Journal of Substance Use

http://informahealthcare.com/jsu
ISSN: 1465-9891 (print), 1475-9942 (electronic)

J Subst Use, 2015; 20(4): 239–246
 DOI: 10.3109/14659891.2014.900580

informa healthcare

ORIGINAL ARTICLE

Cost-effectiveness of counselling as a treatment option for methamphetamine dependence

Sadmir Ciketic[1,2], Reza Hayatbakhsh[1,3], Rebecca McKetin[4,5], Christopher M. Doran[6,7], and Jake M. Najman[1,8]

[1]School of Population Health, University of Queensland, Herston, Brisbane, QLD, Australia, [2]Department of Primary Care and Public Health Sciences, School of Medicine, King's College London, London, United Kingdom, [3]Department of Health, Queensland Government, Mount Isa Hospital, Mount Isa, Queensland, Australia, [4]National Drug and Alcohol Research Centre, University of New South Wales, Sydney, NSW, Australia, [5]Centre for Mental Health Research, Australian National University, Canberra, ACT, Australia, [6]Faculty of Medicine and Health Sciences, University of Newcastle, Newcastle, NSW, Australia, [7]Edith Cowan University Health and Wellness Institute, Edith Cowan University, Joondalup, WA, Australia, and [8]School of Social Science, University of Queensland, Brisbane, QLD, Australia

Abstract

Introduction and aims: Illicit methamphetamine (MA) use is an important public health concern. There is a dearth of knowledge about effective and cost-effective treatments for methamphetamine (MA) dependence in Australia. This article evaluates the cost-effectiveness of counselling as a treatment option for illicit MA use compared with no treatment option.

Design and methods: Data are from 501 individuals recruited into Methamphetamine Treatment Evaluation Study (MATES). The population of MA users from MATES is extrapolated to a total number of 1000 MA users in the intervention group (counselling treatment) and control group (non-treatment group). A decision analytic model is developed that examines the costs and health outcomes [measures as quality adjusted life years (QALYs) gained] for the treatment and comparison group over a 3-year period. A societal perspective is adopted and model inputs are subject to sensitivity and uncertainty analysis to test the robustness of results to parameter variability. Results are discounted by using 3% discount rate and expressed in 2011 Australian dollars.

Results: The incremental cost-effectiveness analysis suggests that counselling is a dominant health care intervention, i.e. saves money and is more effective than a do nothing intervention. The incremental difference in costs is −AU$18.36 million (95% CI −AU$22.80 million to −AU$14.31 million) and the incremental difference in QALY is 107 (95% CI −640 to 820) with a probability of 78.64% of counselling being a dominant and cost-effective treatment within the acceptable incremental cost-effectiveness ratio (ICER) of $63 832 per QALY in the Australian society. The results of the sensitivity analysis show that the ICER is most sensitive to change in five major inputs: baseline utility, utility at 3 months, dealing crime costs, property crime costs and fraud crime costs.

Discussion and Conclusions: The economic evaluation of the cost-effectiveness of counselling for MA dependence, as a first cost-effectiveness study to assess psychosocial treatment options for MA dependence, shows that greater investment in this cost-effective strategy will produce significant cost-savings and improve health outcomes as well as improve a lot of externality issues associated with drug use.

Keywords

Economic evaluation, methamphetamine dependence, treatment options

History

Received 6 December 2013
Revised 21 February 2014
Accepted 28 February 2014
Published online 28 March 2014

Introduction

Illicit methamphetamine (MA) use is a public health problem. MA use is associated with a lower health-related quality of life (HRQL), increased criminal and justice spending (due to a higher engagement in criminal activities of MA users) and increased health care costs. The current knowledge of effective and cost-effective treatment options for MA dependence is limited and there is a clear need for an economic evaluation of available treatment options for MA dependence. The research into the two main components of economic evaluation of treatment options for MA dependence, namely, health-related quality of life (HRQL) and cost studies, provides initial support for a detailed study on cost-effectiveness analysis (CEA) of available treatment options for MA dependence.

Regular and dependent MA users may experience a range of serious physical and mental health problems including MA induced psychosis, psychological morbidity, cognitive dysfunction, a fourfold increased risk of stroke, malnutrition and insomnia as well as the risk of HIV and other blood-borne diseases (Darke et al., 2008; Hando et al., 1997; Kaye et al., 2007; Margolis & Newton, 1971; McKetin & Mattick, 1998; McKetin et al., 2006a; Petitti

Correspondence: Sadmir Ciketic, King's College London, Capital House, 42 Weston Street, London SE1 3QD, UK. Tel: +44 20 7848 6426. Fax: +44 20 7848 6620. E-mail: sadmir.ciketic@uqconnect.edu.au

et al., 1998). Recently, indicators show that harms such as psychosis, emergency department presentations and MA-related crime have increased considerably (Fulde & Wodak, 2007). There was a 59% increase in amphetamine-related psychosis nationally between 1999–2000 and 2003–2004 (Fulde & Wodak, 2007). Further to these findings, there were 15 935 drug treatment episodes in Australia in 2005/2006 where MA was the primary drug of concern (Australian Institute of Health and Welfare, 2007; Cogger et al., 2008). Arrests in New South Wales related to MA abuse rose from 18 per 100 000 in 1995 to 46 per 100 000 population in 2005 – an increase of 253% (McKetin et al., 2006b). The pattern of increased treatment admissions has also been observed in other countries such as the United States (US) where amphetamine/MA-related treatment admissions increased by over 400% over 10 years (Substance Abuse and Mental Health Services Administration, 2006).

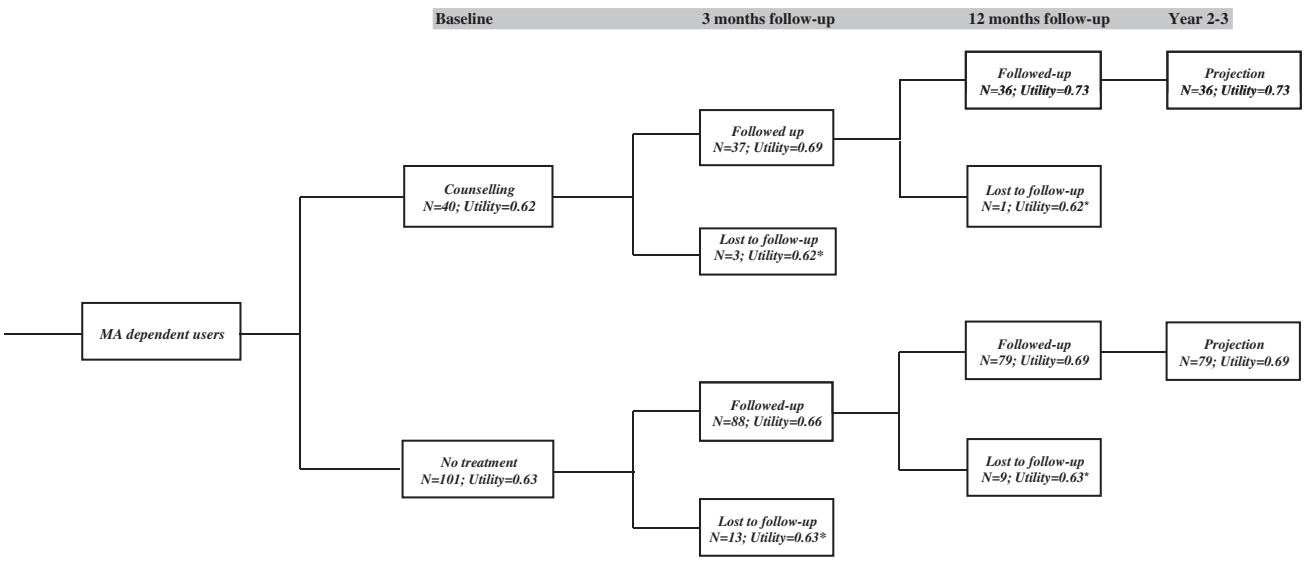
Several review studies provide evidence on treatment outcomes of psychological and pharmacological treatment options for MA dependence (Brensilver et al., 2013; Ciketic et al., 2012; Colfax et al., 2010; Shearer & Gowing, 2004; Srisurapanont et al., 2001). These studies provide evidence that counselling and residential rehabilitation may be effective treatments for MA dependence. McKetin et al. (2012) in their evaluation of treatment outcomes in participants from the Methamphetamine Treatment Evaluation Study (MATES) found evidence of a time-limited benefit of residential rehabilitation in terms of a decrease in MA use when compared to the no treatment group or short detoxification only treatment modality. Further to this body of evidence and research, other authors provide evidence on health-related quality of life (HRQL) of dependent MA users in treatment (Costenbader et al., 2007; Gonzales et al., 2009; Pyne et al., 2008). A recent study provides evidence on HRQL (specifically among MA users in treatment from MATES) treatment outcomes (Ciketic et al., 2013). Studies on cost outcomes of treatment options for MA dependence specifically are scarce. Nicosia et al. (2009) estimated that premature death and loss in wellbeing due to MA use, as measured in QALYs, is substantial, with estimates reaching nearly 900 (range 723–1669) deaths and a total loss of more than 44 000 QALYs (95% CI 32 574 to 74 004). Mark et al. (2007) conducted a study on costs of substance abuse in the US and estimated total spending on substance abuse treatment at US$21 billion in 2003. The findings from Australia indicate that direct social costs of drug dependence and harmful use in Australia for the year 2004/2005 account for AU$56.1 billion, of which illicit drugs accounted for AU$8.2 billion (14.6%). For example, psychostimulants (including amphetamines, MA and cocaine) accounted for AU$3.4 million of gross hospital costs in 2004/2005 (Collins & Lapsley, 2008). Shearer et al. (2010) found in their study on cost-effectiveness of modafinil therapy for psychostimulant dependence (including MA and cocaine) that it would cost an average additional AU$79 to achieve an extra stimulant-free day with modafinil compared with placebo.

The purpose of this study is to examine the cost-effectiveness of counselling for MA dependence. The intervention of outpatient counselling will be compared in terms of cost and health effect outcomes with the no treatment option by utilising cost estimates from secondary data sources and literature in the context of MATES study estimates of crime, health service utilisation patterns and the estimates on the costs of treatment.

Methods

Model design

The model of counselling compared with the no treatment option is a decision tree type model (Figure 1) as described elsewhere in the literature (Drummond et al., 2005; Hunink et al., 2001). For this purpose, Microsoft Excel 2010 (Microsoft Corporation) was used to accommodate the modelling of cost and health outcomes for counselling compared with the no treatment option. Uncertainties of



*** Average utility on these scores has been labeled here as the baseline utility. For modelling of health effects, adjusted utility scores (between period baseline to 3 months and 3 months to 12 months) were used according to the assumptions.**

Figure 1. Decision tree model and health outcomes for MATES participants in counselling as a treatment option for MA dependence compared with no intervention.

model inputs and the probabilistic sensitivity analyses were addressed and handled by using Microsoft Excel (Microsoft Redmond Campus, Redmond, WA) add-in software @Risk, version 5.5.1 from the Decisions Tools Suite by Palisade Corporation (Ithaca, NY).

Target population

The study population included MA users recruited into the MATES study (McKetin et al., 2008, 2010) from agencies across Sydney and Brisbane regions in 2006/2007. Ethical approval for the MATES study was obtained by MATES investigators. The follow-up rates in MATES were documented to be 80% at three months, 74% at 1 year and 66% at 3 years (McKetin et al., 2012). An extrapolation of original MATES population within the study was undertaken to proportionately scale the initial number of 501 MA users to 1000 MA users in both treatment and non-treatment groups for transparent calculations and modelling purposes.

Intervention and comparator

The key details of intervention and comparator include the intervention counselling group and the non-intervention comparison group of 1000 non-treated MA users compared with 1000 treated study entrants. The detailed description of treatment services and available options for treatment are explained elsewhere (Australian Institute of Health and Welfare, 2007).

The MATES sample consisted of 101 participants in the non-treatment group (comparison group) and 400 participants in three intervention groups. The intervention groups included participants whose main form of treatment received was (a) outpatient counselling ($n = 40$), (b) residential rehabilitation ($n = 248$) and (c) inpatient or outpatient detoxification ($n = 112$). The overall number of participants was scaled upwards up to 1000 MA users in each group, the treatment group and the comparison non-treatment group. The details of treatment and non-treatment group are described in the findings published by MATES investigators (McKetin et al., 2008, 2010).

Health-related quality of life

Health-related quality of life (HRQL) outcomes among MA users in treatment were obtained using the SF-6D algorithm (Brazier & Roberts, 2004) to translate responses from the SF-12 Health Questionnaire (Ware et al., 1995) used in MATES into a single preference-based utility score (Table 1). A slight modification to the SF-6D utility estimates as presented in the paper by Ciketic et al. (2013) was necessary in order to incorporate all individuals from MATES ($n = 501$ instead of $n = 349$) in the modelling strategy. More details on validity of use and correlation between SF-12 Health Questionnaire responses and the SF-6D Health Questionnaire utility scores are found elsewhere (Ciketic et al., 2013).

The overall QALYs for the model are estimated as a product of the HRQL (preference-based utility score) and the time or length of the interval in which participants were followed or not followed-up. An approach was adopted to adjust the QALYs for each of the periods as the average between baseline and 3 months, and 3 months and 12 months.

Costs

The costs in the context of MATES study include the following: costs of treatment for MA dependence (counselling treatment), health service utilisation (HSU) costs (hospital admissions, emergency department costs (ED), ambulance costs, psychiatric hospital costs, psychiatrist visits costs, counsellor visits costs, dentist visit costs, general practitioner (GP) visits costs, other HSU costs and specific medications costs) and crime (property, dealing, fraud and violent crime) costs. Exponential extrapolation of unit inputs for costs was used for years 2 and 3 of the model. Health-price index was used, where necessary, to adjust for inflation on cost estimates from previous years. All costs were analysed in Australian Dollars as of year 2011. Costs were discounted at a rate of 3% per year. A detailed summary of costs is provided in Table 2.

Treatment costs

In general, treatment costs of a treatment modality refer to costs associated with the practice of providing treatment, whether it is provided in government or non-government facilities. By utilising the data on measurement of the absolute number of participants and the average length of stay in treatment from McKetin et al. (2010) study it was possible to derive the treatment costs component.

The costs of treatment include: (1) unit costs of treatment were derived from the non-government organisations (The

Table 1. SF-6D preference based utility scores across the three time intervals (baseline, 3 and 12 months follow-up for all participants present at follow-up time points).

Treatment modality	Baseline		3 months follow-up		12 months follow-up	
	N	Mean (95% CI)	*N*	Mean (95% CI)	*N*	Mean (95% CI)
No treatment	101	0.63 (0.61–0.66)	88	0.66 (0.63–0.69)	79	0.69 (0.66–0.72)
Counselling	40	0.62 (0.59–0.65)	37	0.69 (0.65–0.74)	36	0.73 (0.69–0.77)

Table 2. Costs in MATES for 1000 MA users.

	Costs of crime (AU$)	Costs of HSU (AU$)	Costs of treatment (AU$)	Total per person costs[a]	Total costs[a] (AU$)
No treatment	$43 674 704	$11 484 039	–	$52 738	$52 737 671
Counselling	$23 913 937	$11 654 441	$301 177	$34 359	$34 358 886

[a]The column ''total costs'' indicates the sum of all costs discounted at a discount rate of 3%. All costs are expressed in year 2011 Australian Dollars.

Salvation Army, 2008) and partly from Australian government sources (Department of Health and Ageing, 2007); (2) average length of stay in treatment approach was adopted; (3) counselling costs are calculated on the basis that the counselling treatment modality lasts not more than 3 months with a one-off treatment event (13 weeks duration, 7.5 individual sessions and 0.9 group sessions on average and adjusted to the number of weeks participants have completed treatment in MATES (McKetin et al., 2010) and there are no costs of treatment accruing in other periods); (4) treatment length reflected the full episode of treatment and (5) the participants lost to follow-up are assigned half of the time in treatment for whichever period costs apply.

Crime costs

The costs of crime are structured as follows: (1) crime costs consist of costs in four different crime categories, i.e. property crime, dealing, fraud and violent crime; (2) unit costs of crime were derived from Mayhew (2003) and Jiggens (2005); (3) the assumption has been made that each participants committed only one of each of the crime categories; (4) lost-to-follow-up participants reach their initial ''before treatment'' crime levels to 100% in year 4; (5) participants who are followed-up to 12 months are assigned levels of crime as at the 12 months.

Health service utilisation (HSU) costs

Costs in the HSU are made of different categories: hospital admissions, emergency department costs (ED), ambulance costs, psychiatric hospital costs, psychiatrist visits costs, counsellor visits costs, dentist visit costs, general practitioner visits costs, other HSU costs and specific medications costs. Costs derived in the HSU are based on the number of participants in the study at 12 months follow-up with unit costs for each of the cost categories obtained from various sources: Australian Dental Association Queensland (2007), Australian Government Private Health Insurance Administration Council (2003), Commonwealth of Australia (Department of Health and Ageing, 2008) and Department of Health and Ageing (2007, 2010); (4) baseline values are assigned to participants who drop out, i.e. are not followed up.

Cost offsets

Cost offsets refer to the scenario where costs of crime and HSU play an important role in the cost-reductions (cost-savings) over a period of 3 years of CEA. These cost-savings are due to overall lower level of crime activity and HSU patterns among participants in the counselling group compared with the non-treatment group. However, it is important to note that individual components of costs within the counselling treatment group and within different trajectories (drop-outs from MATES) may be higher than that of the non-treatment comparison group.

Analysis

A cost-effectiveness framework was applied following international accepted guidelines on publishing of results in health economic evaluations according to Drummond et al. (2005). In doing so, the health and cost outcomes associated with the counselling treatment and the non-treatment comparison group of MA users were identified. The model features a decision-tree type model with each decision being a final decision in the decision tree node.

Uncertainty analysis has been performed using the Microsoft Excel add-in program, @Risk version 5.5.1 (Palisade Corporation, Ithaca, NY). The number of iterations was set at 10 000. The uncertainty in the results has been addressed in the model by choosing parametric probability distributions for the health and cost input parameters. Distributions were derived from the literature (Briggs et al., 2006) for the following parameters: HRQL at the baseline, HRQL at 3 months and for all cost inputs at the baseline and 12 months. Multivariate sensitivity analysis was conducted by using the Microsoft Excel add-in program @Risk, version 5.5.1 (Palisade Corporation, Ithaca, NY).

The uncertainty of the results of joined probability distribution of cost and health outcomes was assessed by using the cost-effectiveness planes (Black, 1990) given a cost-effectiveness threshold as recommended by World Health Organization guidelines (World Health Organization, 2005). The probability that the intervention is cost-effective was assessed by using the cost-effectiveness acceptability curves (CEACs) (Fenwick et al., 2001, 2006).

Results

Three different scenarios of uncertainty analyses are considered in order to see how the exclusion of major different cost components (cost-offsets) affects the uncertainty in incremental cost-effectiveness ratio (ICER) and model outcomes. The three different scenarios are presented below and they are as follows: base case (all costs included in the analysis), crime as a cost-offset excluded and HSU as s cost-offset excluded from the uncertainty analysis.

Scenario 1: base case

The base case scenario for the CEA of counselling compared with no treatment presents a cost difference of $\Delta C = \text{AU\$} -18.36$ million and health effects difference of $\Delta E = 107$ QALYs (Table 3). The ICER is dominant in this base case scenario.

The cost-effectiveness plane for the base case scenario is presented in Figure 2. Accordingly, it can be concluded that counselling as a treatment option for MA users compared with no treatment option has a 0.78 (i.e. 78.64%) probability of being cost-effective given the ICER threshold ratio of AU$63 832 per QALY as recommended by cost-effectiveness thresholds by the World Health Organization (2005) and Australian Bureau of Statistics (2013).

Scenario 2: crime as cost-offset excluded

The results for the case scenario, with costs of crime excluded from the analysis, show that on the basis of the $\Delta\text{Costs} = \text{AU\$}459\,842$, $\Delta\text{QALY} = 108$ and a mean $\text{ICER} = \text{AU\$}724$ per QALY, which is below the threshold level of AU$63 832 per QALY, it can be concluded that that counselling as a treatment option in MATES compared with the no treatment option meets the threshold level criterion with a 59.34% probability of cost-effectiveness.

Table 3. Results of CEA for counseling treatment compared with no treatment.

Statistic output	Minimum	Maximum	Mean	CI (5%; 95%)
Total $cost_{counselling}$ (AU$)	–	–	34 358 886	–
Total $cost_{no\ treatment}$ (AU$)	–	–	52 737 671	–
Total $QALY_{counselling}$	–	–	2014	–
Total $QALY_{no\ treatment}$	–	–	1907.078	–
ΔQALY	−1457	1658	107	(−640; 820)
ΔCost (AU$)	−28 492 000	−9 637 982	−18 364 110	(−22 797 180; −14 306 670)
ΔCost offset crime (AU$)	–	–	−19 760 767	–
ΔCost offset HSU (AU$)	–	–	−779 572	–
ICER (AU$/QALY)	−226 012 500	70 635 820	Dominant	(−315 229; 312 183)

Median ICER is dominant and not reported in this table. Decisions on cost-effectiveness of intervention compared with the threshold are based on mean ICER.

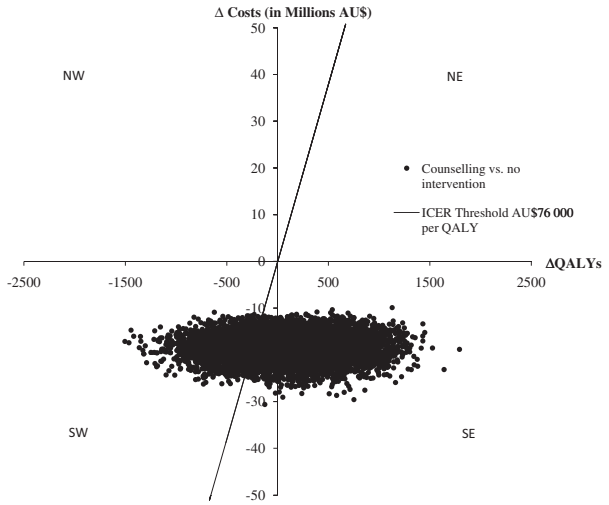


Figure 2. Incremental cost-effectiveness plane for counselling compared with no intervention (with all costs included).

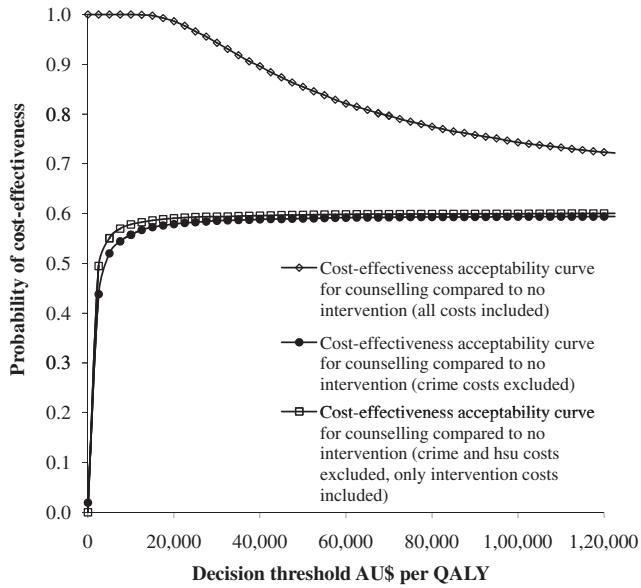


Figure 3. Cost-effectiveness acceptability curves of ICERs (with different costs included) for counselling compared with no treatment.

Scenario 3: health service utilisation costs and crime costs as cost-offsets excluded

The results for the case scenario, with costs of crime and HSU excluded from the analysis, show that on the basis of ΔCosts = AU$300 169, ΔQALY = 108 and a mean ICER = AU$2779, which is below the threshold level of AU$63 832 per QALY, it can be concluded that counselling as a treatment option in MATES compared with no treatment option, under given scenario, meets the threshold level criterion with a 59.91% probability of cost-effectiveness.

Figure 3 shows the representation of uncertainty as a probability of cost-effectiveness using CEACs as a probability of cost-effectiveness given a threshold level or willingness to pay by society for the three different scenarios as described above. CEACs are defined elsewhere in the literature as the probability that an intervention is more cost-effective than its comparator or, in a study comparing more than two interventions, it shows the probability that a given intervention is the most cost-effective given the observed data (Fenwick et al., 2001, 2006).

CEAC for the base case scenario (all costs included) shows that counselling as a treatment option compared with no intervention is 100% cost-effective at no threshold level, as the joint density of costs and effects involves cost-savings. The probability of cost-effectiveness approaches asymptotically the value of 0.61 (i.e. 60.06%; positive ΔQALYs) for infinitely large amounts of willingness to pay (threshold levels; Figure 3) when compared with the two other scenarios, i.e. scenario with excluded crimes costs with a 0.6 (i.e. 59.76%) probability of cost-effectiveness and scenario in which crime as well as HSU costs are excluded, with a probability of 0.60 (i.e. 60.26%; Figure 3).

Multivariate sensitivity analysis

Multivariate sensitivity analysis uses advanced mathematical and statistical methods to simulate the model with assumptions about the variability in each of the parameters (Gold et al., 1996). Overall, 16 inputs were included in the sensitivity analysis and the level of change incorporated a 30% change from the baseline values, whereby the choice of inputs was set to incorporate all categories of inputs. The results of the sensitivity analysis show that the ICER is most sensitive to change in five major inputs: baseline utility, utility at 3 months, dealing, property crime and fraud crime costs (Figure 4).

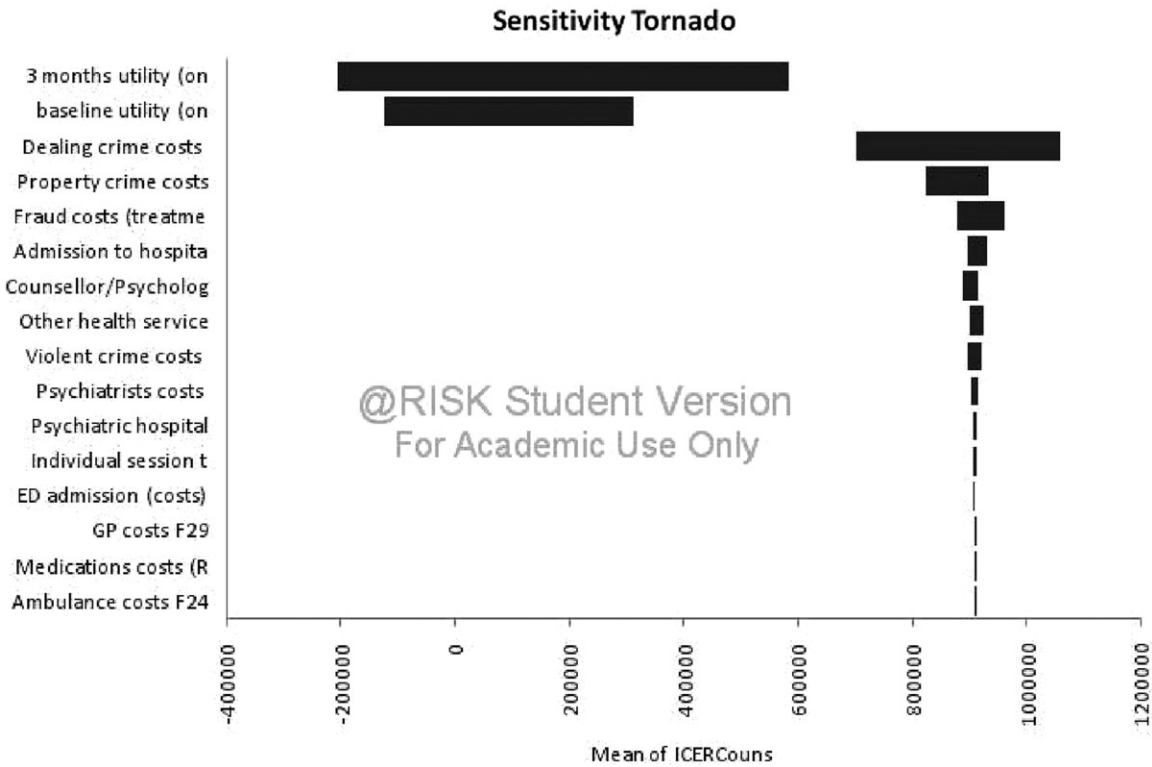


Figure 4. Graphical representation of sensitivity analysis by Tornado plot for counselling compared with no treatment option.

Discussion

The results of the analyses indicate that outpatient counselling is a cost-effective treatment option for MA abuse and dependence in Australia. The application of counselling treatment delivers cost-savings and a gain in QALYs compared with the no treatment option.

This study is one amongst the first to evaluate cost-effectiveness of counselling as one of the most commonly used treatment options for MA dependence in the wider community. Further, none of the existing studies have used utility scores to monitor treatment HRQL outcomes among MA users over time. In addition to these strengths, existing studies do not include social perspectives in costing the intervention compared with the non-intervention scenario. This is especially important for costing crime associated with drug abuse activities.

This study shows that the benefits associated with treatment exposure in terms of costs and effects outweigh treatment costs. Societal costs of not treating amphetamine/MA users are high and it has been shown that under given model assumptions, the application of counselling treatment, will reduce societal costs and lead to an improvement in the overall HRQL of MA users within 3 years of commencing treatment.

Overall, the findings of this study suggest that the existing treatment options for amphetamine/MA dependence in the community are cost-effective in the short to mid-term. Comparable CEAs were previously conducted in the field of opioid treatment options (Connock et al., 2007; Shanahan et al., 2006). Shanahan et al. (2006) suggest that long-term residential rehabilitation treatment is not cost-effective in comparison to pharmacotherapy.

Australian community should benefit from a wider implementation of counselling as a treatment option for MA dependence. In addition to being a cost-effective treatment modality over the doing nothing approach, this treatment modality delivers benefits on a large scale in Australian society: (i) it reduces current inequities among MA users in the community; (ii) it is acceptable to stakeholders; (iii) it is a feasible treatment option to be implemented; (iv) the intervention is sustainable; and (v) the potential for side effects is minimal.

The policy related implementation of the results of this study in the Australian society needs to be considered with caution. First, the issue of efficacy versus effectiveness needs to be considered, i.e. findings of this study as compared to population wide impact outcomes. Second, more attention should be given to community treatment services that treat majority of MA users in Australia. Finally, considerable savings in the Australian society are able to be achieved through the implementation of this treatment modality due to lower spending in the criminal justice sector after the application of treatment among MA users.

Limitations

The first limitation applies to estimating HRQL of MA users in treatment. As described in more details by Ciketic et al. (2013), it may be the case that MA users may have a slightly different HRQL if another instrument was used other than SF-12 Short Form questionnaire in MATES.

The second limitation applies to estimation of cost outcomes in the modelling compared with no treatment option. Perhaps most important limitation is the fact that no detailed data were available and accessible in MATES about

the estimation of costs in relation to crime, i.e. the data on number of crimes for each of the different types of crime committed by MA users were absent other than for one crime type.

Third limitation applies to modelling strategy (e.g. decision tree type modelling approach) undertaken in the CEA of costs and health outcomes for counselling and the non-treatment option. A different model structure may have resulted in different cost and health outcomes.

Finally, this study is limited to short to mid-term findings. To see improvements over the long-term, it would be necessary to model cost and health outcomes over a period of at least 10 years. Also, due to some data limitations, it is possible that this study has underestimated the results.

Conclusion

The implementation of counselling as a treatment option for MA dependence will produce large cost-savings, especially in crime costs component of costs. Even in the scenario when cost offsets are excluded from the analysis, counselling still remains a better approach by reaching 60.26% probability of cost-effectiveness in addressing MA dependence than doing nothing approach, i.e. no treatment option. It is imperative that Australian society implements counselling as treatment option for MA dependence. All parties, including government, MA users and Australian society will benefit in the long-term from counselling provision for MA dependent users in Australia. The findings of this study can be used to inform policy makers about how to better allocate resources and drive better policy decisions for treatment options for MA dependence.

Acknowledgements

The data used in the cost-effectiveness analysis in this paper were derived from and collected through the Methamphetamine Treatment Evaluation Study (MATES), which was conducted by the National Drug and Alcohol Research Centre, University of New South Wales, and was funded by the National Health and Medical Research Council and the Australian Government Department of Health and Ageing. The authors thank Joanne Ross, who was an investigator on the project, researchers working on the project (Erin Kelly, Shelley Cogger, Rachel Sutherland, Grace Ho, Cathie Sammut, Kate Hetherington, Sagari Sarkar, Julia Rosenfeld and Miriam Wyzenbeek), the participating treatment agencies and health services, and the participants.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

Australian Bureau of Statistics. (2013). Annual Gross Domestic Product (GDP), Measures over time, 2002–03 to 2011–12 (financial yearly). Available from: http://www.abs.gov.au/websitedbs/CaSHome.nsf/Home/Economy+Datasets [last accessed 20 Aug 2013].

Australian Dental Association Queensland. (2007). Dental fees survey. *Australian Dental Association Queensland News*. Available from: http://www.ada.org.au/login/Login.aspx?ReturnUrl=%2fmembers%2fdefault.aspx [last accessed 26 Apr 2007].

Australian Institute of Health and Welfare. (2007). *Alcohol and other drug treatment services in Australia 2005–06: Report on the National Minimum Data Set*. AIHW cat. no. HSE 53. Canberra: AIHW.

Black, W. C. (1990). The CE plane: A graphic representation of cost-effectiveness. *Medical Decision Making*, 10, 212–214.

Brazier, J. E., & Roberts, J. (2004). The estimation of a preference-based measure of health from the SF-12. *Medical Care*, 42, 851–859.

Brensilver, M., Heinzerling, K. G., & Shoptaw, S. (2013). Pharmacotherapy of amphetamine-type stimulant dependence: An update. *Drug and Alcohol Review*, 32, 449–460.

Briggs, A., Claxton, K., & Sculpher, M. (2006). *Decision Modelling for Health Economic Evaluation*. Oxford: Oxford University Press.

Ciketic, S., Hayatbakhsh, M. R., Doran, C. M., Najman, J. M., & McKetin, R. (2012). A review of psychological and pharmacological treatment options for methamphetamine dependence. *Journal of Substance Use*, 17, 363–383.

Ciketic, S., McKetin, R., Doran, C. M., Najman, J. M., Veerman, J. L., & Hayatbakhsh, M. R. (2013). Health-related quality of life (HRQL) among methamphetamine users in treatment. *Mental Health and Substance Use*, 6, 250–261.

Cogger, S., McKetin, R., Ross, J., & Najman, J. M. (2008). *Methamphetamine Treatment Evaluation Study (MATES): Findings from the Brisbane site*. NDARC Technical Report No. 295. Sydney: National Drug and Alcohol Research Centre.

Colfax, G., Santos, G. M., Chu, P., Vittinghoff, E., Pluddemann, A., Kumar, S., & Hart, C. (2010). Amphetamine-group substances and HIV. *Lancet*, 376, 458–474.

Collins, D. J., & Lapsley, H. M. (2008). *The Costs of Tobacco, Alcohol and Illicit Drug Abuse to Australian Society in 2004/05*. Vol. 64. Canberra: Commonwealth of Australia.

Connock, M., Juarez-Garcia, A., Jowett, S., Frew, E., Liu, Z., Taylor, R. J., Fry-Smith, A., Day, E., Lintzeris, N., Roberts, T., Burls, A., & Taylor, R. S. (2007). Methadone and buprenorphine for the management of opioid dependence: A systematic review and economic evaluation. *Health Technology Assessment Reports*, 11, 1–171.

Costenbader, E. C., Zule, W. A., & Coomes, C. M. (2007). The impact of illicit drug use and harmful drinking on quality of life among injection drug users at high risk for hepatitis C infection. *Drug and Alcohol Dependence*, 89, 251–258.

Darke, S., Kaye, S., McKetin, R., & Duflou, J. (2008). Major physical and psychological harms of methamphetamine use. *Drug and Alcohol Review*, 27, 253–262.

Department of Health and Ageing. (2007). *Medicare Benefits Schedule Book*. Canberra: Commonwealth of Australia.

Department of Health and Ageing. (2008). *National Hospital Cost Data Collection: Cost Report Round 11 (2006–2007)*. Canberra: Commonwealth of Australia.

Department of Health and Ageing. (2010). *Schedule of Pharmaceutical Benefits*. Canberra: Commonwealth of Australia.

Drummond, M. F., Sculpher, M. J., Torrance, G. W., O'Brien, B. J., & Stoddart, G. L. (2005). *Methods for the Economic Evaluation of Health Care Programmes*. 3rd ed. Oxford: Oxford University Press.

Fenwick, E., Claxton, K., & Sculpher, M. (2001). Representing uncertainty: The role of cost-effectiveness acceptability curves. *Health Economics*, 10, 779–787.

Fenwick, E., Marshall, D. A., Levy, A. R., & Nichol, G. (2006). Using and interpreting cost-effectiveness acceptability curves: An example using data from a trial of management strategies for atrial fibrillation. *BMC Health Services Research*, 6, 52–60.

Fulde, G. W. O., & Wodak, A. (2007). Ice: Cool drug or real problem? *Medical Journal of Australia*, 186, 334–335.

Gold, M. R., Siegel, J. E., Russell, L. B., & Weinstein, M. C. (1996). *Cost-Effectiveness in Health and Medicine*. Oxford: Oxford University Press.

Gonzales, R., Ang, A., Marinelli-Casey, P., Glik, D. C., Iguchi, M. Y., & Rawson, R. A. (2009). Health-related quality of life trajectories of methamphetamine-dependent individuals as a function of treatment completion and continued care over a 1-year period. *Journal of Substance Abuse Treatment*, 37, 353–361.

Hando, J., Topp, L., & Hall, W. (1997). Amphetamine-related harms and treatment preferences of regular amphetamine users in Sydney, Australia. *Drug and Alcohol Dependence*, 46, 105–113.

Hunink, M., Glasziou, P. P., Seigel, J., Weeks, J. C., Pliskin, J. S., Elstein, A. S., Weinstein, M. C. (2001). *Decision Making in Health and Medicine. Integrating Evidence and Values*. Cambridge: Cambridge University Press.

Jiggens, J. (2005). *The cost of drug prohibition in Australia*. Paper presented at the Social change in the 21st century, Queensland University of Technology, Brisbane, Australia.

Kaye, S., McKetin, R., Duflou, J., & Darke, S. (2007). Methamphetamine and cardiovascular pathology: A review of the evidence. *Addiction*, 102, 1204–1211.

Margolis, M. T., & Newton, T. H. (1971). Methamphetamine (''speed'') arteritis. *Neuroradiology*, 2, 179–182.

Mark, T. L., Levit, K. R., Coffey, R. M., McKusick, D. R., Harwood, H. J., King, E., Bouchery, E., Genuardi, J. S., Vandivort-Warren, R., Buck, J. A., & Ryan, K. (2007). *National Expenditures for Mental Health Services and Substance Abuse Treatment, 1993–2003*. Rockville, MD: Substance Abuse and Mental Health Services Administration.

Mayhew, P. (2003). *Counting the Costs of Crime in Australia: Technical Report*. Canberra: Australian Institite of Criminology.

McKetin, R., Ross, J., Kelly, E., Baker, A., Lee, N., Lubman, D., & Mattick, R. (2008). Characteristics and harms associated with injecting versus smoking methamphetamine among methamphetamine treatment entrants. *Drug and Alcohol Review*, 27, 277–285.

McKetin, R., & Mattick, R. P. (1998). Attention and memory in illicit amphetamine users: Comparison with non-drug-using controls. *Drug and Alcohol Dependence*, 50, 181–184.

McKetin, R., McLaren, J., Lubman, D. I., & Hides, L. (2006a). The prevalence of psychotic symptoms among methamphetamine users. *Addiction*, 101, 1473–1478.

McKetin, R., McLaren, J., Riddel, S., & Robins, L. (2006b). *The Relationship Between Methamphetamine Use and Violent Behaviour*. Sydney: NSW Bureau of Crime Statistics and Research.

McKetin, R., Sutherland, R., Ross, J., Najman, J. M., Mamun, A., Baker, A., Mattick, R., & Rosenfeld, J. (2010). *Methamphetamine Treatment Evaluation Study (MATES): Three-year Outcomes from the Sydney Site*. NDARC Technical Report No. 312. Sydney: National Drug and Alcohol Research Centre.

McKetin, R., Najman, J. M., Baker, A. L., Lubman, D. I., Dawe, S., Ali, R., Lee, N. K., Mattick, R. P., & Mamun, A. (2012). Evaluating the impact of community-based treatment options on methamphetamine use: Findings from the Methamphetamine Treatment Evaluation Study (MATES). *Addiction*, 107, 1998–2008.

Nicosia, N., Pacula, R. L., Kilmer, B., Lundberg, R., & Chiesa, J. (2009). *The Economic Cost of Methamphetamine Use in the United States, 2005*. Santa Monica: RAND.

Petitti, D. B., Sidney, S., Quesenberry, C., & Bernstein, A. (1998). Stroke and cocaine or amphetamine use. *Epidemiology*, 9, 596–600.

Private Health Insurance Administration Council (PHIAC). (2003). Operations of the Registered Health Benefits Organisations Annual Report 2002–03. Canberra: PHIAC, Commonwealth of Australia.

Pyne, J. M., French, M., McCollister, K., Tripathi, S., Rapp, R., & Booth, B. (2008). Preference-weighted health-related quality of life measures and substance use disorder severity. *Addiction*, 103, 1320–1329.

Shanahan, M. D., Doran, C. M., Digiusto, E., Bell, J., Lintzeris, N., White, J., Ali, R., Saunders, J. B., Mattick, R. P., & Gilmour, S. (2006). A cost-effectiveness analysis of heroin detoxification methods in the Australian National Evaluation of Pharmacotherapies for Opioid Dependence (NEPOD). *Addictive Behaviors*, 31, 371–387.

Shearer, J., & Gowing, L. R. (2004). Pharmacotherapies for problematic psychostimulant use: A review of current research. *Drug and Alcohol Review*, 23, 203–211.

Shearer, J., Shanahan, M. D., Darke, S., Rodgers, C., Van Beek, I., McKetin, R., & Mattick, R. P. (2010). A cost-effectiveness analysis of modafinil therapy for psychostimulant dependence. *Drug and Alcohol Review*, 29, 235–242.

Srisurapanont, M., Jarusuraisin, N., & Kittirattanapaiboon, P. (2001). Treatment for amphetamine dependence and abuse. *Cochrane Database of Systematic Reviews*. CD003022. doi: 10.1002/14651858.CD003022.

Substance Abuse and Mental Health Services Administration. (2006). Trends in methamphetamine/amphetamine admissions to treatment: 1993–2003. *The DASIS Report*. Available from: http://drugabusestatistics.samhsa.gov/2k6/methTx/methTx.htm [last accessed 14 Oct 2009].

The Salvation Army. (2008). Brisbane recovery services, centre ''Moonyah'' *The Bridge: Residential Drug, Alcohol and Gambling Recovery Program*. Brisbane: The Salvation Army.

Ware, J. E., Kosinski, M., & Keller, S. D. (1995). *How to Score the SF-12 Physical and Mental Summary Scales: A User's Manual*. 2nd ed. Boston: The Health Institute, New England Medical Centre.

World Health Organization. (2005). Cost-effectiveness thresholds. Available from: http://www.who.int/choice/costs/CER_levels/en/index.html [last accessed 27 Aug 2013].