

Subsidising patient dispensing fees: The cost of injecting equity into the opioid pharmacotherapy maintenance system

Author/Contributor:

Chalmers, Jennifer; Ritter, Alison

Publication details:

Drug and Alcohol Review

v. 31

Chapter No. 7

pp. 911-917

1465-3362 (ISSN)

Publication Date:

2012

Publisher DOI:

<http://dx.doi.org/10.1111/j.1465-3362.2012.00472.x>

License:

<https://creativecommons.org/licenses/by-nc-nd/3.0/au/>

Link to license to see what you are allowed to do with this resource.

Downloaded from <http://hdl.handle.net/1959.4/53165> in <https://unsworks.unsw.edu.au> on 2024-03-05

Subsidising patient dispensing fees: The cost of injecting equity into the opioid pharmacotherapy maintenance system

Jenny Chalmers
and
Alison Ritter

Drug Policy Modelling Program
National Drug and Alcohol Research Centre
UNSW, Sydney, NSW, 2052

Abstract

Introduction:

Australian pharmacotherapy maintenance programs incur costs to patients. These dispensing fees represent a financial burden to patients and are inconsistent with Australian healthcare principles. No previous work has examined the current costs nor the future predicted costs if government subsidised dispensing fees.

Methods:

A system dynamics model, which simulated the flow of patients into and out of methadone maintenance treatment was developed. Costs were imputed from existing research data. The approach enabled simulation of possible behavioural responses to a fee subsidy (such as higher retention) and new estimates of costs were derived under such scenarios.

Results:

Current modelled costs (AUS\$11.73m per month) were largely borne by state/territory government (43%), with patients bearing one third (33%) of the total costs and the Commonwealth one-quarter (24%). Assuming no behavioural changes associated with fee-subsidies, the cost of subsidising the dispensing fees of Australian methadone patients would be \$3.9 million per month. If retention were improved as a result of fee subsidy, treatment numbers would increase and the model estimates an additional cost of \$0.8m per month. If this was coupled with greater numbers entering treatment, the costs would increase by a further \$0.4m per month. In total, full fee subsidy with modelled behavioural changes would increase per annum government expenditure by \$81.8m to \$175.8m.

Discussion:

If government provided dispensing fee relief for methadone maintenance patients it would be a costly exercise. However these additional costs are offset by the social and health gains achieved from the methadone maintenance program.

Key words: methadone maintenance treatment; Australia; dispensing fees; affordability.

Introduction

Pharmacotherapy maintenance is a highly cost effective intervention for opioid dependent people [1-2]. Methadone and buprenorphine are judged to be necessary and cost-effective medicines for the treatment of opioid dependence, as demonstrated by their listing on the Australian Government's Pharmaceutical Benefits Scheme (PBS). There is no publically available measure of health expenditures (state and federal) allocated to pharmacotherapy treatment. Despite the known benefits of pharmacotherapy maintenance, fewer than half of Australia's opioid dependent population are estimated to be in treatment on any one day [3]. Patient fees are considered to be one of the major barriers to treatment [4-5]. In this paper we present the findings from an exploration of the likely cost to government were it to subsidise fees for methadone patients.

In Australia, the federal government pays for the opioid maintenance drugs through Section 100 of the *National Health Act 1953*. Section 100 only covers the costs of medication itself, not the cost associated with dispensing the drug. State and territory governments cover this cost in correctional facilities and public clinics. Patients who receive their medication in community pharmacies and private clinics pay a fee, usually referred to as a 'dispensing fee' but could equally be termed an administration or program fee. They represents over 80% of all pharmacotherapy maintenance patients [6]. State and territory governments pay this fee for some identified high risk groups, such as juveniles and pregnant women [5].

The most up-to-date information on pharmacy dispensing fees reveals marked variation, with daily fees ranging from \$1.43 to \$10 [7]. The median daily fee for methadone was \$4.65 [4, 7]. There is evidence of significant difference between the levels of dispensing fees paid by pharmacy patients and private clinic patients [5, 7]. In addition, the vast majority of pharmacies charge patients the same weekly fee, regardless of the number of takeaway doses received [8].

The most obvious concern with dispensing fees is that patients cannot afford them. Although there is no publicly available record of patient sources of income, it is likely that the majority of patients rely on income support payments as their major source of income. Only 17% of treatment entrants who participated in the Australian Treatment Outcome Study in the mid 2000s reported paid work as their main source of income [9]. Three quarters of pharmacy-dispensed participants in a recent Australia-wide study were reliant on income support payments [7].

A study of income support recipients in pharmacotherapy treatment in Melbourne reveals the financial hardship associated with dispensing fees [10]. Patients would rather pay their dispensing fees and go without food or go to emergency organisations for food and accommodation, commit crimes, and/or obtain loans from Centrelink. Despite prioritising dispensing fees, it was common for this group of patients to acquire debts at pharmacies [10]. In a survey of pharmacies in NSW and Victoria, over 70% reported that they provided credit to patients unable to pay their dispensing fees and almost all the pharmacies who provide credit were doing so when surveyed [11]. The implications of acquiring a debt depend on the pharmacist, including dose refusal, treatment termination, penalty fees, insistence on direct debit arrangements, or instalment payments [10-12].

Dispensing debts place pressure on the dispensing pharmacist as well. Although dispensing pharmacies are motivated more by social obligation than financial incentive, a number of NSW pharmacists (10.6%) cited financial issues, including bad debts, as a barrier to dispensing [13]. In health care generally, user fees are considered to be “the most regressive form of healthcare financing available; they contribute to the unaffordable cost burdens imposed on poor households; and they represent one facet of the social exclusion experienced by these households” [14: page 762].

Currently the system does not means-test fees, with the exception of fee relief for high risk groups noted earlier. There appears to be no systematic attempt to shield patients on the lowest incomes from the financial impost of dispensing fees. Furthermore, there is no state or national agreement on appropriate fee levels.

This stands in stark contrast to the PBS, designed to provide Australia-wide equity of access to PBS approved prescription drugs. Through subsidising the price of prescription drugs, incorporating both the cost of the drug and dispensing, it both “recognises capacity to pay and acknowledges that the chronically ill should receive greater assistance” [5: page 24].

Moreover, there is inequity compared with other treatments. The appropriate comparator is long term treatments for opioid dependence (such as long term counselling or rehabilitation). Long-term rehabilitation (such as a therapeutic community) generally does not incur patient fees other than some accommodation costs. Long-term counselling is not associated with patient fees in the public system.

The fee structure, rather than fees themselves, can hinder the most appropriate match of patient to service. Public clinics tend to provide the more expensive specialist support needed by people with complex presentations. Once stabilised, the patient may not need such intensive support. However, if the choice is between free dispensing in the public clinic and fee-for-service dispensing in community pharmacies there is a financial incentive for the patient to remain with the public clinic.

Fees may have implications for patient behaviour and treatment outcomes. Surprisingly little research has attempted to quantify the impact of fees on patients' retention in treatment or entry into treatment, and most of it comes from the USA. Des Jarlais, and colleagues [15] reported that one year retention rates in publicly supported methadone programmes (at low or no cost to patients) in New York during the 1970s were almost 60 per cent compared with the less than 40 per cent retention rates in fee-for-service treatment. However, it is not clear that the analysis controlled for differences in the types of patients that entered the two programs.

Having randomly assigned new methadone maintenance admissions to a San Antonio (Texas) treatment programme to a fee (\$2.50 per day) or no fee status, Maddux, et al. [16] found that fee payment increased the likelihood of treatment cessation. But, the estimated relationship between fee status and treatment cessation was of borderline significance only (at 10 per cent level).

Another US study considered the impact of fees on treatment commencement: the group of participants who received a coupon for 90 days of free treatment were substantially more likely to enter treatment than others, suggesting that treatment uptake is sensitive to costs faced by patients [17].

Colameco and colleagues [18] argued that patient fees were associated with poorer retention rates based on their analysis of 35 buprenorphine-naloxone patients at a US family practice centre. None of the 22 patients retained in the program personally paid for their medication, whereas ten of the thirteen patients lost to follow-up or therapeutically discharged did pay. Payments ranged from \$300 to \$500 per month, which is substantially higher than Australian fees. Furthermore the patients that did not pay were subsidised by their families or medical insurance, suggesting they may have had a higher level of social functioning, a strong predictor of treatment outcome.

While Bammer, et al. [19] is often cited as Australian research supporting the position that fees reduce treatment retention, that study documented a major expansion in

treatment places in the ACT that coincided with the introduction of dispensing fees and in the ensuing two years found no evidence of a fall in the number of new admissions, or a decrease in treatment retention. A recent Australia-wide randomised controlled trial examined the implications of reducing a patient's pharmacy dispensing fee by up to \$15 per week for six months. The trial set a \$5 per week minimum dispensing fee for the intervention group and some patients in this group had pre-trial fees lower than \$20 per week. The study reported "(a) clinically nontrivial improvement in retention (around 5% improvement)" which was not statistically significant [7: page 62].

Official accounts of patient dispensing fees internationally are hard to come by: particularly the distinction between costs of the medication versus the dispensing fee. We located a paper from Germany which noted that the German social health insurance scheme, which covers almost 90 percent of the population, would cover the fees of most patients [20]. The UK government normally covers the fees of patients in receipt of income support, while patients in paid employment pay fees (Alex Fleming, Policy Information Manager, National Treatment Agency for Substance Misuse, personal communication, 26 March 2012). In 17 of the 26 European countries that report to the European Monitoring Centre for Drugs and Drug, the medication is provided free of charge unless treatment is sought from private providers [21]. It is unclear whether dispensing fees are included.

This paper reports on an analysis of methadone dispensing fees, in the context of the overall costs of providing methadone maintenance. Analysis of the total cost, and who bears those costs (state government, federal government or patient) is followed by an analysis of the costs that would be incurred should government pay for dispensing fees, given that reductions in dispensing fees may result in higher retention and increased numbers of patients accessing treatment. A system dynamics modelling approach was employed.

Methods

System dynamics modelling is an increasingly popular tool for public health management. For instance, it has been used in global vaccination policy, public health, health and drug policy (including tobacco control), chronic disease, service planning, health management, patient flow and body system simulations [22-36].

Chalmers et al [3] details the system dynamics model of the Australian opioid pharmacotherapy system used here. The model represents the flows into treatment,

between treatment providers and out of treatment. The typical pattern of pharmacotherapy treatment usage in Australia is that of cycling through multiple episodes of care [37]. This cycling behaviour formed the basis of the model.

The model assumes that a proportion of non dependent opioid users become dependent each year. After a period of time, some dependent users enter one of the three treatment options: treatment in a public clinic; treatment in a private setting (which includes care provided by general practitioners, physicians and psychiatrists along with private clinics); or treatment in prison. The rate of flow into treatment was based on data provided by health departments in NSW and Victoria, factored up to an Australian wide-estimate. Numbers in treatment were derived from the national administrative data set for 30 June 2006 [38]. We distinguished between prescribing and dispensing. Consistent with the administrative data, we assumed 40% and 60% of public clinic patients were dispensed in public clinics and community pharmacies respectively [38]. While this ratio may vary between jurisdictions, the model represents national averages. All patients treated in a private setting, even those in private clinics, were assumed to be dispensed in community pharmacies. Patients remain in treatment for a specified period of time, based on existing research evidence (see [3]). When not in treatment they are considered dependent opioid users, and after a period of time they re-enter treatment. A proportion leaves the model each year (accommodating abstinence and mortality rates).

The costs associated with prescribing methadone, the medication itself, and the costs associated with dispensing methadone were calculated for each patient for every day in treatment. The source data (see Table 1) are dated. For example, the National Evaluation of Pharmacotherapies for Opioid Dependence (NEPOD) studies were conducted in the late 1990's. The NEPOD studies remain the best available Australian estimates of the costs of prescribing methadone maintenance treatment and dispensing methadone in public clinics. All costs were adjusted to 2006/07 dollars, consistent with the years for the prevalence and treatment data. The NEPOD costing approach was to value staff time spent in face-to-face contact with patients and indirect staff time spent on activities such as maintaining patient records, as well as the costs of maintaining and operating service delivery facilities [39]. We consider the treatment costs used in our analyses to be a lower estimate, assuming that the NEPOD study under-estimated the clinically desirable level of counselling and case management costs for patients in the private setting.

We identified three bearers of those costs: the Commonwealth government, state/territory governments and patients. The Commonwealth covers the cost of

methadone (50.4 cents per dose) and the cost of general practitioner prescribing (\$3.78 per day); the state government covers the cost of prescribing (\$14.58 per day) and dispensing (\$1.05 per day) in public clinics and treatment in prison (\$10.31 per day); and the patient covers the cost of dispensing in private clinics or community pharmacies (\$5 per day). There was insufficient information on buprenorphine to calculate an analogous set of costs.

Sensitivity analyses were undertaken while building the model to ensure that its structure was not sensitive to particular parameters. The size of the population of opioid dependent people between treatment depends crucially on the lengths of stay in and between treatment. Relevant sensitivity analyses are reported in Chalmers et al [3].

INSERT TABLE 1 HERE

As can be seen in Table 1, a number of assumptions were required to derive average costs per patient. These included a mean methadone dose of 70mg, and an average dispensing fee of \$5.00 per day.

First, we estimated the total costs of prescribing and dispensing methadone in Australia. We then estimated the cost of subsidising methadone dispensing by \$5 per day for patients dispensed in private clinics and pharmacies (Scenario 1). This simplistic accounting exercise assumes that behaviour is unchanged. In response to a dispensing fee reduction patients may stay longer in treatment and treatment naive patients may enter treatment earlier than otherwise, as suggested by the existing research summarised above. The model allows us to accommodate these possible behavioural changes in our costing estimate. Under scenario 2 the length of stay of fee-subsidised patients increases by 50 per cent, that is from 12 months to 18 months for patients prescribed by general practitioners (since all are dispensed in pharmacies) and from 7 months to 10.5 months for public clinic patients dispensed in pharmacies. In addition, under Scenario 3 the average time to initial treatment entry for the treatment naïve is halved from 4 years to 2 years.

Results

The model estimated the overall cost of the provision of methadone maintenance to be \$11.73 million per month, inclusive of prescribing costs, medication costs and dispensing costs to patients. Forty-three per cent of this cost was borne by State/Territory

governments (\$5.06m per month), 33% was borne by the patients (\$3.90m per month) and the remaining 24% by the Commonwealth government (\$2.77m per month).

The simple accounting exercise under Scenario 1 revealed that the cost of subsidising the dispensing fees of Australian methadone patients would be \$3.9 million per month (see Table 2). Under Scenario 2 the numbers in treatment increased by 5,549 to 37,117; an almost 18 per cent increase. This further increased the costs of subsidising dispensing by \$0.8 million per month to \$4.7 million per month. Under Scenario 3, a further 3,068 opioid dependent people were in treatment, with the dispensing subsidy increasing by another \$0.4 million per month to \$5.1 million. Additional patients also incur medication and prescribing costs: Commonwealth funding of the medication (methadone) and prescribing (GP fees) increased by almost \$1 million per month from the base-case, state/territory government expenditure on prescribing in public clinics increased by \$0.8 million. The third column (Table 2) gives the total program costs to governments per annum under base-case and for the three scenarios. Per annum government expenditure increased by \$81.8m to \$175.8m. The final column isolates the cost of medication and dispensing fees, showing the Commonwealth's financial responsibilities were it to subsidise dispensing fees.

INSERT TABLE 2 HERE

Discussion

The question posed in this policy experiment is what costs government (at state or federal level) would face were the dispensing of methadone to be subsidised. Using a systems dynamics model of the methadone treatment system, which allows simulation of possible behavioural responses to a fee subsidy while accounting for the repercussions of those behavioural responses to the treatment system as a whole, we demonstrated that although current costs (\$11.73m per month) are largely borne by state/territory government (43%), the patients bear one third (33%) of the total costs and the Commonwealth one-quarter (24%).

There is mounting evidence of the financial impost of dispensing fees on opioid dependent people seeking to reduce their consumption of heroin. If fees discourage people from treatment, the cost to governments of covering their fees should be weighed against the cost of their continuing use of heroin, taking a societal perspective. Estimates of the per annum health and crime costs associated with out of treatment

heroin use, per user were between \$6,000 and \$12,000 (3). The extra \$81.8m annual government expenditure predicted by the model compares favourably with the estimated annual health and crime cost savings of methadone maintenance treatment, which range from \$51.7 million to \$103.4 million for the additional 8,617 patients in treatment by simulation end.

An alternative point of comparison is the Commonwealth level of spending on PBS drugs for other chronic relapsing conditions. The total cost of medications used in diabetes was \$272.9 million for the year ended June 2007 and the similar cost for asthma (medications for obstructive airway diseases) was \$427.0 million [40: Table 10a]. If the Commonwealth was to cover the dispensing subsidy, at \$68.9m, the Commonwealth methadone medication and dispensing costs are substantially lower.

There are several key assumptions in our analysis. The dispensing subsidy used was \$5 per day. The subsidy would presumably be negotiated with the Australian Pharmacy Guild (Guild) using an approach akin to that used by the Australian Government and the Guild to determine dispensing costs of PBS drugs. The most recent survey of the dispensing fees charged by pharmacists suggests there is marked disparity around a median of \$5 per day [7]. The second key assumption is that patients are dispensed daily. Clearly this is not the case – many patients receive take-away medication. Thirdly, we assume 100% compliance with daily medication although some patients skip their medication pick-up. For these reasons, the model is likely to overestimate the costs.

On the other hand, there are costs not included in the model, such as the administration costs to government associated with paying pharmacists and the potential capital costs to facilitate expanded capacity to treat the 8,000 or so new patients who would enter treatment if fees were subsidised.

Fourthly, while the ability of the modelling approach to incorporate a range of behavioural changes to policy is a strength of the analyses, the research literature does not provide unambiguous support for the behaviour changes modelled. It appears likely that treatment fees discourage entry to treatment but their impact on retention in treatment is more uncertain. Given the increase in buprenorphine treatment (Subutex and Suboxone) in Australia (36) future research needs to examine buprenorphine, and estimate the costs associated with treatment, along with the impact that fees may have (which may be different from methadone). Finally, this study does not compare investment in fee relief with investment to increase treatment capacity, or funding of

other forms of drug treatment, such as counselling and residential rehabilitation programs. This is an important avenue for future research.

We have demonstrated the potential new costs associated with government subsidy of dispensing fees, without incorporating means-testing, assuming that all patients would qualify for fee-relief. Given the high rate of income support receipt in this patient group, this appears to be a reasonable assumption.

If government provided dispensing fee relief for methadone maintenance patients it would be a costly exercise. We argue that these additional costs are offset by the social and health gains achieved by the methadone maintenance program. Importantly, the Australian government has a number of systems in place, focussed on achieving equity of access to healthcare, which could readily accommodate methadone dispensing fee relief. These arrangements and systems include the existing capacity for Section 100 drugs to be subsidised (eg Highly Specialised Drugs [41]); negotiated agreements on the price of PBS medicines between the Australian Government and the Pharmacy Guild of Australia; the current PBS system for co-payments and concessional patients; and the pharmaceutical allowance for income support recipients.

This study contributes important new data which can inform government about potential costs associated with fee-relief. It also sets the scene for further research on behavioural changes associated with fee-relief. Finally, it provides a basis to commence policy reform.

Acknowledgements

The modelling project underlying this research was funded jointly by the Australian National Council on Drugs and the Drug Policy Modelling Program, which is funded by the Colonial Foundation Trust. Alison Ritter is in receipt of an NHMRC Research Fellowship. We thank Mark Heffernan and Geoff Mc Donnell, who guided the model development process and members of an expert Advisory Group and the ANCD Project Reference Group who provided input as we built the model. We also appreciate the generosity of Government health departments around Australia, especially in Victoria and New South Wales, who provided much needed data for the model, and researchers, including Professor Louisa Degenhardt, Deb Randall and Dr Adam Winstock, who provided access to findings from then unpublished research, and Marian Shanahan, who provided access to the raw NEPOD data and advice on their use.

References

1. Belenko S, Patapis N, French MT. *Economic benefits of drug treatment: A critical review of the evidence for policy makers*. Pennsylvania: Treatment Research Insitute, University of Pennsylvania 2005.
2. Connock M, Juarez-Garcia A, Jowett S, Frew E, Liu Z, Fry-Smith A, Day E, Lintzeris N, Roberts T, Burls A, Taylor R. Methadone and buprenorphine for the management of opioid dependence: a systematic review and economic evaluation. *Health Technology Assessment* 2007; 11(9): 1-190.
3. Chalmers J, Ritter A, Heffernan M, McDonnell G. *Modelling Pharmacotherapy Maintenance in Australia*. Canberra: Australian National Council on Drugs; 2009.
4. Muhleisen P, Clark N, Teo A, Brogan D. Opioid Substitution Therapy: Considering the costs to consumers. *Of Substance*. 2005; 3(1): 14-7.
5. Ritter A, Chalmers J. *Polygon: The many sides to the Australian opioid pharmacotherapy maintenance system*. Canberra: Australian National Council on Drugs; 2009.
6. Australian Institute of Health and Welfare. *National Opioid Pharmacotherapy Statistics Annual Data Collection: 2009 Report. Cat. No. AUS 125*. Canberra: AIHW 2010.
7. Feyer A, Mattick R, Schulman C, Jessop R, Soloman J, Pyper D. *A national pharmacotherapy model for pharmacotherapy treatment for opioid dependence in community pharmacy*. Sydney: Australian Government Department of Health and Ageing 2010.
8. Winstock A, Lea T, Ritter A. The impact of community pharmacy dispensing fees on the introduction of buprenorphine - naloxone in Australia. *Drug and Alcohol Review*. 2007; 26(4): 411-6.
9. Ross J, Teesson M, Darke S, Lynskey M, Ali R, Ritter A, Cooke R. The characteristics of heroin users entering treatment: findings from the Australian treatment outcome study (ATOS). *Drug and Alcohol Review*. 2005; 24: 411-8.
10. Rowe J. *Raw Deal? Impact on the Health of consumers relative to the cost of Pharmacotherapy*. Melbourne: The Salvation Army; 2008.
11. Winstock A. Problems experienced by community pharmacists delivering opioid substitution treatment in New South Wales and Victoria, Australia. *Addiction*. 2010; 105: 335-42.
12. Pharmacy Guild of Australia NSW Branch. *Pharmacy Guild (NSW) Submission to 2008 Review of Pharmacy Incentive Scheme (Methadone)*. Sydney: Pharmacy Guild of Australia 2008.

13. IAB Services. *Review of the Pharmacy Incentive Scheme*. Sydney: IAB Services 2008.
14. Gilson L, McIntyre D. Removing user fees for primary care in Africa: the need for careful action. *British Medical Journal*. 2005; 331(7519):762-5.
15. Des Jarlais DC, Paone D, Friedman SR, Peyser N, Newman RG. Regulating controversial programs for unpopular people: methadone maintenance and syringe exchange programs. *American Journal of Public Health*. 1995;85(11):1577-84.
16. Maddux J, Prihoda T, Desmond D. Treatment Fees and Retention on Methadone Maintenance. *The Journal of Drug Issues*. 1994; 24: 429-43.
17. Booth RE, Corsi K, Mikulich-Gilbertson SK. Improving entry to methadone maintenance among out-of-treatment injection drug users. *Journal of Substance Abuse Treatment*. 2003;24(4):177-85.
18. Colameco S, Armando J, Trotz C. Opiate dependence treatment with buprenorphine: one year's experience in a family practice residency setting. *Journal of Addictive Diseases*. 2005; 24: 25-32.
19. Bammer G, Battisson L, Ward J, Wilson S. The impact on retention of expansion of an Australian public methadone program. *Drug and Alcohol Dependence*. 2000;58(1-2):173-80.
20. Michels I, Stöver H, Gerlach R. Substitution treatment for opioid addicts in Germany. *Harm Reduction Journal*. 2007;4(1):5-17.
21. European Monitoring Centre for Drugs and Drug Addiction. *Annual report 2010: The state of the drugs problem in Europe*. Lisbon, Portugal 2010.
22. Frumkin H, Hess J, Luber G, Malilay J, McGeehin M. Climate change: the public health response. *American Journal of Public Health*. 2008;98(3):435-45.
23. Grassly N, Garnett G. Explicit models make for better policy. *International Journal of Drug Policy*. 2003; 14: 339-41.
24. Homer J, Hirsch G. System dynamics modeling for public health: Background and opportunities. *American Journal of Public Health*. 2003;96(3):452-8.
25. Homer J, Hirsch G, Milstein B. Chronic illness in a complex health economy: the perils and promises of downstream and upstream reforms. *System Dynamics Review*. 2007;23(2-3):313-43.
26. Homer J, Milstein B, Wile K, Pratibhu P, Farris R, Orenstein D. Modeling the local dynamics of cardiovascular health: Risk factors, context, and capacity. *Preventing Chronic Disease: Public Health Research, Practice, and Policy*. 2008;5(2).
27. Masnick K, McDonnell G. A model linking clinical workforce skill mix planning to health and health care dynamics. *Human Resources for Health*. 2010; 8: 1-10.
28. Milstein B, Homer J, Hirsch G. Analyzing national health reform strategies with a dynamic simulation model. *American Journal of Public Health*. 2010; 100(5):811-9.

29. Milstein B. *Hygeia's constellation navigating health futures in a dynamic and democratic world*. Atlanta, GA Syndemics Prevention Network, Centers for Disease Control and Prevention 2008.
30. Milstein B, Jones A, Homer J, Murphy D, Essien J, Seville D. Charting plausible futures for diabetes prevalence in the United States: A role for system dynamics simulation modeling. *Preventing Chronic Disease: Public Health Research, Practice, and Policy*. 2007;4(3).
31. Morecroft J. *Strategic Modelling and Business Dynamics: A Feedback Systems Approach*. London: London Business School; 2007.
32. National Cancer Institute. *NCI Tobacco Control Monograph 18: Greater Than the Sum: Systems Thinking in Tobacco Control*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute 2007.
33. Osgood ND, Mahamoud A, Hassmiller Lich K, Tian Y, Al-Azem A, Hoepfner VH. Estimating the Relative Impact of Early-Life Infection Exposure on Later-Life Tuberculosis Outcomes in a Canadian Sample. *Research in Human Development*. 2011;8(1):26-47.
34. Sterman J. *Business Dynamics: Systems thinking and modeling for a complex world*. Boston: McGraw-Hill; 2000.
35. Thompson KM, Tebbens R. Eradication versus control for poliomyelitis: an economic analysis. *The Lancet*. 2007;369(9570):1363-71.
36. Wolstenholme E. *The Potential of System Dynamics – a new era for strategic planning?*: The NHS Confederation Future Healthcare Network, Leading Edge Series 2005.
37. Bell J, Burrell T, Indig D, Gilmour S. Cycling in and out of treatment; participation in methadone treatment in NSW, 1990-2002. *Drug and Alcohol Dependence*. 2006;81(1):55-61.
38. Australian Institute of Health and Welfare (AIHW). *2006 National Opioid Pharmacotherapy Statistics Annual Data (NOPSAD) statistical report*. Canberra: AIHW 2007.
39. Doran C, Shanahan M, Mattick RP, Ali R, White J, Bell J. Buprenorphine versus methadone maintenance: a cost-effectiveness analysis. *Drug and Alcohol Dependence*. 2003;71:295-302.
40. Australian Government Department of Health and Ageing. *Expenditure and prescriptions twelve months to 30 June 2007*. Data and Modelling Section, Pharmaceutical Policy and Analysis Branch. Canberra: DOHA undated.
41. <http://www.medicareaustralia.gov.au/provider/pbs/highly-specialised-drugs/index.jsp>: accessed 1 June 2011.

42. Mattick R, Digiusto E, Doran CM, O'Brien S, Shanahan M, Kimber J, Henderson N, Breen C, Shearer J, Gates J, Shakeshaft A, NEPOD Trial Investigators. *National Evaluation of Pharmacotherapies for Opioid Dependence: Report of Results and Recommendations*. Sydney: NDARC 2001.

Table 1: Sources for cost estimates used in the model, and bearer of the cost

Cost type	Costs (2006/07 prices)	Reference	Bearer of the cost
Medication cost (per dose)	50.4 cents	PBS \$36 per litre; 1mg = .72c. Av meth dose 70mg	Commonwealth
Costs – prescribing			
Public	\$14.58 per day	Our calculations from raw NEPOD data [42] (Note 1)	State/territory
Private setting	\$3.78 per day	Our calculations from raw NEPOD data [42] (Note 2)	Commonwealth
Prison	\$9.26 per day	Warren & Viney, 2004	State/territory
Costs – dispensing			
Public	\$1.05	Our calculations from raw NEPOD data [42] (Note 1)	State/territory
Pharmacy	\$5.00	From surveys NSW, Vic, ACT, averaged	Patient
Prison	\$1.05	Assumed same as public – no other data	State/territory

Note 1: The NEPOD estimates covered the cost of medical services and any case management/counselling services provided by public clinics surveyed for the NEPOD study. Costs covered one-on-one staff contact with clients, indirect staff time (including time spent maintaining patient records) and the costs of maintaining and operating the clinics (Doran et al., 2003).

Note 2: The cost estimates are derived from observation of patient visits to medical practitioners for the NEPOD study, and include prescribing costs and additional services provided by the medical practitioner as part of each consultation (Doran et al., 2003).

Table 2: Methadone patients, monthly costs of subsidising dispensing in pharmacies and private clinics by \$5/day and total annual costs of the program under various scenarios

	Methadone patients	Monthly costs of subsidising dispensing in pharmacies and private clinics by \$5/day	Total annual costs of the program to governments	Annual cost of subsidising dispensing fees and methadone medication
Base-case	31,568	\$0.0	\$94.0m	\$5.7m
Scenario 1: Subsidise dispensing fees for patients dispensed in pharmacies or private clinics	31,568	\$3.9m	\$140.8m	\$52.5m
Scenario 2: + patients stay longer in treatment	37,117	\$4.7m	\$162.6m	\$63.6m
Scenario 3: + treatment naïve enter treatment sooner	40,185	\$5.1m	\$175.8m	\$68.9m