency costs are considered (French et al., 2000). Despite this, there is little information on either the costs associated with the use of health care services generally, or more specifically the use of drug treatment services over extended periods of time, by heroin users in Australia. A few Australian randomised controlled trials have compared the costs and outcomes of providing specific forms of treatment interventions for heroin dependence (Doran et al., 2003, Gibson et al., 2003, Mattick et al., 2001). However these studies, which involved detailed costing of treatment permitting the comparison of the cost-effectiveness of various treatment interventions for a short period (1 week to 6 months), often did not report data on subsequent drug treatment provision or other health care use during the period of follow-up.

This report documents the economic costs of treatment for heroin dependence and other treatment services based on data collected by 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. ATOS is being conducted by the National Drug and Alcohol Research Centre (NDARC) in collaboration with the Drug and Alcohol Services Council (DASC) of SA and Turning Point Alcohol and Drug Centre, Melbourne.

The main purpose of ATOS is to examine the effectiveness of treatment for heroin dependence as it is delivered in everyday practice. Heroin users were recruited on entry to one of the three major treatment modalities in Australia (methadone/buprenorphine maintenance treatment, detoxification or residential rehabilitation), and were re-interviewed at 3 and 12 months post treatment entry. A comparison group of heroin users who were not in treatment were also recruited in order to allow more confidence in attributing outcomes to treatment. The study commenced in February 2001, and an examination of the baseline characteristics of the sample indicated a high level of poly

drug use, criminality and psychopathology among Australian entrants to treatment for heroin dependence (Ross et al., 2002a, Weekley et al., 2002, Holt et al., 2002).

Examination of use of health services at baseline demonstrated high levels of health services utilisation among this cohort (Darke et al., 2003). At 12 months there were substantial reductions in drug use, risk-taking, crime and injection-related health problems across all treatment groups and less marked reductions among the non-treatment (NT) group. Psychopathology was also dramatically reduced among the treatment modalities, while remaining fairly stable among the non-treatment group (Ross et al., 2004).

This report documents the economic costs of treatment for heroin dependence as well as the economic costs of other health services. This study uses the real world context of ATOS to collect information on the resources used in the original (index) treatment, but also those used in subsequent drug treatment programs. In addition information is collected on the use of general health care services at baseline and in the month prior to the 12-month follow-up interview.

The aims of this study are to:

1. Describe patterns of treatment for heroin dependence and other health services use among heroin users
2. Determine the costs of treatment and other health services use

2. METHODS

2.1 Procedure

ATOS is a longitudinal study of treatment outcome for heroin dependence, with follow-up interviews conducted at 3 and 12 months post treatment entry. Baseline data were collected between February 2001 and August 2002. Treatment entrants were recruited from 38 agencies treating heroin dependence in Sydney, Adelaide and Melbourne. They comprised 21 methadone/buprenorphine maintenance (MT) agencies, 17 detoxification facilities (DTX), and 8 residential rehabilitation units (RR). Eight agencies provided both maintenance and detoxification services. Additionally, in Sydney, a comparison group of heroin users not currently in or seeking treatment (NT) was recruited from needle and syringe programs within the same 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) aged 18 years or over, iv) agreed to give contact details for follow-up interviews, and v) had a good understanding of English. Participants were paid up to AUS\$30 for completing each interview, which took up to 90 minutes to complete at baseline and approximately 20 minutes at the 3 and 12 month interviews.

2.2 Structured interview

At baseline, 3 months and 12 months, participants were administered a structured interview. Sections addressed demographic characteristics, treatment history, drug use history and heroin overdose history. 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 et al, 1992). General physical and mental health was measured using the Short-Form 12 (SF-12; Ware et al, 1996). Past month diagnoses of DSM-IV Major Depression were obtained using the version of the Composite International Diagnostic Interview used in the National Survey of Mental Health and Well-Being (Andrews et al, 1999). Lifetime measures of Post Traumatic

Stress Disorder, Anti-Social Personality Disorder and Borderline Personality Disorder were taken at baseline (see Ross et al, 2002 for details).

A specific section, which was adapted from the NEPOD study, (Mattick et al., 2001) was used to obtain health service utilisation over the month preceding interview.

Information was collected on frequency of use of ambulance services, inpatient and outpatient hospital services, general practitioner (GP) consultations, specialist consultations, diagnostics (including blood and urine tests, x-rays and scans), dental services, other health professional consultations, psychiatric consultations and prescription medications.

2.3 Costing perspective

The preferred perspective in any economic assessment of resource use, that of the societal perspective, which would have included the costs of crime, court costs, costs of jail and lost productivity was beyond the scope of this project. As some participants were required to pay for treatment, (for example, in private clinics, dosing in pharmacies, or counselling), the standard health department/s perspective was also not appropriate. The perspective selected for costing of resources in this study was the treatment cost and included costs to the health department (Commonwealth and States) plus the costs to the individual for treatment and other health services.

Costs were estimated for all drug treatment services used by ATOS participants over the 12-month follow-up period but only for one month prior to each interview for other health services. Personal costs do not include costs of travel or any other costs not directly related to health services use. Table 1 provides a summary of which treatment settings required private expenditures. Interviews conducted at the private clinics found that participant visits to GPs were bulk-billed resulting in no cost to the individual, and this assumption was extended to include all visits to a general practitioner. These costing decisions adhere to the costing principles outlined by Drummond et al (1997).

Table 1: Who pays for drug treatment services?

	Government: State or Commonwealth	Individual
Detoxification - public setting	✓	
Detoxification - private setting*	✓	✓
Public clinic for methadone/buprenorphine maintenance	✓	✓a dispensing fee paid if obtaining at pharmacy
Private clinic for methadone/buprenorphine maintenance	✓	✓
Residential rehab	✓	✓
Public hospital	✓	
General practitioner	✓	**
Medications (not methadone/buprenorphine)	✓***	✓
Ambulance	✓	✓
Social Worker	✓	✓
Psychologist	✓	✓
Counsellor	✓	✓
Dentist	✓	✓

* Data was not available for the costs for detoxification in the private setting; therefore costs from the public sector were used.

** for the purposes of this study assumed all visits were bulk billed to Medicare ;

*** if the medication is on the PBS.

2.4 Consistent methodology for determining costs

Table 2 provides a list of the costs used in this study and their source. There were not the funds available in this study to document actual resource use by all participants. Therefore, it was decided to collect information on days and type of services and then cost these days of care using standard prices from published sources including the Medical Benefits Schedule (MBS)(CDHA, 2004a), Department of Veterans Affairs (DVA, 2004), Pharmaceutical Benefits Schedule (PBS)(CDHA, 2004b), TAFE (DET, 2004), National Hospital Cost Data Collection (AN-DRG) (CDHA, 2001) and other studies, primarily the National Evaluation of Pharmacotherapies for Opioid Dependence (NEPOD)(Digiusto and Kimber, 1999, Mattick et al., 2001). Detailed micro-costing techniques were used in NEPOD to document costs of detoxification (standard inpatient and outpatient, rapid detoxification under anaesthesia or sedation, and buprenorphine)

and the costs per day maintenance therapy (methadone, buprenorphine and naltrexone). As no other valid costs for these treatments were found, costs from this study were used throughout this project where appropriate; alternate sources of costs are discussed below. Where a standard price per treatment episode was not available, cost information from key informant interviews was used. These interviews were conducted with selected index treatment providers in NSW. Key informant interviews addressed the types of services provided, the frequency with which they were provided, who paid for the service and how much it cost.

Once type, location and duration of treatment were identified the appropriate cost was attached to each occasion of treatment. Then all costs were summed for each individual obtaining a total for index treatment, non-index treatment and for other health services used. As the study period was over several years, a standardised cost in 2002 Australian dollars was calculated using the health Consumer Price Index (CPI) (ABS, 2004).

2.5 Index treatment costs

Index treatment refers to the treatment that participants were commencing at the time of baseline interview. Information on days in index treatment was collected from patient treatment files. Costs, as presented in Table 2, were applied to each day or episode of treatment according to type and location of treatment.

2.5.1 Methadone and buprenorphine maintenance

As actual daily dose information was not available, an average dose of 75mg dose of methadone was used across all participants. This assumption, given the low price of methadone, means that any error on dose would have a minimal impact on cost.

Buprenorphine is a more costly medication therefore its cost was based on the median dose of participants of 12 mg at 3 months, and 10mg at 12 months. The price for these doses was obtained from the PBS (CDHA, 2004b).

2.5.1.1 Public clinics

The key informant interviews conducted at the clinics involved in the study were reviewed to assess whether the clinics operated in a manner consistent with that of the

agencies in NEPOD. Once this assurance was obtained, costs per day from NEPOD, adjusted to 2002 dollars, were applied to days in treatment. A standard cost for methadone and a standard cost for buprenorphine were used across all public facilities.

2.5.1.2 Private clinics

Information from key informant interviews was used to determine the costs to government and costs to the individual. Information was obtained on the frequency and type of diagnostic tests undertaken, frequency of visits to a general practitioner and the standard fees charged to clients. Diagnostics and medical visits were costed at 85% of the MBS fee (CDHA, 2004a) with the assumption that no extra billing occurred (this was confirmed in key informant interviews). The fee for medical visits was weighted based on the assumption that initial assessment and consultation would be longer than the subsequent monitoring visits.

2.5.1.3 General practitioner or clinic based with dispensing at a pharmacy

This treatment involved initial contact at a specialized drug and alcohol clinic with subsequent case management at a public clinic or with a GP, with methadone or buprenorphine dispensed at a pharmacy. The initial treatment at the clinic was costed as above for public and private clinics. A similar model of subsequent case management and pharmacy dispensing was reported in NEPOD (Mattick et al., 2001), therefore NEPOD costs were used as a base. These costs were then updated using NSW pharmacy costs derived from a survey of pharmacies in the area where this model of care was used. In this model, the GP or clinic costs are public expenditure with the individual paying a dispensing cost at the pharmacy.

2.5.2 Detoxification

2.5.2.1 Public detoxification services

Specific detoxification costs per episode (inpatient, outpatient, rapid detoxification and buprenorphine) as developed in NEPOD (Mattick et al., 2001) were used. These costs were based on the average length of stay for each type of detoxification. No cost adjustment was made in ATOS for length of stay. The reason for this is that the first few days of treatment are the more resource intensive, thus total average cost divided by

average length of stay is not a valid estimate of cost per day. As we did not have a method for assessing the marginal daily costs of our study group, we used average cost for each type of detoxification. This will overestimate the costs for some participants and underestimate the cost for others.

2.5.2.2 Private detoxification services

With the exception of one facility, all private detoxification services providing index treatment in this study involved the use of outpatient buprenorphine. As costs were not available for this clinic, public costs were applied. Only six percent of the detoxification group were treated in this service. For private outpatient buprenorphine detoxification, costs to the government and the individual were based on key informant interviews. Information was obtained on the frequency and type of diagnostic tests that were undertaken, frequency of visits to general practitioners and standard fees charged to clients. Diagnostics and medical visits were costed as 85% of the MBS fee (CDHA, 2004a) and assumed no extra billing occurred. Again, the fee for medical visits was weighted to account for the longer initial visits.

2.5.3 Residential Rehabilitation

A cost per day for residential rehabilitation was constructed on the basis of financial data from the facilities which had the most participants involved in the study. Where appropriate, these costs were supplemented by TAFE data (DET, 2004) for educational courses and MBS data (CDHA, 2004a) for diagnostics and medical services provided to participants while in residential rehabilitation. In the two facilities where data were obtained, the total cost of providing care also included personal costs. These costs are presented separately where appropriate, as not all facilities had a client payment system. Costs for women were higher as often child care was also necessary.

Table 2: Costs for Index and Non-index Opiate Dependence Treatment (Australian 2002 dollars)

Costs for Index Treatment	Public cost	Private cost	Average episode (days)	Source
Maintenance	<i>Cost per day \$</i>			
methadone (public clinic)	10.89	—	X	NEPOD*
methadone (GP or public clinic plus pharmacy)	2.27	4.65	X	NEPOD*, Pharmacy
methadone (private clinic)	4.25	6.70	X	Key informant interview, MBS, PBS
buprenorphine (public clinic)	16.82	—	X	NEPOD*
buprenorphine (private clinic) 10 mg - use at 12 months	9.63	—	X	Key informant interview, MBS, PBS
buprenorphine (private clinic) 12 mg - use at 3 months	11.13	—	X	Key informant interview, MBS, PBS
buprenorphine (GP or public clinic plus pharmacy)	7.87	5.92	X	NEPOD*, Pharmacy
Detoxification	<i>Cost per episode \$</i>			
inpatient (conventional and buprenorphine)	1,446	—	3.5	NEPOD*
outpatient (not buprenorphine)	623	—	5.0	NEPOD*
buprenorphine (outpatient only, public setting)	506	—	6.4	NEPOD*
rapid opioid detoxification using sedation ODS	2,049	—	2.8	NEPOD*
buprenorphine (outpatient only, private setting)	13.34 (per day)	8.57 (per day)	X	Key informant interview, MBS, PBS
Residential rehabilitation	<i>Cost per day \$</i>			
cost per day women – private costs required	77.91	24.60	X	Key informant interview, TAFE, MBS
cost per day men - private costs required	70.98	22.41	X	
cost for - women - no private costs	102.51	—	X	
cost for men – no private costs	93.39	—	X	
cost initial assessment (once only per episode)	121.95	—	X	MBS
Cost for Non-Index Treatment				
Rapid opiate detoxification- cost per episode	2,049.25	—	2.8	NEPOD
Outpatient counseling – cost per visit	63.81	—	X	DVA
Naltrexone maintenance – cost per day	12.17	—	X	NEPOD

* NEPOD costs adjusted from 1998 to 2002 using CPI

2.6 Non-index treatment costs

Non-index treatment refers to any treatment for opiate dependence that participants underwent subsequent to their index treatment. Detailed questions concerning the type, frequency and duration of such treatments were asked in the 3 and 12-month follow-up interviews. This information was used to estimate total costs for non-index treatment using the costs outlined in Table 2 for index treatment. In most instances it was not known whether non-index treatment was provided by the public or private sector, therefore it was assumed that they were provided by the public sector and the costs for public treatment were applied. As rapid opiate detoxification and naltrexone maintenance were utilised by participants, these were costed using information from NEPOD (Mattick et al., 2001) and outpatient counselling costs were obtained from the DVA (DVA, 2004)(see Table 2).

2.7 Other health services utilisation (HSU) in the month preceding interview

Other health service utilisation refers to any health services that participants may have received in addition to their treatment for heroin dependence. The frequency and cost of these services was determined for the month preceding each follow-up interview. HSU data were collected at baseline to permit a comparison to data collected at 12 months. The baseline data collection is important to establish at baseline whether any participants were receiving treatment for chronic health conditions; to assess the costs and frequency of high resource use treatments; and to assess the frequency of less costly treatments such as visits to general practitioners, counsellors, and dentists.

2.7.1 Hospital visits

Self reported data stating the reason and length of stay for inpatient hospital admissions was used to select an appropriate Diagnostic Related Group (CDHA, 2001). Costs for outpatient and emergency visits were obtained from Appendix 3 of the Manual of Resource Items (CDHA, 2002). A specific cost category was used where there was sufficient information, and where there was insufficient information the price for 'General Medical

doctor present' was used. For participants who stated that they were admitted to hospital but did not stay overnight, the relevant cost from the Appendix 3 of the Manual of Resource Items for Emergency Department and Outpatient presentations was used. Costs were converted to 2002 dollars using the health CPI (ABS, 2004) where necessary.

2.7.2 Home nursing

One participant received home nursing. An estimated weighted average national cost of Home and Community Care services provided in the Manual Resource Items (CDHA, 2002) was used to cost this care.

2.7.3 Ambulance

A general cost of \$238.63 (from the Private Health Insurance Administration Council), (PHIAC, 2003) was applied for each time participants reported use of ambulance services. A different price structure for whether or not the individual required transfer to hospital was not available.

2.7.4 Medications

Costs to the government for prescribed medications were obtained from the PBS (CDHA, 2004b), using the dispensed price for maximum quantity and the least costly brand. When there were multiple prices per dose, the most common dose was used to then convert the price into a price per mg. Where there was no price on the PBS database, prices were obtained from MIMS (MIMS, 2003). Over the counter medications were not included.

For medications covered by the PBS (CDHA, 2004b), the consumer is charged a co-payment of \$3.70 for every medication obtained if they are a concessional patient or \$23.10 for general patients. The status of the study group with respect to whether or not they were concessional patients was unknown, however only 17% reported their main source of income being from a wage or salary, therefore a conservative decision was made to use the concessional co-payment for all medications obtained through the PBS.

2.7.5 Other health services utilisation

Costs for other health services are presented in Table 3. Services such as general practitioner visits, specialist doctor visits and diagnostics were priced according to information from the MBS (CDHA, 2004a) and Appendix 3 of the Manual of Resource Items (CDHA, 2002).

Costs for dentist, other health professional and psychiatric related visits were obtained from the MBS and the Department of Veteran Affairs (DVA) (DVA, 2004).

Table 3: Costs for HSU

Service	Cost Source	Year	Cost per visit/test 2002 \$	Description
GP visit	MBS	2002	17.85	Standard 5-20 minute consultation
Specialist doctor	MBS	2002	29.60	Subsequent consultation
Urine test	Manual of Resource Items	2001	18.54	Microbiology
Blood tests				
General	Manual of Resource Items	2001	25.75	Hematology
Liver function	MBS	2002	16.30	
Blood borne virus	MBS	2002	59.40	
X-ray or Scan	Manual of Resource Items	2001	59.74	Miscellaneous imaging
Dentist				
First visit	DVA	2003	32.77	Comprehensive oral exam
Subsequent visits	DVA	2003	61.19	30 minute consultation
Other health Professionals				
Chiropractor	DVA	2003	31.19	Subsequent consultation
Dietician	DVA	2003	31.78	Subsequent consultation
Speech pathologist	DVA	2003	63.37	Consultation
Osteopath	DVA	2003	31.19	Subsequent consultation
Optometrist	DVA	2003	28.47	Subsequent consultation
Physiotherapist	DVA	2003	33.61	Standard consultation
Occupational therapist	DVA	2003	64.55	Subsequent consultation
Psychiatrist	MBS	2002	59.65	15-30 minute consultation
Psychologist	DVA	2003	63.81	Subsequent consultation
Social/welfare worker	DVA	2003	20.63	Subsequent consultation
Other therapist/counsellors	DVA	2003	63.81	Clinical counsellor, subsequent consultation

2.8 Detoxification prior to index residential rehabilitation

Participants entering residential rehabilitation at baseline were required to have undertaken a detoxification program prior to entering the rehabilitation unit. These costs are estimated and presented separately in the results section. They are not included in the treatment costs as they occurred prior to the commencement of the index treatment. Nor are they included in the baseline HSU costs as it was required treatment, and participants should not have had any treatment for drug use as a condition of eligibility for the study. Information concerning the type of detoxification each participant underwent was collected at the time of baseline interview. Patients for whom this information was unavailable were allocated to detoxification type according to proportions in the NSW data. The appropriate costs from Table 4 were then applied, with cold turkey being assigned a zero cost.

Table 4: Detoxification prior to attending index residential rehabilitation

Type of detox prior to Index RR	Frequency	Percent in each type of detox (%)	Total cost
Inpatient	95	52.9	\$137,636
Outpatient	19	10.6	\$118,72
Cold turkey	66	36.5	\$0
Total	180	100	\$149,508

2.9 Statistical analysis

Where data for continuous variables were non-skewed, means were reported and one-way ANOVAs were performed. Where data were skewed, medians were reported and Mann-Whitney U tests were performed. Chi squared analysis were conducted in order to examine group differences involving dichotomous categorical variables, and Odds Ratios (OR) with 95% Confidence Intervals (95) were calculated. In order to determine factors independently associated with dichotomous variables, logistic regressions were conducted. Independent predictors of continuous variables were determined using linear regression. All analyses were conducted using SPSS for Windows, version 11.0 (SPSS Inc, 2003).

3. RESULTS

3.1 Sample characteristics

A total of 657 individuals were re-interviewed at the 12-month follow-up, representing 80% of the sample of 825 recruited into the study at baseline. Follow-up rates for the four index groups were: 82% of MT, 82% of DTX, 78% of RR, and 66% of NT.

In order to determine factors associated with cohort retention at 12 months, a logistic regression was conducted. Variables entered into the model included having entered treatment at baseline (yes/no), age, gender, previous treatment history (yes/no), criminally active (yes/no), history of attempted suicide, number of heroin use days in the month preceding baseline interview, major depression at baseline, and presence/absence of a personality disorder at baseline. The overall model was significant ($\chi^2_{7df} = 64.5, p = .01$). Participants in the treatment groups were more likely to be retained than those in the NT group (81% v 66%, OR 2.24, 95% CI: 1.35-3.74), and those with a suicide history were less likely to be retained (75% v 83%, OR 0.59, 95% CI: 0.41-0.85). Overall, the sample re-interviewed at 12-month follow-up was broadly representative of the initial sample of 825 recruited into ATOS.

Some baseline characteristics are presented below which are illustrative of the differences across groups but additional information can be found in the baseline reports (Ross et al., 2002b, Holt et al., 2002, Weekley et al., 2002).

3.1.1 Demographics

As the participants in this study self-selected into treatment there is no reason to expect that the characteristics of the index treatment groups would be similar, and as illustrated below there are significant differences between groups.

For the remainder of this report the data collected on 649 participants are used, as cost data was incomplete for 8 individuals and therefore they were excluded. At baseline, the mean age of the 649 participants was 29.5 yrs (SD 7.9, range 18-56), and 64% were male. The age by treatment modality varied across groups ($F_{3,645} = 4.2, p = 0.006$) with DTX group being older

than the RR group (30.5 v 27.7, $p=0.01$). The percentage of male participants recruited according to treatment modality was also different ($\chi^2_{3df} = 14.48$, $p = 0.002$) with more males recruited in DTX than MT (72% v 55%, OR 2.09, 95% CI 1.42-3.07) (Table 5).

3.1.2 Heroin use

Measures of heroin use at baseline showed some variation across the original groups. The age of first intoxication varied by group with a mean of 13.5 years ($F_{3, 645} = 4.66$ $p=0.003$). The DTX, MT, and NT groups all started at an older age than the RR group. Reported days of heroin use in the previous month at baseline varied by treatment modality ($F_{3, 644} = 18.27$ $p<0.001$). The DTX group had more heroin use days than MT (19.2, $p<0.001$) and RR (17.1, $p<0.001$), and NT had more than RR (21.8 versus 17.1. $p=0.003$). Overall, the sample had used a mean of 4.9 (SD 1.7, range 1-10) drug classes in the month preceding interview. There was some variation across groups ($F_{3, 645} = 4.3$ $p=0.005$), with NT using a significantly greater number of drug classes than MT (5.5 vs 4.7, $p=0.024$).

Overall, 26% of the sample had an overdose in the 12 months prior to the baseline interview. Again there was some variation across groups ($\chi^2_{3df} = 1.25$, $p = 0.01$). Of the RR group, 37% reported at least one overdose in the previous year which was significantly more than the 22% of the MT group ($p=0.01$) and 24% of the DTX group ($p=0.03$).

3.1.3 Treatment

At baseline the median number of previous treatment episodes was five, again with some differences across the index groups ($\chi^2_{3df} = 29.6$, $p<0.001$). RR, with a median of 8 previous treatment episodes, had significantly more than MT (4, $p<0.001$); DTX (5, $p=0.016$), and NT (5, $p=0.03$). The DTX group also had more episodes than MT (5 versus 4, $p=0.013$).

3.1.4 Health status

The whole sample had considerable mental health co-morbidity at baseline, however again there was considerable variation between groups. The mean SF-12 mental health score was 31.5, with mental health scores differing significantly according to treatment modality ($F_{3, 643} = 11.3$ $p < 0.001$) with RR (28.1) showing greater disability than MT (32.3, $p = 0.004$). All of the groups, MT (32.3, $p = 0.01$), DTX (31.3, $p = 0.001$) and RR (28.1, $p < 0.001$) showed more disability than NT (37.7). Over the whole sample, 40% met the criteria for a lifetime diagnosis of post traumatic stress disorder (PTSD). Forty five percent of the sample was assessed as having a diagnosis of borderline personality disorder (BPD). RR had a higher percentage of people with PTSD compared to DTX (50% versus 36%, OR 1.77, 95% CI 1.15-2.73) and NT (50% versus 30%, OR 2.28, 95% CI 1.16-4.48). With BPD, the DTX modality had higher rates than MT (46% versus 34%, OR 1.61 CI 1.10- 2.34) and RR was higher than all the other modalities (63% versus 40%, OR 2.46, 95% CI 1.67-3.64).

Table 5: Selected baseline characteristics

	Total (N=649)	MT (N=225)	DTX (N=235)	RR (N=136)	NT (N=53)	Comparisons
Demographics						
Age	29.5	29.4	30.5	27.7	30.7	$F_{3,645}=4.2, p=0.006$
Male (%)	64	55	72	63	68	$\chi^2_{3df} = 14.48, p=0.002$
Drug use						
Mean age first intoxicated (any drug)	13.5	13.7	13.6	12.6	14.1	$F_{3,645} = 4.66 p=0.003$
Heroin use days (last month)	20.3	19.1	22.8	17.3	21.8	$F_{3,644} = 18.27 p=0.000$
Drug classes used (last month)	4.9	4.7	4.9	5.1	5.5	$F_{3,645} = 4.3 p=0.005$
Overdose past 12 months (%)	26	22	24	37	21	$\chi^2_{3df} = 1.25, p=0.01$
Treatment						
Median number of treatment episodes	5	4	5	8	5	$\chi^2_{3df} = 29.6, p=0.000$
Physical Health						
SF-12	43.6	43.6	42.8	45	43.8	NS
Injection related health problems	75	71	74	84	76	NS
Risk taking						
Daily injections (%)	80	78	84	75	83	NS
Mental Health						
SF-12	31.5	32.3	31.3	28.1	37.7	$F_{3,643} = 11.3 p=0.000$
Post-traumatic stress disorder (%)	40	40	36	50	30	$\chi^2_{3df} = 9.14, p=0.028$
Borderline personality disorder (%)	45	34	46	63	43	$\chi^2_{3df} = 0.1, p=0.000$

3.2 Outcomes

Over the 12-month follow-up period there were considerable improvements in the general functioning of all groups. The levels of heroin use and criminal involvement at baseline and 12 months are presented here to demonstrate that the provision of treatment has beneficial outcomes. An in depth analysis of these and other outcomes is discussed elsewhere (Ross et al., 2004). The percentage of participants abstinent from heroin increased from 2% at baseline to 56% at the 12 month interview. The percentage of the MT group abstinent at the 12 month interview was 65.3%, 51.5% of the DTX and 62.2% of the RR. A greater percentage of those recruited into an index treatment compared to those not in treatment were abstinent at the 12 month interview. However, both those in an index treatment group and the non-treatment group showed an increased percentage of participants abstinent from heroin. At 12 months (baseline) heroin had been used on a mean of 2.9 (19.2) days by the MT group, 6.0 (22.8) days by the DTX group and 4.2 (17.1) days by RR and 10.3 (21.8) days by the NT group. Overall at 12 months, the proportion reporting any crime in preceding month was 26% compared to 55% at baseline, an improvement of 52%.

Table 6: Key outcome measures

Outcome	Total (N=649)		MT (N=225)		DTX (N= 235)		RR (N=136)		NT (N= 53)	
	*BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth
Heroin use days last month (mean)	20.2	4.9	19.2	2.9	22.8	6.0	17.1	4.2	21.8	10.3
Heroin abstinent last month (%)	1.7	56.2	3.6	65.3	0.0	51.5	2.2	62.2	0.0	24.5
Any crime committed last month (%)	55	26	45	19	59	28	61	26	60	39

*BL=Baseline

3.3 Treatment services and costs

3.3.1 Index Treatment

The costs of index treatments were calculated for each participant for the 12-month follow-up period and the total was \$1,894,861 for the 649 participants. On average the index treatment costs were \$2,920 per person with a 95% confidence interval of \$2,585-\$3,254 (Table 7).

Table 7: Index treatment at 12 months – costs and days in treatment

	Total (N=649)	MT (N=225)	DTX (N=235)	RR** (N=136)	NT (N=53)
Cost per person - mean	\$2,920	\$2,459	\$1,339	\$7,550	\$0
- SD	\$4,337	\$1,667	\$330	\$7,472	\$0
- median	\$1,446	\$2,491	\$1,446	\$4,080	\$0
Days - mean	83.1	224.7	6.6	76.7	0
Cost per day in treatment - mean	\$35	\$11	\$203	\$98	\$0

*** does not include an estimated total expenditure of \$149,508 (mean \$1,124) for required detoxification prior to entering RR*

The RR group has the highest mean cost of index treatment (\$7,500) and this reflects both its relatively high cost per day (\$98) and the mean length of time of 77 days (SD 76.7) in this treatment. The mean cost of MT at \$2,459 is a function of the time in treatment, which at 225 days (SD 140) is the longest, but the lowest cost per day at \$11. While the DTX group has the highest mean cost per day (\$203), this group has the lowest mean cost (\$1339) due to the short duration of treatment (6.6 days SD 3.5).

3.3.2 Non-index treatments

In addition to the index treatment, the sample received other drug treatments during the 12 months (Table 8). Seventy percent of the sample reported at least one episode of non-index treatment during the 12 months. The MT group, which had the longest mean length of time in their index treatment, were the least likely (47.1%) to engage in non-index treatment, whereas the DTX group with the shortest stay in index treatment (6.6 days) were the most likely to have used additional treatment (87.7%). Over the 12-month follow-up period, in addition to their index treatment, 41.6% of the sample had also undergone maintenance therapy, 19.6% residential rehabilitation and 25.6% detoxification with clear differences across the original treatment groups (Table 8).

Table 8: Percent of each index group with at least one non-index episode of the following:

Type of non- index treatment	Total (N=649)	MT (N=225)	DTX (N=235)	RR (N=136)	NT (N=53)
	%	%	%	%	%
Maintenance therapy	41.6	41.3	53.2	17.6	52.8
Detoxification	25.9	7.1	43.0	29.4	20.8
Rehabilitation	19.6	3.1	24.7	40.4	13.2
Naltrexone maintenance	3.7	3.1	6.8	0.7	0.0
Outpatient counselling	16.2	8.0	20.9	26.5	15.1
No non-index treatment	30.2	52.9	12.3	25.7	26.4

As discussed above, all groups used considerable additional treatment beyond their original index treatment. As a way of further understanding resource use across the groups, the mean length of time spent in non-index treatments is presented (Table 9) while Table 10 provides a summary of the total days and episodes in non-index treatment and associated costs. The mean number of days in non-index methadone was 37.0, and 20.8 for buprenorphine and 16.7 for rehabilitation. Examining the data across the groups, the tendency for the MT group to return to a form of maintenance therapy and the RR group to return to RR is evident. These data also show that the DTX group had a considerable number of days in both maintenance and rehabilitation. The NT group has a mean of 60 days in non-index MT and 18.8 days in buprenorphine. In terms of understanding resource use examining the number of detoxification episodes is also useful. On average, all groups had less than one episode of non-index detoxification, however, e.

Table 9: Time in non- index treatment over 12 months

	Total (N=649)		MT (N=225)		DTX (N=235)		RR (N=136)		NT (N=53)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Treatment days										
Methadone maintenance	37.0	78.4	47.5	91.0	39.6	75.4	7.7	34.0	56.0	95.7
Buprenorphine maintenance	20.8	58.6	15.6	52.0	32.6	73.5	9.5	36.7	18.8	47.9
Naltrexone maintenance	2.2	17.7	2.4	17.3	3.7	23.8	0.3	3.9	0.0	0.0
Outpatient counselling	2.2	7.2	1.0	5.1	2.5	7.4	3.9	9.8	1.7	5.1
Residential rehabilitation	16.7	50.3	2.8	21.7	17.0	45.0	43.4	80.5	5.5	26.4
Detoxification episodes										
Outpatient	0.2	0.37	0.1	0.7	0.3	0.7	0.2	0.8	0.2	0.6
Buprenorphine	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Inpatient	0.4	1.2	0.1	0.4	0.6	1.1	0.6	1.9	0.3	0.9

Over the 12 month period the total cost of non-index treatment was \$2,120,283 with a mean of \$3,267 (95% CI \$2,855-3,679). The mean number of days in the non-index treatment across all groups was 96.4 days, with a range of 71 to 102 across the groups. Again there is considerable variation across the groups; with the MT and RR groups having longest stays in their index treatment and having the shortest mean number of days in non-index treatments. The NT group had a mean of 84.8 days in non-index treatment. DTX had the most episodes of non-index treatment.

Table 10: Total days, episodes and costs for non-index treatment

	Total (N=649)	MT (N=225)	DTX (N=235)	RR (N=136)	NT (N=53)
Costs per person - mean	\$3,267	\$1,331	\$3,899	\$5,814	\$2,153
- SD	\$5,344	\$2,669	\$4,699	\$8,267	\$3,485
- median	\$1,559	\$0	\$2,735	\$2,595	\$1,470
Days - mean	96.4	71.1	101.6	70.7	84.8
Episodes - mean	1.6	0.9	2.3	1.8	1.4

3.3.3 Total treatment (combining index and non-index treatment)

The total treatment (index and non-index) costs at 12 months were \$4,015,363 for the 649 individuals, with a mean of \$6,187 per person (95% CI \$5677 -\$6697). As is common in health care expenditures, the distribution of the total costs is skewed. Table 11 demonstrates the extent of this, with at the low end, 25% of individuals accounting for only 6% of the costs, and at the top, 25% of individuals accounting for 60% of total treatment expenditures.

Table 11: Distribution of costs

Costs	Percentage of costs	Percentage of individuals
\$1-\$2,490	6.3%	25%
\$2,491-\$3,920	13.2%	25%
\$3,921-\$6,774	20.4%	25%
\$6,775-\$39,345	60.1%	25%

Table 12 presents the days and episodes in index and non-index treatment, as well as the costs for each group. It is important to note that these are raw costs, with no adjustment for the duration of use of heroin, pre-existing physical and mental health co-morbidities, age, or any other factor that may impact upon resource use during treatment. Overall, there was a mean of 2.6 episodes of treatment when index and non-index treatments are combined. The MT

group had on average 1.9 episodes of treatment with 295.8 days spent in treatment (76% of the days occurred in the index treatment). The DTX group had on average 3.3 treatment episodes and 108 days in treatment, however as only 6% of the treatment days were in the index treatment this suggests that this group had considerable additional treatment. The NT group had 1.4 episodes of treatment with an average of 84.4 days in treatment. The RR group had 52% of days in the index treatment with an average of 147.4 days over 2.8 episodes of treatment.

Table 12: Total treatment – costs, days and episodes in treatment at 12 months (index and non-index treatment)

	Total (N=649)	MT (N=225)	DTX (N=235)	RR** (N=136)	NT (N=53)
Cost per person - mean	\$6,187	\$3,790	\$5,238	\$13,364	\$2,153
- SD	\$6,618	\$2,389	\$4,736	\$9,371	\$3,485
- median	\$3,920	\$3,920	\$4,168	\$10,998	\$1,470
Days - mean	179.5	295.8	108.2	147.4	84.8
Episodes - mean	2.6	1.9	3.3	2.8	1.4

** does not include an estimated total expenditure of \$149,508 for required detoxification prior to entering RR (mean of \$1,124).

3.4 HSU resources and costs

3.4.1 Resource use

In addition to treatment for heroin use, all groups used a variety of other health services at baseline and follow-up. There appears to be a general decrease in health services use in the treatment groups at 12 months, especially in the RR group, which had higher use of health care services at baseline in most categories (Table 13). At baseline, over 60% of all individuals in the MT, DTX and RR groups report visiting a GP at least once in the preceding month compared to 50% of the NT group. At the 12-month follow-up there was decrease in the number of individuals in the MT, DTX and RR groups who reported visiting a GP. Between 45% and 56% of each group report at least one prescription medication (excluding methadone and buprenorphine) in the month preceding their baseline and 12 month interviews, again with some decrease noted in the treatment groups at 12 months, but no change in the NT group.

Of those who were attended by an ambulance, 65% resulted in a visit to an emergency department. The number, of individuals who had at least one attendance from an ambulance

declined from baseline to 12 months in all treatment groups while increasing in the non-treatment group. At baseline, 20% of the treatment group and 9% of the NT group reported at least one visit to a psychiatrist, psychologist or counsellors. At 12 months the use of these mental health services has increased by 3 percentage points in each treatment group and by 14 percentage points in the NT group. Use of dental services increased in the MT, DTX, and NT groups.

Table 13: Percent of individuals that use various health services (HSU) in the month prior to the baseline and at 12 months interviews

% with at least one:	Total (N=649)		MT (N=225)		DTX (N=235)		RR (N=136)		NT (N=53)	
	BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth
GP visit	65	56	69	53	64	59	64	57	53	55
Specialist visit	6	7	8	7	5	6	9	10	6	8
Medications	51	44	56	42	51	45	52	43	45	45
Ambulance attendance	11	6	8	4	11	6	15	5	11	17
Emergency visit	12	6	7	7	11	6	15	4	13	15
Outpatient clinic visit	4	5	6	5	4	5	3	4	6	9
Admission to hospital	9	8	6	8	7	5	16	9	6	15
Dentist visit	9	12	8	12	9	11	10	11	13	17
Other health professionals*	4	6	4	4	3	6	6	7	0	4
Social/welfare worker	17	17	12	15	15	18	26	17	11	23
Mental Health										
Psychiatrist visit	7	7	5	5	6	9	8	7	4	9
Psychologist visit	5	6	5	3	6	9	7	5	4	6
Counselling	12	14	8	14	14	9	15	23	6	11
Mental health total**	20	23	17	20	21	23	27	30	9	23

* Other health care professionals refers to physiotherapy, chiropractors, naturopaths, optometrists

**Mental Health total is not a sum of categories as individuals may utilise more than one service.

Table 13 provides information on uptake of services and Table 14 provides information on the quantity (on average) of those services used. The mean number of contacts with treatment services in the month prior to the baseline and 12 month interviews is presented by index treatment group in Table 14. The mean number of visits to general practitioners and prescriptions obtained declined in all the treatment groups. In contrast, the NT group reported an increase in the GP visits (1.02 to 1.77). Relative to baseline, the RR group reported using fewer of all types of health services at 12 months. The DTX group had fewer or a similar

number of contacts at 12 months, with the exception of ‘other HSU contacts’ which included social workers, physiotherapists and counsellors. The mean number of encounters decreased in three categories (GP visits, ambulance contacts, and prescriptions) and increased in hospital visits and other HSU contacts for the MT group. The costs associated with this resource use are found in Table 15.

Table 14: Quantity of health services utilisation (HSU) in the month prior to the baseline and 12 month interviews

Mean visits per person:	Total (N=649)		MT (N=225)		DTX (N=235)		RR (N=136)		NT (N=53)	
	BL	12mth	BL	12mth	BL	12mth	BL	12mth	BL	12mth
Doctor visits (range)	1.8 0-30	1.26 0-18	1.70 0-24	0.96 0-10	1.89 0-28	1.36 0-18	2.09 0-30	1.37 0-10	1.02 0-3	1.77 0-12
Hospital visits (incl ED & outpatient)	0.39	0.59	0.40	1.10	0.30	0.29	0.50	0.24	0.70	0.72
Ambulance contacts	0.13	0.10	0.12	0.06	0.12	0.13	0.18	0.05	0.11	0.26
Medications prescribed	2.3	1.37	1.60	1.09	2.70	1.44	3.00	1.16	1.50	2.72
Other HSU contacts	1.35	1.65	0.80	1.25	1.30	1.80	2.40	2.05	1.20	1.64

3.4.2 HSU costs

The overall expenditure for the whole sample (N=649) on HSU in the month prior to the baseline interview was \$252,862 and \$298,843 in the month prior to the 12 month follow-up. This represents an 18% increase. The mean and median HSU costs are presented below (Table 15). The difference between the means and medians again reflect the skewed nature of the cost data. The mean expenditure overall, increases from \$390 at baseline to \$460 at 12 months.

Expenditures increase in all groups except the RR group where the mean expenditures declined from \$777 at baseline to \$473 at 12 months. These increased costs can be attributed to increased use of dental services, some very expensive hospital stays and an increase in use of counselling and social work services.

Table 15: One month HSU costs at baseline and 12 months

	Total (N=649)	MT (N=225)	DTX (N=235)	RR (N=136)	NT (N=53)
Baseline - mean	\$390	\$235	\$350	\$777	\$229
- SD	\$1,076	\$478	\$903	\$1,859	\$513
- median	\$108	\$97	\$106	\$171	\$87
12 mth - mean	\$460	\$355	\$507	\$473	\$670
- SD	\$1,771	\$1,130	\$2,359	\$1,494	\$1,621
- median	\$90	\$72	\$90	\$137	\$61

As shown in Table 16, a small proportion of the ATOS cohort use the majority of the HSU expenditures. At baseline, 19% of individuals consumed no HSU resources, while 15% of the group consumed 74% of the resources. A similar pattern is seen at the 12-month follow-up interview, where 23% report no additional use of health care services, and 79% of the resources were used by 14% of individuals. The data were examined for each index group (not shown), and the pattern is consistent with the data in Table 16, with the exception of the methadone group at baseline, where expenditures were somewhat evenly spread across categories.

Table 16: Distribution of HSU costs per person in one month

	Baseline		12 month	
	% of Total costs	% of Individuals	%of Total costs	% of Individuals
\$0	0	19	0	23
\$1-100	4	29	2	24
\$101-200	7	19	6	20
\$201-500	15	18	13	20
>\$500	74	15	79	14

Overall, at both baseline and 12-month follow-up hospital/ambulance expenditure accounts for the majority of HSU costs at 57.8% and 63.6% respectively (Table 17). The proportion of the total expenditure attributed to hospital and ambulance expenditure increased in all groups with the exception of RR. On the other hand, the proportion of expenditures on GPs and specialists declined in all groups except RR. Expenditure on medications (not including methadone, buprenorphine or naltrexone) declined in all groups while expenditures on ‘other’ services (dentists, psychologist, counselling, diagnostics and social work) increased or remained stable among the treatment groups and declined in the NT group.

Table 17: HSU costs and percent expenditure by group

	Total (N=649)		MT (N=225)		DTX (N=235)		RR (N=136)		NT (N=53)	
	BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth	BL	12 mth
Mean expenditure	\$390	\$460	\$235	\$355	\$350	\$507	\$777	\$473	\$229	\$670
	percent expenditure:									
Hosp/ambulance	57.8	63.6	44.9	63.0	54.3	65.0	67.1	56.4	56.9	73.4
GP/specialist	10.7	7.6	16.0	7.3	11.9	7.9	7.2	8.4	9.9	6.2
Medications	14.8	8.2	17.2	7.0	18.1	8.0	11.1	9.8	13.6	8.4
Other*	16.7	20.5	21.9	22.7	15.7	19.1	14.6	25.3	19.6	12.0

* Other includes: dentists, psychologist, counselling, diagnostics and social work.

Regression analysis examined factors associated with HSU costs at 12 months. Variables entered into the model include age, sex, OTI score for heroin use, SF-12 physical health score, SF-12 mental health score at baseline with HSU costs as the dependent variable. The model was significant ($F_{5,645} = 7.76, p=000$). Only the SF-12 physical summary score was a significant predictor of HSU costs ($\beta = -34.8, t = -5.05, p < 0.001$) suggesting that a worse physical status led to an increase in HSU costs.

3.4.2.1 Personal and public expenditures

The proportion of the total HSU expenditure that was paid directly by the individual on items such as medications, dentists and counsellors decreased or remained constant across all groups from baseline to 12 months. This suggests that there was no increase in the burden on individuals for the payment of health care services during the 12 month period of follow-up (Table 18).

Table 18: Percent of HSU expenditures that were paid by the individual

	Total (N=649)	MT (N=225)	DTX* (N=235)	RR (N=136)	NT (N=53)
Baseline %	9	14	10	6	14
12 months %	5	7	5	5	2

4 DISCUSSION

The total heroin treatment costs for the 649 participants over a period of 12 months were estimated to be \$4,015,364 or a mean of \$6,187 per person with a mean number of days in treatment of 179.5. The data in this report support the conclusion that it is feasible to conduct longitudinal research on heroin users in Australia including the estimation of costs of treatment.

As this was a cohort study, not an RCT, it reflects the real-world conditions of self-selection into treatment, as well as the movement in and out of treatment. As individuals often leave initial treatment, but later return to similar or different types of treatment for heroin use, economic costs were estimated for both index and non-index treatment. The mean index treatment costs were \$2,920 for an average of 83 days of treatment, while non-index treatment costs were \$3,267 for an average of 96.4 days.

The types of non-index treatment received varied across the groups; in the MT and RR groups there was a tendency to obtain a similar type of non-index treatment as their index treatment (41.6% of MT group returned to maintenance therapy and 40.4% of the RR group attended additional residential rehabilitation as non-index treatment). The DTX group took up a variety of non-index treatments, with 53.2% receiving maintenance, 43% additional detoxification and 25% rehabilitation and 21% outpatient counselling. The NT group also enrolled in a variety of treatment types with 52.8% taking up methadone treatment, 20.8% attending an episode of detoxification, and 13.2% attending residential rehabilitation.

In terms of days of treatment, the uptake of the non-index treatment is influenced by the average number of days in the index treatment. For example, the MT group which had a mean of 225 days in index treatment had only 47% engaging in non-index treatment whereas the DTX group with a mean of 6.6 days in index treatment had 88% with non-index treatment over the 12 months. In the RR group, which had a mean of 77 days in the index treatment, 74% had a non-index treatment.

There was considerable variation in costs across the ATOS sample which is common with health care expenditures. At the lower end, 25% of the individuals in the sample accounted for only 6% of the total expenditures, while at the top, 25% of individuals accounted for 60% of the expenditures.

In addition to the treatment costs, information on other health services utilisation was determined for one month prior to the baseline and 12 month interviews. The total cost of HSU at baseline was \$252,862 and at 12 months was \$298,843 with a mean of \$390 at baseline and \$460 at 12 months. As with treatment costs, there was a large variation in costs across individuals with 19% of the sample reporting no additional use of health services, while 15% accounted for 74% of expenditures at baseline and 79% at 12 months.

Fifty-eight percent of the total HSU costs at baseline and 64% at 12 months were attributable to hospital and ambulance encounters even though the mean number of encounters was less than one. These costs reflect some long and expensive care received for overdoses, mental health admissions and acute care following accidents. Costs attributable to GP or specialists accounted for 10.7% of the total HSU expenditure at baseline declining to 7.6% at 12 months; medications made up 15% of the total at baseline and 8% at follow-up.

If the assumption is made that a combination of baseline and 12 month HSU costs reflects, on average, the monthly costs throughout the year (this assumption is made with caution) we can estimate an annual HSU cost per person of \$5,100. Combining the treatment costs, and the estimate of HSU costs, results in an annual cost of \$11,287 per person.

To put the average \$11,287 expenditure per participant into perspective, the annual expenditure on health in Australia in 2001/02 was \$3,292 per person for every man, woman and child including those who may have never used any health services in that year as well as those treated for a chronic illness (AIHW, 2004). In comparison, a study that examined the costs of health care for the first year following a stroke found the costs varied from AUS \$4,932 to \$28,266 depending on the type of stroke (Dewey et al., 2003). Similarly, the cost per year of intensive case management for a person with schizophrenia was estimated to be \$35,700, and cost for routine case management was AUS \$26,100 (costs converted to 2002 prices for comparison using CPI) (Johnston et al., 1998). This would suggest that an average of \$11,287 per person for treatment of heroin use and their other health services use is not an excessive amount.

The costs used in this study were estimates of resource use for the various treatments provided and are our best estimate of the health costs. Both personal and provider costs of treatment are

included while participant time and travel costs were not. The data on treatment and health services use collected for this study were a combination of self-report (non-index treatment and HSU) and data collected from audits of patient treatment files (index treatments). While debate continues in the literature as to the accuracy and comprehensiveness of self-reported health service utilisation compared to the use of administrative records, recent work by Killeen et al. (2004) demonstrates that the level of agreement for self-report health service utilisation for medical, psychiatric and substance abuse treatment is good. Given that the range of providers from which individuals in this study may be obtaining treatment includes hospitals, private and public clinics, residential rehabilitation facilities, pharmacies, medical practitioners, and counsellors, the use of self-reported data was the only method feasible for collection of this data in this study.

There are obvious differences in use of resources across the four groups in this study. Given that individuals self-selected into different treatment options, possibly suggesting different objectives (i.e. abstinence versus harm reduction), the treatment groups would not be expected to have similar demographic, drug use or health characteristics; and in fact there are documented differences in demographics, drug use history, health status, and treatment histories of these cohorts. Therefore, there is no *a priori* reason that the resource use, thus costs (if it affected by these characteristics), should be similar across the treatment groups, however additional work is required to explore this.

Some economists might argue that hotel type (food and accommodation) costs of residential rehabilitation should be excluded from the total costs, particularly when some residential facilities required individuals to cover a portion of these costs. However, in this study not all facilities required this payment, nor did we have the resources to ascertain what proportion of cost were hotel-type costs. The argument for excluding these costs is that everyone faces food and lodging costs and to therefore include them in the totals overestimates the costs of RR. However, some participants of this study had no fixed address or were homeless and if they had not received treatment, many would have had very low expenditures on housing, and in addition some individuals would have had household to maintain even if they were in treatment. We therefore included all costs that were attributable to treatment, however based on personal contributions, approximately 20% of the RR daily costs might be considered hotel type costs.

Finally, what did the \$6,187 of drug treatment purchase? There were a number of key outcomes measures used in ATOS, with only three key indicators reported in this report. The outcome measures, change in heroin free days, abstinence in preceding month and committed any crime in the previous month, each showed a significant improvement from baseline to the 12 month interview. There was, on average, 15.3 more heroin free days per month at 12 months, a 76% improvement. There was a 55% improvement in rates of abstinence and a 52% decrease in the numbers who committed crime in the previous month. In this study, the cost savings related to decrease in crime were not estimated, however results from NTORS in the UK determined that the cost of crime decreased by 50% in two years post treatment compared to the year prior to treatment (Godfrey et al., 2004).

In summary, this report documents the patterns of use and economic costs of health care for a group of heroin users in Australia. It details the quantity, type and economic cost of all the drug treatments and general health services that this group accessed over a 12 month period. In contrast to previous costing studies in Australia, ATOS is a cohort design, thus the information presented here reflects health service utilisation and costs under real-world conditions.

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