POLICING METHAMPHETAMINE PROBLEMS: A FRAMEWORK FOR EVALUATING COSTS AND UTILITY OF ALTERNATIVE POLICY APPROACHES

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Abstract

Increasingly, governments and police agencies want to know that expenditure in law enforcement is being used both effectively, to achieve the desired outcomes, and is an efficient use of resources. But most of the existing 'what works' literature focuses on the effectiveness question, and fails to consider the cost-effectiveness of law enforcement expenditure. Further, there has been little attempt to use economic analysis to help policy-makers decide between competing policy options for law enforcement problems. We use the methamphetamine problem in Australia to illustrate a methodology for conducting a comprehensive cost-comparison analysis of five distinct intervention options, including a third party policing intervention called Project STOP, enabling an assessment to be made of their relative desirability. This assessment can help inform decision-making about effective use of policing resources.

Key Words: cost-effective policing; third-party policing; law enforcement evaluation; economic analysis; methamphetamine; analytical hierarchy; policy development

1.0. Introduction

Recent years have seen enthusiastic adoption of the 'what works' paradigm in policing (see Sherman 2009). But as the costs of law enforcement rise, especially in a difficult fiscal environment, the question is being re-phrased as 'what works most cost-effectively'. Increasingly, governments and their police agencies want to know that expenditure in law enforcement is being used both *effectively*, to achieve the desired outcomes, and is an *efficient* use of resources. Most of the existing 'what works' literature focuses on the effectiveness question, examining for example the impact of focused policing of hot spots (see Weisburd 2005) or street level drug law enforcement (Mazerolle, Soole and Rombouts, 2006).

There has been much less attention paid to any form of systematic evaluation of the efficiency or cost-effectiveness of law enforcement expenditure. Police agencies have traditionally allocated resources and pursued interventions based on perceived priorities, operational demands and likelihood of success, rather than based on value for money (Stockdale and Whitehead, 2003). Cost-effectiveness evaluations require the identification of policy objectives and options, and then the use of economic frameworks to measure inputs, outputs and outcomes for those options. Ideally, these frameworks should enable comparisons of alternative policy options, to help in the making of informed choices about how best to use limited police resources. Policy-makers can then choose not only between effective and ineffective strategies, but also identify those that are both effective and cost-efficient.

This is not to imply that economic evaluation should be the only, or even a dominant factor in policy making on law enforcement issues. Calls for more 'evidence-based' policy making often assume a straightforward transferral of scientific data into public policy. In fact, such data is only one component of the policy process, which must also take into account competing sources of information, values, the views of stakeholders and their political agendas (see Ritter, 2009) and the implementation process. This is particularly the case in law enforcement, where in many countries the political law and order agenda is the dominant policy paradigm (Edwards and Sheptycki, 2009).

Despite this, the collection of cost-effectiveness data is, or should be, a crucial part of an informed policy process. This raises complex issues, including the best way to cost various policy alternatives, and to measure their benefits. Another problem is how to compare alternative policy options which involve varying costs and differential effectiveness rates. For example, one high cost option may produce medium level benefits with few unwanted side effects – should this be preferred over a medium cost option with high benefits and higher side effects? Further, one intervention may produce different outcomes, some positive and some negative (see Caulkins 1998).

While there is no simple answer, in this paper we suggest an approach that can assist policy makers faced with such complex questions. We do so by outlining a method for an economic analysis to be applied to strategies to reduce the effect of the methamphetamine problem in Australia. This methodology involves comparison of alternative policy options from a cost-effectiveness perspective. The five options subject to analysis comprise: (1) Project STOP - a third party policing initiative to address the problem of precursor diversion through Australian community pharmacies; (2) an outright ban on pseudoephedrine-based products sold in Australian pharmacies; (3) a prescription only model of products containing pseudoephedrine; (4) increased street-level policing responses; and (5) a do nothing model. The overall research questions are: first, what is the cost-effectiveness of different intervention options aimed at reducing the methamphetamine problem; and second, how can this be compared between options? We will first obtain data on the costs associated with the development, implementation and evaluation of our five intervention options. Next a method for estimating differential effectiveness rates between these five options is discussed. This method, the Analytical Hierarchy Process (AHP), provides a structured model for analysing the various levels/components in a decision problem and ranking alternative solutions using relative priority/utility scores, based on the experience and knowledge of experts and practitioners in the area. The AHP method can assist in identifying how experts rate the relative effectiveness of different intervention options. This rating may not be the best evidence, in that the experts' views are subjective and based on incomplete knowledge, however, given the paucity of available research on what works in drug law enforcement (as discussed further below) it is the best available evidence in the current environment. The final step involves combining the comparative cost data with the rates of effectiveness to perform cost-effectiveness or cost-utility analysis. Such analysis enables identification of which intervention option (or options) is most likely to be both effective and cost-efficient.

This remainder of this paper is divided into nine sections. We begin with a brief survey of the policy responses to methamphetamines problems in Australia, and the development of Project STOP as a third party policing intervention. Then we discuss the benefits and limitations of economic analysis in the policy process (Section 3). This is followed by a review of earlier economic studies which evaluate the impact of drug law-enforcement policies, and a statement of where the gaps in the literature lie (Section 4). Modes of economic evaluation which could be employed to analyse alternative intervention options aimed at reducing the methamphetamine problem are then discussed in Section 5. In Section 6, we outline our methodology for conducting a comprehensive cost-comparison analysis of five distinct intervention options. Section 7 discusses methods of assessing differential effectiveness rates of these options. One such method, the AHP approach, is discussed in more detail in Section 8. Combining costs and effectiveness/utility scores to assess the relative desirability of the various intervention options is examined in Section 9. Some concluding thoughts are provided in Section 10.

2.0. Policy responses to methamphetamines problems in Australia

The costs of illicit drug problems in Australia in 2004-2005 were estimated to be around A$8.1 billion (Collins & Lapsley 2008). This figure includes social and economic costs associated with illness, premature death, crime, reduced community amenity, accidents and lost productivity. Common illicit drugs used in Australia are cannabis, heroin and amphetamine-type stimulants, which includes the synthetically produced stimulant methamphetamine. A national survey found methamphetamine prevalence rates in the general community of 6 per cent, behind cannabis (33.5 per cent), ecstasy (8.9 per cent) and hallucinogens (6.7 per cent) in 2007 (AIWH 2008). This represents a decline over earlier years, down from around 9 per cent in 2005 (AIWH 2008), however other evidence suggests associated harms to be increasing. Such evidence includes emergency hospital admissions and ambulance attendances attributed to methamphetamine use (Victorian Government 2006). In the state of Queensland, hospital treatments due to methamphetamines increased 31.7 per cent from 1998-1999 to 2001-2002, and ambulance call-outs for the same reason increased from 1999 to 2001 by 234 per cent (CMC 2003). Possible explanations for the increase in reported harms include the increasing availability of more harmful forms of the drug, such as crystalline methamphetamine (or 'ice'), and increased use of injection (AIC 2007).

Potential state responses to this problem fall into four main categories: prevention, such as education and community approaches; law enforcement, including source country programs, border interdiction and domestic policing approaches; treatment, aimed at getting users to reduce or cease their use; and harm reduction, to reduce harmful side effects of use, such as by needle exchange programs (Ritter & McDonald 2008). To a large extent, the Australian experience has been dictated by the international regulatory regime on illicit drugs, which has in turn been driven by the United States led 'war on drugs' (Bull 2008). This environment favours law enforcement approaches to illicit drugs.

Australian governments' reliance on law enforcement responses is considerable, with around 56 per cent of total illicit drug expenditure spent on such interventions, 22 per cent on prevention, 19 per cent on treatment, and 2 per cent on harm reduction (Moore 2008). Domestic law enforcement approaches typically include strategies such as undercover operations, crackdowns, drug-free zones, intensive street policing, raids, and drug driving test programs. More recent, innovative strategies include hotspot targeting, financial monitoring of suspects, precursor controls, and third party approaches (Mazerolle , Soole & Rombouts 2006).

While as discussed, the evidence suggests some changes in the demand for methamphetamine, there have also been changes in supply patterns. Supply comprises the importation, manufacture, trafficking and selling of the drug, as opposed to its consumption. In Australia, the major source of methamphetamine is local production in clandestine laboratories (ACC 2007), using precursor chemicals, principally pseudoephedrine, a component in cold and influenza medications. The precursors have also been obtained predominantly from local sources, with a smaller proportion illegally imported. Illicit supplies of pseudoephedrine are obtained by diversion of legal products, principally cold and influenza medications bought from pharmacies.

The availability of licit precursors has become increasingly regulated in recent years. At the international level, the 1988 *Convention against the illicit trafficking in narcotic drugs and psychotropic substances* requires signatory states, such as Australia, to incorporate into domestic law measures against drug trafficking and the diversion of precursor chemicals. In Australia, the response to this convention has been fragmented by the federal division of power. The federal government has responsibility for customs, imports and border control; while the eight states and territories have power over most law enforcement, and pharmacy regulation. Significant measures addressing precursor diversion have occurred at both levels, including national level 'rescheduling' of pseudoephedrine-based products, meaning that they can only be sold at licensed pharmacies by a pharmacist, rather than being available 'across the counter'; and state-based tighter guidelines for the handling, storage, dispensing and sale of such products in pharmacies, along with increased criminal offences and penalties for diversion (ACC 2007). These state-based guidelines and regulations have varied significantly across the different jurisdictions.

The new regulatory environment, at both state and federal level, increased the compliance burden for pharmacists. They are now subject to detailed rules about what products they may stock, where in their stores they keep them and how, who may sell them and to whom, how they must be labelled, and what information must be kept regarding such sales. As a result of this compliance burden, Project STOP was developed by the Queensland branch of the Pharmacy Guild of Australia and the Queensland Police Service. Project STOP is a real-time online recording system which shows pharmacists a customer's recent sales history for pseudoephedrine-based products at other pharmacies in the same State. This assists pharmacists in deciding whether or not to proceed with suspect sales, as well as aiding their statutory record-keeping and reporting obligations. Initially trialled in Queensland, the database was rolled-out throughout Australia as part of the *National Strategy to Prevent the Diversion of Precursor Chemicals into Illicit Drug Manufacture*, in late 2006 (ACC 2006).

As discussed earlier, most law enforcement responses to illicit drugs such as methamphetamine are largely reactive. They rely on after-the-event investigation and prosecution of people involved in diversion and manufacturing, using methods such as informants, undercover operations, crackdowns and raids (Mazerolle et al 2006). By contrast, Project STOP has a preventive focus, aimed principally at preventing diversion from occurring in the first place by improving pharmacists' knowledge and ability to refuse suspect sales. In addition, Project STOP is part of a new regulatory mechanism that shifts responsibility for part of the policing function to third parties. It does this by requiring pharmacists to gather information and pass it on to police, with the Project Stop database providing the key technology for this to occur. This constitutes 'third party policing', by which some policing functions are undertaken by third parties using regulatory or civil law levers at their disposal (Mazerolle and Ransley 2006), especially as pharmacists face disciplinary or legal sanctions for not complying with the requirements of the scheme. This mandating of policing functions by third parties has also been extended to other bodies, such as chemical wholesalers and retailers (Cherney, O'Reilly and Grabosky 2006).

Project STOP, therefore, represents a major expansion in law enforcement efforts directed at the problem of methamphetamines. It has imposed significant compliance costs on non-police burden bearers, especially pharmacists and their associations, and the health agencies that regulate them. In addition, it has resulted in extra burdens for the public who face hurdles in accessing medications needed for legitimate reasons. This has occurred without any evaluation of either the impact of Project STOP on the problem it seeks to address, or its cost effectiveness in doing so. This paper sets out a framework for such a costs-effectiveness framework. Before discussing that framework, we consider the advantages and limitations of this type of study in informing law enforcement policy.

3.0 The benefits and limitations of economic analysis

The importance of economic analyses is predominantly policy-based. Reuter and Bushway (2008) describe it as "a natural extension of the economist's normative framework, focused on maximising society's welfare" (p.41). By providing evidence of the costs and benefits of different policy options, economic evaluations allow decision-makers to make more informed decisions regarding the efficacy of the available options and the opportunity costs[i] of those choices (Manning, 2008), and have become an integral component of empirical evaluations of interventions in the crime and justice domain (Manning, Homel, & Smith, 2006). In fact, economists such as Levitt (1996) suggest that evaluations of the effect of any policy, no matter how rudimentary, should incorporate an economic agenda. Economists should aim at evaluating the efficiency or overall desirability of a society's allocation of resources taking into account more than just costs but also the social impacts of various policy options (Foster, Dodge, & Jones, 2003, p.78). This leads to two fundamental questions: first, were resources expended to achieve a given outcome the most efficient investment; and second, are there other ways to invest to achieve a better outcome?

The call for more evidence based policy has furthered the agenda for this type of analysis, with economics seemingly able to provide the objective quantification of facts that proponents argue should be the basis of all policy decisions (Neylan 2007). Social sciences such as economics offer a promise of removing policy decisions from the messy world of contested values, politics and clashing stakeholders, to one of objective rationality. In law enforcement policy, where law and order agendas have been so prominent (see Currie 2007), the promise of 'scientification' has been particularly alluring. But, as Neylan (2007) points out, all science involves unstated assumptions shaped by ideology and values. Edwards and Sheptycki (2009) question the possibility or desirability of scientifically detached research, and ask why should the 'contributory expertise' of social scientists be favoured over the views of other political and moral actors on questions which are inherently values-laden? They suggest instead that research knowledge should be assessed in context – the historical, political, cultural and economic conditions in which the particular problem is situated. Similarly, Head (2007) suggests a three lens approach to evidence based policy, in which research, political and practice-based sets of evidence should be incorporated. Research data is an important first step towards a comprehensive understanding of the topic. However, by incorporating the views and experiences of expert practitioners via the AHP model, we will be able to view the problem in a way that integrates the three lenses of research, practice and politics.

4.0. Earlier economic studies to evaluate the impact of drug law-enforcement policies

Economists studying drug crime need to investigate how drug markets respond to various forms of intervention, especially the question of "…how will more restrictive access to specific inputs (e.g., precursor chemicals for drugs such as methamphetamines) affect prices, the size of the market and the distribution of returns across groups of participants?" (Reuter and Bushway 2008, p.48). This is an important question given that governments now invest heavily in policies to suppress the effects illegal drug markets have on individuals and society at large (Walsh, 2004). It focuses on the impact of policy on the drug market, including both on the demand for and the supply of illegal drugs. Reuter and Bushway were not the first to see the importance of understanding the impact of drug law-enforcement policies on drug markets, but they were the first to argue the need for economists and criminologists to collaborate to further knowledge into an ever evolving social phenomenon.

Early researchers such as Moore (1973), who explained why discrimination on the price of heroin was a desirable policy, and Eatherly (1974), who discussed the implications of drug policies on the pecuniary drug price, were pioneers in this area. Subsequently, more research has been directed toward understanding the impact of price and availability with respect to demand for drugs. Examples include Cameron and Williams (2001) who estimated the cross-elasticity between cannabis, alcohol and cigarettes; and Manski, Pepper and Petrie (2001) who added to the existing literature considering the price elasticity of cocaine.

While these studies considered demand-side elasticity for drugs, little research has been conducted with regard to the supply-side of the market for any illicit drugs, including methamphetamines. This point is made clear by Reuter and Bushway (2008) who posit "…economists assume that the supply curve is flat, i.e. that consumers can purchase any quantity they wish at the prevailing price, established by the level of enforcement" (p.54).

Understanding the forces impacting on demand, supply and price in the market for particular drugs, and the interdependence of such markets where users are able to substitute one type of drug for another, is important to understanding drug market interventions. It is crucial to such tools as cost-benefit analysis. Although cost-benefit analysis has been relatively limited with respect to the study of crime (see Reuter & Bushway, 2008), governments and non-government organisations are reorienting their approach to crime prevention so that decisions are formulated on the foundations of efficacy of alternative intervention strategies (Welsh & Farrington, 2001a). Much emphasis, over recent years, has been placed on economic evaluations of such interventions. Examples include: early childhood interventions like the Perry Preschool Program, the Syracuse Family Development Research Program and Elmira Nurse Home Visitation Program (e.g. S. W. Barnett, 1993; S. W. Barnett, 1996; Greenwood, Karoly, Everingham, Hoube, Kilburn, Rydell, Sanders, & Chiesa, 2001); middle-childhood programs like the Seattle Social Development Project (Hawkins, Catalano, Kosterman, Abbot, & Hill, 1999); developmental crime prevention studies for interventions through adolescence (Lipsey, 1984; Welsh & Farrington, 2001b), juvenile offender programs including multisystemic therapy, functional family therapy, aggression replacement training, adolescent diversion programs, multidimensional treatment fostercare, juvenile intensive supervision programs, and boot camps (see Aos, Phipps, Barnoski, & Lieb, 2001); and, adult offender programs such as job counselling and job search for inmates leaving prison, drug courts, short-term financial assistance for inmates leaving prison, subsidised jobs for inmates leaving prison, adult intensive supervision programs, case management substance abuse programs, work release programs, community-based substance abuse treatment, moral reconation therapy, adult basic education, sex offender treatment programs life skills programs and other cognitive and behavioural therapies (see Aos et al., 2001).

Cost-benefit studies of drug-related interventions, that is, studies that investigate both the efficacy and efficiency of drug interventions, vary in terms of method used (e.g. cost-effectiveness versus cost-savings) as well as methodological rigour (which includes the transparency of the method used, the unit of analysis (e.g. reduced drug use), population target (e.g. population level or targeted group), and time and timing of the intervention). Examples include: (1) Kraft, Rothbard, Hadley, McLellan and Asch (1997) – who investigated the cost-effectiveness of supplementary services provided during methadone maintenance; (2) Barnett and Swindle (1997) and Shephard, Larson and Hoffman (1999) who examined the cost-effectiveness of inpatient and services more generally for substance abuse treatment; (3) Barnett, Zaric and Brandeau (2001) who examined the cost-effectiveness of buprenorphine maintenance therapy for opiate addiction; (4) Daley, Argeriou, McCarty, Callahan, Shepard and Williams (2000) who examined the economic benefits of substance programs for pregnant women; (5) McCollister, French, Inciardi, Butzin, Martin and Hooper (2003) who studied the cost-effectiveness of post-release substance abuse treatment for criminal offenders; and (6) Zarkin, Lindrooth, Demiralp and Wechsberg (2002) who investigated the costs and cost-effectiveness of enhanced interventions for people with substance abuse problems at-risk of HIV.

The bulk of cost-benefit studies have focused on outcomes of treatment for drug use and dependency. There is however a dearth of economic studies conducted by economists with respect the cost-benefit of supply-side drug law enforcement interventions -- for example, precursor diversion strategies. Moreover, no evidence exists demonstrating both the cost-effectiveness of legislating versus not legislating precursor chemical policies and the opportunity costs of various options to reduce the methamphetamine problem in Australia. The purpose of this paper is to outline a methodology that could be employed to close this gap. Before we do that, we briefly summarise the alternative modes of economic analysis that could have been employed and justify the particular method we have selected.

5.0. Economic evaluation

Economic analysis as we use it here is a generic term used to denote an array of research techniques that have two common components: (1) they examine costs and outcomes; and (2) they compare two or more interventions/policies/therapies or service arrangements. Simply stated, economic evaluation involves comparing alternative courses of action in terms of both their costs and consequences (Boardman, Greenberg, Vining, & Weimer, 1996; Boardman, Greenberg, Vining, & Weimer, 2006; Drummond, O'Brien, Stoddart, & Torrance, 1997; Levin & McEwan, 2001). In this context, the total cost of a program or intervention should be thought of as the opportunity cost to society of undertaking the program or intervention. This particular component of economic analysis is the focus of this first section of our methodology. Specifically, the opportunity cost is operationalised as the cost of one policy option (e.g., Project STOP - a third party policing initiative) aimed at reducing the problems associated with methamphetamine use, as opposed to using those resources for other alternatives (e.g., an outright ban on pseudoephedrine-based products sold in Australian pharmacies or a prescription only model of products containing pseudoephedrine).

Five commonly used forms of economic evaluation are cost-savings, cost-effectiveness, cost-benefit, cost-utility analysis, and cost analysis/cost-comparison analysis (Drummond et al., 1997). The various techniques address slightly different decision-making questions; they also require slightly different data, and have different theoretical underpinnings. Choosing the most appropriate form of economic analysis will depend upon the question/s being asked, available data, dependable tools to measure outcomes, and of course, ones budget. To assist in selecting the appropriate method of analysis, we provide a brief summary of the most popular methods. Additionally, we provide a table (Table 1) highlighting the benefits and drawbacks of each method.

Insert Table 1 About Here

5.1. Cost-savings analysis

Cost-savings analysis explores whether the program's funding is self-sustainable by determining the costs and potential savings that are associated with a program for the funding body (Manning, 2004, 2008; Manning et al., 2006; Patrick & Erikson, 1993). For example, a government may be interested in estimating the potential savings of an early childhood intervention program with respect to savings to the educational system (e.g. remedial reading intervention) or reductions in future costs to the criminal justice system. In other words, this method aims at estimating the potential savings to stakeholders resulting from the impact of an intervention. The drawback of this method is the difficultly of placing monetary values on salient life benefits (e.g. quality of life, feelings of safety).

5.2. Cost-effectiveness analysis and cost-utility analysis

Cost-effectiveness analysis (CEA) explores the best way of achieving a particular outcome by disaggregating a particular benefit and examining how much benefit results from each dollar spent. In CEA, the evaluation compares at least two programs or interventions with respect to their costs and their respective outcomes or benefits (e.g. natural units such as life years saved). This method becomes problematic when a program involves multiple measures of effectiveness.

Cost-utility analysis (CUA), another form of cost-effectiveness analysis, is a method of describing the relative preference strength of each outcome over a range of health and non-health related domains with respect to their associated costs (Gold, Siegel, Russell, & Weinstein, 1996). In other words, one evaluates program alternatives according to a comparison of their costs and perceived utility (Manning, 2008). The method is similar to that of CEA in that a ratio is developed (costs divided by utility). The methods CEA and CUA are identical on the cost side but differ significantly on the effectiveness side. For example in CEA levels of effectiveness are limited to programme-specific outcomes (e.g. increasing academic test scores). However, in CUA, outcomes may be single or multiple, can be general as opposed to program specific and may incorporate a notion of value (Boardman et al., 2006).

5.3. Cost-benefit analysis

Cost-benefit analysis (CBA) involves quantifying the costs and benefits of a program/policy. CBA converts the costs and benefits associated with the program/policy into dollar terms. This enables the stakeholder to determine which programs represent the best value for money, despite programs having different costs and benefits. Therefore, results of a CBA analysis may be presented as a cost-benefit ratio, or a comparison of net costs between two programs. CBA is useful when more than one or a number of outcomes are considered essential in the analysis, or if the outcomes of the interventions being examined are dissimilar.

In CBA the common metric is the dollar. However, this becomes problematic when attempting to translate outcomes such as lives saved or cases prevented into dollar terms. Drummond et al (1997) and Manning (2004) posit that a number of challenges exist, most notably however is that many CBA analyses include only those costs and benefits that are easy to assess, thereby missing important but unquantifiable outcomes.

5.4. Cost analysis, cost-comparison analysis and cost-minimisation analysis

Cost analysis (CA) is a useful economic technique for policy development and accountability. CA allows policy-makers to model the opportunity costs associated with various policy options. CA also assists policy-makers and stakeholders to control costs by identifying how and where money is being diverted. The method therefore involves estimating the costs of one or more programs. It may be considered an economic technique as opposed to an accounting technique as economists tend to incorporate both implicit and explicit costs as opposed to only explicit costs captured by accountants.

The technique is limited with respect to a single alternative, as it does not answer questions regarding opportunity costs of resources or the most efficient and effective use of those resources. However, one may apply a cost-comparison model to evaluate the opportunity costs associated with the various alternatives. The technique is strengthened when one conducts a series of sensitivity analyses (e.g.

Manning et al., 2006). An offshoot of this method is cost-minimisation analysis (CMA). I n CMA the costs are assessed in the same way as other economic analysis techniques (e.g. cost-benefit, cost-savings). However, in CMA the outcomes (including effectiveness) of the programs are assumed to be statistically equivalent. Therefore, the comparison is simply between program costs.

6.0. The economic analysis model used in this study

We argued earlier that a comprehensive economic evaluation (e.g. cost-benefit) should be disaggregated into a number of well-defined studies. That is, one should firstly define the costs and then the benefits/effectiveness/utility/savings. The significance of cost analysis has been downplayed over the years mainly because the methods employed were non-economic. Instead, costs included in quasi-economic studies were based on accounting models. In this study however, we propose a purely economic approach. We provide a methodology for identifying the economic costs of a policy by valuing inputs (direct, indirect and intangible) so that one can identify the opportunity costs associated with different policy options. With this information, it is then possible to conduct a cost-comparison analysis before moving onto a full cost-utility analysis. Before describing our proposed economic evaluation model, we briefly introduce the concept of opportunity costs – since these are the type of costs that lie at the heart of good economic as opposed to accounting analysis of alternative policy options.

6.1. Opportunity costs

Policy intervention requires input (i.e. resources); however, inputs used inevitably draw resources from other available policy options. Hence, once available resources have been fully invested for one purpose (e.g. reactive policing (supply-side intervention) or education-based interventions (demand-side intervention)), they are no longer available for use for another option (e.g. prevention (combined supply/demand-side intervention)). Economists have coined this phenomenon as an opportunity cost. Conceptually, opportunity cost is the cost of the option (i.e. goods and services) that could have been utilised had the available resources been "…used instead in the best alternative way" (Boardman et al., 2006, p.93). Opportunity costs, however, relate to what must be given up today and in the future, not what has already been given up. The latter reflects a sunk cost. For example, if one were evaluating a decision to place safe injecting rooms into a drug-active environment, a sunk cost would include, for example, the cost of building the rooms; as opposed to labour, which would be a variable cost. Further, when assessing the opportunity cost of the injecting room scenario, we would be valuing those inputs as their value stands today. That is, we value these inputs in their current best alternative use.

Assuming the absence of market failures for the inputs required to implement the hypothetical government policy intervention/program (policy option), this intervention/program faces a horizontal supply schedule for the inputs required. Thus, the purchase of these inputs for the policy opt ion will have a negligible effect on the price of the inputs. For example, the additional labour (police) required to enact an enforcement model in a high-risk drug area will not alter the wage rates needed to attract police into the police force in total. That is, the policy option can purchase the additional inputs at the market price, or their costs in the absence of the policy option.

Identifying opportunity costs in efficient markets with negligible price effects is best represented diagrammatically (Figure 1). In this figure, if an intervention purchases q^* units of a given input, the demand curve would shift to the right by q^*. A horizontal supply curve implies that margin costs remain unchanged, thus the price of the given unit remains unchanged, and the price remains at P_0. The opportunity cost is represented by the area under the supply curve, and P_0 represents the opportunity cost of one additional unit of the input. However, what we are interested in finding is the opportunity cost to society for the use of the given input. The opportunity cost of additional units of input (i.e. q^*) is the original price of the input multiplied by the number of units purchased (i.e. P_0 x q^*). This is represented in the diagram by the area abq_0q_1. Thus, if q^* units were not used for the purpose of the given policy option, then P_0 x q^* could have been used for another option.

Insert Figure 1 about here

6.2. The benefit-cost model

Earlier, we identified five common methods of economic analysis: cost-savings, cost-effectiveness, cost-benefit, cost-utility, and cost /cost-comparison analysis. A scan of the literature also revealed that a common method employed to measure outcomes of treatment for drug use and dependency is cost-benefit analysis. The cost-benefit criterion states that an intervention would be considered successful if the benefits of the intervention B_1 exceed the costs of the intervention C_1. This may be represented mathematically as:

$$B_1 > C_1 \qquad (1)$$

Equation 1 represents the final result in terms of the economic evaluation. However, one must consider the process of arriving at the end result. Firstly, B_1 is the sum of two components; E_1 and P_1; where E_1 is the effect of the intervention, and P_1 is the monetary value assigned to the effect. Summing E_1 and P_1 constructs the benefit measure to form the product of the effect multiplied by the price (Equation 2).

$$B_1 \equiv P_1 \times E_1 \qquad (2)$$

Applying this to equation 1 we have

$$P_1 \times E_1 > C_1 \qquad (3)$$

Assuming that we are only focussing on one intervention, we can divide both sides of the Equation 3 by C_1 to obtain a cost benefit ratio that must exceed unity (Equation 4)

$$\frac{P_1 \times E_1}{C_1} > 1 \qquad (4)$$

However, assuming that resources are limited and funds used for one intervention precludes their use for another purpose, it is not sufficient that the benefit-cost ratio of a given intervention exceeds unity. Rather, we must compare alternative options to identify the option that provides more benefits per dollar outlaid on costs. This is represented in Equation 5.

$$\frac{P_1 \times E_1}{C_1} > \frac{P_2 \times E_2}{C_2} \text{ and therefore } \frac{B_1}{C_1} > \frac{B_2}{C_2} \qquad (5)$$

Translating equations 1.1 to 1.5 for use in other forms of economic evaluation (e.g. cost-savings and cost-utility) is achieved simply by exchanging the term *B* (Benefit) into *S* (savings) and *U* (utility). However, one must acknowledge that the derivation of these terms will differ. For example, utility is an effect that is not converted into a dollar value, but rather a measure of the satisfaction that an individual gains from a given activity.

6.3. Identifying costs

As proposed earlier, an economic evaluation model should be disaggregated into a number of well-defined studies. That is, one should firstly conduct a thorough analysis of the cost side of the equation before evaluating the benefits or potential benefits. Essentially, in the first stage of our first study, benefits of the intervention play no part in the evaluation. Therefore, we need to remove both parts of the benefit term ($B_1 \equiv P_1 \times E_1$). This does not mean that P x $E = 0$; rather, benefits between available options are seen as comparable; whereby P x $E = 1$. With this specification, the cost-comparison model becomes:

$$\frac{1}{C_1} > \frac{1}{C_2} \qquad (6)$$

Therefore, Equation 6 is equivalent to:

$$C_1 < C_2 \qquad (7)$$

Next, one needs to identify the costs of the alternatives. In our methodology, this would require systematically identifying the direct, indirect and intangible costs associated with: (1) Project STOP - a third party policing initiative in cooperation with Pharmacy Guild of Australia; (2) an outright ban on pseudoephedrine-based products sold in Australian pharmacies; (3) a prescription only model of products containing pseudoephedrine; (4) increased reactive policing responses; and (5) a do nothing model, or commonly termed status quo. Direct costs incorporate elements such as personnel, facilities and equipment; indirect costs may include elements such as the cost of lost production because of patient participation (e.g. time off work) or volunteer participation; and, intangible costs include elements such as pain and suffering, grief and suffering of the participant and/or their family, and loss of opportunities (Manning, 2004).

The most effective method of summarising costs is to employ the use of a cost worksheet. Using a cost worksheet allows one to set out all ‘ingredients’ so that the allocation of costs can be distributed across stakeholders. As well as attaching costs to individual stakeholders, a total cost column is included. This column represents the opportunity cost of undertaking the given option as opposed to “using the ingredients for their most productive alternative use” (Levin & McEwan, 2001, p.79). Table 2 provide a schematic example of a cost worksheet. For the purposes of this study, a separate cost worksheet will be completed for the five alternatives.

Insert Table 2 about here

An additional level of complexity is added to this cost study as costs of regulation must be included. There is a dearth of academic papers in this area, which propose models of costing regulation. However, regulation is an important component of any response to reducing the impact of the methamphetamine problem.

6.4. Costing regulation

There are two obvious benefits to costing regulation; first, it is a critical component of the economic evaluation - without regulation costs we are unable to fully measure the opportunity costs of the five proposed options; and second, the information provides stakeholders with important data to assist in decision-making. Costs of regulation include direct costs (e.g. regulatory charges, compliance costs and administrative costs), and indirect costs (e.g. financial costs and the impact of regulation on market structures). Figure 2 provides a schematic representation of the costs of regulation.

Insert Figure 2 about here

Regulatory charges are reasonable easy to estimate given that these costs are normally reported as accounting costs. Examples of regulatory costs include fees or charges paid by clients in return for licences/permits or any other service provided by the regulatory body. The calculation of regulatory costs is provided in Equation 8, where RC is regulatory charge, C_i is unit cost of the fee or license, and Q is quantity. Further Q is calculated by multiplying P_n (number of businesses) by f (frequency of license or permit per year).

$$RC = (C_i \times Q) \tag{8}$$

where $Q = (P_n \times f)$.

Compliance cost is related to the capital and production costs associated with the regulation. Examples include requirements for the business to buy new equipment, maintain the equipment, undertake training and evaluation to meet the new regulatory requirements, and provide reports and publications to the regulatory body or third party agencies (e.g. pharmacy guild and police). The calculation of compliance cost is provide in Equation 9, where C_c represents the total compliance cost, C_u is unit cost of the input and Q is quantity. Additionally: I represents inputs which include wages costs, overhead and non-wage costs or the costs of an external service provider; t is the time required to complete the activity (hours); P_n is the number of businesses affected; and f is the number of times the activity is completed (per year).

$$C_c = (C_u \times Q) \tag{9}$$

where $C_u = (I \times t)$, and $Q = (P_n \times f)$.

Some costs that occur as result of the regulation such as increased barriers to entry, restraints or barriers to innovation, a decrease in consumer choice and quality, and limiting competition (i.e. intangible costs) may difficult to quantify. However, there is opportunity to conduct a qualitative discussion with respect to these important costs. Other costs such as increased prices on products and services (i.e. indire4ct costs) can be quantitatively assessed and as such can be included into the cost analysis. Further, regulatory delays may impose costs to business through forgone revenue. For example, a pharmacy may be faced with capital holding costs as a result of delays in the licensing/permit process. Thus, if there is a delay in the licensing/permit process there is a holding cost associated with the amount of money already invested in the project. Equation 10 provides a method of calculating the annual value of holding costs to the individual pharmacy. In this equation, H_c represents the annual value of holding costs, C_u represents the unit cost (which is calculated by multiplying the annual capital value of approvals ϕ by an estimate of percentage borrowed/spent ε by the annual interest rate/365 days μ), and Q (quantity) equals the average delay D_a (in days) to gain approval.

$$H_c = (C_u \times Q) \quad (10)$$

Where $C_u = (\phi \times \varepsilon \times \mu)$ and $Q = D_a$

6.5. Discounting costs

Once all costs have been collected and distributed among stakeholders, allowance must be made for the differential timing of costs. Individuals tend to have positive time preferences; that is, an individual perceives costs incurred in the present to be less of a burden than costs incurred in the future (Manning, 2004). Based on this premise, future costs must be discounted to properly compare them with present costs. We calculate alternative investment patterns by calculating their present value. The formula for estimating the present value of future cost outlay is presented in Equation 11.

$$P = \sum_{n=1}^{n} F_n(1+r)^{-n} = \frac{F_1}{(1+r)} + \frac{F_2}{(1+r)^2} + \frac{F_3}{(1+r)^3} \quad (11)$$

where P = present value; F_n = future costs at year n, and r = the discount rate.

The choice of discount rate has always been controversial but three conceptual approached are available; (1) returns to consumer savings options (cash rate) (Levin & McEwan, 2001); (2) average returns to investment made by the private sector (Boardman et al., 1996); and (3) weighted average of methods 1 and 2 (Levin & McEwan, 2001).

6.6. Examining incremental costs

After identifying costs, distributing costs among stakeholders, discounting costs, and calculating total costs, one is able to conduct an incremental cost-comparison analysis of the available options. We employ the term incremental cost analysis here to refer to a change in the scale of activity. In other words, the difference, in cost or effect, between two or more options being compared. Figure 3 provides a diagrammatic representation of the incremental cost curve, where $IC_{a'}$, Q_1 is the cost of option 1 at quantity (activity level) Q_1, $IC_{b'}$, Q_1 is the equivalent estimate for option 2. The incremental difference (cost) between option 1 and option 2 at quantity (activity level) Q_1 is $IC_{a\text{-}b}$, Q_1.

Insert Figure 3 about here

Figure 3 highlights that the incremental cost is equal to the change in total cost divided by the change in quantity. This may appear to be a marginal cost, however, we distinguish the incremental cost from the marginal cost by holding Q constant at Q=1 (Q_1). Therefore we compare the alternatives (activities) at Q= Q_1. We represent the incremental cost mathematically as:

$$IC = \Delta TC / \Delta Q \qquad (12)$$

where $TC = \sum_{i=1}^{n} (P_i \times Q_i)$, IC = incremental cost; Q = quantity/activity; Δ =change in activity; TC = total cost; P_i = price of inputs (derived from Table 3); and Qi = quantity of inputs.

7.0. Comparing methods of evaluating effectiveness rates

Ideally when new intervention programs are introduced data would be collected in a systematic way allowing the effectiveness of these programs to be measured and compared in both absolute and relative terms. Often this is not the case and we have to, after implementation, use available information to indirectly estimate effectiveness. For example, one might be able to obtain data on factors relating to the methamphetamine problem (e.g., X, Y and Z; where: X = difficulty in accessing other drugs; Y = social factors contributing to dependency; and, Z = policing the methamphetamine problem (i.e. resource allocation decisions)) prior to implementation of an intervention and on those same factors (X, Y and Z) after implementation and seek to attribute the change in X, Y and Z to the intervention – in effect conduct an interrupted time series analysis of the factors contributing to the methamphetamine problem. Unfortunately many variables other than the intervention may be impacting on the factors contributing to the methamphetamine problem – for example, changing demographics or changing economic conditions. As a result any time series analysis would need to be multivariate in character and have a sufficient number of observations to allow for meaningful statistical tests of effectiveness to be performed. Often intervention programs need to be evaluated before the required time series of observations could be observed. As a result, other methods for performing such evaluations need to be identified. A second option would be to have a semi-experimental design incorporated in the implementation of the intervention program, with some sections of the population participating in the program and others not and comparisons made with respect to the prevalence of the factors (X, Y and Z) in the control and non-control groups. This requires that the control and non-control groups needing to be carefully selected as being comparable in terms of factors that might influence the prevalence of the X, Y and Z factors other than the intervention program. It also, arguably, involves ethical/moral issues in the determination of who should be subject to the intervention and who should not. An alternative approach which could be explored is to draw upon expert opinion, such as that of experienced practitioners who have worked with the methamphetamine problem and the associated X, Y and Z factors over an extended time periods and make use of their subjective judgements regarding the relative effectiveness of proposed alternatives. One version of such an approach is the analytical hierarchy process (AHP) procedure, which is described in the next section.

8.0. The Analytical Hierarchy Method

Developed by Saaty (1980), the AHP is a method to assist in making complex policy decisions in areas involving multiple criteria. The method assists in capturing subjective and objective information by identifying and weighting the criteria considered essential to these decisions. The method also provides a means of checking the consistency of the various weights employed thus reducing bias in the overall decision-making process (Manning, 2008; Saaty, 1994).

There are problems in applying the AHP method to some policy questions. Its main benefit is to give coherence to, and allow the ranking of, experts' knowledge about competing alternatives with multiple attributes. It is less useful in areas where knowledge is limited. It could be argued that knowledge about alternative law enforcement approaches to methamphetamines is such an area. However, this is not the case, particularly in Australia, where the different state systems of regulation, along with a history of policy experimentation over the past ten years, has provided policy makers with sources of information and knowledge about the effects of different approaches. For example, in that period precursors have been rescheduled, law enforcement crackdowns have been experienced, and different states have taken at least three distinct approaches to regulating the way in which precursor medications can be sold. We argue that experience in this arena is likely to provide some valuable insights worthy of being understood via AHP, particularly given the paucity of other research evidence in the area.

The first step in AHP involves constructing a hierarchy, which serves as a tool to model a problem as it represents all the salient elements in relation to the problem. Moreover, the hierarchy represents the relationships among all elements within the various levels of the hierarchy. In its simplest form a hierarchy, as described by Saaty (2000), is comprised of a number of levels. The top of the hierarchy identifies the goal (e.g., reducing the impact of the methamphetamine problem). The next level down (Level 1) represents the key factors relating to the methamphetamine problem (e.g., X, Y and Z as discussed in Section 6.0); below that level (Level 2) are the key characteristics of the interventions being considered (e.g., policing enforcement model, harm-reduction model, and a third-party policing model); and, at the bottom of the hierarchy (Level 3) are the solutions or options available (e.g., (1) Project STOP, (2) an outright ban on pseudoephedrine-based products sold in Australian pharmacies; (3) a prescription only model of products containing pseudoephedrine; (4) increased reactive policing responses; and, (5) a do nothing model). The size and complexity of the hierarchy may be considered unlimited as many more levels may be included should they prove necessary to fully analyse the problem. Additionally, each criteria may include *x* number of items salient to the given criteria. Figure 4 serves as a visual illustration of a hierarchical structure of the methamphetamine problem.

Insert Figure 4 about here

The next step is to survey a group of experts (e.g. academics, practitioners, policy-makers) in order to attain relative utility weights for each of the criteria in the hierarchy. In short, the decision-maker judges the importance of each criterion in pair-wise comparisons (expressed by posing the questions "which of the indicators is more important?" and secondly, "by how much?"), which is expressed on a semantic scale of 1 (equality) to 9 (i.e. an indicator may be voted to be 9 times more important than the one to which it is being compared). After all the pair-wise comparisons for criteria on all levels of the hierarchy are made, the relative preference weights of the various indicators are then calculated using an eigenvector technique. Scores are then synthesised, resulting in a prioritised ranking, weighting or relative utility value for each decision alternative (Saaty, 2000). Manning (2008) provides a full description of the AHP technique.

9.0. Comparing costs and differential effectiveness rates

Once cost data and relative utility scores for all the alternatives have been collected, it is then possible to combine the two elements to form a cost-utility ratio. The alternative with the lowest cost/alternative ratio is considered to be the best available option from the perspective of the economic analysis. Table 4 highlights that hypothetical policy option 1 (C/U = $93.75) is the preferred option in comparison to the available alternatives.

The final step is to test whether the ranking of alternatives is sensitive to key assumptions of the analysis (Levin & McEwan, 2001). To conduct a sensitivity analysis one must firstly identify a key or group of key parameters. Generally, the key parameter is the importance weight that is assigned to each attribute. Consequently, it is important to gauge whether the ranking of alternatives change when alternative sets of weights are employed (Torrance, 1986). Further, one may over- or under-value the associated costs of policy options. Thus, it is also important to gauge the effect of potential increases or decreases in the estimated costs of the policy alternatives being evaluated (Manning, 2008). A full description of conducting a sensitivity analysis in cost-utility studies is available from Levin and McEwin (2001).

10.0. Conclusion

Methamphetamines problems are a significant policy issue in Australia, as in many other countries. Governments overwhelmingly favour law enforcement responses to these problems, at the expense of diverting resources to other types of options, such as prevention, treatment or harm reduction. Increasingly, there is a need to establish that these resources have been well spent – that the law enforcement options pursued are both effective, in terms of achieving their objectives, but also represent the most efficient way of doing so. Much of the ‘what works’ literature in policing has focused on the effectiveness question, but there is a need to develop methodologies which can answer the ‘what works at what cost’ question.

We have proposed an evaluation framework that should enable the collection and comparison of costs information for different policy options. In our case study, these options are the use of Project STOP as a third party policing approach, an outright ban of pseudephidrine-based precursors, their re-scheduling as prescription only products, increased traditional drug law policing efforts, and a do nothing model. We have suggested a comprehensive evaluation model incorporating studies aimed at identifying first the costs of the various options, and then their utility. Then we propose use of the analytical hierarchy method to compare the relative costs and benefits of the options, based on the views of a range of experts. In the next stage of our research, we propose trialling our proposed model with data currently being collected.

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Table 1: Approaches to economic analysis

Type of analysis	Measure of cost	Measure of outcomes	Strengths	Weaknesses
Cost-effectiveness	Monetary value of resources	Units of effectiveness	• Easy to incorporate standard evaluations of effectiveness • Good for alternatives with small number of objectives	• Hard to interpret when there are multiple measures of effectiveness • Only useful for comparing two or more alternatives
Cost-Benefit	Monetary value of resources	Monetary value of benefits	• Can judge absolute worth of a project • Can compare CB results across a variety of projects	• Difficult to place monetary values on salient life benefits
Cost-savings	Monetary value of resources	Monetary savings resulting from impact of intervention	• Good for assessing the savings generated to stakeholders	• Difficult to place monetary values on salient life benefits
Cost-utility	Monetary value of resources	Units of utility	• Incorporates individual preferences for units of effectiveness • Incorporates multiple measures of effectiveness into single measure of utility	• Difficult to arrive at consistent and accurate measures of individual preferences • Cannot judge overall worth of a single alternative

Adapted from: Levin, H. M., & McEwan, P. J. (2001). *Cost-effectiveness analysis* (2nd ed.). London: Sage Publications.

Figure 1: Opportunity costs with negligible price effects

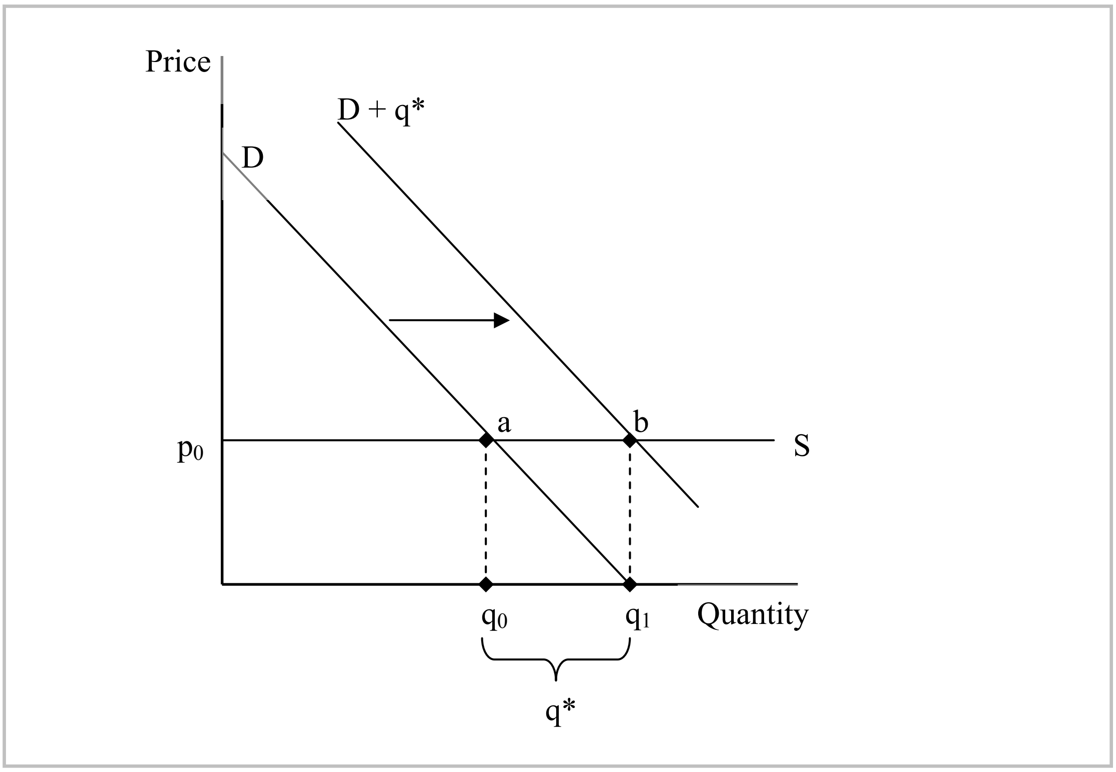


Table 3: Example of a cost worksheet

Cost elements	Cost to individual businesses (e.g. pharmacies)	Cost to government agencies (e.g. Queensland Health)	Cost to private organisations (e.g. Pharmacy Guild)	Cost to Individuals (Patients)	Total Costs
Direct Costs					
Personnel					
Facilities					
Materials and equipment					
Other direct inputs					
Client inputs					
Indirect Costs					
Cost of lost production					
In-kind participation					
Intangible costs					
Pain and suffering					
Lost opportunities					
Total cost of elements					
User fees					
Subsidies					
Net costs					

Figure 2: Example of costs of regulation

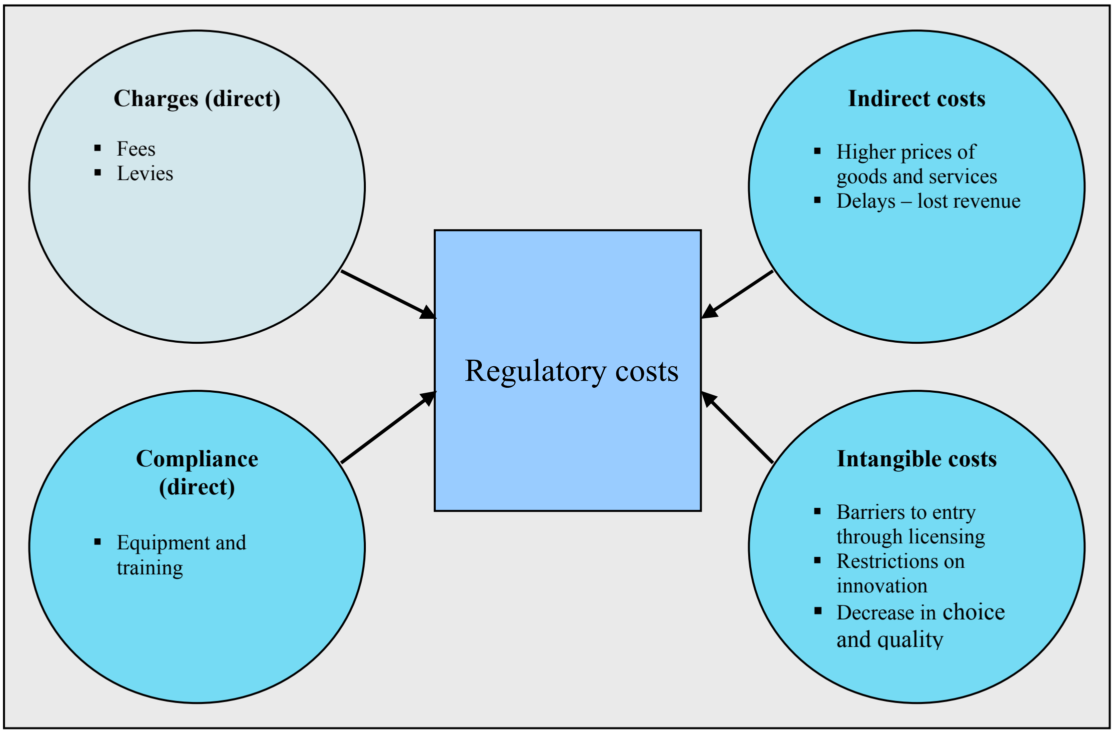
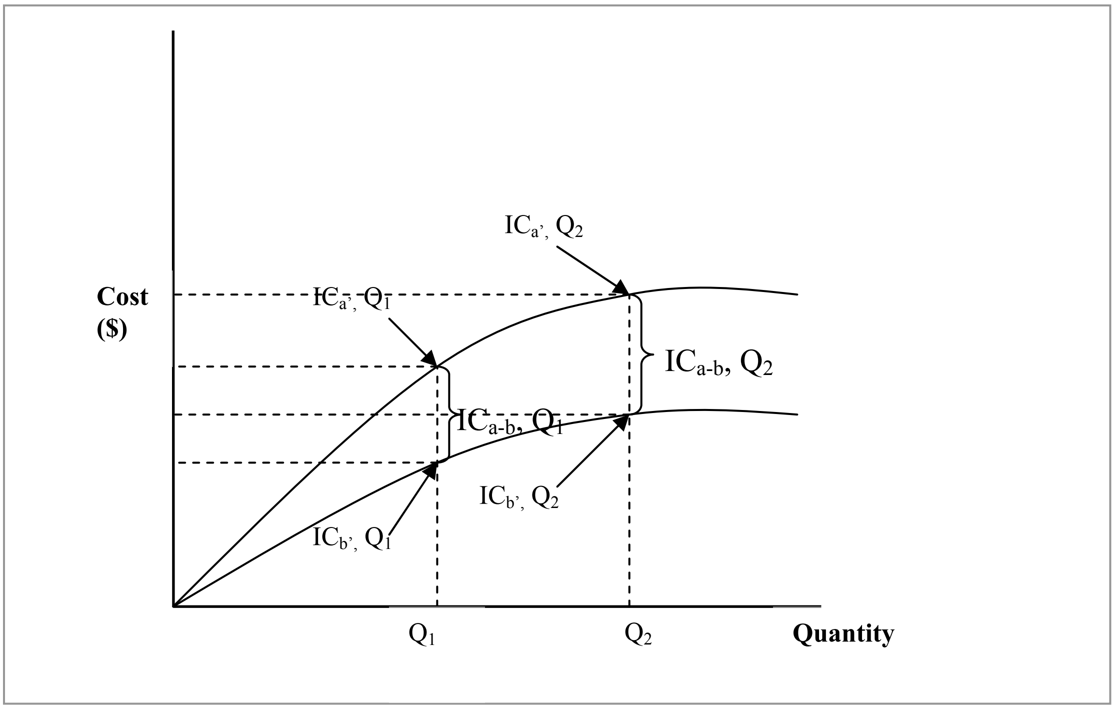


Figure 3: Incremental cost curves



Adapted from: Drummond, M. F., O'Brien, B., Stoddart, G. L., & Torrance, G. W. (1997). *Methods for economic evaluation of health care programmes* (2nd ed.). New York: Oxford University Press, p. 62.

Figure 4: An example of the AHP model

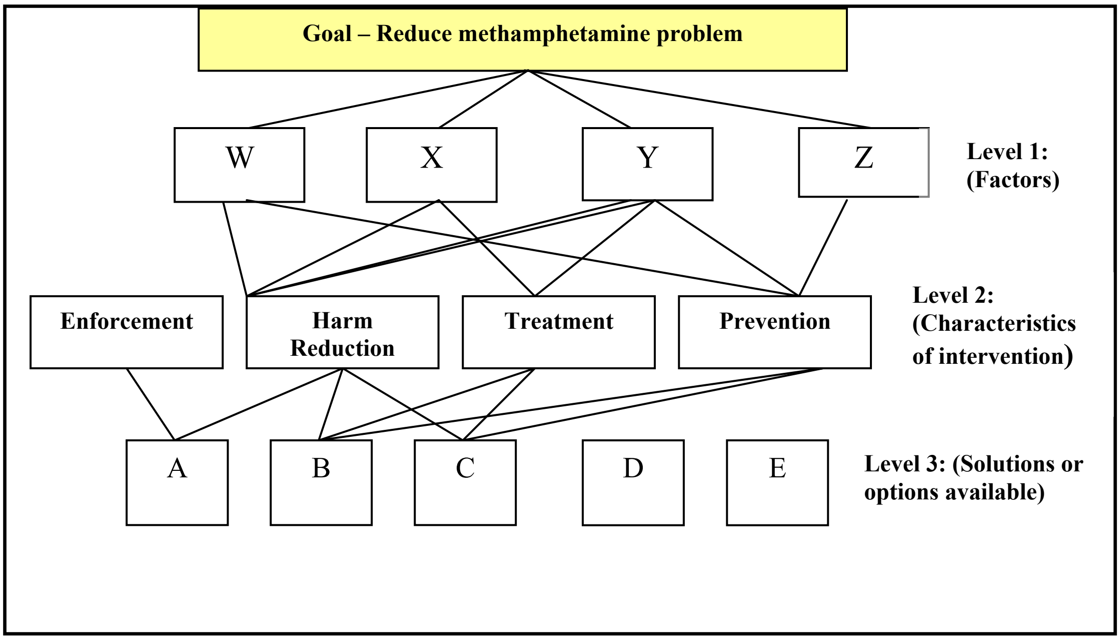


Table 4: Costs utility ratios of four alternative policy options

	Policy Option 1:	Policy Option 2:	Policy Option 3:	Policy Option 4:
Average cost per student	$30,000.00	$28,000.00	$25,000.00	$20,000.00
Overall utility	320	240	216	116
Cost-utility ratio	$93.75	$116.67	$115.74	$172.41

Adapted from: Manning, M. (2008). *Economic evaluation of the effects of early childhood intervention on adolescent outcomes*. Unpublished PhD, Griffith University, Brisbane.

Notes

[i] Opportunity cost is the cost incurred (sacrifice) by choosing one option over the next best alternative (which may or may not be equally desired). Hence, the opportunity cost of utilizing resources for one purpose opposed to utilizing the money for an alternative purpose. (Manning, 2004; Willis, Homel, & Gray, 2006, pp. vii-viii).