

DRUG POLICY MODELLING PROGRAM
MONOGRAPH 20

**CANNABIS USE DISORDER TREATMENT AND
ASSOCIATED HEALTH CARE COSTS IN NEW
SOUTH WALES, 2007**

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National Drug and Alcohol Research Centre

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Drug Policy Modelling Program Monograph Series

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THE DRUG MODELLING POLICY PROGRAM

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Drugs are a major social problem and are inextricably linked to the major socio-economic issues of our time. Our current drug policies are inadequate and governments are not getting the best returns on their investment. There are a number of reasons why: there is a lack of evidence upon which to base policies; the evidence that does exist is not necessarily analysed and used in policy decision-making; we do not have adequate approaches or models to help policy-makers make good decisions about dealing with drug problems; and drug policy is a highly complicated and politicised arena.

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DPMP strives to generate new policies, new ways of making policy and new policy activity and evaluation. Ultimately our program of work aims to generate effective new illicit drug policy in Australia. I hope this Monograph contributes to Australian drug policy and that you find it informative and useful.



Alison Ritter

Director, DPMP

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
ADHD	Attention deficit hyperactivity disorder
AIHW	Australian Institute of Health and Welfare
ALOS	Average length of stay
AOD	Alcohol and other drug
AR-DRG	Australian Refined Diagnosis-Related Group
Assess	Assessment
BAC	Blood alcohol concentration
BEACH	Bettering the Evaluation and Care of Health
BITRE	Bureau of Infrastructure, Transport and Regional Economics (formerly BTE)
BTE	Bureau of Transport Economics
CBT	Cognitive Behavioural Therapy
CMI	Contingent management interventions
CPI	Consumer Price Index
CT	Computed tomography
DALY	Disability-adjusted life years
DATCAP	Drug Abuse Treatment Cost Analysis Program
DCIS	Disease Cost and Impact Studies
Detox	Withdrawal management (detoxification)
DSM	Diagnostic and Statistical Manual of Mental Disorders
Dx	Diagnosed/diagnosis
ED	Emergency Department
ELOS	Expected length of stay
FPS	Focussed Psychological Strategies
FTE	Full time equivalent
GPMHMP	General Practitioner Mental Health Management Plan
GP	General practitioner
HPA	Health Policy Analysis Pty Ltd
Hosp	Hospital; hospitalisation
ICD-10- AM	International Statistical Classification of Diseases
IDRS	Illicit Drug Reporting System
Info & educ	Information and education
JHC	Jacq Hackett Consulting

KII	Key informant interviews
LBW	Low birth weight separations
LOS	Length of stay
MBS	Medicare Benefits Scheme
MERIT	Magistrates Early Referral into Treatment
ME(I)	Motivational Enhancement (Therapy)
MI	Motivational interviewing
NCPIC	National Cannabis Prevention and Information Centre
NDSHS	National Drug Strategy Household Survey
NGO	Non-government organisations
NHCDC	National Hospital Cost Data Collection
NHMD	National Hospital Morbidity Database
NIDA	National Institute on Drug Abuse
NMDS	National Minimum Data Set
NMHWBS	National Mental Health and Well Being Survey
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
NSW	New South Wales
OR	Odds ratio
PAF	Population attribution fraction
PBS	Pharmaceutical Benefits Scheme
PHREDSS	NSW Health's Public Health Real-time Emergency Department Surveillance System
Pop	Population
PYLL	Potential years of life lost (premature death)
RCT	Randomised controlled trial
Rehab	Residential rehabilitation
RR	Risk ratio; relative risk
RTA	Road traffic accidents; Road Traffic Authority of NSW
Schizop	Schizophrenia/psychotic disorder diagnosis/treatment
Seps	Separations
SCRGSP	Steering Committee for the Review of Government Service Provision
THC	Tetrahydrocannabinol
Tx	Treated/treatment
YLDs	Years lived with disability

EXECUTIVE SUMMARY

Aims

The aim of this monograph is to estimate the costs of treatment and health care related to cannabis use disorders in New South Wales (NSW) for the year 2007. It describes the costs associated with treatment for cannabis use disorder and the health care costs attributable to cannabis use. The rationale for this study was to identify these costs for policy and other research purposes as comprehensive studies on cannabis treatment costs have not been undertaken.

Specifically, the types of treatment are:

Treatment in drug treatment agencies:

- Counselling
- Withdrawal management (detoxification)
- Residential rehabilitation
- Assessments (a precursor to treatment)
- Information and education

Treatment in general practice (provided by general practitioners (GP)):

- GP consultations

Treatment in hospitals:

- Cannabis-related hospital admissions

Treatment of health consequences attributable to cannabis use:

- Schizophrenia/ psychotic disorders
- Low birth weight (LBW) babies in hospitals
- Road traffic accident casualties

Method

There are two types of costs estimated in this study:

1. Costs associated with cannabis dependence/use disorder (in drug treatment agencies, general practice and hospitals); and
2. Costs associated with providing health care for health consequences attributable to cannabis use (schizophrenia/psychotic disorders, LBW babies and road traffic accident casualties).

The costs of treatment in drug treatment agencies and general practice (in 1) were estimated by identifying the resources used and then multiplying their amount required (e.g. number of counsellor hours) for the treatment by their associated unit costs. For residential rehabilitation

and hospital costs, the average costs (per day, separation) were taken from existing costing studies and applied to the number of separations or length of stay. The costing method for (1) is further outlined below:

- The number of episodes, consultations, or separations were identified and counted;
- A unit cost was then applied to these counts. These are discussed more in detail in each sub-section of treatment and health care types. Examples of unit costs are the Medicare Benefits Scheme (MBS) fee, Pharmaceutical Benefits Scheme (PBS) cost per pack, cost per day, hourly wage cost, and, hospital cost weights;
- Completion rates as a proportion of all treatment episodes for withdrawal management and counselling episodes were used to calculate the number of completed and non-completed episodes. Costs were calculated for all reported treatment episodes and also for those completed and not completed;
- For residential rehabilitation, an average cost per day was obtained from other costing studies for services in NSW. This was then multiplied by the average length of stay from the literature and the number of episodes;
- For cannabis hospital separations, both as principal and secondary diagnoses were taken into account when calculating the costs of treatment. Specifically, admissions where cannabis was the secondary diagnosis and alcohol the primary has been found to influence hospital costs significantly (Pacula, Ringel, Dobkin, & Truong, 2008). The additional cost of the secondary diagnosis, in addition to the primary diagnosis, was added onto the hospital cost;
- Where appropriate, an on-cost of 28% was added to the estimated wage costs for treatment services provided in the community setting. Additionally, in some instances, such as for counselling and withdrawal management, overhead costs of 28% were also added to ensure comparability to hospital and GP consultations costs;
- Not included in the cost calculations were support and case management, and counselling under the Magistrates Early Referral into Treatment (MERIT) scheme. These costs are included elsewhere in a project examining criminal justice costs.

For (2), costs associated with providing health care to treat health consequences of cannabis use, a comprehensive literature review was conducted to include health consequences of cannabis use that had the strongest and most convincing evidence. The costing method was slightly different: the number of persons (for psychotic disorders and road traffic accident casualties) were multiplied by respective average costs from costing studies (Andrews & Tolkien II Team, 2006; BITRE, 2009), while for LBW babies, the number of hospital separations were multiplied by NSW hospital cost weights. Attributable fraction methods were derived from data in the literature and applied to general data to obtain the numbers attributable to cannabis use. These numbers were then applied to the respective costs.

The focus of this study was on cost of treatment for cannabis borne by health departments (State and Commonwealth) in NSW in 2007; and a one-year costing for the 2006-07 period was adopted. Costs were adjusted to reflect the reference year, 2007. This removes the effect of

inflation and allows costs from different years to be compared on an equal dollar-for-dollar basis (ABS, 2008b; Riddell, Shanahan, Roxburgh, & Degenhardt, 2007). As costs are only calculated for one year, no discounting was applied (Drummond, Sculpher, Torrance, O'Brien, & Stoddart, 2005).

For the three largest costs, one-way sensitivity analyses were conducted on parameters that were considered sensitive to changes to the impact on costs. Data for the 'sensitive' parameters were obtained from the literature.

Results

The main estimate of total treatment and health care costs of cannabis use for NSW in 2007 was \$16.9 million with a range from \$16.9 - \$22.0 million obtained from sensitivity analysis:

Treatment and health care costs, NSW, 2007

Cannabis treatment	No. episodes/ separations	Cost (2007 \$)	% cost	Cost per occasion
Residential rehabilitation (episodes*)	431	\$2,898,684	17.1%	\$6,725
Hospital (separations)	902	\$1,307,610	7.7%	\$1,450
Withdrawal management (detoxification) (episodes*)	1,127	\$1,083,124	6.4%	\$961
Counselling (episodes*)	2,451	\$1,072,308	6.3%	\$437
GP (consultations)	3,018	\$217,170	1.3%	\$72
Assessment only (episodes*)	1,727	\$163,674	1.0%	\$95
Information and education only (episodes*)	113	\$35,098	0.2%	\$310
Subtotal cannabis treatment	-	\$6,777,668	40.1%	
Treating health consequences of cannabis use	No. persons/ separations	Cost (2007 \$)	% cost	Cost per occasion
Psychotic disorders/schizophrenia (persons)	916	\$6,220,049	36.8%	\$6,790
Road traffic accident casualties (persons)	443	\$2,309,115	13.7%	\$5,212
Low birth weight (separations)	90	\$1,605,291	9.5%	\$17,837
Subtotal health consequences treatment	-	\$10,134,454	59.9%	
Grand total	-	\$16,912,123	100.0%	

Note: Totals may not sum due to rounding

* All episodes, including complete and incomplete.

Sensitivity analysis conducted showed that the largest impact on treatment costs was for the proportions of 'cannabis drivers' killed and injured: there was a two-fold increase (200%) in treatment costs for road traffic accident casualties when these variables were varied at 11% and 7.1% respectively, compared to assuming that the rate of cannabis-related accident fatality and injury was the same (2.39%). The next largest impact was when the length of stay in residential rehabilitation treatment varied from 53.1 days to 147.3 days. This resulted in an increase in

treatment costs by about 177%. However, these parameters did not have a large impact on the overall total costs. Total costs ranged from \$16.4 million to \$22.1 million.

While this study's total cost estimate is comparable to another Australian study (Collins & Lapsley, 2008), that estimated the total health care costs from drug abuse at \$16.6 million (adjusted for NSW and 2007 prices) Collins & Lapsley costs did not include drug treatment costs. On the other hand, Moore (2007) used a burden of disease approach (DALY), which resulted in an estimate of \$421 million (2007 dollars) for the NSW total burden related to cannabis use.

As with any study, there are limitations and we outline some below.

1. This study was not intended to assess the outcome of treatment or health care services for cannabis use.
2. This study did not include intangible costs, e.g. opportunity costs, pain and suffering, etc.
3. The lack of data meant assumptions had to be made in cost estimations.

Due to lack of data some treatments and their costs were not included. The key missing costs are those provided by private psychologists and psychiatrists.

Policy makers or researchers wishing to estimate the cost of providing treatment to cannabis, or other users, may use the estimation methods in this study as a guide. For example, they might adopt the same or similar methodology to estimate counsellor cost or the number of counselling sessions, attribution fraction methods, and, also use the costs and amount of resources as a guide in their own costing study. As other studies have not detailed the number of resources and unit costs for health care and treatment, this study would provide guidance in terms of such costing exercise. The results of this study would be useful in informing decision and policy making, particularly in funding or allocating resources to drug treatment agencies in NSW. It could also be used as a guide in facilitating economic or clinical evaluation of drug treatment programs, across treatment settings (drug treatment centres, GPs and hospitals).

INTRODUCTION

Cannabis is the most widely used illicit drug in Australia: 33.5% of the Australian and 31.1% of the NSW populations aged 14 and over have used it at least once in their life (AIHW, 2008b). Of these, 9.1% of the former and 8.0% of the latter have used it in the last 12 months. Cannabis use is often perceived as innocuous but it was the second most common principal drug of concern for which treatment was sought in 2006-07¹, consisting of 31,980 (23%) closed treatment episodes in Australia (total all drugs: 140,475)(AIHW, 2008d). When all drugs of concern were taken into account (the principal and all other drugs of concern nominated by the client), 46% of the episodes included cannabis (p. 21).

Despite this, to date, it appears that not much is known about the resource implications of providing treatment or treating the consequences of cannabis use, such as psychotic disorders. Although there are guidelines for the management of cannabis use disorder (e.g. Astolfi, Leonard, & Morris, 1998; Copeland, Frewen, & Elkins, 2009; Englander, Lang, Lacy, & Cash, 2002; Rees, Copeland, & Swift, 1998; Steinberg, et al., 2005), they are yet to be broadly accepted as standard treatment algorithms. Nevertheless, they are similar in treatment approaches, in that they are mainly psychological interventions (e.g. counselling) in various forms, whether individually- or group-based. While these interventions can be combined with other treatments such as pharmacological management of symptoms of withdrawal, there is no approved medication for treating cannabis use disorder (Copeland, et al., 2009). Despite the existence of such guidelines, most of them do not specify 'who does what' and the resources required for providing treatment (Andrews & Tolkien II Team, 2006, p. 19). The lack of general adherence to guidelines plus notable gaps in data collection makes it a challenge to estimate the resources used in the treatment for cannabis use².

There have been several attempts by researchers to quantify health care costs as a result of illicit drug use. For example, specifically for cannabis, the estimated gross hospital costs were \$3.054 million in 2004-05 (\$3.24 million in 2007 dollars) (Collins & Lapsley, 2008). Another study using drug-attributable disability adjusted life years (DALY) estimated that in 2005 the annual health costs due to cannabis use was about \$1,195 million (\$1,303 million in 2007 dollars) (Moore, 2007). However, the estimates did not lay out the resources used and what the resources were used for (i.e. types of treatment etc.). Cost data collected in United States (US) through the Drug Abuse Treatment Cost Analysis Program (DATCAP) indicated that the total annual cost estimates ranged from about USD75,000 to USD3.8 million (about AUD100,000 to AUD5 million)³ (French, Mauskopf, Teague, & Roland, 1996; French, Popovici, & Tapsell, 2008). However, the cost estimates were not broken down by drug types.

¹ Within specialist alcohol and drug treatment services, excluding pharmacotherapy maintenance in primary care settings.

² For example, treatment algorithms or therapeutic guidelines provide information on treatment paths that a client/patient should follow given a health condition. The number of times medications need to be taken, the dosage, the health professionals they need to consult, etc. would provide an indication on how resources can be costed. For cannabis dependence, there are no such treatment guidelines; as such, without knowing the number of counselling sessions for example, or type or dosage of medication for withdrawal management, it is difficult to estimate the correct amount of resources and unit costs without other information obtained elsewhere (literature, primary sources, etc.).

³ Based on an exchange rate of USD1 = AUD1.317 on 15 May 2009 (XE, 2009).

Detailed costing approaches have also been employed for specific drugs (heroin) (Shanahan, et al., 2003; 2006) and for specific treatment types (residential rehabilitation) (HPA, 2005). However, to date it appears that treatment and other health care costs have not been estimated for each illicit drug separately.

There are treatment services available to specifically treat cannabis use disorder or dependence, such as those provided by specialist drug treatment agencies. Currently, these agencies provide treatment such as counselling, withdrawal management, residential rehabilitation, assessment, and information and education (AIHW, 2008c). Services provided by general practitioners (GPs) and in hospitals also treat cannabis use disorder or dependence, e.g. GP counselling and prescription of medication for withdrawal symptoms, and hospital-provision of inpatient detoxification. Privately funded services aside, costs of drug treatment agencies, GPs, and hospitals are borne by governments.

However, using cannabis can have other deleterious health consequences that also require GP and hospital services; and these add to the cost of the health system. Such health consequences could include (Hall & Pacula, 2003):

- Psychosis and/or schizophrenia, and mood disorders;
- Aerodigestive and respiratory tract diseases such as lung cancer and other pulmonary diseases;
- Cardiovascular complications;
- Impaired psychomotor and cognitive functioning leading to injury or accidents;
- Impairment of the immune system; and
- Pregnancy outcomes such as low birth weight babies.

After a comprehensive literature review (summarised in Appendix A), it was concluded that there were three conditions that had the strongest and most convincing evidence attributable to cannabis use: schizophrenia/psychotic disorders, low birth weight (LBW) babies born to mothers who use cannabis during pregnancy and road traffic accident casualties. If such health care costs related to such health consequences were not calculated, the total costs of cannabis use treatment and health care would be underestimated. This study adopts a government's perspective, therefore health care and treatment costs that were funded or paid by governments were included in this study. It estimated the costs of treatment for cannabis use provided in drug treatment agencies, general practice and hospitals. It also estimated the costs of treating health consequences due to cannabis use.

This report provides estimates of the costs of treatment and health care related to cannabis use disorders in NSW for the year 2007. In the next section, the methods of the study are described for treatment in drug treatment agencies, general practice and hospitals. It also describes the health consequences attributable to cannabis use, such as schizophrenia/ psychotic disorders, LBW hospital separations and road traffic accident casualties. The resources and costs from available sources are discussed for each treatment type and health consequence. The results of the costing are presented after each treatment component described in the methods. Sensitivity analyses were conducted on parameters where there was uncertainty around their measurement

(e.g. average costs, length of session, odds ratios). Limitations and conclusions of the study are then discussed.

The results of this study would be useful in informing decision and policy making particularly in funding or allocating resources to drug treatment agencies in NSW. It could also be used as a guide in facilitating evaluation, economic or clinical, of drug treatment programs, across treatment settings (drug treatment centres, GPs and hospitals).

METHODS AND RESULTS

Overview of methods

There is no single source of information on cannabis treatment; as such the variety of data sources meant that estimating treatment and other health care costs, as a result of cannabis use, was not a simple matter. Every attempt was made to be consistent across methods; however, data availability often meant this was not possible. Where clear inconsistencies existed they were pointed out and sensitivity analysis was used to explore the implications. Data and costs were obtained from the literature and published sources. Where there were gaps in these primary sources, key informant interviews were employed to understand what the treatment entailed in order to obtain more accurate data and estimates.

There are two types of costs estimated in this study:

1. Costs associated with cannabis dependence/use disorder (in drug treatment agencies, general practice and hospitals); and
2. Costs associated with providing health care for health consequences attributable to cannabis use (schizophrenia/psychotic disorders, LBW babies and road traffic accident casualties).

The costs of treatment in drug treatment agencies and general practice (in 1) were estimated by identifying the resources used, and then multiplying their amount required (e.g. number of counsellor hours) for the treatment by their associated unit costs. For residential rehabilitation and hospital costs, the average costs (per day, separation) were taken from existing costing studies (HPA, 2005; Riddell, et al., 2007) and applied to the number of separations or average length of stay.

The costing method for (1) is further outlined below:

- The number of treatment episodes for each treatment type, consultations, or separations were identified and counted;
- A unit cost was then applied to these counts. These are discussed more in detail in each sub-section. Examples of unit costs are the MBS fee, PBS cost per pack, cost per day, hourly wage cost and hospital cost weights;
- Completion rates as a proportion of all treatment episodes for withdrawal management and counselling episodes were used (more below, Table 2) to calculate the number of completed and non-completed episodes. Costs were calculated, and presented, for completed episodes and for those that were not. Such split is important as the amount of resources used in incomplete episodes were less than in completed ones; if all episodes were assumed completed then this would overestimate the costs.
- For residential rehabilitation, the costs vary depending on the length of stay (LOS) of a client's treatment plan/program, which could vary from one to 12 months. An average length of stay (ALOS) was found for cannabis residential rehabilitation in NSW (HPA, 2005); and this was used to multiply with the number of closed treatment episodes and the average cost per day (estimated in HPA, 2005) to obtain the annual cost. As the

estimated ALOS was an average of all episodes that were completed and not completed by clients, the cost of completed episodes (as employed in withdrawal management and counselling treatments) was not presented.

- For cannabis hospital separations, both as principal and secondary diagnoses were taken into account when calculating the costs of treatment. Specifically, admissions where cannabis was secondary diagnosis and alcohol primary has been found to influence hospital costs significantly (Pacula, et al., 2008). The additional cost of the secondary diagnosis, in addition to the primary diagnosis, was added onto the hospital cost.
- Where appropriate, an on-cost (superannuation, leave loading, etc.) of 28% was added to the estimated wage costs for treatment services provided in the community setting. Additionally, in some instances, such as for counselling and withdrawal management, overhead costs of 28% were also added to ensure comparability to hospital and GP consultations costs.
- Not included in the cost calculations were support and case management, and counselling under the Magistrates Early Referral into Treatment (MERIT) scheme. These costs are included elsewhere in a project examining criminal justice costs. However, if the MERIT scheme refers to any residential programs, those costs would be included in this section as data limitations meant it was not possible to separate the residential program costs into MERIT and Non-MERIT.
- Also not included are any additional resource implications of treating comorbid cannabis users, although a brief discussion is found in Appendix B.

For (2), costs associated with providing health care to treat health consequences of cannabis use, the method was slightly different: the number of persons (for psychotic disorders and road traffic accident casualties) were multiplied by respective average costs from costing studies (Andrews & Tolkien II Team, 2006; BITRE, 2009), while for the LBW babies the number of hospital separations were multiplied by the NSW hospital cost weights. Attributable fraction methods were derived from data in the literature and applied to general data to obtain the numbers attributable to cannabis use. These numbers were then applied to the respective costs.

As previously stated, the focus of this study was on the cost of treatment for cannabis borne by health departments (State and Commonwealth) in NSW; and a one-year costing for the 2006-07 period was adopted. Costs were adjusted to reflect the reference year, 2007. This removes the effect of inflation and allows costs from different years to be compared on an equal dollar-for-dollar basis (ABS, 2008b; Riddell, et al., 2007). As costs are only calculated for one year, no discounting was applied (Drummond, et al., 2005).

For the top three costs, one-way sensitivity analysis was conducted on parameters that were considered sensitive to changes to the impact on costs. Data for the 'sensitive' parameters were obtained from the literature.

Summary of resources and costs of treatment and health care provision

The table below summarises the resource and cost variables used in the calculation of each treatment and health care provision type.

Table 1: Resources and cost variables

	Treatments for cannabis use disorder /dependence						Treatment for consequences of cannabis use			Both A and B
	(A)						(B)			(C)
Resources	Counselling	Detox	Rehab	Assess	Info & educ	GP	Schizop	LBW	RTA	Hospital
GP/specialist		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Nurses		<input checked="" type="checkbox"/>								
Medication		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>				
Counsellors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Hospital/ rehab bed			<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Media material	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>					
No. of resources/ Frequency/ length of sessions										
Episodes/ seps	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Persons							<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Session length	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Attribution to cannabis use										
PAF/ responsibility							<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Cost										
Cost weight AR-DRG							<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
MBS/ PBS cost		<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Award rates	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Average costs from other studies			<input checked="" type="checkbox"/>							<input checked="" type="checkbox"/>

Notes: Included in calculation in this study

Cells merged across different resources and/or variables (i.e. for schizophrenia/ psychotic disorders, LBW separations, road traffic accident casualties and hospital separations) indicate that these resources/variables were not calculated separately but had been estimated as average costs by the respective sources.

For Abbreviations see p.vii – ix

The first six categories (A) relate to treatment for cannabis use disorder or dependence (counselling, withdrawal management, rehabilitation, assessment, information and education and GP consultations), the next three (B) relate to the health consequences of use (schizophrenia/ psychotic disorders, LBW separations and accident casualties) and the last one (C) relates to both treatment for the disorder/dependence and health consequences. It should be noted that the measurements of episodes and session length are different for different treatment types. For example, the session length for counselling was in minutes, while for residential rehabilitation in

days (LOS or ALOS). Also, for residential rehabilitation and hospital costs, the average cost per day/separation, as estimated comprehensively in other studies (HPA, 2005; Riddell, et al., 2007), was multiplied by the number of episodes and separations.

Costs are calculated in two ways. First for all episodes as if completed, and then taking into account actual completion rates.

Treatment in drug treatment agencies

This sub-section describes treatment for cannabis use disorder and dependence in various drug treatment agencies. Data were available from the National Minimum Data Set (NMDS) as reported by the Australian Institute of Health and Welfare (AIHW). Treatment is broken down by major treatment types: counselling, withdrawal management (detoxification), residential rehabilitation, assessment (for treatment plans), information and education and support and case management. Each treatment type is described in this section. For each treatment type, the resources used to provide the treatment type (e.g. number of counsellors, GPs, medications), the length of session (hours, length of stay), treatment episodes, and costs will be discussed. This is followed by the results.

Overview

Drug ‘treatment’ in the drug treatment agency context generally refers to treatment for drug use disorder or dependence. In 2006-07, 262 government-funded alcohol and other drug treatment agencies in NSW, including acute care and psychiatric hospitals that offer outpatient services, supplied data to the NMDS (AIHW, 2008e). With exception of four cannabis clinics, which are run and funded by the NSW Department of Health (NSW Health), these agencies provide treatment for alcohol and all illicit drugs and not just cannabis per se. Cannabis use disorder is often treated with other substance misuse and mental health disorders (JHC & Mayne, 2007); as such, it is difficult to apportion the amount of resources used in treating cannabis use disorder specifically. In NSW, treatment for cannabis was most likely to take place in non-residential treatment facilities (92% of episodes), followed by ‘other’ treatment settings (6%) (AIHW, 2008e, p. 11). The majority of those who sought treatment for cannabis use in drug treatment agencies in NSW were male (70%) with a median age of 28 (27 for female). Around 12% of episodes involved clients with Aboriginal or Torres Strait Islander origin. Self-referral was the most common source of referral (32% of episodes), followed by referrals from court diversion programs (16%) (AIHW, 2008e).

Closed treatment episodes⁴ where cannabis was the principal drug of concern totalled about 32,000 in 2006-07 in Australia. Of these, 7,072 (18.6%) episodes were provided in NSW (AIHW, 2008e). The top three treatment types nationally were counselling (33.5%), followed by information and education only (24%), and withdrawal management (detoxification) (13.8%) in 2006-07 (AIHW, 2008h) (see Table 1). The distribution of treatment types is similar for NSW,

⁴ A closed treatment episode refers to a period of contact with defined start and end dates between a client and a treatment. A client may have more than one closed treatment episode in any one year, therefore the number of such episodes may not equate to the total number of persons in Australia receiving treatment for cannabis (or other drugs) (AIHW, 2008e).

with counselling having the highest number of closed treatment episodes (31.7%), although withdrawal management was the second highest (21%), followed by assessment only (19.3%). ‘Information and education’ episodes represent the least common treatment type in NSW representing 1.6% (versus 24% in Australia). See Table 2.

Table 2: Cannabis treatment types in drug treatment agencies, Australia and NSW, 2006-07

Treatment type	No. episodes Australia (cannabis only)*	% Total episodes	No. episodes NSW (cannabis only)**	% NSW (all drugs)*	% Australia completion rates (cannabis only)##
Counselling	10,707	33.5%	2,451	31.7%	50.4%
Withdrawal management (detoxification)	4,403	13.8%	1,127	21.0%	65.2%
Assessment only	3,391	10.6%	1,727	19.3%	79.6%
Residential rehabilitation	1,760	5.5%	431	9.7%	36.8%
Support and case management only	3,497	10.9%	NR	9.7%	5.6%
Information and education only	7,685	24.0%	113@	1.6%	64.2%
Other#	537	1.7%	NR	7.0%	62.8%
Total	31,980	100.0%	7,072	100.0%	-

Source: AIHW (AIHW, 2008e; 2008), Phillips et. al. (2009, Figure 77, p. 99)

Note:

* As reported in AIHW for Australia (AIHW, 2008d) and NSW (AIHW, 2008e).

** Reported in AIHW (AIHW, 2008e) and Phillips et. al. (2009, Figure 77, p. 99)

@ ‘information and education only’ episodes where it was estimated in this study: total NSW cannabis treatment episodes (7,072) multiplied by the proportion of NSW episodes for all drug treatment (1.60%).

AIHW (2008d) defines this as pharmacotherapy, although it is not clear what this category refers to, and whether it really applies to the treatment of cannabis use disorder. As such, this category is not included in the calculation of the treatment costs.

In the AIHW, ‘treatment completed’ is defined as when all of the immediate goals of the treatment have been completed as planned. Includes situations where the client, after completing this treatment, either does not commence any new treatment, commences a new treatment episode with a different main treatment or principal drug, or is referred to a different service provider for further treatment (AIHW, 2008f). The number of completed episodes as a proportion of total number of episodes for that treatment type for cannabis for Australia (AIHW, 2008h). NSW completion rates for cannabis treatment were not reported.

NR Not reported. ‘Support and case management’ and ‘other’ were not included in this study. See discussion.

Where possible, all data were obtained from published sources (see Table 1 for data variables). For treatment in drug treatment agencies, the numbers of NSW treatment episodes were obtained from Phillips et. al. (2009, Figure 7, p. 99), except for “information and education only”, where data was not reported. Lack of data meant that some estimates were used, for example, the number of ‘information and education’ treatment episodes for NSW was not available from Phillips et. al. (2009); therefore it was estimated as follows: total NSW cannabis treatment episodes (7,072) were multiplied by the proportion of ‘information and education’ in all drugs for NSW (1.60% column 5 in Table 2).

Not all closed treatment episodes (i.e. episodes with starting and ending dates) are completed treatments. Column 6 in Table 2 provides completion rates. For example, only 50.4% of counselling episodes were considered completed (column 6). Costs were calculated for completed and non-completed episodes.

As it is not apparent what the resource implications were for treatment type labelled ‘other’, these episodes were excluded, as was ‘support and case management’, as discussed earlier.

Treatments in detail

Counselling

Counselling is a psychosocial or psychological intervention that entails various strategies or approaches. It is the umbrella term used for psychological interventions in the NMDS defined as any method of individual or group counselling directed towards identified problems with alcohol and/or other drug use or dependency. In particular, the most common psychological interventions for treating cannabis use disorder reported in the literature and in practice are cognitive behavioural therapy (CBT) and motivational interviewing (MI) or enhancement therapy (MET) (Budney, Roffman, Stephens, & Walker, 2007; McRae, Budney, & Brady, 2003), which can also be combined with voucher-based contingency management (CMI) (Budney, et al., 2007). Although different counselling techniques exist to treat cannabis use disorder, the data (NMDS) does not differentiate. The various techniques are discussed briefly below.

CBT focuses on teaching clients skills relevant to stopping cannabis use and managing other problems that may interfere with good outcomes (Budney, et al., 2007). MET addresses ambivalence to change, or stopping cannabis use, and seeks to strengthen motivation to change. Often a combination of CBT and MI over a number of sessions is used (see, for example, Budney et. al., 2007, Copeland, et. al., 2009). Sometimes they are combined with contingent management interventions (CMI). CMI has been demonstrated to improve effectiveness when used in conjunction with CBT and MI in clinical trials (Copeland, et al., 2009), although it has not been used in Australia (JHC & Mayne, 2007).

Randomised clinical trials (RCTs) have found that CBT reduces cannabis use and cannabis-related problems, although continuous abstinence rates are modest. They can be as low as approximately 15% six to 12 months after treatment (Denis, Lavie, Fatseas, & Auriacombe, 2006) and as high as 35% (McRae, et al., 2003). An RCT comparing MI with drug information and advice in the United Kingdom (UK) for cannabis users found no difference between the two interventions (McCambridge, Slyn, & Strang, 2008). For further information about these technique types and effectiveness, see Budney et. al. (2007), Nordstorm and Levin (2007) and Copeland et. al. (2009). Cohort studies of CBT to treat cannabis dependence have found that fewer number of sessions (say, one to two sessions) generally have better retention rates than more (say, six sessions) (Copeland, Swift, Roffman, & Stephens, 2001; JHC & Mayne, 2007).

Despite various models employed in RCTs, the US Department of Health and Human Services’ Substance Abuse and Mental Health Services Administration (SAMHSA) (Steinberg, et al., 2005)

guidelines for cannabis brief counselling are basically ten-weekly one-on-one sessions that include:

- Initial assessment session;
- Sessions 1 and 2: enhancing motivation (following ME principles). This involves preparing an individualised treatment plan and using cognitive behavioural therapy (CBT) and motivational interviewing (MI) or enhancement (ME) counselling techniques in counselling sessions;
- Sessions 3-9: skills building and case management.

This approach could involve telephone, family and individual counselling, relapse prevention and social skills training, abstinence counselling, and vocational support. Other interventions (JHC & Mayne, 2007) that are less widely used include:

- Mindfulness-based relapse prevention (MBRP), which is meditation-based interventions;
- Insight-adherence-abstinence approaches, which integrates elements of CBT, MI, psycho-education, support therapy and drug prevention strategies to treat patient with a first episode of psychosis;
- The Behavioural Treatment for Substance Abuse in Severe and Persistent Mental Illness (BTSAS), which employs a harm-reduction model, where progress of treatment is reinforced while infrequent use is not punished;
- The Multidimensional Family Therapy (MDFT) is a family-based treatment program designed for adolescents with drug and behavioural problems and substance abuse prevention. In the literature review conducted by JHQ & Mayne (2007), it appears that there has been only two trials that have examined the efficacy or effectiveness of MDFT.

Number and length of sessions and episodes

Although the optimum number of counselling sessions is unknown (Copeland, et al., 2009), following key informant interviews, it appears that counselling sessions for treating cannabis use disorder roughly follow the model in the SAMHSA guideline (outlined above), consisting of six to eight hourly weekly sessions. In the 2003-04 NMDS report, the median days of treatment for counselling for cannabis was 41 days (AIHW, 2005), or about 6 weeks, which was close to the SAMHSA guideline as well as for that reported in key informant interviews. Nevertheless, sometimes counselling sessions, such as those provided in “brief interventions”, could be as short as one to two sessions, although some could consist up to six sessions (Copeland, et al., 2009, p.27).

A combination of CBT and MET can be provided in brief interventions (Copeland, et al., 2009; Rees, et al., 1998) or counselling (Steinberg, et al., 2005). Sessions are typically 45 to 60 minutes in length; and a completed episode would include an initial assessment, advice and information, assessment of motivation for change, problem solving, goal setting, relapse prevention, harm reduction, skills building and case management (Copeland, et al., 2009; Steinberg, et al., 2005).

In this study, an average number of seven one-hour counselling sessions will be used for a completed episode (six to eight sessions per episode are the norm) in the calculation of the

counselling cost for treating cannabis clients. For episodes that were incomplete, four sessions would be used to calculate the cost.

Resources and costs

To assign unit costs to the length of each counselling session (one hour), the hourly wage of counsellors were obtained. Different counsellor qualifications or levels have different award rates attached to them (NSW Health, 2009). Counselling or brief interventions can be provided by a range of professionals: psychologists, counsellors and social or drug and alcohol (AOD) workers (with or without degrees). A mix of professionals providing counselling in drug treatment agencies have been reported in non-government organizations (NGO) in the AOD industry, of which 60% of the staff had no degrees (Gethin, 2008)⁵. In cannabis clinics, staff consisted of psychologists (32%), followed by nurses (27%) and counsellors/social workers (23%) (JHC & Mayne, 2007). In 2008, the National Cannabis Prevention and Information Centre (NCPIC) conducted a survey (unpublished, n=179, response rate 30%) of drug treatment agencies providing treatment to cannabis users. It was found that in general, the personnel that provided treatment to cannabis clients were ‘other-’ and ‘non-degreed counsellors’, averaging 30.2% and 29.7% respectively of the mean number of full-time equivalent (FTE) staff. Although it was not clear whether these degreed and non-degreed counsellors were psychologists, counsellors or social workers, it is generally accepted that counsellors with a Master degree are registered psychologists. In the NCPIC survey, such counsellors (with Master’s) totalled about 1 FTE, or 7% of the total number of FTE staff providing treatment to cannabis clients.

Given the limited data on the specific distribution of professions providing counselling in cannabis use disorder, the information from the NCPIC survey was used. The salary or wage rates of the different counsellor types were obtained from the NSW Health 2008 award rates (NSW Health, 2009) that have been pro-rated into hourly rates. Middle salary levels were used. The results of the weighted costs of counsellors are presented in Table 3.

Table 3: Proportions of counsellors and weighted cost per hour

Type of counsellor	% of total FTE	Indexed at 100%	Cost/one-hour session \$ 2007 dollars	Weighted cost/hour
Psychologists	7.1%	11%	\$35.99	\$3.81
Degreed Social worker/counsellors	30.2%	45%	\$46.15	\$20.80
Non-degreed counsellors (AOD worker)	29.7%	44%	\$54.76	\$24.27
Total	67.0%	100%		\$48.89

Source: NSW Health (2009); NCPIC survey (2008, unpublished)

⁵ They regarded non-professional workers (without degrees) were more affordable to employ, although they would like to employ more professional workers (i.e. clinicians) (Gethin, 2008). There are also a significant number of ex-users working in the drug AOD NGO sector.

This weighted cost per hour, \$48.89 in 2007 dollars, was also used to calculate the cost of counselling in withdrawal management (detoxification) and assessment sessions.

Also included in the counselling costing were the costs of information pamphlets and/or booklets regarding quitting cannabis. The cost per pamphlet was estimated to be \$0.77 each and a booklet \$1.39 each, totalling \$2.17. For more details about the costing methods, see 'Information and education' section. Assuming there was one pamphlet provided per episode, the costs of these printed media were multiplied by the number of counselling episodes (e.g. \$2.17 * 2,451, etc.).

As discussed earlier, an average of seven one-hour counselling sessions were used for a completed episode. The number of NSW counselling episodes in 2006-07 was 2,451 (Phillips & Burns, 2009, Figure 77, p. 99) with 50.4% reported as completed (1,235 episodes). If we assume completed is on average seven episodes, and not completed on average four episodes, then the costs of completed and not completed episodes can be calculated. Average cost per completed (seven sessions per episode) and partly completed episode (i.e. four sessions) were estimated to be \$342 and \$196 respectively.

Table 4 presents the data used to calculate the cost of counselling.

Table 4: Data for calculating counselling costs

Variable	Data	Source
No. of sessions complete	7	Literature (see discussion) and KII (2008)
No. of sessions partly completed	4	Assumption
Length per session (hour)	1	Literature (see discussion) and Key informant interviews (2008)
No. of NSW episodes per year	2,451	Phillips et. al. (2009), Figure 77, p. 99
Completion rate	50.4%	AIHW (2008h)
Printed media costs per episode (2007 \$)	\$2.05	Estimated from 'Information & education', see Table 12
Counselling cost per completed episode (2007 \$)	\$331	Calculation
Counselling cost per non-completed episode (2007 \$)	\$197	Calculation
CPI deflator 2007/2008	0.95	ABS (2008b)

Results

Table 5 presents the costs of counselling for all, completed and partly completed episodes. The last column is the sum of completed and partly completed episodes.

Table 5: Costs of counselling for cannabis use, NSW, 2007

Variable	Cost for 50.4% of episodes completed	Cost for 49.6% of episodes not completed	Sum of completed & incomplete episodes
No. of episodes	1,235	1,216	2,451
Counselling costs	\$409,456	\$240,002	\$649,458
Printed media costs	\$2,534	\$2,493	\$5,027
Total cost	\$411,990	\$242,495	\$654,485
With on-costs 28%	\$527,347	\$310,394	\$837,741
Total with 28% overhead costs	\$675,004	\$397,304	\$1,072,308

The cost of counselling was about \$1.1 million, with 63% of the costs for completed episodes (\$675,000). If all episodes were assumed completed (n=2,451), then the total cost would be \$1.3 million (not shown).

Residential rehabilitation

Residential rehabilitation in the NMDS refers to an intensive treatment program that integrates a range of services and therapeutic activities that may include counselling, behavioural treatment approaches, recreational activities, social and community living skills, group work and relapse prevention. It can provide a high level of support (i.e. up to 24 hours a day) and tends towards a medium to longer-term duration. Rehabilitation activities can occur in residential or non-residential settings. Across all drugs, many residential rehabilitation services offer programs of around three months (HPA, 2005), although this can vary from one to 12 months (KII, 2008). Another feature of residential rehabilitation programs is that counselling sessions are both group and individual sessions (HPA, 2005), for other drug users as well, and not just cannabis users. Nevertheless, sometimes sessions are likely to be more group sessions (KII, 2008).

Resources and costs

For residential rehabilitation, it is not clear what the expected length of stay (LOS) should be as programs differ across individuals and treatment agencies and may range from one month to a year (KII, 2008; NCPIC, 2008). In an unpublished survey of cannabis treatment providers (response rate: 30%), most respondents reported an expected LOS of 90 days (NCPIC, 2008) for inpatient residential rehabilitation. The 2005-06 NSW Health report on the NMDS found that the median number of days of treatment in residential rehabilitation for cannabis was 49 days (NSW Health, 2007b). Across all drugs, it has been reported that the average LOS (ALOS) in NSW was 60.2 days (HPA, 2005) while for cannabis clients, the ALOS was on average 53.1 days in 2003-04⁶. ALOS is an average of all episodes that were completed and not completed by clients. As such, the 'cannabis ALOS' of 53.1 days would be the best estimate available specifically for cannabis.

⁶ Total days in episodes (27,950) divided by active episodes (526) (HPA, 2005, p. 37)

As there have been comprehensive costing exercises for drug residential rehabilitation conducted elsewhere (HPA, 2005; Shanahan et al., 2007), it would be reasonable to utilise the average cost per day from these studies. As HPA examined residential rehabilitation for all drugs and Shanahan et. al. only heroin, this study used the average cost from HPA’s study⁷. The estimated average cost per client per day (across all drugs) was \$117, with a range of \$95 (services in regional areas) to \$146 (services in Sydney area) (HPA, 2005). These costs included on-costs and overhead costs (HPA, 2005, p. 11). The average cost of \$117 (\$127, 2007 \$) was used in the cost calculation while the lower and upper ranges were used in the sensitivity analysis. See Appendix A for a summary of Shanahan et al.’s study (2007).

As per ‘Counselling’, there may be printed materials (booklets/pamphlets) that are handed out to clients. The costing methodology adopted by HPA (2005) included an analysis of the expenses in the financial statements residential rehabilitations in NSW. Therefore, printed materials in the operating expenses would have been included in arriving at the ALOS cost.

Table 6 presents the resources and cost data for calculating the cost of residential rehabilitation:

Table 6: Data for calculating the costs of residential rehabilitation

Variable	Data	Source
Avg length of stay for cannabis	53.1	HPA (2005)
No. NSW episodes	431	Phillips et. al. (2009), Figure 77, p. 99
% completion rate	36.8%	AIHW (2008h)
Average cost per client day (2007 \$)	\$127	HPA (2005)
CPI deflator 2007/2004	1.08	ABS (2008b)

Results

There were 431 episodes of residential rehabilitation for cannabis in NSW in 2006-07 (Phillips & Burns, 2009, Figure 77, p. 99). With an overall reported average length of stay of 53.1 days and at an average cost of \$117 per client day, this equates to an annual expenditure of \$2.9 million (Table 7).

Table 7: Costs of residential rehabilitation for cannabis use, NSW, 2007

Variable	All episodes
No. of episodes	431
Cost per closed episode	\$2,898,684

If the expected LOS of 90 days (NCPIC, 2008) was taken into account (see discussion above), then the cost would total \$4.9 million.

⁷ The treatment profile for heroin residential rehabilitation also appeared to be different from cannabis (e.g. the ALOS residential rehabilitation was about 150 days versus 53.1 for cannabis).

Withdrawal management (detoxification)

The NMDS defines withdrawal management as any form of withdrawal management, including medicated and non-medicated, in any delivery setting. This included outpatient and inpatient treatment settings. Inpatient settings appeared to be similar to residential rehabilitation treatment (KII, 2008). In both settings, clients can request to be included in medicated programs (Copeland, et al., 2009), although there are currently no medications prescribed for cannabis dependence. However, a few pharmacotherapies such as rimonabant, divalproex sodium, bupropion, nefazodone and fluoxetine have been trialled as part of the treatment for some symptoms of this condition. More recently, pericyazine (Samara & Morgan, 2008) was examined as a potential medication, although it has not been found to be effective (Hart, 2005; JHC & Mayne, 2007; Nordstrom & Levin, 2007). Nevertheless, other common medications are also given to ameliorate symptoms due to cannabis withdrawal. Medications include benzodiazepines and diazepam for sleep problems and anxiety, sedating anti-histamines for nausea and loss of appetite, and pain-killers for muscle cramps, pain and headache (Astolfi, et al., 1998). In practice, it appears that the medication most often prescribed is mirtazapine, an anti-depressant (KII, 2008). It is generally prescribed for withdrawal symptoms such as insomnia, agitation, irritability, appetite change (Ferguson, 2007). A medical practitioner is required to prescribe medications to clients on medicated detoxification programs. In this study, mirtazapine was included in the costs of withdrawal management for a proportion of cannabis clients.

Besides medications, clients receive support and counselling throughout the four to seven days of withdrawal symptoms (Astolfi, et al., 1998). Counselling techniques are similar to that provided in 'Counselling' (see section above) (KII, 2008).

Although it is not clear to what extent medicated detoxification has been employed (compared to non-medicated detoxification), from the key informant interviews, it appeared that clients who are on medicated detoxification are mainly those with mental health comorbidities e.g. anxiety, depression, or those who have no confidence in abstaining or reducing use. Clients wanted to be seen by a medical doctor for referrals into residential detoxification or rehabilitation, or symptoms requiring medication. It also appeared that in general, outpatient withdrawal management was more favoured than an inpatient one (Redfern Clinic, 2007).

Other services or activities provided for clients on withdrawal management programs include information and education, harm minimization, relaxation techniques, diet, sleep hygiene, and other activities to distract them while withdrawing from cannabis use.

Resources and costs

Inpatient withdrawal management

As a proportion of all treatment the proportion of outpatient and inpatient cannabis treatment episodes were similar at 9.4% and 9.3% respectively (NSW Health, 2007b, p. 27). The distribution indexed to 100% for all withdrawal episodes resulted in 49.7% for inpatient episodes, and 50.3% outpatient. The median duration of inpatient treatment was seven days (NSW Health, 2007b, p. 27). The average cost per day used for inpatient withdrawal was the same as the cost

used for residential rehabilitation (\$127 per day). Costs were reported for completed and incomplete episodes.

Outpatient withdrawal management

The average cost of outpatient withdrawal management was not known. As such, costs would be estimated using the same method as employed in 'Counselling', where the resources, their amount and unit costs were used. Costs were estimated for medicated and non-medicated programs. For medicated programs, the cost components are as follows:

- a. Prescription costs, which include the cost of seeing a medical doctor or registrar and medication;
- b. Counselling costs, which are assumed to be similar to those calculated for the counselling treatment type as discussed above. Printed materials (booklets and pamphlets) were assumed to be handed in counselling sessions.

As mentioned earlier, mirtazapine is most commonly prescribed for cannabis clients in a medicated withdrawal management program. It is prescribed in a dosage of 30mg at one to 1.5 tablets per day at night, which can be increased to two tablets per day for five-to-six weeks (KII, 2008). This is equivalent to a 30-tablet pack of 30mg of the medication. The PBS schedule rate was used to cost this.

Costs were calculated for completed and non-completed episodes. In non-completed episodes, it was assumed that the cost of the unused tablets is not recoverable (i.e. it is a 'sunk' cost); and thus the cost of a 30-tablet pack of the medication was included in the cost calculation. Counselling sessions in the partly completed episodes were assumed to be partly completed as well, as adopted in the 'Counselling' section. That is, it is assumed that only four sessions were completed and costed.

According to key informant interviews from a cannabis clinic, 20% of all of their clients requested to see a medical doctor when entering into a withdrawal management program. A medical doctor was assumed to spend 20 minutes with a client. Award rates were obtained from the NSW Health award rates and pro-rated into an hourly rate. Although this may not be specifically for cannabis use disorder, a survey of drug treatment agencies for cannabis found that 7% responded that they provided medicated detoxification programs. As such, medication was assumed to be prescribed to 7% of those who (20%) saw a medical doctor (7% * 20%).

For non-medicated programs, counselling and printed media costs were included. The number of episodes of those who saw a medical doctor but did not progress on to a medicated detoxification program, as well as those who did not see a medical doctor and did not progress on to a medicated detoxification program were included and their respective costs calculated.

Results

Table 8 shows the resources and variables used in the calculation of medicated detoxification.

Table 8: Data for calculating withdrawal management costs

Resource/variable	Data	Source
No. NSW episodes	1,127	Phillips et. al. (2009), Figure 77, p. 99
% inpatient of total withdrawal management episodes	49.7%	NSW Health (2007b), calculation
% outpatient of total withdrawal management episodes	50.3%	NSW Health (2007b), calculation
No. median days inpatient withdrawal	7	NSW Health (2007b)
Average cost per client day (inpatient withdrawal)	\$127	HPA (HPA, 2005)
Completion rate	65.20%	AIHW (2008h)
% received medication	7%	NCPIC survey (2008)
Registrar/medical doctor (20 minutes)	\$15.75	NSW Health (2009)
Medication	\$25.81	Commonwealth of Australia (2008c)
Printed media costs per episode	\$2.05	Estimated from 'Information & education', see Table 12
Counselling cost per completed episode	\$331	See 'Counselling' section
Counselling cost per non-completed episode	\$197	See 'Counselling' section
CPI deflator 2007/2008	0.96	ABS (2008b)

The costs of withdrawal management for medicated and non-medicated episodes are presented in Table 9.

Table 9: Costs of withdrawal management (detoxification) for cannabis use, NSW, 2007

Inpatient episodes	Cost for 65.2% episodes completed	Cost for 34.8% episodes completed	Sum - completed & incomplete episodes
No. episodes	365	195	560
Total cost inpatient	\$323,771	\$172,811	\$496,582
Cost + on-cost 28%	\$414,427	\$221,197	\$635,625
Cost + on-cost 28% + overhead 28%	\$530,467	\$283,133	\$813,600
Outpatient episodes			
No. referred to medical officer	74	39	113
No. episodes provided medication	5	3	8
No. episodes no medication	290	155	445
Referral cost	\$1,163	\$621	\$1,784
Medication-cost	\$133	\$71	\$205
Counselling cost	\$122,409	\$38,945	\$161,354
Printed media costs (see 'Information & education')	\$757	\$405	\$1,162
Cost - medicated	\$27,648	\$9,113	\$36,761
Cost - non-medicated	\$96,814	\$30,913	\$127,727
Total cost outpatient	\$124,463	\$40,042	\$164,504
Cost + on-costs 28%	\$159,312	\$51,253	\$210,566
Cost + on-costs 28% + overhead 28%	\$203,920	\$65,604	\$269,524
Total outpatient and inpatient	\$734,387	\$348,737	\$1,083,124

Based on the assumption made about the distribution between inpatient and outpatient withdrawal management episodes, 560 were inpatient and 566 were outpatient. The total inpatient cost was about \$530,000.

For outpatient withdrawal management episodes, there were 113 episodes (1,127 * 50.3% * 20%) where a referral was made to a medical officer; and 8 (7% * 113) of these were provided medication. The balance of the episodes not in an outpatient medicated program was 445.

The total cost of outpatient medicated detoxification program for cannabis use was approximately \$37,000, and approximately \$128,000 for non-medicated program, totalling approximately \$164,000. Including inpatient costs, this was \$1.1 million including on-costs and overhead costs. Completed episodes totalled approximately \$734,000 and incomplete ones \$350,000. If all episodes (n=1,127) were assumed completed, then this would cost \$1.13 million (not shown).

Assessment

Assessment sessions are the initial point of contact where the treatment provider evaluates the client’s cannabis use, their general health and well-being, their level of dependence if applicable,

and their motivation for change, as well as to begin to build rapport with the client (KII, 2008; Steinberg, et al., 2005). Such sessions take approximately 90 minutes. Clients can be asked to complete a questionnaire or the treatment provider may interview the client using a structured questionnaire. Depending on the setting, the person conducting the assessment could be a GP, counsellor, AOD workers, or other health professional.

In practice, key informant interviews revealed that ‘assessment’ sessions could involve ‘information & education only’ and/or ‘some counselling’ (KII, 2008). Also, in the NMDS, a treatment type is coded as ‘assessment only’ if the client does not return for further sessions (AIHW, 2008d)⁸.

Resources and costs

In this study, it was assumed that there was one session per episode, each session lasted 90 minutes, and that any trained personnel (counsellors, psychologists) would be able to conduct the assessments. A 100% completion rate was assumed in this study although 79.6% was reported in the NMDS (AIHW, 2008h). The reason for this assumption is that to ensure the costs of initial contact, making appointments and time waiting for clients were included. The cost per session was the same cost used in the ‘Counselling’ section.

A summary of the data used to calculate the cost of counselling is presented in Table 10.

Table 10: Data for calculating assessment costs

Variable	Data	Source
Length of session (minutes)	90	KII (2008)
No. of session per episode	1	KII (2008)
% NSW episodes	1,727	AIHW (2008h)
Completion rate	100%	Assumption
Cost per session	\$74.04	Calculation
CPI deflator 2007/2008	0.95	ABS (2008b)

Results

The costs estimated for assessment only episodes are presented in Table 11. The cost of assessments was about \$154,000 in 2007 dollars.

Table 11: Costs of assessment for cannabis use, NSW, 2007

Variable	Cost (2007 \$)
No. of episodes	1,727
Total cost	\$127,870
Total with 28% on-costs	\$163,674

⁸ The median days of cannabis assessment was reported to be eight days by NSW Health (2007b), although this could mean that between the start and end date of a treatment, a client dropped out eight days into the program, and not that on average they were treated or assessed for eight days.

Information and education

As mentioned, ‘information and education’ is not necessarily a separate process from assessment or counselling sessions which would include information and education and counselling. This is particularly so for young people or coerced non-dependent users who are not expected to return for more sessions (KII, 2008). However, at the initial point of contact some form of information on cannabis use and abstinence, perhaps supplemented by printed brochures and materials may be provided. As with assessment, the person providing information and education could be counsellors, nurses, triage officers, GPs or other health professionals. Often ‘information and education’ may take other more public forms, such as community presentations, and other promotional and networking activities (KII, 2008) on a weekly or monthly basis.

Resources and costs

As information and education sessions are not necessarily separate sessions from ‘Assessments’ sessions, it is difficult to estimate the time spent in providing information and education to cannabis clients. From key informant interviews, typical sessions could last from 30 to 60 minutes. Therefore, an average of 45 minutes was used to calculate the cost of information and education sessions. The number of NSW sessions in 2006-07 was estimated to be 113 (see notes on Table 2).

Typically, such sessions would also include the provision of information booklets or pamphlets to clients. Another medium of information and education also includes the Internet. It is estimated that printing 1,000 double-sided, coloured and folded pamphlets, has an average cost of \$0.77 a piece and a 16-paged A5-sized and coloured booklet cost approximately \$1.40 per booklet. (Australian Trade Printers, 2009; Dark Horse Print Design, 2009; KainosPrint, 2009; The Online Printer, 2009). For print media costs, it was assumed that, on average, one flyer and one booklet were handed out in one session (about \$2.17 in total), totalling \$245 for 113 NSW episodes.

Most treatment agencies have Internet websites that clients could use for self-help. The costs for setting up a website are sunk costs; that is, once the initial set-up costs are outlaid, they are not recoverable. Therefore, whether or not the clients really use it the agency would still have outlaid the costs; as such they were included in the cost estimation. The cost of setting up Internet websites where clients can access information for self-help was included. From a survey on the Internet at the time of writing, a website may cost approximately \$5,000 to \$7,000 to design and set up. It can be assumed that the copyright of such website is for five years. Taking the average of indicative website set-up cost, \$6,000, this equated to \$1,200 per year. In addition, an average monthly ongoing cost of \$35 (domain name registration, web hosting and administration fees) was included (Messageforce, 2009). In total, the yearly cost of maintaining a website can be estimated to be \$1,620.

The website cost per year of \$1,620 was estimated for one agency. In NSW, it was reported that there were 10 non-government organisation (NGO) drug treatment sites that were members of Network of Alcohol and Other Drug Agencies (NADA) that provided information and education services in 2008 (Gethin, 2008). NSW Health has a DrugInfo website ([www.druginfo.nsw.gov.au/illicit_drugs/cannabis_\(marijuana\)](http://www.druginfo.nsw.gov.au/illicit_drugs/cannabis_(marijuana))), as well as the Sutherland

Cannabis Clinic (www.sesiahs.health.nsw.gov.au/Cannabis_Clinic/). NSW Police also has a website (www.police.nsw.gov.au/data/assets/file/0007/2410/Cannabis.pdf). The Australian Government Departments of Health and Ageing have documents of the health effects of cannabis use (www.health.gov.au/internet/main/publishing.nsf/Content/health-pubs-drug-cannab2-home.htm). The National Cannabis Prevention and Information Centre (NCPIC), is an Australian Government-funded centre that provides an information hotline and information via pamphlets and website (www.ncpic.org.au). In total, there were 15 websites located that cannabis seekers could utilise for information and education. This number was then applied to the estimated annual website cost (\$1,620) to obtain an estimate of total website costs.

As with ‘Assessment’, a 100% completion was assumed. The calculations of website and print media costs are presented in Table 12.

Table 12: Website and print media costs

Website costs	Cost 2007 \$
Web site development	\$5,679
Yearly cost (÷ 5 years copyright)	\$1,136
Ongoing costs per month	\$33
Total yearly cost	\$1,533
Print media costs per session	Cost 2007 \$
Flyer per piece	\$0.73
Booklet per piece	\$1.32
Total print media costs	\$2.05

The data used to calculate the costs of information and education are summarized in Table 13.

Table 13: Data for calculating the costs of information and education

Variable	Data	Source
Length of session (hour)	0.75	KII (2008)
No. of session per episode	1	Assumption
No. Australia episodes	7,685	AIHW (2008e)
Estimated NSW episodes	113	Calculations, see Table 1
Estimated no. of websites NSW	15	Gethin (2008), NSW Health (2008a, 2008b), NSW Police (2010), DoHA (1994), Department of Defence (2010)
% Completion rate	100%	Assumption
Cost per session (excluding media)	\$37.02	Calculations
Website cost yearly	\$1,533	Various (see text)
Print media cost all episodes	\$232	Various (see text)
CPI deflator 2007/2008	0.95	ABS (2008b)

Results

The costs estimated for cannabis information and education for all and completed episodes are presented in Table 14.

Table 14: Costs of information and education for cannabis use, NSW, 2007

Variable	Cost (2007 \$)
No. of episodes	113
Personnel cost	\$4,189
Website costs	\$23,000
Print media costs	\$232
Total personnel & media costs	\$27,421
Total with 28% on-costs	\$35,098

The cost of information and education for cannabis treatment in NSW was estimated to be about \$35,000 in 2007 dollars.

Treatment provided by general practitioners (GPs)

'Cannabis consultations'/referrals

Although little is known about GP management of cannabis use problems (Arcuri, Frewen, Copeland, Harrison, & Britt, 2008), an analysis of the Bettering the Evaluation and Care of Health (BEACH) data from April 2000 and March 2007 (n=689,000 encounters) found there were 129 consultations (0.02%) with at least one recorded cannabis problem ('cannabis consultations'). From this it was estimated that the annual number of GP consultations nationally with at least one recorded cannabis problem ('cannabis consultations') was 19,000 (Arcuri, et al., 2008). The authors noted that this was likely to be an underestimate because there were 3,650 illicit drug problems recorded, but the GP did not identify the specific drug in 2,841 (77.8%) of them (i.e. it is possible that cannabis was present among the 2,841 problems but the proportion or number was not known). Of those visits where cannabis was recorded as a problem, about half (46.6%) of the consultations were standard consultations (Level B item 23), which is usually less than 20 minutes, 36.2% were long ones (Level C item 36), which is usually between 20 and 40 minutes and only 2.6% were prolonged consultations (Level D item 44), which is longer than 40 minutes. This information was used to calculate the GP costs by MBS item.

Of the medications most frequently prescribed during cannabis consultations, 7.8 per 100 of such consultations were for anxiolytic, 4.7 for antidepressants, 2.3 for a drug used in nicotine dependence and 0.8 for antipsychotic. The rate of medication prescribed per 100 cannabis consultations was used in the calculation of medication costs (by PBS items) in the GP setting.

In addition GPs can also develop a plan for counselling under a Focussed Psychological Strategies (FPS)/ GP Mental Health Management Plan (GPMHMP) which involves preparing a treatment plan and up to six sessions with a psychologist. However, data is not available as to the use of this for cannabis clients.

Resources and costs

The number of ‘cannabis consultations’ for NSW, was calculated from the national number of such consultations (n=19,000 estimated by Arcuri et. al., 2008). To estimate the number of consultations for NSW, the proportion of NSW cannabis closed treatment episodes in drug treatment agencies (7,702/31,980 = 22.1%, see Table 2) was applied to 19,000. The different types of consultations for cannabis problems, and the associated costs by MBS Items were also reported (Arcuri, et al., 2008) (calculations are explained in notes in Table 16). Medication costs for those reported most commonly prescribed in ‘cannabis consultations’ (i.e. anxiolytics, antidepressants and antipsychotics) were included. MBS costs were obtained for November 2008 prices (Commonwealth of Australia, 2008a)⁹. The completion rate of GP consultations was assumed to be 100%. Table 15 presents the data for this.

Table 15: Data to calculate GP ‘cannabis consultation’ costs

Variable	Data	Source
% medical practitioner referral National Minimum Data Set	3.20%	AIHW (2008d)
% cannabis closed treatment episodes in NSW (from NMDS)	7,072/31,980 = 22.1%	AIHW (2008e), Table 2 in this study
National no. of cannabis consultations p.a.	19,000	Arcuri et. al. (2008)
Consultation costs (Medicare)	Table 16	MBS November schedule (Commonwealth of Australia, 2008a)
% breakdown of consultation length	Table 16	Arcuri et. al. (2008)
Medications prescribed	Table 17	PBS schedule (Commonwealth of Australia, 2008c)
Assumed completion rate	100%	Assumption
CPI deflator Jun 2007/Dec 2008 (for PBS cost)	0.96	ABS (2008b)
CPI deflator Jun 2007/Nov 2008 (for MBS cost)	0.95	ABS (2008b)

⁹ GP salaries were factored into MBS costs and such costs have factored in on-costs and overhead costs. As this study focuses on costs paid by governments private costs were not included.

Results

The costs of GP ‘cannabis consultations’ and referrals are presented in Table 16.

Table 16: Costs of GP ‘cannabis consultations’, NSW, 2007

Cannabis consultations	n=129	Medicare item no. *	Fee (2007 \$)	No. of consultations*	Cost (2007 \$)
Standard consultation	46.6%	Level B item 23	\$31.91	1,957	\$62,452
Long consultation	36.2%	Level C item 36	\$60.63	1,520	\$92,185
Prolonged consultation	2.6%	Level D item 44	\$89.21	109	\$9,742
			Total	3,587	\$164,379

Source: Arcuri et. al. (2008); Commonwealth of Australia (2008a)

Note:

* Number of consultations for NSW: 19,000 * 22.1% * 46.6% and so on.

It was estimated that total GP consultation costs that relate to treating cannabis use disorders were approximately \$164,000 in 2007 dollars. The cost of GPs providing referrals to treatment outside the GP setting was estimated to be \$8,844 in 2007 dollars. The costs of medications prescribed are presented in Table 17.

Table 17: Costs of medications commonly prescribed

Medication	% consultations	PBS drugs	Estimated no. consultations	PBS price (2007 \$)*	Total cost (2007 \$)
Anxiolytics	7.8%	Diazepam 5mg	1,482	\$7.19	\$10,661
Antidepressants	4.7%	Mirtazapine 30mg	893	\$25.81	\$23,049
Antipsychotics	0.8%	Olanzapine	152	\$125.53	\$19,080
				Total	\$52,791

Source: Arcuri et. al. (2008); PBS Schedule (Commonwealth of Australia, 2008c)

Note:

* These are prices per pack in the PBS schedule. For olanzapine, the price was a weighted average of four dosages (2.5mg, 5mg, 7.5mg and 10mg) based on the number of scripts reported by PBS Statistics for the period June 2006 – June 2007.

It was estimated that medications prescribed during cannabis consultations cost \$53,000 in 2007 dollars. Therefore, the total cost of consultations and medications was \$217,170.

Treatment in hospitals

Cannabis-related hospital stays could relate to treatment for cannabis use disorder or dependence as well as that for the health consequences of its use (e.g. mental health problems). This section outlines hospital separations where cannabis was identified as the principal diagnosis (where the admission was for cannabis-related conditions) or as a secondary diagnosis if the primary one was for alcohol.

Nationally, among illicit drug-related hospital separations, cannabis was the drug that resulted in the third most separations. Relative to other states, NSW had the highest number of separations

(Roxburgh & Burns, 2009). In 2006-07, there were about 150 per million persons with a principal cannabis-related hospital separation among persons aged 15-54 in Australia, while there were about 250 per million persons in NSW (Phillips & Burns, 2009). It was reported that cannabinoids or cannabis made up 772 same day hospital separations (23.7%) and 2,491 overnight (76.3%) separations, totalling 3,263 separations in 2006-07 (AIHW, 2008d). In an analysis of emergency department presentations in two Sydney hospitals in 2004-2006, cannabis presentations were often related to physical problems (injury, nausea, vomiting and abdominal pain, cardiovascular, respiratory) (65%), or mental health problems (anxiety, suicide risk, etc.) (Indig, Arcuri, & Copeland, 2008).

Using the National Hospital Morbidity Database (NHMD) data, it was estimated elsewhere that the cost of hospital separations related to cannabis use disorder was \$8.4 million in 2005 or \$1,294 per separation (\$1,371 2007 AUD) (Riddell, et al., 2007). In addition to hospital admissions, where the principal reason for admission was cannabis, other researchers using US hospital data have found that cannabis use in patients with a primary alcohol diagnosis was associated with a longer length of stay (LOS) and higher charges (Pacula, et al., 2008). After controlling for other drug use and hospital characteristics, hospital costs were 7% higher due to alcohol and cannabis use. Mood and thought (such as depression and anxiety) diagnoses did not result in statistically significant longer LOS. As such, an additional cost (7%) for those with alcohol related admissions who also used cannabis-was included (see Pacula, et al., 2008 for more information).

Resources and costs

The number of cannabis-related hospital separations for NSW in 2006-07 was obtained from Phillips et. al. (n=902) (2009, Figure 84, p. 103). As the number of hospital separations with alcohol as principal diagnosis with cannabis as secondary ('alcohol primary, cannabis secondary' diagnoses thereafter) were only available for NSW for 2004-05 (Roxburgh et. al., 2008) an estimate for 2007 was generated. This was done using information from 2004-05 on the ratio of 'alcohol primary, cannabis secondary' diagnoses (1,793) to cannabis principal diagnosis (2,815). The resulting ratio (0.64) was then applied to the number of separations where cannabis was the principal diagnosis (902), equalling 575 of 'alcohol primary, cannabis secondary' diagnoses. As per GP consultations, the completion rates are assumed to be 100%.

The data are presented in Table 18.

Table 18: Estimating the number of hospital separations

Australia 2004-05 data		
	Data	Source
'Alcohol principal, cannabis secondary' separations	1,793	Roxburgh and Degenhardt (2008)
'Cannabis principal' separations	2,815	Roxburgh and Degenhardt (2008)
Ratio	1,793/ 2815= 0.64	Calculation/assumption
NSW 2006-07 data		
'Cannabis principal' separations	902	Phillips et. al. (2009), Figure 84, p. 103
Estimated 'alcohol principal, cannabis secondary' separations	0.64 * 902= 575	Estimation
Variable		
Completion rate	100%	Assumption
Cost per separation 2007 dollars	\$1,371	Riddell et. al. (2007)
Average weighted cost of alcohol DRGs	\$1,756	Commonwealth of Australia (2008b)
7% of average weighted cost of alcohol DRGs	\$123	Pacula et. al. (2008)
CPI deflator 2007/2005	1.06	ABS (2008b)

Average hospital cost for a cannabis separation was estimated to be \$1,294 in 2005 (Riddell, et al., 2007); \$1,371 in 2007 dollars. This was applied to the number of 'cannabis primary' separations (n=902). For the cost of 'alcohol primary, cannabis secondary' separations, weighted Diagnosis-Related Group (DRG) cost per alcohol-related hospital separation was required. The average cost weights of alcohol DRGs were \$1,756 in 2006-07 (Commonwealth of Australia, 2008b); and 7% of this was \$123. This was then multiplied by the estimated number of 'alcohol primary, cannabis secondary' separations.

Results

Cannabis-related hospital cost per separation was estimated to be \$1,371 in 2007 dollars (Riddell, et al., 2007). Multiplied by the number of NSW cannabis separations in 2006-07 (902) this totalled \$1.24 million. The hospital cost weights for alcohol (7% of total cost weights) was multiplied by the estimated number of 'alcohol principal, cannabis secondary' separations (575), totalling \$70,613.

Table 19 presents the total costs, which were estimated at \$1.31 million.

Table 19: Hospital costs for cannabis-related admissions, NSW, 2006-07

Cost variable	Cost
Total additional hospital costs due to cannabis use in those with an alcohol diagnoses	\$70,613
Total cannabis hospital separation cost	\$1,236,997
Total cannabis related hospital costs	\$1,307,610

Treatment cost for health consequences attributable to cannabis use

As mentioned, a literature review (see Appendix A) concluded that among all potential health-related consequences of cannabis use, evidence was strongest for these three conditions (schizophrenia, low-birth weight newborns, road traffic accidents) related to its use. Despite this, to our knowledge, the costs to treat these conditions that are attributable to cannabis use have not been estimated. Importantly, not all of those who were treated and/or diagnosed with psychotic disorders or schizophrenia developed the condition due to cannabis use; and there is an ongoing debate about the possibility of self-medication using cannabis amongst this population (see, for example, McLaren, Lemon, Robins, & Mattick, 2008). Given this, this study has employed the population attribution fraction to estimate the number of recent cannabis users who had had treatment and/or a diagnosis for schizophrenia and/or psychotic disorders. Similar methods were used to attribute cannabis use to the number of persons injured or killed in road traffic accidents and low birth weight newborns.

Schizophrenia/psychotic disorders

While there has been no conclusive evidence on the direct relationship between cannabis use and schizophrenia and/or psychotic disorders, the condition has been linked to cannabis use. In those with a family history of schizophrenia there is evidence of an increased risk of developing a psychotic disorder or the worsening of schizophrenia in the context of cannabis use (Moore, et al., 2007). From the most recent systematic review, people who use cannabis daily have a 109% higher risk of developing psychotic symptoms compared to those who have never used (odds ratio (OR) of 2.09, 95% confidence interval (CI): 1.54, 2.84), while those who had ever used have a 41% higher risk (OR: 1.41, 1.20, 1.65) than those who have never used (Moore, et al., 2007). A recent retrospective cohort study of 3,801 young adults born between 1981 and 1984 in Queensland found that those who had used cannabis six years or more were significantly more likely to develop psychosis-related outcomes than those who had never used (McGrath, et al., 2010). 14.3% of the sample had used for six years or more. The adjusted ORs (for age, sex, hallucinations at age 14 and parental mental illness) of Peters Delusions Inventory (PDI) score was significant at 4.2 (95% CI: 4.2, 5.8), and for hallucinations the OR was 2.8 (95% CI: 1.9, 4.1)¹⁰. The paper also concluded that reverse causality (i.e. in commencing cannabis use) was more likely to occur in those vulnerable to psychosis), with the risk doubling (OR = 1.9, 95% CI: 1.5, 2.5). When depression and anxiety-related disorders were taken into account, the strength of the association between cannabis use and psychosis-related outcomes was reduced, to an adjusted OR of 2.1 (95% CI: 1.4, 3.1) for hallucination at 21 year follow-up. In summary, given the demonstrated significant relationship between schizophrenia/psychotic disorders and cannabis as described above, associated health care costs were included in this study.

¹⁰ The authors reported that the OR for non-affective psychosis was 'significant' although after adjusting for sex, age, hallucinations at age 14 years and parental mental illness, the 95% CI included 1 (1.002, 4.3; OR = 2.1).

Resources

Resources to treat schizophrenia/psychotic disorders differ depending on the severity and/or phase of the condition. In the early, diagnostic or prodromal phases, diagnosis and/or treatment are usually carried in the outpatient setting, by a GP or specialists in mental health services (e.g. crisis team, mental health team, psychiatrist) (Andrews & Tolkien II Team, 2006). Hospitalisation may be required if there is a risk of harm to self or others in the first episode. Physical investigations (including computed tomography (CT) scan of the brain, electrocardiogram, etc.) are conducted to assess the client's general health and primary cause for the condition before treatment commences. Other resources as part of the treatment include anti-psychotic medications, such as clozapine. Treatment plan involves a range of mental and allied health services, such as CBT, MI, vocational and social rehabilitation, family support, other forms of counselling and case management (which could be managed by a GP in rural areas). When schizophrenia is diagnosed even if recovery is achieved, it is recommended that medication is continued for approximately one to two years (Andrews & Tolkien II Team, 2006).

Number of persons with schizophrenia and/or psychotic disorders

The number of persons who had used cannabis by frequency of use and were treated for and/or diagnosed with schizophrenia/psychotic disorders in last 12 months in NSW were obtained from the NDSHS 2007. To obtain the number persons in treatment due to cannabis use, the population attributable fraction (PAF) was calculated and applied to the data. The PAF was calculated using the odds ratios (ORs) obtained from Moore et. al.'s (2007) meta-analysis. Reflecting the different ORs for those who had used most frequently (i.e. daily) and those who used less frequently (i.e. weekly, monthly, etc.), two respective PAFs were calculated and applied accordingly to the number of persons. The resulting number was then multiplied by the costs of treatment and diagnosis. The calculation is outlined in Appendix E. The number of persons by treatment/diagnosis status was then multiplied accordingly by the different costs (see discussion on costs below).

Costs

In the literature, there are three main studies in Australia that have estimated the cost of treating schizophrenia (Access Economics, 2002; Andrews & Tolkien II Team, 2006; Carr, Neil, Halpin, & Holmes, 2002b). Access Economics' (2002) health care cost estimates were based on AIHW's Disease Cost and Impact Studies (DCIS) (Mathers, Stevenson, Carter, & Penm, 1998) approach in 2001 dollars, and prevalence data for schizophrenia. Andrews et. al.'s (2006) cost estimates were derived from the Low Prevalence Disorder Study which used costs from the MBS, PBS, Australian-Refined Diagnosis Related Group (AR-DRG) cost weights, the NSW government's case mix rates (Carr, Neil, Halpin, & Holmes, 2002a), and prevalence data from the National Survey Data.

Carr et. al.'s (2003) estimate was based on cost of illness approach in possibly 2000 dollars (not clearly stated in the paper) in a one-month survey in urban areas in Australia. Once converted to 2007 dollars, the annual costs estimated by these three studies are relatively similar at \$18,606 (Andrews & Tolkien II Team, 2006); \$23,580 (Access Economics, 2002); and \$21,609 (Carr, et al., 2003).

There are different phases of the condition by length and severity, and hence there are different management strategies and costs associated in each phase. Andrews et. al. (2006) constructed a model to estimate the costs of each phase. As mentioned above, the health care costs they used covered GP, hospital and community care, which included on-costs (administration) and overhead costs.

Results

The NDSHS 2007 data has information on the treatment status of cannabis users who had either been diagnosed and/or treated for either schizophrenia and/psychotic disorders (see previous sub-section). As such, the different treatment status and phases of the condition were matched accordingly to estimate the costs of each treatment status from the NDSHS data. The costs calculated for each phase of schizophrenia and/or psychotic disorder attributed to cannabis use are presented in Table 20.

Table 20: Schizophrenia/psychotic disorder health care costs attributable to cannabis use, NSW, 2006-07

NDSHS treatment status*	Phase of condition**	Average cost**	No. #	Total cost
Diagnosed only	Diagnostic/assessment phase, Week 1	\$4,252	44	\$188,452
Diagnosed and treated	Combination of diagnostic/assessment, initial and second management phases, Weeks 1 through 52	\$18,554	-	-
Treated only	Complete/partial remission, Years 2-5	\$3,139	-	-
Diagnosed only for schizophrenia/psychosis	Diagnostic/assessment phase, Week 1	\$4,252	416	\$1,768,398
Treated only for schizophrenia only	Complete/partial remission, Years 2-5	\$3,139	95	\$297,947
Diagnosed and treated for schizo/psychosis only	Combination of diagnostic/assessment, initial and second management phases, Weeks 1 through 52	\$18,554	184	\$3,409,714
Treated only for psychosis only	Complete/partial remission, Years 2-5	\$3,139	177	\$555,539
	Total		916	\$6,220,049

Note:

* From the 2007 National Drug Strategy Household Survey (NDSHS) (AIHW, 2008a).

** From Andrews et. al. (2006).

Estimated in this study. See Appendix E for details.

NA Not applicable. There were no cannabis users with such treatment status in the NDSHS data (2008a).

The total annual cost of treatment for psychosis/schizophrenia cannabis users in NSW is estimated to be \$6.22 million in 2007 dollars.

Low birth weight babies born to mothers who use cannabis during their pregnancy

A review of the literature (Burns, Mattick, & Cooke, 2006; Fergusson, Horwood, & Northstone, 2002; Hall & Pacula, 2003; Montebello, 2006; Room, Fischer, Hall, Lenton, & Reuter, 2008) revealed that the most consistent evidence or finding of the association between pregnancy outcomes and cannabis use was low birth weight (LBW). LBW can be defined as weighing less than 2500g at birth (English, Hulse, Milne, Holman, & Bower, 1997) or small for gestational age at the 10th percentile (Burns, et al., 2006). Previously, older, non-Australian studies established a relationship (e.g. Hatch & Bracken, 1986; Hurd, et al., 2005) while the most recent NSW study found an OR of 2.0 (95% CI: 1.7, 2.2) of giving birth to a LBW babies if a mother used cannabis during their pregnancy (Burns, et al., 2006).

Number of LBW baby separations and costs

Although aetiological fractions had been calculated for low birth weight baby separations that were attributed to illicit drug use (see Ridolfo & Stevenson, 2001), such estimates were not available for cannabis. As such, an OR of 2.0 from an Australian study (Burns, et al., 2006) was used to calculate the number of LBW babies attributable to cannabis use. Hospital data (public and private) for NSW in 2006-07 were used (NHCDC data, Commonwealth of Australia, 2008b).

There were 638 LBW babies born to mothers who reported using cannabis in the NSW Midwives Data Collection from 1998-2002, out of a total of 40,761 LBW babies (born to both drug and non-drug using mothers) (Burns, et al., 2006) in the period (1998 – 2002). The proportion of LBW babies born to cannabis users (1.6%) from Burns et. al. (2006) was then applied to this total to obtain an estimate of the number of LBW babies due to cannabis use in NSW, 90.

This study estimated the excess hospital costs for caring for LBW babies (those weighing < 2,499g at birth) compared to caring for babies of normal birth weight (those > 2,499g at birth). Hospital cost weights (public and private) for both normal birth weight and low birth weight babies were obtained from the same source (NHCDC) for 2006-07 (Commonwealth of Australia, 2008b). The average cost weight for a normal birth was 1.22 while for LBW births it was about five times higher, 5.78. This resulted in an excess cost 4.56 times the average cost per DRG to care for LBW babies. The average cost per DRG in NSW for 2006-07 was \$3,924.

Results

\$3,924 was multiplied by 4.56 times the excess LBW baby separations and the number of such separations estimated earlier (90). The data and results are presented in Table 21.

Table 21: LBW hospital separation costs attributable to cannabis use, NSW, 2006-07

Variable	Data	Source
% cannabis Low Birth Weight (LBW) separations / all LBW separations	1.6%	Burns et. al. (2006)
Estimated no. NSW LBW separations attributable to cannabis use	90	Calculation
Completion rate	100%	Assumption
Differential cost weight: (LBW minus Normal Birth Weight (NBW) cost weights)	4.56	NHCDC data (Commonwealth of Australia, 2008b)
Average cost per DRG (\$) NSW	\$3,924	NHCDC data (Commonwealth of Australia, 2008b)
Cost NSW LBW babies due to cannabis use 2006-07	\$1,605,291	Calculation

There were also extremely low weight newborn separations i.e. those <1,000g. Such very low LBW baby separations can be considered outliers and thus if excluded from the analysis may give a better indication of LBW baby separations attributable to cannabis use. When these were excluded, the differential cost weight dropped to 3.10. This resulted in a cost of \$1,036,177, which is 35.5% lower than the original estimate.

Road traffic accident casualties

It has been reported that drivers who have recently consumed cannabis are at the same risk of having a crash as drivers with a blood alcohol concentration (BAC) above 0.05 (Laumon, Gadegbeku, Martin, & Biecheler, 2005) although it has been argued that impairment may not be as directly related to blood tetrahydrocannabinol (THC) levels as is BAC (Room, et al., 2008). Also, the presence of alcohol in cannabis users' system often confounds conclusive causes of motor vehicle injuries. Moreover, it has been argued that the effects of cannabis on cognitive functioning may be modest as drivers who have used cannabis tend to drive more slowly and take fewer risks than alcohol-intoxicated drivers (Sewell, Poling, & Sofuoglu, 2009). According to the NDSHS, NSW had the highest rate nationally (29%) of those who had used cannabis in the past 12 months and driven under its influence (AIHW, 2008b). When accidents occur and the person is permanently injured, the health care and social costs may be ongoing requiring long term care for a considerable amount of time.

Based on evidence from the literature, this study estimated the costs of health care, and also the costs of long-term care due to permanent disability.

Number of motor vehicle casualties attributable to cannabis use

The number of accidents and persons involved in the accidents were obtained from the NSW government's Road and Traffic Authority (RTA) 2007 crash statistics report which includes a breakdown of the types of vehicle or road user (controller, passenger, pedestrian), as well as casualty type (fatal, injured) involved in the accident (RTA, 2008). Non-casualty cases were not included in the model. Table 22 presents data from the RTA's 2007 crash statistics.

Table 22: Total recorded road traffic accidents and persons where an injury was reported, NSW, 2007

Total recorded accidents	Total accidents	Total persons involved	Controller/ driver	Passenger	Pedestrian
Fatal accidents	405	435	286	81	68
Injury accidents	19,914	25,845	17,858	5,868	2,119
Total recorded accidents	20,319	26,280	18,144	5,949	2,187

Source: RTA (2008)

Before the costs can be estimated, it was necessary to attribute the number of people killed or injured due to cannabis use. This was done using data from a recent study (Biecheler, Peytavin, Group, Facy, & Martineau, 2008) that estimated the degree to which various substances' were responsible for causing the accidents. This study employed a method to attribute 'responsibility' based on Robertson and Drummer (1994) which used strict scoring guidelines in the absence of laboratory data on the presence or absence of drugs (Drummer et. al., 2001). This model has been validated for alcohol involvement in fatal accidents. Drivers in accidents in which there were two or less mitigating factors identified, other than a drug, were given a score placing them into a 'contributory' group. Drivers with less than two mitigating factors were deemed 'culpable'. Scores were given depending on the number of such factors. Drivers with scores over 15 were

considered ‘non-culpable’. Drugs that contribute to accidents would be expected to show an over-representation of drivers in the culpable group compared to the non-culpable group. Hence, the responsibility ratio would be larger than the control (drug-free) group if drugs had an adverse effect on driver performance. For cannabis, it was estimated that of the 2.39% of drivers with cannabis detected in their system in an accident, cannabis was ‘responsible’ for the accident in 70% of them. In 1.70% of the drivers detected with both alcohol and cannabis, alcohol and cannabis were jointly responsible in 93.3% of the accidents (Biecheler, et al., 2008).

In the next sections, the methodology is explained in more detail. However, before that, a summary of the data and variables used to calculate the costs of road traffic accident casualties (Table 23) is presented.

Table 23: Data used to calculate the costs of casualties from traffic accidents attributable to cannabis use, NSW, 2007

Variable	Data	Source
% Cannabis only drivers in fatal accidents	2.39%	Biecheler et. al. (2008)
% Cannabis only responsible for crash	70%	Biecheler et. al. (2008)
% Serious injuries in accidents	20.89%	RTA (2000)
% Handicapped due to accident	14.0%	ABS (2008b)
% Handicapped accidents on street	37.0%	ABS (2008b)
Average medical cost per fatality 2007 \$	\$4,457	BITRE (2009)
Average medical cost per injured person (serious) 2007 \$	\$18,675	BITRE (2009)
Average medical cost per injured person (minor) 2007 \$	\$1,647	BITRE (2009)
Average cost of community services per permanently disabled person 2007 \$	\$6,699	SGRGSP (2009)
CPI deflator 2007/2006	1.02	ABS (2009)

As data on the number of injuries separated into serious and minor were not available for NSW post-1998 (RTA, 2008), the proportion of serious injuries to total injuries in accidents in 1998 (20.89%) was applied to the 2007 accident data. This method has been used elsewhere (Connelly and Supangan (2006).

Some of those who were seriously injured may require long term care (BITRE, 2009). To estimate those seriously injured and needing long term community care, the estimated number of persons seriously injured (attributable to cannabis use) was multiplied by 37% (proportion due to accidents) (ABS, 1990) . Of the 37%, 14% were due to road accidents. Therefore, the number of those who were seriously injured was multiplied by 37% and by 14%.

Table 24 presents the estimated number of persons injured and killed attributable to cannabis use by vehicle user type.

Table 24: Estimated number of persons in accidents attributable to cannabis use, NSW, 2007

Estimated cannabis-affected accidents	Driver	Passenger	Pedestrian	Total
Fatal accidents	5	1	1	7
Serious injuries	62	20	7	90
Permanently injured & needing long term care	3	1	0	5
Minor injuries	236	78	28	341
Total recorded accidents	306	100	37	443

Source: RTA (RTA, 2000, 2008); Biecheler et. al. (2008); ABS (1990)

Note:

Example of attributable driver number estimations:

Fatal accidents = 286 * 2.39% * 70%

Serious injuries = 17,858 * 2.39% * 70% * 20.89%

Permanently injured = Seriously injured (62) * 14% * 37%

Minor injuries = 17,858 * 2.39% * 70% * (1-20.89%)

Costs

Cost data were obtained from the updated 2006 road crash cost model (BITRE, 2009); and the long term care costs were obtained from the Steering Committee for the Review for Government service Provision’s (SCRGSP, 2009) “Report on Government Services 2009” from the “services for people with disability” component. Only hospital and medical costs (BITRE, 2009) and a component of the long term care cost, the community support care costs (SCRGSP, 2009) were included. Hospital and medical costs consist of ambulance, hospital and other medical costs such as allied health, medications, specialist and GP costs. Long term care costs include the cost of community support services out of the hospital system for persons who are permanently disabled from accidents (SCRGSP, 2009).

Results

The estimated health care costs due to cannabis-related accidents are presented in the following table.

Table 25: Estimated health care costs due to cannabis-related accidents, NSW, 2007

Accident/injury cost	Driver	Passenger	Pedestrian	Total
Fatal accidents				
Health care costs	\$21,285	\$6,028	\$5,061	\$32,374
Serious injuries				
Health care costs	\$1,163,078	\$382,178	\$138,009	\$1,683,265
Long term care costs	\$21,612	\$7,102	\$2,564	\$31,278
<i>Total serious injury costs</i>	<i>\$1,184,689</i>	<i>\$389,280</i>	<i>\$140,573</i>	<i>\$1,714,542</i>
Minor injuries				
Health care costs	\$388,459	\$127,645	\$46,094	\$562,198
<i>Total health care costs</i>	<i>\$1,572,822</i>	<i>\$515,851</i>	<i>\$189,163</i>	<i>\$2,277,837</i>
Total costs	\$1,594,434	\$522,953	\$191,728	\$2,309,115

The annual health care costs due to cannabis related accidents in NSW in 2007 was estimated to be approximately \$2.3 million, while long term care costs were about \$31,000. This totalled about \$2.3 million. Health and long term care costs were the highest for serious injuries (\$1.7 million, 74%). These costs were highest for the driver (\$1.6 million, 69%), and the lowest for pedestrians (about \$192,000, 8.3%).

SUMMARY OF ALL CANNABIS TREATMENT AND OTHER HEALTH CARE COSTS

Overall, the health care costs were about \$16.9 million in 2007. Of this, \$6.8 million (40.1%) related to cannabis treatment (in drug treatment agencies, GP clinics and hospitals), while the major proportion of it, \$10.1 million (60%) related to treating the health consequences of cannabis use. The top three treatments were for psychotic disorders/schizophrenia (\$6.2 million, 36.8%), residential rehabilitation (\$2.9 million, 17.1%) and road traffic accident casualties (\$2.3 million, 13.7%).

In drug treatment agencies, although counselling was the most sought treatment for cannabis use disorder at 33.5% of treatment episodes the cost of counselling accounted for only 6.3% of total treatment costs. Residential rehabilitation accounted for 17.1% of total costs. On a per occasion basis, the three most expensive health care or treatments were for LBW baby separations (\$17,837 per separation), psychotic disorders/schizophrenia (\$6,790 per person) and residential rehabilitation (\$6,725 per closed treatment episode).

Table 26 presents the total treatment costs for cannabis use.

Table 26: Treatment costs of cannabis use, NSW, 2007

Cannabis treatment	No. episodes/separations	Cost (2007 \$)	% cost	Cost per occasion
Residential rehabilitation (episodes*)	431	\$2,898,684	17.1%	\$6,725
Hospital (separations)	902	\$1,307,610	7.7%	\$1,450
Withdrawal management (detoxification) (episodes*)	1,127	\$1,083,124	6.4%	\$961
Counselling (episodes*)	2,451	\$1,072,308	6.3%	\$437
GP (consultations)	3,018	\$217,170	1.3%	\$72
Assessment only (episodes*)	1,727	\$163,674	1.0%	\$95
Information and education only (episodes*)	113	\$35,098	0.2%	\$310
<i>Subtotal cannabis treatment</i>	-	<i>\$6,777,668</i>	<i>40.1%</i>	
Treating health consequences of cannabis use	No. persons/separations	Cost (2007 \$)	% cost	Cost per occasion
Psychotic disorders/schizophrenia (persons)	916	\$6,220,049	36.8%	\$6,790
Road traffic accident casualties (persons)	443	\$2,309,115	13.7%	\$5,212
Low birth weight (separations)	90	\$1,605,291	9.5%	\$17,837
<i>Subtotal health consequences treatment</i>	-	<i>\$10,134,454</i>	<i>59.9%</i>	
Grand total	-	\$16,912,123	100.0%	

Note:

* All episodes, including complete and incomplete.

Table 27 presents the costs for treatment in drug treatment agencies (from NMDS data).

Table 27: Costs of treatment in drug treatment agencies, NSW, 2007

Treatment type	No. episodes	Cost
Residential rehabilitation	431	\$2,898,684
Counselling	2,451	\$1,072,308
Withdrawal management (detoxification)	1,127	\$1,083,124
Assessment only	1,727	\$163,674
Information and education only	113	\$35,098
Total	-	\$5,252,888

Treatment for cannabis use disorder in drug treatment agencies in NSW cost \$5.3 million in 2007. This is 31% of the total cost estimated in this study.

Sensitivity analysis

The data herein has many caveats. As such the parameters used to calculate treatment costs for cannabis use disorders are subject to significant uncertainty (Moore, 2007). In this report, the parameters that are considered sensitive were identified; and sensitivity analyses were conducted for the top three highest costs (Table 26): treating schizophrenia/psychotic disorders, residential rehabilitation and road traffic accident casualties.

The parameters and data used in the sensitivity analysis are shown in Table 28. One-way sensitivity analyses were conducted.

Table 28: Parameters and estimates used in sensitivity analysis

Parameter	Data	Source
Schizophrenia/psychotic disorders		
Odds ratio (OR) of most frequent cannabis use	1.92	Moore et. al. (2007)
OR of ever used cannabis	1.82	Moore et. al. (2007)
Accidents		
<i>Cannabis detected in drivers *</i>		
% in drivers killed	11%	Mann et. al. (2008)
% in injured drivers	7.10%	Mann et. al. (2008)
<i>Cannabis and alcohol in drivers*</i>		
% Cannabis + alcohol drivers in fatal accidents	1.70%	Biecheler et. al. (2008)
% Cannabis + alcohol responsible for accidents	93.30%	Biecheler et. al. (2008)
Serious injuries in accidents*		
% Serious injuries in accidents	32.58%	Connelly & Supangan (2006)
Residential rehabilitation		
ALOS - all drugs (days)	60.2	HPA (2005)
Mean days - heroin	147.3	Shanahan et. al. (2006)
Lower cost (regional area) estimate (2007 \$)	\$103	HPA (2005)
Upper cost (Sydney area) estimate (2007 \$)	\$158	HPA (2005)

Note:

* These sets of parameters were tested simultaneously.

Schizophrenia/psychotic disorders attributable to cannabis use

In Moore et. al. (2007) systematic review of the relationship between psychotic disorders and cannabis use, it was found that the study NEMESIS had the greatest heterogeneity in the pooled odds ratios (ORs) and was excluded in their sensitivity analysis. Excluding this study in our sensitivity analysis resulted in an OR for most frequent use of 1.92 (CI 95%: 1.50, 2.47), while for those who had ever used cannabis the OR was 1.82 (1.01, 3.30). A sensitivity analysis using these ORs was conducted to examine if this made a significant impact on the estimated cost of treating schizophrenia/psychotic disorders. The resulting PAFs were 11.30% for most frequent use, and 13.92% for ever used. The estimated number of users who were diagnosed with and/or treated for schizophrenia and/or psychotic disorders was 1,112 (versus 916 in baseline).

Residential rehabilitation

It was discussed earlier that the length of time in residential rehabilitation could range from one month to 12 months. Residential rehabilitation costing studies estimated mean days of treatment for heroin of 147.3 days (Shanahan, et al., 2006) and 60.2 days across all drugs (HPA, 2005). Also, the average cost per day of the services could range from \$95 (regional NSW, \$103 in 2007 dollars) to \$146 (Sydney, \$158 in 2007 dollars). One-way sensitivity analyses were conducted using these assumptions.

Road traffic accident casualties attributable to cannabis use

In the literature, many studies have found that cannabis was usually not solely responsible for driver culpability (Liguori, Gatto, & Jarrett, 2002); and the results were statistically significant only when alcohol was also involved (Drummer, Chu, & Gerostamoulos, 2001). It was also reported the proportion of drivers that had both cannabis and alcohol in their system (2.84%), as well as the responsibility level of both these substance in accidents (93.3%) (Biecheler, et al., 2008). A one-way sensitivity analysis was conducted on this.

The percentage of cannabis detected in cannabis drivers in accidents is also reported to range from 7.10% of those injured (Longo et. al., 2000 in Mann et. al., 2008) to 11% (Drummer, 1995 in Mann, et. al., 1995) of those killed (Mann, Stoduto, MacDonald, & Brands, 2008). Although no statistical significance was found in Drummer's (1995) study, it was thought to be worthwhile to apply this estimate in the sensitivity analysis and assess its impact on treatment cost.

Another parameter considered in accident costing was the proportion of serious injuries of total injuries. A proportion of 32.58% (versus 20.89% used in the baseline in this report), which was a Queensland proportion of serious to total injuries in 2003, was used in another road traffic accident cost estimation study (Connelly & Supangan, 2006). The Queensland proportion was chosen because several factors that closely matched NSW's factors, including geographical characteristics and fatalities-to-(total)-injuries ratios of comparable states (see Connelly & Supangan, 2006 for more information).

Results

The results of the sensitivity analysis are presented in Table 29 below. The largest impact of treatment costs was the proportions of 'cannabis drivers' killed and injured: there was a two-fold increase (200%) in treatment costs for road traffic accident casualties, although this did not impact the total costs (27%) as significantly. The next largest impact was the length of days in residential rehabilitation treatment: staying at a residential rehabilitation for about five months would increase the treatment cost by about 177%. The impact on total cost was less at 30%. The higher average cost limit (\$158 per day) did not impact the costs as significantly (25% of treatment cost, 4% total cost). Other parameter changes did not appear to impact the costs as significantly: individual treatment costs changed by -5.2% (cannabis and alcohol together being involved and responsible) to 38% (a higher proportion of those seriously injured); and total costs changed by -0.7% (cannabis and alcohol together being involved and responsible) to 30% (a higher LOS in residential rehabilitation to 147.3 days).

Table 29: Results of sensitivity analysis on health care costs

Variable	Treatment cost	Total cost	Diff from baseline health care cost	Diff from baseline total health care cost
Schizophrenia/ psychotic disorders				
Baseline	\$6,220,049	\$16,912,123	-	-
OR excluding NEMESIS study	\$8,108,086	\$18,800,160	30.4%	11.2%
Accidents				
Baseline	\$2,309,115	\$16,912,123	-	-
Cannabis + alcohol involved/responsible	\$2,188,251	\$16,791,259	-5.2%	-0.7%
11% killed & 7.1% injured drivers with cannabis detected	\$6,925,709	\$21,528,718	199.9%	27.3%
32.5% of serious injuries	\$3,185,998	\$17,789,007	38.0%	5.2%
Residential rehabilitation				
Baseline	\$2,898,684	\$16,912,123	-	-
ALOS - all drugs (days) - 60.2 days	\$3,286,007	\$17,299,445	13.4%	2.3%
Mean days - heroin - 147.3 days	\$8,035,402	\$22,048,840	177.2%	30.4%
Lower cost (regional area) estimate (2007 \$103)	\$2,353,633	\$16,367,071	-18.8%	-3.2%
Upper cost (Sydney area) estimate (2007 \$158)	\$3,617,162	\$17,630,600	24.8%	4.2%

Perhaps more interestingly, is that accounting for alcohol involvement with cannabis in road traffic accidents had minor, and less, impact on treatment (-5.2%) and total (-0.7%) costs. In other words, cannabis alone has a higher cost of treating road traffic accident casualties, ceteris paribus. In terms of the overall total costs, the lowest and highest estimates were related to residential rehabilitation parameters: total costs ranged from \$16.4 million (lower average cost per day) to \$22.1 million (higher LOS).

SUMMARY AND CONCLUSIONS

This study has contributed to the estimation of the cost of treatment and health care in the illicit drug literature, by identifying the resources required to provide the treatments and costing them accordingly. In addition to the lack of consistent guidelines for treating cannabis use disorders, little has been documented about how cannabis use disorders are actually, or should be, treated in the GP, community and hospital settings; and consequently what resources are required to provide the different treatment types. Furthermore, consistent data and data collection are difficult to find for treatment resources used to treat cannabis use disorders.

Through literature survey and key informant interviews, information was collected on the types of treatment available in NSW, providing an understanding of the process involved in each of the treatment types and settings and the resources required to provide such treatment. Total treatment costs were estimated to be at about \$17 million. Treating psychotic disorders was the most costly among all treatment or health care types: \$6.2 million (36.8%). This is followed by residential rehabilitation (\$2.9 million, 17.1%) and road traffic accident casualties (\$2.3 million, 13.7%). In the drug treatment agency setting, despite counselling being the most common treatment sought for cannabis use disorder in NSW (31.7% of total closed treatment episodes, 2006-07), residential rehabilitation was the most expensive. NSW's recurrent health expenditure in 2006-07 was \$28.964 billion (AIHW, 2008g). Given this, the estimated costs of cannabis treatment and health care represent less than 0.1% of this expenditure (NSW Health, 2007a, pp. 198-210).

In comparison to similar Australian studies, Moore (2007) estimated an annual health cost of \$1,195 million (\$1.303 million in 2007 dollars) for cannabis use for the whole of Australia. The estimate was a product of \$120,000, a value of life years (VOLYs) estimated from Australian disability weights (Abelson, 2003), and the number of disability-adjusted life years (DALYs) (9,964 units) attributable to cannabis use. These DALYs were made up of years lived with disability (YLDs) for cannabis dependence (9,089 units), other drug dependence (609 units), maternal drug dependence and newborn drug toxicity (135 units), and potential life years lost (PYLL) due to abuse and poisoning conditions (130 units). If a rough estimate was taken, using a proportion of NSW population to Australian population in 2007¹¹ (ABS, 2008a), this would equate to \$421 million (2007 \$). This much higher estimate, compared to this study's, is due to that the DALY is a measure of burden of disease, rather than health care expenditure per se¹².

Collins and Lapsley's (2008) annual health care (hospital) cost estimates for cannabis use were \$3.054 million (\$3.24 million in 2007 dollars), or \$1.07 million for NSW (estimated using the proportion of NSW population, in 2007 dollars). The hospital cost estimated in this study was \$1.3 million, which is comparable to Collins and Lapsley's estimate. The estimated total health care cost across all drugs for the whole of Australia was \$252.9 million (\$267.2 million, 2007 dollars). Taking the NSW proportion of it, this would be \$83.2 million (\$89.0 million, 2007 dollars). To estimate the amount for cannabis (for NSW), using the proportion of cannabis

¹¹ NSW population: 6.9 million, Australian population: 20.7 million (ABS, 2008a), giving a proportion of 33.3%.

¹² See Begg et. al. (2007) for more information.

treatment episodes in NSW, 22.1%¹³ (AIHW, 2008e), this would equate to \$19.7 million (2007 dollars), which is comparable to this study's total estimate. However, Collins and Lapsley's study did not appear to have included drug treatment agencies. Moreover, this and Moore's (2007) studies did not report the cost by state.

To our knowledge, this is the first examination of the costs, and cost components, of treating cannabis use disorder and health consequences. This study has documented the methodology to calculate the costs, which would provide a starting point and snapshot of what treatment actually entails, and how much it costs to provide different treatments and health care associated with cannabis use. Similar exercises could be employed in costing treatment for cannabis or other drugs in other jurisdictions.

There are limitations and implications in this study many of which have been identified throughout the report. Firstly, this study was not intended to assess the outcome of treatment or health care services for cannabis use, nor was it intended to compare their effectiveness or efficacy. Rather, this study examined the resources, rather than the outcome, such as quality of life measures of users of such services. However, costs of treatment for other main drug problems for which cannabis might also be a problem (e.g. tobacco or heroin with cannabis), were not included here. For example, it was reported that cannabis and tobacco users attending treatment sessions also try to reduce tobacco intake; and this would double the withdrawal condition (ABC, 2008).

Secondly, this study was severely limited by the lack of data (e.g. number of resources to provide counselling, LOS of residential rehabilitation). Besides needing to make assumptions transparent in costing studies, the 'best' estimates, rather than 'conservative' ones (Moore & Caulkins, 2006) need to be used. Wherever possible, this study has used the best data in the assumptions to calculate the costs.

Thirdly, the costs in this study may be underestimates for a number of reasons. Firstly, the number of GP consultations or episodes under the GP Mental Health Plan where comorbid cannabis clients might be captured is not known. To our knowledge, there is no such available information to enable an estimation of the cost. Secondly, medication costs could also be underestimated: for example, cannabis users may use other medication than what was reported in the literature or they may use medication in medicated withdrawal management treatment longer than reported in the literature or key informant interviews. Thirdly, the number of persons with psychotic disorders (in the NDSHS 2007 data) may also be underestimated as it was based on self-reports.

Fourthly, this study did not include costs that are intangible, such as opportunity costs (e.g. transport, time off work to attend treatment or productivity loss and carer costs). Data on these costs might assist planners in ascertaining important factors for treatment location.

Finally, the unit of measurement for the number of treatment or health care 'occasions' were not all the same (i.e. episodes, consultations, persons, separations). This is not an issue for identifying

¹³ As used in calculating the number of NSW GP consultations; see Table 15.

current costs but may make forecasting changes in treatment uptake post policy changes more difficult. There is clearly a need for data linkage and longitudinal data collection to obtain information on treatment uptake, retention and treatment paths. Nevertheless, the AIHW is embarking on a data linkage project with all Australian jurisdictions for the NMDS (AIHW, 2009); and a longitudinal study (Cannabis Cohort Research Consortium) is being conducted by the Universities of Queensland and NSW (Queensland Alcohol Drug and Research Centre, 2010).

Policy makers or researchers wishing to estimate the cost of providing treatment to cannabis use, or other users, would be able to use the estimation methods in this study as a guide. For example, they could adopt the same or similar methodology to estimate counsellor cost or the number of counselling sessions, calculate the number of users with psychotic disorders or low birth weight baby separation attributed to cannabis use, and also use the costs and amount of resources as a guide in their own costing study. As other studies had not detailed the number of resources and unit costs for health care and treatment, this study would provide guidance in terms of such costing exercise.

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APPENDIX A: HEALTH CONSEQUENCES OF CANNABIS USE: REVIEWING THE EVIDENCE

Introduction

Cannabis has been widely used recreationally for many decades. Although it is illegal in many countries, in some countries possession of small amount and/or for personal consumption is allowed, such as in the Netherlands, Belgium and some states of the United States for medical purposes (Huestis, 2002 in Seamon, Fass, Maniscalco-Feichtl, & Abu-Shraie, 2007, p. 1-2).

Despite its illegal status, historically prohibition has not been based on evidence of health harms. In fact, it has generally been linked more with social issues and broader cultural patterns. In the 1800s, hemp was used in the production of rope, sails and clothes, and also for medicinal purposes (NAHIC, 1997). It was not until the Mexican Revolution in 1910 that cannabis was associated with recreational use by Mexican immigrants. Since then, it has become associated with violence, crime, madness and other socially-deviant behaviours that were primarily linked to immigrants (Bonnie & Whitebread, 1970). In Australia, cannabis, among other drugs, was prohibited well before their use became a major social issue (Bolt, 2006).

According to Hall and Pacula (2003, p. 1-2), ideally, societal policies towards cannabis use by young people should be informed by:

1. the health harm due to cannabis use;
2. the harm to the health of non-users;
3. the extent to which criminal law deters young people from using cannabis;
4. the harms from using prohibition laws to deter cannabis use;
5. the social costs that would arise due to changing the laws prohibiting use by young people.

The health and psychological consequences of regular cannabis use is not as well understood as those of alcohol and tobacco (Hall & Pacula, 2003). As such, this paper provides the first step in reviewing the health consequences of cannabis use. It reviewed the latest evidence and data available in the literature that can be used to build a model on the health consequences of cannabis use. This paper examined the latest evidence on physical health, mental health and dependence. Specifically, there have been comprehensive reviews (Degenhardt, Calabria, Hall, & Lynskey, 2008; McLaren, et al., 2008; Room, et al., 2008; UK Home Office, 2008) that have identified convincing evidence that the following health complications could arise from cannabis use:

Mental health outcomes:

- Short term/acute effects: pleasure (a benefit):
 - “high”, alertness, panic attacks, etc.;
- Long term effects:
 - Psychosis and/or schizophrenia; and mood disorders, specifically depression.

Physical health outcomes:

- Aerodigestive and respiratory tract diseases such as lung cancer and other pulmonary diseases;
- Cardiovascular complications (ischaemic heart disease (IHD), chest pain, ocular heart disease (OHD), hypertension, cardiovascular disease (CVD), coronary artery disease (CAD), etc.);
- Impaired psychomotor and cognitive functioning that can lead injury or accidents;
- Impairment of the immune system; and
- Pregnancy outcomes such as low birth weight babies.

The purpose of this paper is to review the literature to identify:

- Convincing evidence of certain health outcomes due to cannabis use; and
- Data (prevalence, risk ratios etc.) of such health outcomes to calculate the cost of health care.

Specifically, this paper seeks to identify health consequences attributable to cannabis use that have the strongest and most convincing evidence. These will be included in a model to estimate the cost of health care to treat such conditions. Data such as prevalence rates and effect size (risk or odds ratios) would be identified from the most reliable studies or papers to include in the model.

This paper summarises the review and the results from the review.

Methods

A search of the literature was conducted on MEDLINE, the Cochrane Library, the Internet and grey literature. As randomisation of humans is not appropriate in terms of studying cannabis use and its health effects, and that extrapolating animal studies results to human are problematic, epidemiological methods can be used to achieve this using statistical methods (Hall & Pacula, 2003, p. 35). Epidemiological study designs such as cohort (Fergusson, Poulton, Smith, & Boden, 2006), case-control (Aldington, et al., 2008a) and case studies (Mateo, Infante, Gomez Beldarrain, & Garcia-Monco, 2006) are often conducted to ascertain such effects in the cannabis literature. The studies reviewed here include systematic reviews and/or meta-analyses, besides the epidemiological studies mentioned. Such evidence are approximately Levels III-2 and III-3 evidence as defined by the National Health and Medical Research Council of Australia (NHMRC2008). Case studies, which represent the lowest evidence level (Level IV) were excluded. Where possible, studies were assessed for their risk of bias, consistency, generalisability and applicability.

Results

Mental health

Short term/ acute effects

Despite the beneficial feelings or effects from cannabis ('highs' or pleasurable feelings), in some people, there is an increased risk of acute intoxication that leads to panic attacks, paranoia and confused feelings, and in some instances, precipitate some psychotic state that have users seeking medical help, especially in naïve users, rendering the need for anxiolytic medications (Room, et al., 2008; UK Home Office, 2008). However, there are no data on the prevalence or relative risk of this. Nevertheless, it is conceivable that such data would manifest in hospital and GP data (see such relevant sections in the report) instead. Given the paucity of evidence and that the number of such incidents may be included in hospital and GP data, no separate analyses were undertaken to include these diagnoses in the model.

Long term effects

Psychotic symptoms/ disorders and schizophrenia

In addition to older cohort studies (Arseneault, et al., 2002; Ferdinand, et al., 2005; Fergusson, Horwood, & Ridder, 2005), more recent studies, comprehensive reviews and meta-analyses have examined the causal link between psychotic disorders and/or schizophrenia and cannabis use (Degenhardt, et al., 2008; Green, Young, & Kavanagh, 2005; McGrath, et al., 2010; McLaren, et al., 2008; Moore, 2007). Despite this, there has been no conclusive evidence about the causal effect of cannabis use on schizophrenia, and whether there is a reverse causal effect. That is, it can be hypothesised that people with schizophrenia and/or psychotic symptoms are more likely to use cannabis to self-medicate (McLaren, et al., 2008). Moreover, it has been reported that a contributory causal relationship of cannabis to such conditions is biologically plausible (Degenhardt, et al., 2008), and there is a genetic vulnerability to psychosis that increases the likelihood of cannabis use, and then the likelihood for them to develop psychosis. It can be concluded from the literature and evidence that although there has been no concrete evidence about the direction of causation, there is a relationship between these conditions and cannabis use.

Data to be included in the model were from the most recent and widely-accepted systematic review (e.g. Moore, et al., 2007), which found that there is an increased risk of psychotic outcome in patients who had ever used cannabis, with a pooled adjusted OR of 1.41 (95% CI 1.20, 2.84), with greater risk of developing schizophrenia in frequent (daily) users (OR: 2.09, 95% CI 1.54, 2.84). They found that the association effect between cannabis use and affective outcomes was less strong, with a majority of affective outcome (e.g. depression) studies not adequately addressing reverse causation (p. 325). As such, only psychotic disorders and/or schizophrenia were included in the model.

Dependence

The probability of becoming dependent after ever using cannabis is much smaller than with other substances, which is around 8-10% (Anthony, Warner, & Kessler, 1994). Dependent users may

smoke between 1 to 7 grams per day whilst for many ‘recreational’ smokers a gram may last for months. The proportion of those could be diagnosed as dependent were also examined and reported by several researchers (Nocon, Wittchen, Pfister, Zimmermann, & Lieb, 2006; Room, et al., 2008; Swift, Hall, & Teesson, 2001a, 2001b). The rule of thumb for the risk of being dependent suggested by Hall and Pacula (2003, p. 75) is:

- Ever used: 1/10 (10%)
- Used more than a few times: 1/5 – 1/3 (20% - 33%)
- Daily users: 1/2 (50%)

It is conceivable that those in treatment as reported in the National Minimum Data Set (NMDS) were dependent users, although increasingly non-dependent users are referred to treatment as a result of court outcomes. As such, the number of treatment episodes captured in the NMDS would have included those who were dependent on cannabis.

Physical health

A survey of the literature revealed that there were fewer studies on physical health, compared to mental health, and its link with cannabis use. Most physical health studies had small sample sizes and the quality of studies varied. As such, the evidence of association is often not very strong, questionable, unreliable or uncertain, whereas the comparatively more abundant studies in mental health produce more consistent results. Nevertheless, a paucity of studies (or interest) in physical health relative to mental health does not necessarily mean that cannabis use is less detrimental to one’s physical health.

Aerodigestive and respiratory tracts

Cannabis smoke is carcinogenic and mutagenic although THC alone does not appear to be either (Hall, Christie, & Currow, 2005). There are also mixed and inconsistent evidence from epidemiological and case-control studies (e.g. Aldington, et al., 2008b; Hashibe, et al., 2006). In the UK Home Office’s review, they found that cannabis does not cause respiratory depression or suppress the gag reflex even during extreme intoxication (2008, p. 9). Other authors also commented that studies that found significant association (e.g. Zhang et. al., 1999; Bofetta et. al., 2000 in Hashibe et. al., 2005) were fraught with poorly controlled confounding, interview and recall bias, subject recall and honesty, and randomisation issues. The long-term damage is in the respiratory tract and lungs, with an increased risk of having chronic bronchitis. Nevertheless, it is uncertain whether these long-term effects are caused by cannabis use per se. In summary, evidence of such health consequences and cannabis use is limited and was not included.

Cardiovascular complications

Cannabis has similar effects as moderate exercise and these do not constitute a risk in healthy adolescents or adults; and tolerance occurs with repeated use (UK Home Office, 2008). However, it has been reported that it could be dangerous to people with existing heart diseases, particularly coronary artery disease (CAD), arrhythmia, hypertension, those with increased risk of stroke or older people (Aryana & Williams, 2007). Also, combined cannabis and other drug use,

such as cocaine and amphetamines may have synergistic cardiovascular effects (Fisher, Ghuran, Vadamalai, & Antonios, 2005). It has also been reported that the association between cannabis use and cardiovascular complications was not so well-established (in well-designed studies), and that this could be attributed to underreporting (Fisher, et al., 2005; Moussouttas, 2004), with many of them case reports with very small sample sizes (Aryana & Williams, 2007; Moussouttas, 2004). As such, it can be concluded that such association cannot be established given the limited evidence. However, as the cohort of cannabis users' age such complications may become an issue.

Other physical health complications

Other less common health outcomes that are associated with cannabis use in the literature were periodontal diseases (Cho, Hirsch, & Johnstone, 2005; Thomson, et al., 2008) and immune system deterioration (Pacifi, et al., 2003). Cannabis users generally have poorer oral health than non-users, although the number of studies in this area was limited and thus no concrete conclusion could be drawn. This is the same for studies on the immune system and cannabis use. In immunocompromised cannabis users, a review of several epidemiological studies found that cannabis use did not exacerbate progression of HIV-infected users to AIDS (Room, et al., 2008). In summary, evidence of such health consequences and cannabis use is limited and was not included in the costing study.

Pregnancy and postnatal outcomes

Despite of the paucity of studies on pregnancy outcomes and cannabis use, a review of the literature (Hall & Pacula, 2003; Montebello, 2008; Room, et al., 2008) revealed that the most consistent evidence or finding of the association between pregnancy outcomes and cannabis use is low birth weight (LBW), which is defined as less than 2500g at birth. There was less evidence on other birth outcomes such as birth defects and behavioural complications (Room, et al., 2008). There were three most recent studies on birth weight and cannabis in the literature (Burns, et al., 2006; Fergusson, et al., 2002; Hurd, et al., 2005), which found significant relationship between LBW and cannabis use in women who used cannabis before and/or during pregnancy. However, data on the likelihood and/or prevalence (e.g. RRs or ORs) of giving birth to a LBW baby were presented only in one study (Burns, et al., 2006). Other studies that presented ORs were very dated (Cornelius, Taylor, Geva, & Day, 1995; English, et al., 1997; Hatch & Bracken, 1986). In summary, LBW had the most convincing and consistent evidence as a health consequence of cannabis use, with data from the most recent and Australian study (Burns, et al., 2006). The OR from Burns et. al. (2006) was used in the model (OR: 2.0, 95% CI: 1.7, 2.2).

Cognitive functioning, and accidents and injuries

In the short-term, the acute effects of cannabis use may include altered perceptions of space and time, impaired learning and memory, difficulty in problem-solving and loss of coordination (UK Home Office, 2008). There is evidence on the biological plausibility for cannabis use and cognitive functioning (Solowij & Michie, 2007; Solowij & Monterrubio, 2006), although there is a major problem in interpreting studies as there might be a bi-directional relationship between cognitive impairment and cannabis use (Solowij, 1998 in Room, et al., 2008). It has been reported

that drivers who have recently consumed cannabis or amphetamine are at the same risk as having a crash as drivers with a blood alcohol concentration (BAC) above 0.05 (Laumon, et al., 2005). There may also be a dose-response impairment of performance after cannabis use in simulated driving studies (Huestis, 2002 in Room, et al., 2008, p. 11), particularly if its use was combined with alcohol use (Fergusson & Horwood, 2001; Laumon, et al., 2005). The presence of alcohol in cannabis users' system often confounds conclusive causes of motor vehicle injuries. However, it was argued (Room, et al., 2008, p. 26) that impairment may not be as directly related to blood THC levels as is BAC. Moreover, it has been discussed that the effects of cannabis on cognitive functioning may be modest due to that drivers who have used cannabis tend to drive more slowly and take fewer risks than alcohol-intoxicated drivers (Smiley, 1999 in Room, et al., 2008).

A recent study (Biecheler, et al., 2008) estimated the degree of a substance's responsibility for causing the accidents. The method used in determining 'responsibility' was based on an Australian (Drummer, et al., 2001; Robertson & Drummer, 1994) methodology using strict scoring guidelines in the absence of laboratory data on the presence or absence of drugs¹⁴. It was estimated that of the 4% of drivers with cannabis detected in their system in an accident, cannabis was responsible in 70% of them ($4\% * 70\% = 2.8\%$ of drivers). In 2.84% of the drivers detected with both alcohol and cannabis, alcohol and cannabis was responsible in 93.3% of the accidents ($2.84\% * 93.3\% = 2.65\%$ of drivers). Given there is convincing evidence and data on cannabis use and road traffic accidents, the health care cost of this outcome was estimated in the cost model.

Conclusion

Cannabis is the most widely used illicit drug in the world and Australia. While it is often perceived as innocuous, health complications associated with its use have been reported. As such, it is worthwhile examining the types of health complications and extracting data on the evidence of the complications to inform policy making. In particular, knowing the health complications and the costs associated with their treatments, would aid government decisions about health care provisions, health care resource allocations and implications to the health system.

In this review, the health consequences and outcomes that were strongly associated with cannabis use were identified to be included in a model to estimate the cost of cannabis treatment: psychotic disorders, low birth weight babies and road traffic accident casualties. Data identified from the review was used in the model. Cost data was discussed in a separate report.

¹⁴ This has already been described in the report in the section 'Number of motor vehicle casualties attributable to cannabis use' in the 'Road traffic accidents' section. As such, the details are not repeated here; please refer to the main section of the report for the details.

APPENDIX B: TREATMENT AND COMORBIDITY

Comorbidity, or dual diagnosis, in this instance refers to people who have other medical conditions such as a mental health diagnosis alongside drug use problems. In the NDSHS 2007 data, of those who had used cannabis in the last 12 months nationally, 25% had been diagnosed and/or treated for a mental health condition and 29% in NSW (AIHW, 2008a). The prevalence of people with mental health disorders or symptoms is also high in the AOD (alcohol and drug) treatment setting (Mills, et al., 2010); and this imposes a need for AOD workers to manage mental health issues as well as AOD issues of these clients. In fact, a Victorian review in 1993 found that AOD workers felt overwhelmed as their knowledge and the resources available to them were inadequate to manage clients with comorbidity, suggesting that extra resources and knowledge were required. The allocation of extra funds by the NSW government to cannabis clinics (JHC & Mayne, 2007) could reflect this. Moreover, some studies have also shown that such clients have poorer treatment outcomes: increased relapse rates, exacerbations of positive symptoms¹⁵, non-compliance with treatment and poorer social functioning (Green et. al., 2003 in Copeland, 2004). However, there is a lack of quality of studies with strong evidence of best practice that focus on the treatment of cannabis users with mental health comorbidities (Laker, 2008; Mills, et al., 2010); and there is currently no evidence-based pharmacotherapy or psychological interventions for comorbidities¹⁶. Despite this, it is generally recommended that the best practice is to use the most effective treatment for each disorder (Mills, et al., 2010, p.73). In some cases, treatments can be integrated, in others they must be calibrated. Pharmacotherapy should be supported with psychosocial interventions.

The recently published guidelines (Mills, et al., 2010) recommended management strategies summarised below:

- Identifying comorbidity, conducting assessments informally and formally and case formulating;
- Managing comorbidity using counselling techniques (CBT, MI, etc.) to allow AOD treatment without mental health symptoms disrupting the process;
- Treating comorbidity using psychosocial and pharmacotherapy interventions;
- Referring clients to other health professionals if the conditions cannot be addressed by one professional or agency alone.

In treating clients with comorbidity, there were four models of care recommended:

- Sequential; where if one disorder is considered secondary to the other, the primary one is sometimes treated first;
- Parallel; where the disorders were treated simultaneously but treatments are independent of each other;

¹⁵ Positive symptoms are symptoms that appear to reflect an excess/distortion of normal functions e.g. hallucinations, delusions, racing thoughts (Raboch, 2008).

¹⁶ There is an RCT currently in progress in Denmark to treat young people with cannabis abuse (as opposed to dependence) and psychosis (CapOpus, 2009).

- Integrated; where the disorders were treated simultaneously by the same agency or provider;
- Stepped care; where flexible matching of treatment intensity with case severity is adopted.

Despite such guidance, data are not available as to the prevalence of clients treated using these models. Even in costing mental health treatment, where comorbidity occurs, only the principal complaint was included in cost analysis to avoid double counting (Andrews & Tolkien II Team, 2006, p. 20). Given the lack of evidence in them and knowledge of additional resources in this area, costing the treatment of cannabis use disorder and mental health conditions was not possible in this study.

APPENDIX C: BRIEF REVIEW OF STUDIES THAT CALCULATED THE COST OF RESIDENTIAL REHABILITATION PROGRAMS

Shanahan et. al. (2006) calculated the private and public costs per day of residential rehabilitation for heroin dependent users in 2002 dollars, based on key informant interviews. Using the median days of 45.4 days based on the maximum reportable inpatient rehabilitation time length of 12 weeks (84 days), the costs per episode for 2007 were estimated to be:

Table A1: Private and public costs by gender – heroin residential rehabilitation

Cost per day	Public cost	Private cost	Total cost per day	Total cost for median duration of treatment days	2007 dollars
Female	\$77.91	\$24.60	\$102.51	\$4,664.21	\$5,317.19
Male	\$70.98	\$22.41	\$93.39	\$4,249.25	\$4,844.14

Source: Shanahan et. al. (2006)

Costs for female clients were higher due to child care costs that they would have to account for when receiving rehabilitation services (HPA, 2005; Shanahan, et al., 2006).

APPENDIX D: WEIGHTED COST OF ALCOHOL DIAGNOSTIC RELATED GROUPS (DRGS)

The table below presents the weighted cost of hospital DRGs related to alcohol admissions in NSW for 2006-07, published in the National Hospital Cost Data Collection (NHCDC). These costs were used in the calculation of ‘alcohol-principal, cannabis-secondary’ diagnoses.

Table A2: Alcohol DRG cost weights

DRG	DRG Description*	No. of Seps	Average cost per DRG	Weighted cost
V60A	Alcohol Intoxication & Withdrawal + Cc	1,146	\$2,635	\$3,019,710
V60B	Alcohol Intoxication & Withdrawal-Cc	4,036	\$1,126	\$4,544,536
V62A	Alcohol Use Disorder & Dependence	941	\$3,472	\$3,267,152
V62B	Alcohol Use Disorder & Dependence + Sd	126	\$1,117	\$140,742
	Total	6,249	\$8,350	\$10,972,140
	Average weighted cost			\$1,756

Source: Commonwealth of Australia (2008b)

Note:

* As presented in the report (Commonwealth of Australia, 2008b).

DRG Diagnostic Related Group

Seps Separations

Cc Complication or co-morbidity

Sd Substance dependence

APPENDIX E: CALCULATING THE COSTS OF SCHIZOPHRENIA/PSYCHOTIC DISORDER TREATMENT

Number of persons in treatment

The number of people who have ever used cannabis in the last 12 months was obtained from the NDSHS 2007 dataset. Due to the low number of unweighted population in the NSW data, the proportions of the unweighted population of people for the whole of Australia were used in this study. The proportions are then applied to the weighted NSW population numbers in the survey (on the left hand side of the tables). The tables on the right hand side show the proportions, and estimated NSW number of persons in treatment are presented in the following tables.

Table A3: Estimated number of persons diagnosed and/or treated for schizophrenia and/or psychotic disorders who used cannabis everyday in the last 12 months, NSW, 2007

Proportion of Psychotic disorders					Estimated number of Psychotic disorders				
Schizop	Dx only	Tx only	Both	Neither	Schizop	Dx only	Tx only	Both	Neither
Dx only	0.45%	-	-	0.904%	Dx only	360	-	-	724
Tx only	-	-	-	0.222%	Tx only	-	-	-	178
Both	-	-	-	-	Both	-	-	-	-
Neither	1.993%	1.021%	0.352%	-	Neither	1,596	818	282	-

Total weighted NSW population = 80,084

Estimated NSW Dx/Tx = 3,958

Source: AIHW (2008a)

Note:

The columns show the number of people diagnosed and/or treated for psychotic disorders, while the rows show those diagnosed and/or treated for schizophrenia. The table on the left hand side (LHS) shows the proportion of Australians who used cannabis who were diagnosed and/or treated for schizophrenia and/or psychotic disorders in the last 12 months, while the table on the right hand side (RHS) shows the number of persons estimated in this study.

Schizop Schizophrenia

Dx Diagnosed

Tx Treated

Table A4: Estimated number of persons diagnosed and/or treated for schizophrenia and/or psychotic disorders who used cannabis once a week or more in the past 12 months, NSW, 2007

Proportion of Psychotic disorders					Estimated number of Psychotic disorders				
Schizop	Dx only	Tx only	Both	Neither	Schizop	Dx only	Tx only	Both	Neither
Dx only	-	-	-	0.085%	Dx only	-	-	-	85
Tx only	-	-	-	0.505%	Tx only	-	-	-	505
Both	-	-	-	0.198%	Both	-	-	-	198
Neither	-	0.625%	0.131%	-	Neither	-	626	131	-

Total weighted NSW population = 100,061

Estimated NSW Dx/Tx = 1,545

Source: AIHW (2008a)

Note:

As per the previous table.

Table A5: Estimated number of persons diagnosed and/or treated for schizophrenia and/or psychotic disorders who used cannabis about once a month in the last 12 months, NSW, 2007

Proportion of Psychotic disorders					Estimated number of Psychotic disorders				
Schizop	Dx only	Tx only	Both	Neither	Schizop	Dx only	Tx only	Both	Neither
Dx only	-	-	-	0.564%	Dx only	-	-	-	291
Tx only	-	-	-	-	Tx only	-	-	-	-
Both	-	-	-	-	Both	-	-	-	-
Neither	0.601%	-	-	-	Neither	310	-	-	-

Total weighted NSW population = 51,619

Estimated NSW Dx/Tx = 601

Source: AIHW (2008a)

Note: As per the previous table.

Table A6: Estimated number of persons diagnosed and/or treated for schizophrenia and/or psychotic disorders who used cannabis every few months in the past 12 months, NSW, 2007

Proportion of Psychotic disorders					Estimated number of Psychotic disorders				
Schizop	Dx only	Tx only	Both	Neither	Schizop	Dx only	Tx only	Both	Neither
Dx only	-	-	-	-	Dx only	-	-	-	-
Tx only	-	-	-	-	Tx only	-	-	-	-
Both	-	-	-	-	Both	-	-	-	-
Neither	0.870%	0.054%	0.45%	-	Neither	562	35	290	-

Total weighted NSW population = 64,959

Estimated NSW Dx/Tx = 887

Source: AIHW (2008a)

Note: As per the previous table.

Table A7: Estimated number of persons diagnosed and/or treated for schizophrenia and/or psychotic disorders who used cannabis once or twice a year in the last 12 months, NSW, 2007

Proportion of Psychotic disorders					Estimated number of Psychotic disorders				
Schizop	Dx only	Tx only	Both	Neither	Schizop	Dx only	Tx only	Both	Neither
Dx only	-	-	-	0.050%	Dx only	-	-	-	71
Tx only	-	-	-	0.215%	Tx only	-	-	-	308
Both	-	-	-	0.143%	Both	-	-	-	204
Neither	0.094%	0.133%	0.58%	-	Neither	134	191	837	-

Total weighted NSW population = 143,372

Estimated NSW Dx/Tx = 1,745

Total estimated NSW Dx/Tx = 8,737

Source: AIHW (2008a)

Note: As per the previous table.

Attribution to cannabis use

The estimated total weighted persons in NSW who had used cannabis and been diagnosed and/or treated for schizophrenia and/or psychotic disorders in the past 12 months were 8,737.

To attribute the number of people with the condition to cannabis use, the population attribution fraction (PAF) was used.

PAF is the portion of the total burden of a disease in a population that should be ascribed to certain cause(s) of the disease (Chatterjee & Hartge, 2003). It is the proportional reduction in average disease risk over a time interval that would be achieved by eliminating the exposure of interest from the population while distributions of other risk factors do not change (Rockhill, Newman, & Weinberg, 1998). It is similar to aetiological fractions as calculated by Ridolfo and Stevenson (Ridolfo & Stevenson, 2001); however, their estimates did not include mental health conditions attributed to illicit drugs. As such, calculations were conducted in this study to obtain such estimates.

To calculate PAF, the formula is $pd \cdot ((RR-1)/RR)$, where pd is the proportion of cases exposed to the risk factor, and RR is the adjusted relative risk(s). To estimate the RR from the OR , a formula was given in Zhang and Yu (Zhang & Yu, 1998): $RR = OR / ((1-Pn) + (Pn \cdot OR))$, where Pn is the incidence of the outcome of interest in the nonexposed group, and other abbreviations are as defined earlier. To calculate Pn the weighted number of population in NSW that had not used cannabis in their lifetime in the NDSHS 2004 survey is subtracted from that in the NDSHS 2007 survey (113,417). Divided by the total NSW population (5.8 million), and three years since this incidence number is over a three year (2004-2007) period, this gives an incidence rate of 0.65%. The incidence rate is then applied to the OR conversion formula to obtain the RR .

Two OR s were used, one for the most frequent use (daily use) and another for less frequent use (i.e. weekly, monthly, less than monthly and yearly), as reviewed from the literature. These are 2.09 and 1.41 respectively (Moore, et al., 2007). Applied to the PAF formula, this gave PAFs of 12.3% and 8.98% respectively.

The following tables show the estimated number of persons when the PAFs were applied to the data. Please note the totals in the tables below may not sum due to rounding.

Table A8: Estimated number of persons who used cannabis everyday in the last 12 months diagnosed and/or treated for schizophrenia and/or psychotic disorders attributable to cannabis use, NSW, 2007

Estimated number	Psychotic disorders				
	Schizophrenia	Dx only	Tx only	Both	Neither
Dx only		44	-	-	89
Tx only		-	-	-	22
Both		-	-	-	-
Neither		196	101	35	-
TOTAL					487

Source: AIHW (2008a), Zhang and Yu (1998)

Note: As per the previous table.

Table A9: Estimated number of persons who used cannabis once a week or more in the last 12 months diagnosed and/or treated for schizophrenia and/or psychotic disorders attributable to cannabis use, NSW, 2007

Estimated number	Psychotic disorders				
	Schizophrenia	Dx only	Tx only	Both	Neither
Dx only		-	-	-	8
Tx only		-	-	-	45
Both		-	-	-	18
Neither		-	56	12	-
TOTAL					139

Source: AIHW (2008a), Zhang and Yu (1998)

Note: As per the previous table.

Table A10: Estimated number of persons who used cannabis about once a month in the last 12 months diagnosed and/or treated for schizophrenia and/or psychotic disorders attributable to cannabis use, NSW, 2007

Estimated number	Psychotic disorders				
	Schizophrenia	Dx only	Tx only	Both	Neither
Dx only		-	-	-	26
Tx only		-	-	-	-
Both		-	-	-	-
Neither		28	-	-	-
TOTAL					54

Source: AIHW (2008a), Zhang and Yu (1998)

Note: As per the previous table.

Table A11: Estimated number of persons who used cannabis every few months in the last 12 months diagnosed and/or treated for schizophrenia and/or psychotic disorders attributable to cannabis use, NSW, 2007

Estimated number	Psychotic disorders				
	Schizophrenia	Dx only	Tx only	Both	Neither
Dx only		-	-	-	-
Tx only		-	-	-	-
Both		-	-	-	-
Neither		50	3	26	-
TOTAL					80

Source: AIHW (2008a), Zhang and Yu (1998)

Note: As per the previous table.

Table A12: Estimated number of persons who used cannabis once or twice a year in the last 12 months diagnosed and/or treated for schizophrenia and/or psychotic disorders attributable to cannabis use, NSW, 2007

Estimated number	Psychotic disorders				
	Schizophrenia	Dx only	Tx only	Both	Neither
Dx only		-	-	-	6
Tx only		-	-	-	28
Both		-	-	-	18
Neither		12	17	75	-
TOTAL					157
GRAND TOTAL					916

Source: AIHW (2008a), Zhang and Yu (1998)

Note: As per the previous table.