School-based drug prevention – The Gatehouse intervention

Introduction

School-based interventions have always been a mainstay of drug prevention policy. There are two reasons for this. Firstly, it is widely recognised that significant changes in social relationships and learning environment during adolescence are important factors in determining the initiation of drug use. Given that most adolescents spend a large proportion of their daily time at school, it is logical to focus the prevention effort in a school setting. Secondly, the school setting is usually adequately flexible to adopt a wide range of educational policies. Therefore, school-based interventions offer a systematic and efficient way of reaching the intervention targets [1-3].

Various models of school-based drug prevention programmes have been tested for their effectiveness [3]. One promising model is a program for secondary school students from Melbourne, Australia, known as the *Gatehouse Project* [1]. This paper presents an economic evaluation of the Gatehouse intervention compared with current practice, from a perspective that predominantly focused on the health sector. The evaluation assessed the public health consequences and economic credentials of the intervention as a hypothetical scenario, where the Gatehouse intervention was implemented nationally across Australia.

Method

This evaluation modelled the cost-effectiveness of a national Gatehouse intervention according to the same efficacy as found in the original trial. The following sections firstly describe the intervention; then the assumptions for the national scenario; and finally, the method for cost-effectiveness analysis.

Intervention

Target recruitment

In the trial, 16 metropolitan and regional districts in Melbourne were randomly allocated to either intervention or control groups. Thirty two schools were selected from these districts according to a probability proportional to the number of secondary schools [4]. Twenty six (81%) of the selected schools consented to participate, of which 12 schools were from districts allocated to the intervention group. Target population for the intervention was Year 8 (14 years old) students. Of the 3,623 Year 8 students in all participating schools, 2,678 (74%) students participated in the baseline data collection.

Description

The Gatehouse intervention is conceptually based in attachment theory – a theory that emphasises the importance of establishing secure emotional and social connections for well-

adjusted personal and social development [1]. Therefore, the overall objective is to improve adolescents' sense of connectedness to their social and learning environment, through which, the rates of substance use can be reduced [1]. The intervention design applies the health promotion principles endorsed by the Ottawa Charter for health promotion [5]. The overall intention is therefore more comprehensive than other school based interventions which typically emphasise mostly individual knowledge or skills.

The intervention was delivered over 3 years and had 3 key components. Details for each of these components are described below and illustrated in the intervention pathway (Figure 1, p4). Note that the Gatehouse project standardized the intervention process rather than specific intervention activities.

(I) School Liaison Team

The school liaison team (SLT), aka the intervention team or 'critical friends', was a specialist team based at the project. Each facilitator from this team assisted with professional development for teachers and provided ongoing support for participating schools. The SLT comprised team members with extensive experience in education. In the trial, each SLT member worked intensively with 2 to 4 intervention schools [4, 6]. Note that most facilitators were working on a part-time basis.

(II) Whole school strategy

The whole school strategy consisted of five sequential stages (Table 1) [7]. The first stage involved establishing a school-based adolescent health team (AHT), aka the action team or school team. This team coordinated the implementation of strategies and typically comprised six to eight members who were representative of the school community [7]. The organisation was closely associated with the existing school structures.

Table 1. Five stages of the whole school strategy

Stage		Descriptions
1	Establishment	▪ **Establish adolescent health team** ▪ Raise awareness of issues ▪ Involve whole school community
2	Review	▪ Examination current policies, programs and practices ▪ Identifying priorities for action through a conduct of survey
3	Planning	▪ Plan implementation of evidence-based strategies
4	Training and implementation	▪ Training & ongoing support for teachers & broader school community ▪ Implement strategies
5	Evaluation	▪ Monitor, evaluate and communicate progress ▪ Celebrate achievements

(Adapted from Gatehouse project team guidelines) (p. 18) [7]

A survey of Year 8 students was conducted in Stage 2 to identify the risk and protective factors in the school social and learning environment relating to the 3 key themes – security, communication and positive regards [7]. The data from this survey were then used to identify and implement a wide range of evidence-informed strategies in stages 3 and 4 (see examples in Appendix A). In stage 5, the progress and achievements of the intervention were monitored and communicated to interested parties.

(III) Teaching resources

Gatehouse curriculum materials were delivered to Year 8 and Year 9 students in English, Health or Personal development classes over a 10-week school term [4, 6]. The materials focused on the skills of managing difficult and conflicting emotions without providing specific drug education. In the trial, students from the intervention schools were exposed to teaching materials for about 15 hours over a median of 20 lessons that were delivered mostly during English lessons [4, 6].

Intervention effects

- Health risk behaviours

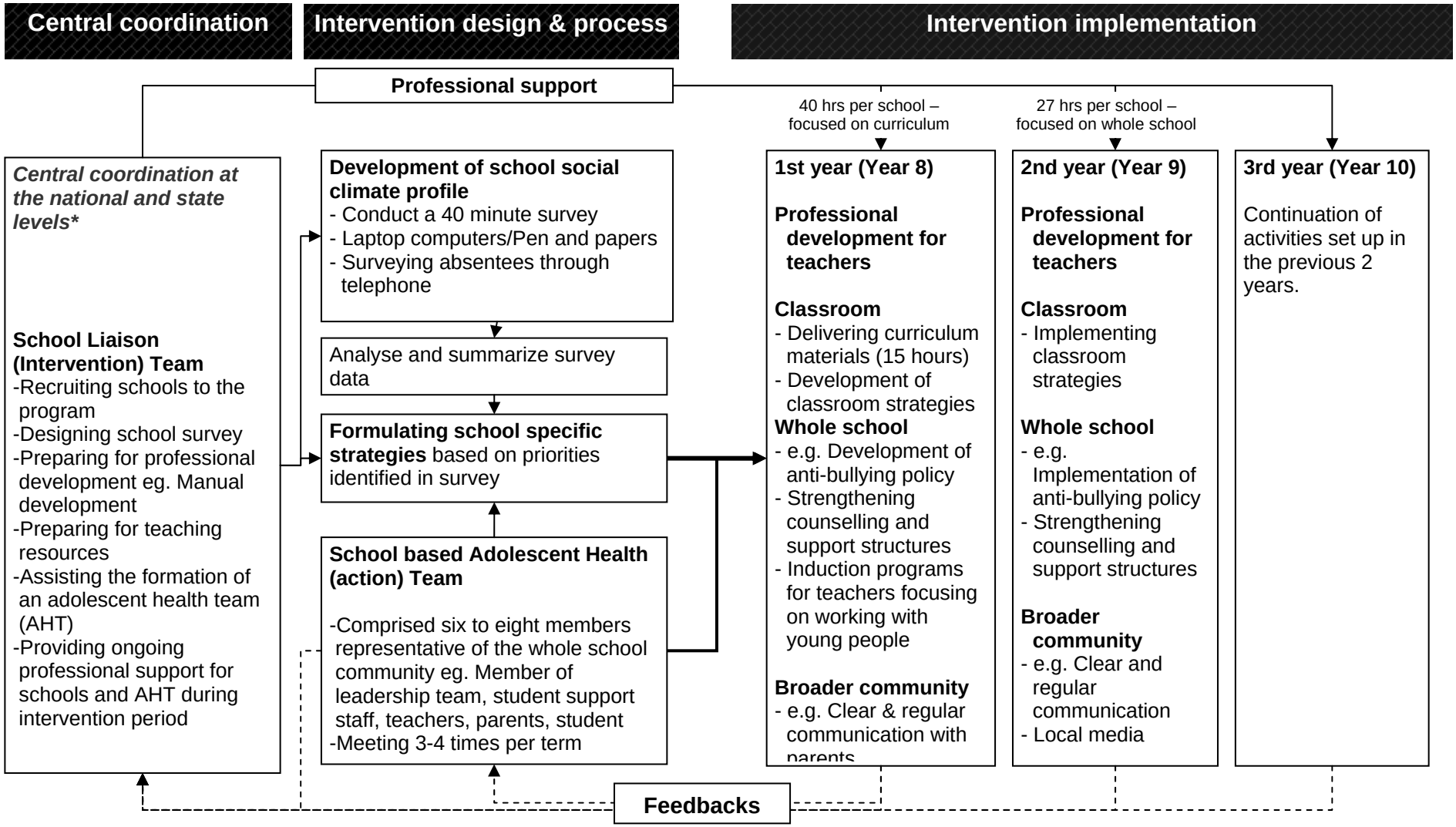
When comparing the prevalence of weekly cannabis use between Gatehouse participants and those in the control schools at Year 10, the trial found "weak evidence" for an intervention effect (adjusted OR 0.72, 95% CI 0.39,1.33) [4]. However, a statistically significant intervention effect was found on the prevalence of weekly cannabis use amongst *non-smokers* at baseline (adjusted OR 0.50, 0.26 – 0.98). The authors suggested that the intervention effect "may be contingent on the implementation prior to initiation of tobacco use" (p.27) [4].

When comparing amongst *consecutive* cohorts of Year 8 students between the intervention and control schools for a composite measure of health risk behaviours including substance use, an adjusted logistic regression model found an intervention effect (OR) of 0.71 (95% CI: 0.52, 0.97) [8] i.e. the intervention has a sustained effects on health risk behaviours on subsequent cohorts of year 8 students.

- Mental health status

The Gatehouse project did not demonstrate statistically significant effects on depressive symptoms or social and school relationships either in the initial Year 8 cohort at Year 10 follow-up [6] or subsequent Year 8 cohorts [8]. The authors suggested that the lack of a sustained and specific intervention might have resulted in the lack of a clear effect. The authors also explained that "key determinants of depressive symptoms may differ from those for health risk behaviours, perhaps operating outside the secondary school setting or at a developmentally earlier point" p.1586) [8].

Figure 1. Pathway for the Gatehouse intervention



***** Assumed additional component for the national scenario. Note that this component was not part of the original trial design.

Comparator

The ACE-Prevention project specified 'current practice' as the comparator. At the time when the Gatehouse intervention was trialled, all schools in Victoria (including schools receiving the Gatehouse intervention) were implementing a compulsory school drug program under an initiative known as "Turning the Tide" (TTT) [9]. The Victorian government committed a total funding of $100 million over four years from 1996 to 1999. The fund was distributed in five broad categories, with most of the fund committed to treatment and support (62%) [9]. A total of $17.25 million over the duration of the initiative was spent in school-based education programmes [9].

Although the TTT initiative was formally assessed [9], the main evaluation focus was on the structure and process. The evaluators did not have sufficient data to assess the quantitative impact on the rates of drug use. However, according to interviews conducted as part of the evaluation, stakeholders doubted the effectiveness of the school-based programs in influencing the uptake of drug use [9].

On the other hand, since 1999, the Commonwealth Government has been implementing an initiative known as the National School Drug Education Strategy (NSDES). Through this initiative, schools have received a total of $47.5 million for drug education [10] (Table 2). The initiative aimed to "strengthen the provision of educational programmes and supportive environments" and "assisting students with drug-related problems and deterring the presence and use of unsanctioned drugs" (p.2) [11].

Table 2. Total funding for the National School Drug Education Strategy from 1998-2008

Year	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08
Totals (Millions)	2.5	4	4	3.7	3.8	5.5	6*	6*	6*	6*
Cumulative total	2.5	6.5	10.5	14.2	18	23.5	29.5	35.5	41.5	47.5

*Guesstimates based on a total of $47.5 million (adapted from NSDES report [10])

The NSDES initiative has also been formally evaluated, although the focus was, again, on the qualitative assessment of the implementation process. Based on assessments made against eight key objectives, the evaluators concluded that NSDES has made a "significant contribution to the development and support of school drug education across Australian schools" (p.10) [11]. No assessments, however, were made for impacts on the rates of drug use.

This economic evaluation neither attempt to estimate the effect size nor to incorporate the cost of TTT in the analysis because the Gatehouse intervention was implemented *concurrently* with background TTT activities. Therefore, it is assumed that TTT activities were distributed evenly amongst all the schools. Thus, the *incremental* costs and effect of TTT can be considered as nil.

National implementation

Coordination

It is anticipated that central coordination is essential for the national implementation of the intervention. At the national level, two central project officers were assumed to administer the overall coordination of program implementation. Furthermore, a total of 13 project officers were assumed at the state level – two officers for each state in QLD, NSW, VIC, SA and WA; and one officer in TAS, ACT and NT.

The Gatehouse intervention provided professional support to participating schools via school liaison officers who, in the trial, worked intensively with 2 to 4 intervention schools per officer. However, most of the officers were working part-time. Thus, this evaluation assumed that one full-time officer would work with 6 to 10 schools within a geographic cluster [Personal communication with George Patton]. The school liaison officers were assumed to make approximately 14 to 18 and 18 to 24 trips to each school, in the first 2 years respectively. In the third year, about 12 to 16 visits are made. The frequency of school visits are negatively correlated with the number of schools per SLT officer. These visits are essential to promote mutual understanding between the schools and the facilitators so that the facilitators can become a trusted resource.

Recruitment

When estimating the number of schools recruited and the size of target population for the national scenario, the same school recruitment (81%) and student participation (74%) rates as reported in the trial were assumed as the median rates. Although it is likely that all students in the participating schools will be 'exposed' and benefit from the intervention, the reported 74% 'participation' was used to avoid over-estimation of benefit. The estimate was based on a total 2,570 secondary schools and 266,747 Year 8 students in Australia in year 2003 [12].

Teacher professional development

The evaluation assumed that one teacher was appointed from each participating school to attend the initial six-hour introductory professional development session. This training was assumed to be conducted in a group of 12 teachers at a hired venue by the SLT. These sessions were assumed to take place during school term and teacher positions were back-filled by casual relief-teachers on the day. Each participating teacher received 2 team guidelines and 4 curriculum manuals for their schools. Any additional manuals can be printed from the Gatehouse Project webpage. Once a school engages with the project, ongoing professional development sessions are delivered to all teachers by the SLT officer during their school visits.

Implementation

The AHT typically consisted of 6 to 8 members who were representative of the school community. Accordingly, this evaluation assumed that the AHT comprised 1 school principal, 2 school teachers, 1 school service officer, 1 parent volunteer and 2 student representatives. The AHT was assumed to meet 2 to 4 times per term [7] i.e. up to 48 meetings over 3 years.

In the initial trial, all school surveys were conducted on laptop computers. However, the surveys are now administered on-line. For schools that have inadequate computing facilities, the surveys are assumed to be administered in pencil and paper format.

Analysis

Health benefit

A Markov model was constructed in TreeAge Pro [13] with links to Microsoft Excel to estimate the potential health gain resulting from implementing a national Gatehouse intervention in the reference year of 2003. The structure, input data and the validation of output data for this model were described in another working paper [14]. Briefly, a 17-state Markov model was constructed to simulate the initiation of cannabis use, progression in use, reduction and complete remission by annual cycles. The complete matrix of annual transition probabilities between health-states were derived from observations made in a Victorian adolescent cohort [15] and three well-recognised patterns of cannabis use in the population. These observations are that: (I) cannabis use initiation typically occurs after 10 years of age; (II) cannabis use peaks in young adulthood; and (III) cannabis use declines to a negligible level after 65 years of age.

Following 10-year-old Australian children for 90 years, the model estimated annual prevalence for cannabis use at different levels of use – non-use, light use, weekly use and daily use. The estimated prevalence for current practice was validated against data observed in the National Drug Strategy Household Survey 2004 [16].Three health related consequences of cannabis use were modelled – schizophrenia [17], heroin and poly-drug use (HPU) [18] and road traffic accidents (RTAs) [19]. By applying the relative risks according to the extent of cannabis use, the age-specific prevalence of schizophrenia and HPU, and the incidence of annual RTA and fatality rate were estimated. Most of the epidemiological inputs for the model were obtained from the Australian Burden of Disease and Injury Study (AusBoD) 2003 [20].

The potential health gain was calculated using Disability Adjusted Life-Years (DALYs). The DALY is a composite population health measure that sums the years of life lost due to premature mortality (YLL) and the equivalent ‘healthy’ years lost due to disability (YLD) [20]. The DALY was selected as the common metric to evaluate health gains in the ACE-Prevention project.

In this model, the YLD was calculated, cycle by cycle, by multiplying the number of people in each health state (i.e. annual prevalence) with the corresponding DW. The disability weights (DW) used in this model were based on the Dutch weighting system [21]. Where co-morbidities were present in a health state (e.g. health states with schizophrenia and HPU), a validated multiplicative method was used to adjust the DWs [22]. A list of the DWs used can be found in Appendix B. The model also tracked the incidence of RTAs. Given that the level of disability of injury resulting from a non-fatal RTA varies considerably, this evaluation did not estimate the YLDs by applying an average DW value as described above. Instead, age-specific 'incident YLD' due to RTA derived from the AusBoD study was applied to each incident RTA case.

The YLL component of a DALY was calculated in the model by assessing the number of death in each cycle and using the following formula:

$$\text{YLL} = \frac{1 - e^{-D*L}}{D}$$

Where D is the annual discount rate (3%) and L is the health-adjusted life expectancy in the Australian population of 2003 at the age of death

This evaluation modelled the impact of Gatehouse intervention by applying an intervention effect size of 0.71 (95% OR 0.52, 0.97) [8] to the initiation of cannabis use for individuals aged between 14 to 18 years. The counterfactual was the scenario under current practice where the relative risk of cannabis use initiation was assigned a value of 1. After the "intervention years", the initiation rate was set to return to that observed in the current trend (i.e. RR=1).

Two assumptions were made when applying the effect size. Firstly, the composite effect size observed in the trial was attributed equally to all health risk behaviours including cannabis use. This assumption was made because the trial had insufficient statistical power to further estimate the effect by substance types after adjusting for 'cluster effect'. Secondly, the model assumed that intervention had an effect lasting throughout the secondary school years (up to 18 years). Although the trial only found 'weak' evidence for the initial Year 8 cohort at Year 10, a sustained effect was demonstrated on subsequent year 8 cohorts at 4 year follow-up. This means that, once the intervention is in place, the intervention effect can be realised and possibly persists throughout the secondary school years due to sustained changes in the school environment.

Costs

Pathway analysis was conducted based on Figure 1 (p.4) to identify resource use. Table 3 (p.10) specifies the cost items, unit costs, sources and assumptions for costing. Where applicable, costs were adjusted to real prices in the 2003 reference year using health price index.

- Costs included

All costs to the government, schools and individuals involved in the delivery of the intervention were accounted for. These included the coordination of implementation at the national and state levels; the employment of school liaison officers; the recruitment of schools; the professional development for teachers from participating schools; the conduct and analysis of the whole school survey; the AHT meetings and information sessions; the printing of team guidelines, teaching resources and newsletters; and the delivery of curriculum materials.

- Costs excluded

According to the ACE-Prevention methodology, the intervention was evaluated as operating in a 'steady state'. That is, trained personnel, infrastructure and other resources were assumed to be available for the program implementation. Therefore, the evaluation excluded the costs associated with the initial set-up; the training provided to the national and state coordinating officers; and the development of the school survey, team guidelines and teaching resources.

This evaluation also excluded (I) the costs associated with the specific activities implemented at the school level as a result of intervention process (see costing assumption); and (II) adolescent time costs because of a lack of suitable time cost valuation method for adolescents.

- Costing assumptions

(I) The costs of employing the national and state coordinators included 60% on-costs in addition to the base-salary. This is to cover salary on-costs such as superannuation, overheads, consumables, administrative support, and routine monitoring, support and evaluation.

(II) The evaluation accounted for the travel costs to the training venue for the participating teachers in the introductory professional development session by assuming that 35% of teachers travelled from rural areas (150km) and 65% from urban areas (25km) [Ref].

(III) The evaluation estimated, except for the student representatives, the opportunity cost of AHT participation using published wage rates. For the parent volunteer, opportunity cost was calculated using the time cost valuation method of Jacob and Fassbender [23].

(IV) For the conduct of school survey, no cost was attributed because the survey was administered online during school hours and adolescent time cost was excluded. The preparation of reports for the schools is assumed to be included in the SLT salary.

(V) No cost was estimated for the teaching of curriculum materials because they were delivered during normal school hours.

(VI) As previously mentioned, the Gatehouse intervention standardized the intervention process rather than specific intervention activities. Given the wide range of activities implemented at the school level (appendix B) and considerable variation between participating schools, this evaluation did not attempt to cost these activities individually. It is important to note that most of the activities were making use of existing school resources and were generally implemented during school hours. The Gatehouse intervention can therefore be viewed as addressing the technical efficiency within the school by "reorienting services" using available resources. Nonetheless, some schools may not be adequately resourceful to implement the intervention and other schools may require financial support to participate. Therefore, a sensitivity analysis was conducted to include a $5000 grant per participating school.

Table 3. Intervention costs

Costing parameter (Costing unit)	Cost to Government /project	Cost to schools	Unit cost sources	Assumption
National and state central coordination officer salary (annual)	$141,696		Australian Public Service commission www.apsc.gov.au	EL2 level 3 salary ($88560) + **60% on-costs**
SLT – liaison officer salary (annual)	$97,744		Australian Public Service commission www.apsc.gov.au	APSC 6 level 1 salary ($61090) + **60% on-costs**
School principal salary (hour)		$49.13	Vic Government Department of education and early childhood development (DEECD)	Midpoint of range 3 salary ($94,402 - $107,199)
Teacher salary (hour)		$33.54	DEECD	Subdivision A3 of accomplished classroom teacher ($52,931) + 30% on-costs
School service officer (hour)		$30.94	DEECD	Level 2 range 4 (52/52 calendar year employment mode) ($48.832) + 30%
Volunteer time (hour)		$17.17	Calculated from data published by ABS	Wage rate adjusted for gender ratio and workforce participation statistics
Composite AHT time costs (hour)		$164.33	Calculated	Assuming AHT comprised 1 principal, 2 teachers, 1 service officer, 1 parent representative and 2 students
Casual relief teachers (day)		$193.01	DEECD (Aug 2004)	Relief teachers for teachers attending professional training during school term
Travelling cost (km)		$0.58	RACV 2003 vehicle operating costs	Private medium 2-3 litres vehicle
Team guidelines for whole school change (unit)	$27.00		Estimated from Officework rates	Printing, covers and binding for 160 page document
Teaching resource for emotional well-being (unit)	$14.00		Estimated from Officework rates	Printing, covers and binding for 70 page document
Venue hire	$110.00		Estimated	Based on LEAP study
Newsletter for students and parents		$2.00	Estimated	

- Cost offsets

Cost offsets refer to the anticipated economic costs that would have occurred in the absence of intervention. Consistent with a health sector perspective, this study incorporated the costs of disease treatment when estimating cost-offsets. The figures were derived from the Disease Costs and Impacts Study data [24] undertaken by the Australian Institute of Health and Welfare (AIHW). These costs have been adjusted to 2003 by AIHW. The average cost per prevalent case was derived for each of the modelled consequences (i.e. schizophrenia, RTA and HPU).

In addition, the cost-offsets were also calculated with or without the inclusion of the estimated cost for cannabis and heroin consumption that would have been incurred by individual users if the intervention was not implemented. The consumption cost was estimated from the street prices of cannabis and heroin as reported by the Australian Crime Commission [25]. Since the price of cannabis varies by the parts of the cannabis plant and by the total quantity in a single transaction, an average cost of $28 per gram were used to estimate the annual costs of cannabis use. The following table outlines the steps in estimating the annual cost of cannabis use for light users, weekly users and daily users.

Table 4. Estimated Annual cost of cannabis consumption for cannabis users

Parameter	Light users	Weekly users	Daily users	Source/assumption
Use frequency (week)	0.1	2	7	Estimated
Nº joint per use	1	2	2	[26]
Nº Joints per year	5	208	728	Calculated
Gram/joint	0.25	0.25	0.25	Estimated
Cost (pa) per cannabis user	**$37**	**$1467**	**$5135**	**Calculated**

For individuals using heroin and poly-drugs, annual per user cost of $26,700 was estimated. The calculation was based on a median price of $54 ($30 to $150) per 150 milligram (one hit) [25] of heroin, using 1.9 hits per use [16]. This cost was adjusted according to age in order to reflect the different proportions of heroin users in different categories of use frequency at different age [16].

Cost-offsets per case for each health state are listed in Appendix C.

Cost-effectiveness

An incremental cost-effectiveness ratio (ICER) was calculated. This ratio represents the additional cost per additional DALY averted by Gatehouse as against current practice. The analysis presented the ICER in three forms: **(I)** without considering the cost-offsets; **(II)** considering the cost-offsets, but *without* the costs of drug consumption by users (CO1) and; **(III)** considering the cost-offsets *with* the costs of drug consumption (CO2).

Uncertainty

Ninety-five percent uncertainty intervals were determined for all outcome measures by Monte Carlo simulation with 2000 iterations. Table 5 (p.12) shows the distributions of uncertainty around input parameters. Based on the result of the uncertainty analysis, an 'acceptability curve' was plotted to evaluate the intervention's probability of being cost-effective against different willingness-to-pay thresholds.

Table 5. Distributions of uncertainty around input parameters

Parameter	Distribution	Median (Uncertainty Range)	Sources
Intervention effect	Lognormal	Ln(0.71) Ln(se) = 0.156	Gatehouse project [8]
School participation rates	Triangular*	0.81 (0.5, 0.9)	Gatehouse project [8] and other school based programs
No. of schools per liaison officer	Triangular	8 (6,10)	Estimate based on Gatehouse project [8] and personal communication with George Patton
No. school trips by a liaison officer in three years	Uniform	44, 58	Estimate from personal communication with George Patton If 10 schools-Y1: 14 visits, Y2: 18 visits; Y3: 12visits; If 06 schools-Y1: 18 visits; Y2: 24 visits, Y3: 16 visits
No. Team guidelines	Uniform	2 (1, 3)	Estimate
No. Curriculum manuals per school	Uniform§	5 (3, 5)	Estimate
No. AHT meeting over 3 years	Uniform	24, 48	Estimate from personal communication – 2 to 4 meetings per term over 3 years
No. Newsletter over 3 years	Triangular	3 (2, 4)	Estimate
Salary loading for national, state and project officer salaries	Triangular	0.6 (0.5, 0.7)	Estimate
Salary loading for teachers	Triangular	0.3 (0.2, 0.4)	Estimate
Cost of team guidelines for whole school change	Triangular	$27±20%	Estimate
Cost of teaching resource for emotional well-being	Triangular	$14±20%	Estimate
Venue hire	Triangular	$110±20%	Estimate
Cost of laptop computers	Triangular	$1,500 (1000, 2000)	Estimate
Attribution of computer cost to Gatehouse project	Triangular	0.5 (0.3,0.7)	Estimate

*In a triangular distribution, the greatest probability of being chosen is the value representing the top of the triangle (i.e. the most likely value), while the probability of other values being chosen tapers off towards the extremes of the base of the triangle between the minimum and maximum values; §Uniform distribution is used equal probability between two values

Sensitivity

The evaluation tested the effect of including an amount of $5000 per participating school over 3 years as a blanket figure to cover the resources expended on the wide range of activities during

the program's implementation stage and the backfilling of or payment to teachers who attend professional development sessions. This amount of financial support for the participating schools ($5000) was recommended by the Gatehouse intervention team.

Results

Target recruitment and workforce

The evaluation estimated that a median of 1,919 secondary schools in year 2003 would participate in the Gatehouse intervention (Table 6). Approximately 160,900 students of the total 266,747 Year 8 students in Australia in 2003 [12] would participate in the intervention if the Gatehouse intervention was implemented nationally. The evaluation estimated that a total of 238 1EFT school liaison officers were required to provide professional supports to these schools. These officers are additional to the assumed 15 project officers who would coordinate the intervention at the national and state levels.

Table 6 Cost-effectiveness results for the Gatehouse intervention in Australia

	Median	**95% uncertainty range**
Number of school participated	1,919	1427; 2230
Number of students participated	160,900	119,600; 187,000
Number of Project Liaison officers (1EFT)	238	170; 315
Total DALY averted	**1,412**	**422; 2788**
Total Intervention cost – 3 year program	**$91.8M**	**$68.3M; $117.8M**
Total cost-offsets (without consumption cost) (CO1*)	$4.2M	$1.3M; $11.2M
Total cost-offsets (with consumption cost) (CO2§)	$ 99.4 M	$71.1M; $128.4M
Cost/DALY averted (no CO)	**$63,900**	**$34,200; $199,300**
Cost/DALY averted (with CO1)	$60,400	$31,600; $195,200
Cost/DALY averted (with CO2)	Dominant	Dominant; $17,900

*CO1 includes medical estimates for cases of schizophrenia, road traffic accident and heroin and poly-drug use;
§CO2 includes CO1 and consumption costs of cannabis and heroin

Health benefit

According to the model, implementation of the Gatehouse intervention in Australia could avert an average of 1,412 DALYs. More than 95% of the DALYs averted arose from morbidity associated with cannabis use rather than from premature mortality resulting from the consequences of cannabis use.

Costs

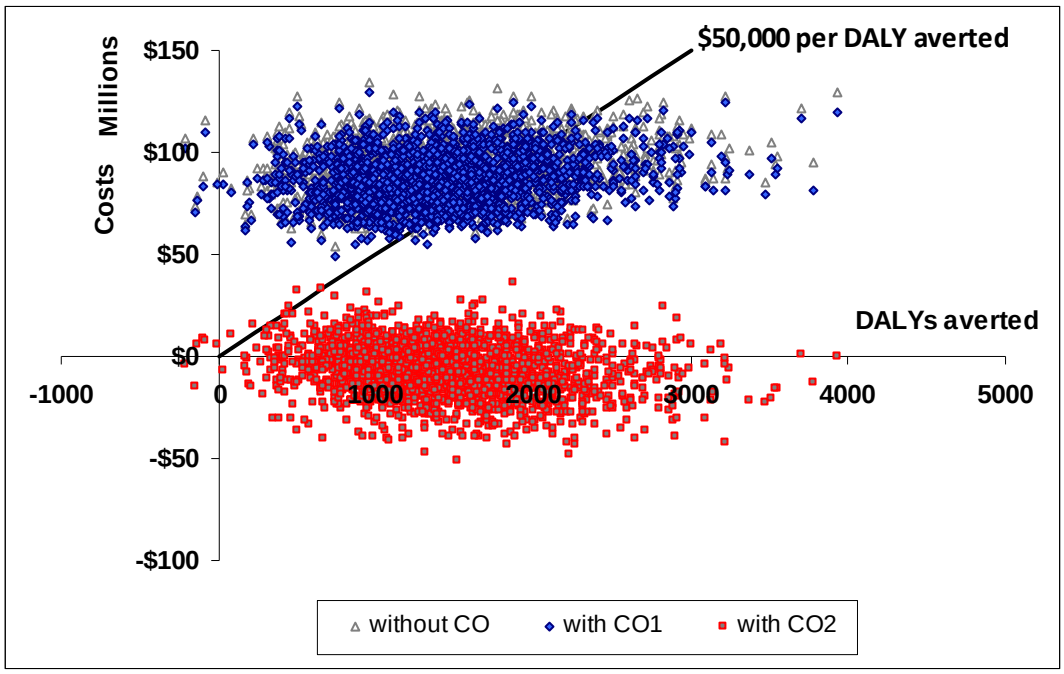
A median total cost for the national Gatehouse intervention was found to be $91.8 million (Table 6) ***over the 3 year*** intervention period. A large proportion of the total cost was associated with the appointment of project liaison officers. When cost-offset was evaluated without including the costs of drug consumption i.e. health sector cost-offsets, the median cost was $4.2 million. This increased substantially to $99.2 million when the drug consumption costs were included.

Cost-effectiveness

When comparing the Gatehouse intervention with current practice without considering the potential cost-offsets, the analysis found the ICER to be $63,900 per DALY averted (Table 6). When cost-offsets consisting only of medical treatment costs were incorporated, the ICER reduced to $60,400 per DALY averted. When the cost-offsets incorporated both the treatment costs and the drug consumption costs, the intervention can be considered a 'dominant' intervention compared to current practice. That is, the Gatehouse intervention produced more health gains than current practice at a negative net cost.

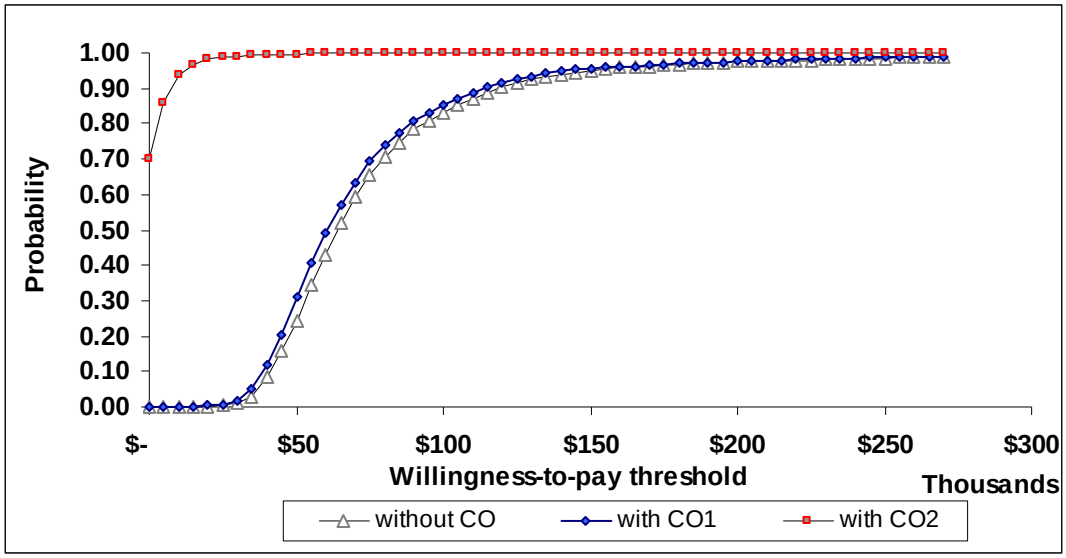
Figure 2 illustrates the range of cost-effectiveness estimates for the Gatehouse intervention according to probabilistic uncertainty analysis. Using $50,000 per DALY averted as the threshold below which an intervention is considered as cost-effective, the Gatehouse intervention has about 24% likelihood of being cost-effective when no cost-offset is incorporated (Figure 3). When CO1 and CO2 were incorporated, 30.8% and 99.4% of the ICERs were below $50,000 per DALY averted, respectively.

Figure 2. Cost-effectiveness of uncertainty analysis



*CO1 includes medical estimates for cases of schizophrenia, road traffic accident and heroin and poly-drug use;
§CO2 includes CO1 and consumption costs of cannabis and heroin

Figure 3. Acceptability curve for Gatehouse intervention



*CO1 includes medical estimates for cases of schizophrenia, road traffic accident and heroin and poly-drug use;
§CO2 includes CO1 and consumption costs of cannabis and heroin

Sensitivity analysis

When an amount of $5000 per participating school was included as a guesstimate for resources expended on the wide range of school activities during the program's implementation stage, the intervention costs over 3 years increased to $100.8M (95%UI: 74.9M; 127.4M). Using $50,000 as the cost-effectiveness threshold, the likelihood of being a cost-effective intervention reduced to 18.1% and 22.8% when no CO and CO1 were included in the estimate. The intervention remains highly cost-effective when CO2 was included.

Discussion

Based on the current assumptions, the findings of this economic evaluation suggest that the Gatehouse school-based program for adolescents, if implemented nationally, is likely to be a cost-effective intervention only when cost-offsets are considered. When compared with current practice without incorporating cost-offsets and using $50,000 per DALY averted as the "value for money" threshold, the Gatehouse intervention has only approximately 24% probability of being cost-effective. However, when health sector cost-offsets were incorporated, the probability rose to 30.8%. When cost-offsets inclusive of drug consumption costs were incorporated, the intervention was found to be a 'dominant' intervention to current practice.

The total costs of implementing the Gatehouse intervention was estimated at $91.8 million over three years. This cost is substantially higher than the current level of funding for school based drug prevention programs. The main cost-driver was the assignments of project liaison officers who play a critical role in coordinating and providing ongoing professional support to participating schools. An estimated 238 school liaison officers are required if this intervention is

to be implemented nationally across Australia. The availability of these officers should be a key consideration if the Gatehouse intervention were to roll out nationally.

As school based interventions continue to be an important policy option for drug prevention, the need for economic evaluations that contribute to a coherent body of scientific evidence within the Australian context is pressing [27, 28]. The findings of this economic evaluation are particularly informative because the intervention, modelling and the evaluation method are consistently within the Australian context.

Several caveats of this evaluation need to be noted. Firstly, the Gatehouse intervention has the potential to benefit other health risk behaviours including the use of substances other than cannabis, such as tobacco and alcohol [8]. In addition, the intervention may offer benefits to wider social outcomes such as educational attainment, employment and crime. As a main limitation of this study, the evaluation did not attempt to assess these outcomes due to the scope of the simulation model [14]. The inclusion of these potential benefits will further improve the cost-effectiveness of the Gatehouse intervention.

Common to all economic evaluations, the cost-effectiveness results are sensitive to the applied intervention effect size. In this evaluation, it was reasonably assumed that the effectiveness of the national Gatehouse intervention operating at a 'steady state', is the same as efficacy observed in the original trial. The efficacy is dependent on the adherence to the intervention process as well as committed participation from all relevant parties. Therefore, the Gatehouse intervention can be considered as efficient use of resources *only if* adherence, participation and the required expertise to deliver the intervention are established. This point is especially important because a lack of ongoing commitment has been a hindering factor to the success of past school-based drug programs in Australia [28]. Indeed, the multilevel Gatehouse intervention is "fundamentally complex" and its "success requires long term commitment by funders, government departments, communities, and schools" (p. 1002) [6].

This study provides evidence that a national school-based Gatehouse intervention in Australia is likely to be cost-effective in comparison to current practice if cost-offsets were taken into consideration. However, the implementation of this national program is coupled with costs substantially higher than the current funding to deliver school based drug prevention program main because of the intensive ongoing interaction between the school liaison officers and the schools. Nonetheless, the intervention has been proven to deliver substantial gain despite the limited range of benefit being considered in this study. It is important to note that the cost-effectiveness of the Gatehouse program is contingent upon successful recruitment of schools, adherence to the intervention process and sustained commitment by funders, government departments, communities, and schools.

References

1. Patton, G., Bond, L., Butler, H. & Glover, S. (2003) Changing schools, changing health? Design and implementation of the Gatehouse Project, *J Adolesc Health*, 33, 231-9.
2. Faggiano, F., Vigna-Taglianti, F. D., Versino, E., Zambon, A., Borraccino, A. & Lemma, P. (2008) School-based prevention for illicit drugs use: A systematic review, *Prev Med*, 46, 385-96.
3. Faggiano, F., Vigna-Taglianti, F. D., Versino, E., Zambon, A., Borraccino, A. & Lemma, P. (2005) School-based prevention for illicit drugs' use, *Cochrane Database Syst Rev*, CD003020.
4. Bond, L., Thomas, L., Coffey, C., Glover, S., Butler, H., Carlin, J. B. *et al.* (2004) Long-term impact of the Gatehouse Project on cannabis use of 16-year-olds in Australia, *J Sch Health*, 74, 23-9.
5. World Health Organization (1986) Ottawa Charter for Health Promotion (Ottawa, Canada, WHO).
6. Bond, L., Patton, G., Glover, S., Carlin, J. B., Butler, H., Thomas, L. *et al.* (2004) The Gatehouse Project: can a multilevel school intervention affect emotional wellbeing and health risk behaviours? *J Epidemiol Community Health*, 58, 997-1003.
7. Centre for Adolescent Health (2005) Part One - An Overview of the Whole school strategy *Gatehouse Project Team Guidelines* (Melbourne, Centre for Adolescent Health).
8. Patton, G. C., Bond, L., Carlin, J. B., Thomas, L., Butler, H., Glover, S. *et al.* (2006) Promoting social inclusion in schools: a group-randomized trial of effects on student health risk behavior and well-being, *Am J Public Health*, 96, 1582-7.
9. Health Outcomes International Pty Ltd., Hoult Consulting., Siggins Miller Consultants. & National Drug and Alcohol Research Centre (N.D.A.R.C). (2000) Evaluation of Turning the Tide - Final Report (Victoria, Department of Premier and Cabinet).
10. Department of Education Training and Youth Affairs (1999) National School Drug Education Strategy (Canberra, Commonwealth Government of Australia).
11. Health Outcomes International Pty Ltd. (2004) Evaluation of the National School Drug Education Strategy (NSDES) and COAG Tough on drugs in schools initiative - Final report (Canberra, Commonwealth Department of Education Science and Training.).
12. Australian Bureau of Statistics (2003) Schools, Australia, 2003. cat. no. 4221.0 (Canberrra, Australian Bureau of Statistics).
13. Treeage Software (2008) TreeAge Pro 2008 (Williamstown, MA).
14. Tay-Teo, K. S., Bulfone, L., Doran, C. & Hall, W. (2008) Modelling the public health consequences of cannabis use in Australia (Working Paper).
15. Coffey, C., Lynskey, M., Wolfe, R. & Patton, G. C. (2000) Initiation and progression of cannabis use in a population-based Australian adolescent longitudinal study, *Addiction*, 95, 1679-90.
16. Australian Institute of Health and Welfare (2005) 2004 National Drug Strategy Household Survey: Detailed Findings. *Drug Statistics Series No. 16, AIHW cat no. PHE 66* (Canberra, AIHW).
17. Semple, D. M., Mcintosh, A. M. & Lawrie, S. M. (2005) Cannabis as a risk factor for psychosis: systematic review, *Journal of Psychopharmacology*, 19, 187-94.
18. Degenhardt, L., Hall, W. & Lynskey, M. (2001) The relationship between cannabis use and other substance use in the general population, *Drug Alcohol Depend*, 64, 319-27.
19. Drummer, O. H., Gerostamoulos, J., Batziris, H., Chu, M., Caplehorn, J., Robertson, M. D. *et al.* (2004) The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes, *Accident Analysis & Prevention*, 36, 239-48.
20. Begg, S., Vos, T., Barker, B., Stevenson, C., Stanley, L. & Lopez, A. (2007) The burden of disease and injury in Australia 2003. (PHE 82. Canberra: AIHW).
21. Stouthard, M., Essink-Bot, M., Bonsel, G. & Group., D. D. W. (2000) Disability weights for diseases - A modified protocol and results for a Western European region, *European Journal of Public Health*, 10, 24.

22. Flanagan, W., Mcintosh, C. N., Le Petit, C. & Berthelot, J. M. (2006) Deriving utility scores for co-morbid conditions: a test of the multiplicative model for combining individual condition scores, *Popul Health Metr*, 4, 13.
23. Jacobs, P. & Fassbender, K. (1998) The measurement of indirect costs in the health economics evaluation literature. A review, *Int J Technol Assess Health Care*, 14, 799-808.
24. Mathers, C., Stevenson, C., Carter, R. & Pehm, R. (1998) Disease costing methodology used in the Disease Costs and Impact Study 1993-94. *Health and Welfare Expenditure Series no. 3. AIHW cat. no.HWE7* (Canberra, Australian Institute of Health and Welfare).
25. Australian Crime Commission (2005) Illicit Drug Data Report 2003 - 2004 (Canberra, Australian Crime Commission).
26. Reilly, D., Didcott, P., Swift, W. & Hall, W. (1998) Long-term cannabis use: characteristics of users in an Australian rural area, *Addiction*, 93, 837-46.
27. Rush, B., Shiell, A. & Hawe, P. (2004) A census of economic evaluations in health promotion, *Health Educ Res*, 19, 707-19.
28. Midford, R. (2007) Is Australia 'fair dinkum' about drug education in schools? *Drug Alcohol Rev*, 26, 421-7.

Appendices

Appendix A - Same examples of activities adopted by the Gatehouse intervention schools

Classroom

Security	Communication	Positive Regard
Collaborative development of classroom agreements or rules	Revision of curriculum - teaching and learning strategies to foster positive interactions: discussion groups; collaborative work; speaking and listening; questioning; listening to differing points of view justifying a position.	Reviewing nature of assessment and feedback on student work
Establishment of procedures to make the classroom a place where privacy and confidentiality are respected		Positive and constructive assessment processes, involving students and parents wherever possible
Development of strategies for preventing and dealing with teasing and put downs	Use of journals and drama	Regular verbal recognition of student contributions and achievements
Seating arrangements to avoid exclusion	Focus on teacher/tutor relationship with students	Peer education
Students in work teams/table groups	Use of proactive classroom management techniques to maintain student interest, create a good working environment and positive relationships	Displays of student work
Decrease in numbers of teachers working with each class		Developing knowledge of decision-making processes and creating leadership opportunities
Application of bullying policy in classrooms	Ensuring that the physical environment facilitates communication and interaction	Inviting student input in planning activities

Whole school

Security	Communication	Positive Regard
Establishing confidentiality procedures	Development of teacher teams working with student groups	Increasing the opportunities for students participation in decision making bodies
Development and implementation of anti-bullying policy by staff, students and parents	Establish or enhance pastoral care/home group structures	Training student leadership teams
Teacher professional development in preventing and dealing with incidents of bullying	Introduction of teacher as mentor program	Students involved in reviewing and rewriting policies
Mapping areas of school where students feel unsafe	Enhance role of student support staff	Extending the range of activities that receive public acknowledgement
Supervision of risk or unsafe areas during lunch and recess	Induction programs for teachers focussing on working with young people, including referral procedures for those students experiencing difficulties	Reviewing school discipline policies
Peer mediation/peer support programs	Student forums, parent and community forums	Cross-age tutoring/mentoring/ buddy systems
Reviewing and enhancing transition programs at various transition points	Review of diary use as a means of communicating with parents	Student Action teams
Strengthening counselling and support structures	Social skills programs	Co-curricular activities
		Student councils and committees

School and community

Security	Communication	Positive Regard
Involving wider community in development of anti-bullying policy	Creating welcoming atmosphere for parents and visitors to the school	Foster the participation of parents in school activities, including decision-making and involvement in curriculum
Parent information forums on policies relating to bullying and developing a positive environment	Clear and regular communication with parents	Creating and maintaining an welcoming atmosphere for visitors
After school safety programs	School newsletter	Use of local media to publicise school and student achievements
Creating links between primary and secondary students	Parent surveys	Integrated studies involving work in community
	Joint planning with primary schools	Review and extension of involvement in community-based programs
	Strengthening communication with relevant community agencies via the adolescent health team	Joint initiatives with community organisations
	Community service programs	

Appendix B – Disability weights for health-states in the cannabis model

Cannabis use level	Non-users				Light users				Weekly users				Daily users				
Comorbidity / Age	Nil^	SZP*	HPU§	SZP + HPU	nil	SZP	HPU	SZP + HPU	nil	SZP	SZP + HPU	SZP + HPU	nil	SZP	HPU	SZP + HPU	Dead
10	0.025	0.423	0.263	0.597	0.025	0.448	0.288	0.597	0.045	0.459	0.303	0.605	0.045	0.459	0.303	0.605	1.000
15	0.032	0.420	0.261	0.600	0.032	0.452	0.293	0.600	0.057	0.466	0.312	0.610	0.057	0.466	0.312	0.610	1.000
20	0.040	0.416	0.259	0.603	0.040	0.456	0.299	0.603	0.065	0.471	0.318	0.614	0.065	0.471	0.318	0.614	1.000
25	0.049	0.413	0.257	0.607	0.049	0.461	0.306	0.607	0.068	0.473	0.320	0.615	0.068	0.473	0.320	0.615	1.000
30	0.053	0.411	0.256	0.609	0.053	0.464	0.309	0.609	0.073	0.475	0.323	0.617	0.073	0.475	0.323	0.617	1.000
35	0.057	0.409	0.255	0.610	0.057	0.466	0.312	0.610	0.070	0.473	0.321	0.615	0.070	0.473	0.321	0.615	1.000
40	0.061	0.407	0.254	0.612	0.061	0.468	0.314	0.612	0.073	0.475	0.323	0.617	0.073	0.475	0.323	0.617	1.000
45	0.074	0.402	0.250	0.617	0.074	0.476	0.324	0.617	0.082	0.480	0.330	0.621	0.082	0.480	0.330	0.621	1.000
50	0.083	0.398	0.248	0.621	0.083	0.481	0.331	0.621	0.091	0.486	0.337	0.624	0.091	0.486	0.337	0.624	1.000
55	0.098	0.391	0.243	0.627	0.098	0.489	0.342	0.627	0.098	0.489	0.342	0.627	0.098	0.489	0.342	0.627	1.000
60	0.117	0.383	0.238	0.635	0.117	0.500	0.356	0.635	0.117	0.500	0.356	0.635	0.117	0.500	0.356	0.635	1.000
65	0.143	0.372	0.231	0.646	0.143	0.515	0.374	0.646	0.143	0.515	0.374	0.646	0.143	0.515	0.374	0.646	1.000
70	0.178	0.356	0.222	0.660	0.178	0.535	0.400	0.660	0.178	0.535	0.400	0.660	0.178	0.535	0.400	0.660	1.000
75	0.231	0.334	0.208	0.682	0.231	0.564	0.438	0.682	0.231	0.564	0.438	0.682	0.231	0.564	0.438	0.682	1.000
80	0.285	0.310	0.193	0.704	0.285	0.595	0.478	0.704	0.285	0.595	0.478	0.704	0.285	0.595	0.478	0.704	1.000
85	0.349	0.282	0.176	0.731	0.349	0.632	0.525	0.731	0.349	0.632	0.525	0.731	0.349	0.632	0.525	0.731	1.000
90	0.393	0.264	0.164	0.749	0.393	0.656	0.557	0.749	0.393	0.656	0.557	0.749	0.393	0.656	0.557	0.749	1.000
95	0.415	0.254	0.158	0.758	0.415	0.669	0.573	0.758	0.415	0.669	0.573	0.758	0.415	0.669	0.573	0.758	1.000
100	0.409	0.257	0.160	0.756	0.409	0.665	0.568	0.756	0.409	0.665	0.568	0.756	0.409	0.665	0.568	0.756	1.000

^ Background disability; *SZP: Schizophrenia; §HPU: Heroin and poly-drug use

Appendix C – Cost-offset estimate (in AUD 2003) for health-states in the cannabis model

Cannabis use level	Non-users				Light users				Weekly users				Daily users			
Comorbidity / Age	Nil	SZP*	HPU§	SZP + HPU	nil	SZP	HPU	SZP + HPU	nil	SZP	SZP + HPU	SZP + HPU	nil	SZP	HPU	SZP + HPU
10	-	17,917	1,172	19,089	37	17,954	1,209	19,126	1,467	19,384	2,639	20,556	5,135	23,052	6,307	24,224
15	-	22,647	2,352	24,999	37	22,683	2,389	25,035	1,467	24,114	3,819	26,466	5,135	27,782	7,487	30,134
20	-	22,647	20,547	43,194	37	22,683	20,584	43,230	1,467	24,114	22,014	44,661	5,135	27,782	25,682	48,329
25	-	14,276	19,660	33,936	37	14,313	19,696	33,972	1,467	15,743	21,127	35,403	5,135	19,411	24,795	39,071
30	-	14,276	21,176	35,452	37	14,313	21,213	35,489	1,467	15,743	22,643	36,919	5,135	19,411	26,311	40,587
35	-	9,928	20,804	30,731	37	9,964	20,840	30,768	1,467	11,395	22,271	32,198	5,135	15,063	25,939	35,866
40	-	9,928	14,384	24,311	37	9,964	14,420	24,348	1,467	11,395	15,851	25,778	5,135	15,063	19,519	29,446
45	-	7,944	13,936	21,880	37	7,980	13,973	21,917	1,467	9,411	15,404	23,347	5,135	13,079	19,071	27,015
50	-	7,944	13,936	21,880	37	7,980	13,973	21,917	1,467	9,411	15,404	23,347	5,135	13,079	19,071	27,015
55	-	6,409	13,807	20,216	37	6,446	13,843	20,253	1,467	7,876	15,274	21,683	5,135	11,544	18,942	25,351
60	-	6,409	13,807	20,216	37	6,446	13,843	20,253	1,467	7,876	15,274	21,683	5,135	11,544	18,942	25,351
65	-	10,124	13,765	23,889	37	10,160	13,802	23,926	1,467	11,591	15,233	25,356	5,135	15,259	18,900	29,024
70	-	10,124	13,765	23,889	37	10,160	13,802	23,926	1,467	11,591	15,233	25,356	5,135	15,259	18,900	29,024
75	-	12,008	14,376	26,385	37	12,045	14,413	26,421	1,467	13,476	15,843	27,852	5,135	17,143	19,511	31,520
80	-	12,008	14,376	26,385	37	12,045	14,413	26,421	1,467	13,476	15,843	27,852	5,135	17,143	19,511	31,520
85	-	19,956	15,209	35,165	37	19,992	15,246	35,201	1,467	21,423	16,676	36,632	5,135	25,091	20,344	40,300
90	-	19,956	15,209	35,165	37	19,992	15,246	35,201	1,467	21,423	16,676	36,632	5,135	25,091	20,344	40,300
95	-	19,956	15,209	35,165	37	19,992	15,246	35,201	1,467	21,423	16,676	36,632	5,135	25,091	20,344	40,300
100	-	19,956	15,209	35,165	37	19,992	15,246	35,201	1,467	21,423	16,676	36,632	5,135	25,091	20,344	40,300

*SZP: Schizophrenia; §HPU: Heroin and poly-drug use

Appendix C – Second stage filter criteria – (DRAFT ONLY)

Cost per DALY averted	Strength of evidence	Equity	Acceptability	Feasibility	Sustainability	Relevance to indigenous population	'other effects' (not captured in modelling)
No cost offsets: $63,900 **+ cost offsets CO1*:** $60,400 **+ cost offsets CO2§:** Dominant	"Limited evidence of effectiveness" – The effect is unlikely to be due to chance but it is obtained from only one good quality level II study	Potential to increase inequities if intervention uptake rates are different between schools located in low/high SES areas. However, given the higher rates of drug use in lower SES areas, intervention may offer greater benefit	Consistent with the national drug strategy – Acceptable to the Government. Requires ongoing support from schools, students, local communities and Government	Availability of professionally trained school liaison officers who assist the delivery of intervention may be a potential issue	Likely to be sustainable once established and implemented but requires ongoing support from stakeholders	Relevance – high rate of cannabis use in indigenous population. **However**, there is lower school attendance rate in indigenous adolescents	**Positive:** Reduction in other health risk behaviours such as alcohol and tobacco use May potentially benefit social outcomes such as educational attainment, employment and crime **Negative:**
Decision point: Cost-effective if cost offsets were included	Appropriate evaluation alongside program implementation	Not an issue if uptake of intervention is evenly distributed	Not likely to be an issue but may require advocacy	Workforce may be an issue	Sustainable if implemented	May be an issues in reaching intervention targets	Potentially having wider positive benefits

Policy Considerations: The implementation of a national school-based drug prevention intervention based on the Gatehouse project is very likely to be cost-effective. Further, the intervention has potentials to benefit wider outcomes not included in this evaluation. However, the effectiveness estimate was obtained from only one good quality level II study. The availability of professionally trained school liaison officers may be an issue in term of feasibility. The school-based Gatehouse intervention may not reach intervention targets in indigenous population because of low school attendance.

*CO1 includes medical estimates for cases of schizophrenia, road traffic accident and heroin and poly-drug use;
§CO2 includes CO1 and consumption costs of cannabis and heroin