Cost-effectiveness of interventions for reducing road traffic injuries related to driving under the influence of alcohol

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Keywords: Cost-effectiveness analysis, economic evaluation of alcohol-related road traffic injuries prevention intervention, driving under influence of alcohol, economic evaluation in Thailand, road traffic injury and economic evaluation

Running title: Cost-effectiveness of reducing drink driving

ABSTRACT [First-level Header]

Objective: To determine the cost-effectiveness of interventions to reduce road traffic injuries caused by driving under the influence of alcohol in Thailand.

Methods: We used generalized cost-effectiveness analysis and included costs from a health sector perspective. The model considered road traffic crash victims who were injured, disabled or died. We obtained proportions of alcohol-related crashes from the Thai Injury Surveillance system. Intervention effectiveness was derived from published reviews and a study in one province of Thailand. Random breath testing (RBT), selective breath testing (SBT) and mass media campaigns, both current and intervention scenarios, were compared to a "do nothing" scenario. We calculated intervention costs and cost offsets of prevented treatment costs in 2004 Thai Baht (1USD=41 Baht) and measured benefits in terms of disability-adjusted life years (DALYs) averted. Interventions with incremental cost-effectiveness ratios (ICERs) below 110,000 Thai Baht (1x GDP per capita) per DALY (2,680 $US) were considered very cost-effective.

Results: Compared to doing nothing, mass media campaigns, RBT and SBT are all cost saving. When averted treatment costs are ignored and only intervention costs are included, all three interventions are very cost-effective with ICERs of 10,300, 14,300 and 13,000 Baht/DALY, respectively. The current mix of mass media campaigns and sobriety checkpoints is therefore also cost-effective, but underinvestment in checkpoints limits its overall effect.

Conclusions: A greater intensity of conducting sobriety checkpoints in Thailand is recommended to complement the investment in mass media campaigns. Together these interventions have the potential to reduce the burden of alcohol-related RTI by 24%.

Introduction [First-level Header]

Driving under the influence (DUI) of alcohol increases the risk of crashes, running red lights, violating the speed limit, and failure to use seatbelts and helmets [1,2]. In Thailand in 2004, 24,800 people died and 543,000 were injured due to road traffic crashes leading to an estimated 5,800 new cases of long-term disability [3-5]. Economic loss related to road traffic injuries (RTIs) was high, ranging from 1.7% to 2.3% of Thailand's gross domestic product (GDP) [6]. In 2004, the costs of RTIs were estimated at between 185,000 and 204,000 million Baht (4,510-4,980 million $US) (56% human cost, 25% property damage cost, and 19% general crash costs) [7]. Injury Surveillance (IS) data from 1999 to 2004 showed that 35%-48% of injury victims aged over 15 years had an illegal blood alcohol concentration (BAC) of above 50 mg/100 ml. Only 24%-37% of fatal RTI victims are known to have had an illegal BAC. Victims who died at the scene had no BAC test administered, so this is probably an underestimate of the true proportion attributable to alcohol [8]. The proportion of fatal or non-fatal RTI that was alcohol-related increased to 50-58% during holiday periods [6].

Resources for health and other societal goals are scarce anywhere, including in Thailand, and choices have to be made regarding what interventions to implement. One of the criteria is whether an intervention offers enough health gains relative to the resources invested. In high-income counties, several interventions to prevent DUI have been successfully implemented and are cost-effective [9-14]. Some of these interventions have been adopted in low- and middle-income countries as well, however studies examining local costs, effectiveness, and cost-effectiveness are very limited [1,12,15,16]. Thailand and other low- and middle income countries have committed a high level of resources to the reduction of road traffic crashes, alcohol-related injury, and imbibing [16-19]. Country based economic evaluations can provide policy makers with important evidence when setting policy relating to interventions to reduce road traffic crashes [1,12,15,16,20]. In this study, we evaluated the cost-effectiveness of sobriety checkpoints and mass media campaigns in Thailand.

Methods [First-level Header]

This paper is part of the 'Setting Priorities Using Information on Cost-Effectiveness' (SPICE) project, which conducted economic evaluations of interventions addressing road traffic injuries, cardiovascular disease, depression, schizophrenia, and tuberculosis in Thailand [21,22].

Cost-effectiveness analysis [Second-level Header]

This study used generalized cost-effectiveness analysis (GCEA) using guidelines published by the World Health Organization (WHO) [23,24]. As opposed to the more common incremental analysis in which the comparator is 'current practice', GCEA uses a 'do nothing' comparator that reflects the hypothetical situation in which no intervention was taking place (i.e., it takes away the effect of current practice). This permits to evaluate also interventions that are currently implemented, not only new interventions.

The analysis was performed from a health sector perspective [25]. The time-horizon for intervention implementation was one year with health outcomes and treatment costs measured over a lifetime. All costs and benefits were referenced to 2004 and a 3% discount rate was applied [24]. We express health outcomes as the number of disability-adjusted life years (DALYs) due to fatal RTI (years of life lost; YLL) and long- and short-term disability (years lived with disability; YLD) averted [26-29]. The incremental cost-effectiveness ratio (ICER) of each intervention was compared to willingness to pay thresholds of one and three times GDP per capita for one DALY, which WHO considers the thresholds for 'very cost-effective' and 'cost-effective', respectively [24].

Burden of road traffic injuries [Second-level Header]

In this study, RTIs victims were diagnosed based on ICD-10 coding [30]. The burden of RTIs for this study was derived from 'The national burden of road traffic injuries in Thailand' described elsewhere, but briefly summarized here [3]. The WHO definition was used for defining fatal- and non-fatal RTIs [1]. Deaths were modelled to occur 1) at the scene; 2) at the emergency department; 3) during hospital admission; or 4) at home after discharge due to complications related to the injury. Each death resulted in a number of life

years lost (YLL) that depends on the life expectancy at the age of death. Thai life expectancy was used rather than the 'ideal' standard West-26 life table that is used in burden of disease studies [5]. Non-fatal short- or long-term disability was modelled separately for those attending emergency department only and for admitted cases. Cases of long-term disability were divided into those with and without added risk of mortality to estimate the appropriate average duration of disability. In calculating the number of years lived with disability (YLD), the severity of disability was taken into account by multiplying duration with the disability weights of the GBD study [3].

Costs [Second-level Header]

We calculated the annual costs of interventions and adjusted to 2004 values using the 'core consumer price index' (Bank of Thailand, 2009). A lifelong timeframe was applied to calculate health care costs associated with long-term disability [7, 27]. We included the expenditure on mass media campaigns and the cost of law enforcement [25]. We adopted a provider perspective; a summary of cost is provided in Table 1-2.

Health care costs avoided [Third-level Header]

We calculated RTI treatment costs based on data from a 2004 costing study which covered all 4 regions of Thailand and Bangkok [7]. Treatment costs were classified by injury consequence (fatal, disability, admitted, and non-admitted case) (Table 1). We estimated the proportion of fatal RTI that was treated based on data from the injury surveillance system in 2004 and data from the Royal Thai Police in 2004. Data showed that 45.1% of RTI victims died at the scene, 3.1% in an emergency department, 49.3% during admission, and 2.5% died from complications within or beyond 30 days. We assumed no costs for those who died at the scene.

INSERT TABLE 1 HERE

Costs of sobriety checkpoints [Third-level Header]

Costs related to sobriety checkpoints were obtained from our own bottom-up costing in one metropolitan police unit and one traffic police unit in 2006. Cost estimates were made for staffing time and resources used in 1) stopping vehicles; 2) selecting drivers and administering breath tests; 3) reporting; and 4) dealing with drivers with a positive BAC test. The unit costs of positive breath tests was higher than for negative tests because a proportion of those with a positive BAC test were re-tested for validation purposes, and further costs were involved in obtaining a confession from illegal drink drivers and issuing fines. The metro police's unit cost of BAC tests for negative and positive results was 3831 and 4036 Baht respectively, compared to 4804 and 5063 Baht for traffic police. We used a nationwide survey that reported 12.3% of drivers had a BAC higher than the legal threshold of 50 mg/100 ml to calculate a weighted average cost for a BAC test [31]. The cost of checkpoints (Table 2) was calculated by multiplying this weighted average with the total number of metro-police (88) and traffic police (1,369) checkpoints and their coverage (4.6% for current practice and 100% or every two weeks for the intervention scenario).

Cost of mass media campaigns [Third-level Header]

The current cost of mass media campaigns is an average cost over five years. Data were obtained from the Thai Health Foundation annual reports in 2003-07 [32]. The estimated current expenditure for the whole country mass media campaigns against DUI in 2004 was 186 million Baht or about 3 Baht per person (Table 2). The expenditure on mass media campaigns in 2004 was higher than it was during the intensive mass media campaigns in Khon Kaen, so we assumed that mass media currently achieves its maximum potential effects. The total cost of running the media campaign is applied to the model.

INSERT TABLE 2 HERE

Interventions [Second-level Header]

Effectiveness of sobriety checkpoints [Third-level Header]

There are two types of sobriety checkpoint: a) random breath testing (RBT), where police stop vehicles randomly, and b) selective breath testing (SBT), where vehicles are stopped if drivers show signs of DUI [14,33,34]. In Thailand, there are three types of police checkpoints: 1) regular traffic checkpoints during weekdays; 2) special checkpoints operating during holiday periods such as New Year and Songkhran (Thai New Year) festival; and 3) and SBT and RBT checkpoints outside holiday periods [35].

Sobriety checkpoints are effective in reducing alcohol-related RTIs. A summary of the evidence was published by Elder et al and Shults et al., who reported that sobriety checkpoints (SBT or RBT) reduced alcohol-related RTI by 13%-27% (Table 3) [14,34]. SBT and RBT work through deterrence theory in which drivers perceive that they are at risk of apprehension by police if they drink and drive [34]. Systematic reviews showed that RBT and SBT would be similarly effective in terms of reducing the risk of fatal RTI, injuries, and crashes [14,33,34,36].

This study concentrated on police checkpoints that use breath or blood testing for alcohol, compared to no intervention. Each checkpoint needs 10-15 officers for a typical period of two hours [35]. A study in Khon Kaen municipality in Thailand reported on a strong mass media campaign in combination with at least 1-2 SBT stations per police station per week [37]. We modelled a rollout of this level of intervention intensity to the whole country. In comparison, in Bangkok, the average number of checkpoints was only 2-3 times per police station per year in 2004. This is just 4.6% of the coverage in Khon Kaen which we took as the maximum coverage that could be achieved in Thailand [35]. We assumed for our current scenario that the coverage in the rest of the country was at the same level as in Bangkok and used this rate in our calculation of the partial null or ‘do nothing’ scenario. This may overestimate the coverage elsewhere however it is the only official data available.

Effectiveness of mass media campaigns [Third-level Header]

We define mass media campaigns as road safety advertising campaigns targeting drinking and driving. Several campaigns were designed to increase public recognition of alcohol-related RTI and to persuade their target population to either take personal steps to avoid drinking and driving or to keep others from driving under the influence of alcohol [13,38,39]. The conceptual basis of mass media campaigns emphasizes: 1) message content (e.g. promoting fear of arrest, fear of self harm); 2) message delivery (e.g. target audience, media channels, frequency and time of action of the message); and 3) message pre-testing to ensure the message is understood by the target audience [2,13,38].

A systematic review showed that the median decrease in alcohol-related crashes was 13% (inter-quartile range: 6% to 14%) (Table 3) [13]. It is clear, however, that "accurate information alone is unlikely to motivate people who drink and drive to stop doing so" except for a small group of people already predisposed to change [40]. Mass media campaigns are most likely to reduce DUI if their messages are reinforced by other efforts [13,41,42]. A mass media campaign is therefore a promising intervention when combined with other drinking and driving countermeasures, especially sobriety checkpoints [13,43-45].

In Thailand, drivers were exposed to media campaigns via various modes with television, poster and radio being the foremost routes. The campaigns mainly aim to increase fear of arrest and emphasise the severity of punishment and the consequences of road traffic injuries. The frequency and coverage of media campaigns was higher before and during long holiday periods. Surveys found that in 2004 overall 81% of the public recalled exposure to messages from the DUI mass media campaign [46]. We assumed for our current scenario that coverage in the whole country was reached it maximum level (100%) and used this proportion for calculation the partial null or 'do nothing' scenario and intervention scenario.

INSERT TABLE 3 HERE

Adjusted effectiveness of interventions [Third-level Header]

Sobriety checkpoints and mass media campaigns are community interventions and their effect may vary according to socioeconomic and environmental factors [47]. In this study, the effectiveness for each

intervention is taken from the international literature (Table 3). To adjust for local factors, the effectiveness of mass media campaigns and sobriety checkpoints was adjusted using the study from Khon Kaen [37]. The interventions in Khon Kaen achieved a 23.4% reduction in road traffic crashes. Based on a pooled estimate of the effectiveness of sobriety checkpoints (RBT, SBT) and mass media campaigns from the literature from industrialised countries, a 28.7%-30.4% overall reduction in road traffic crashes would have been expected (Table 3). Presuming the intensity of both the mass media campaign and the sobriety checkpoints in Khon Kaen was comparable to the average intensity of the interventions studied in the international literature; we estimated that the maximum reduction in alcohol-related road traffic crashes that can be achieved in Thailand with these interventions was 76.9% of that estimated in the international literature (we used the upper end of the 28.7%-30.4% range to avoid overestimating effectiveness).

Modelling [Second-level Header]

We developed a decision model in Excel (Microsoft Corporation, Redmond, USA) to measure health effects and costs associated with DUI interventions.

Current and null scenarios [Third-level Header]

Current practice was calculated by multiplying current coverage of mass media and sobriety checkpoints by their adjusted effectiveness [13,14,34,35,46]. Current coverage of mass media campaigns was determined based on expenditure. We defined as ‘full coverage’ the expenditure during the Khon Kaen study which cost 890,000 (770,000-980,000) Baht per year (Personal communication, Kulleab, S; 2010) or 0.51 Baht per head. Current expenditure on mass media campaigns is higher than this (Table 2), so we assumed that mass media currently achieves its maximum effect. We thus estimated that current practice is responsible for a 10.6% reduction in alcohol-related road traffic injuries, which was the average effect observed in international studies into the effect of mass media campaigns (Table 3).

The theoretical 'do nothing' or 'partial null' scenario was calculated by removing the effects of currently implemented interventions, which led to a hypothetical situation with a higher RTI burden than was observed in 2004.

Effectiveness of interventions [Third-level Header]

The interventions were modelled to result in a percentage reduction in the burden of RTI attributable to DUI (Table 3). The number of DALYs (YLL + YLD) attributable to DUI was calculated by applying the proportions of alcohol-related RTIs (by injury consequences, age, and sex) from IS data (1999-2004) provided by the Bureau of Epidemiology, Ministry of Public Health to the total burden of RTI (Table 4 and Figure 1). After an injury, victims' BAC (driver, passenger, occupant, and pedestrian) was measured using a breath or blood test and the result was recorded in IS data collection forms. In this study, all death, severe, mild, and minor injury victims were defined as alcohol-related RTI victims if their BAC or that of the driver involved in the crash was over 50 mg/100 ml. Only those injuries associated with an illegal BAC were included in the model. DALYs averted were calculated by multiplying the full coverage of mass media and sobriety checkpoints by their adjusted effectiveness (Table 3). Costs avoided were calculated by multiplying the number of cases prevented with the average unit costs for death, disability, and hospitalised and non-hospitalised cases (Table 1). The ICER of each intervention was compared to willingness to pay thresholds [24].

INSERT TABLE 4 HERE

Uncertainty analysis [Second-level Header]

Uncertainty was assessed by multivariate probabilistic sensitivity analysis using the Excel add-in software program Ersatz (www.epigear.com, Brisbane, Australia) with 2,000 iterations for each intervention. Table 4 lists the parameters with their distributions.

Results [First-level Header]

Burden of alcohol-road traffic [Second-level Header]

In 2004, 175,000 DALYs (95% uncertainty interval (UI) 152,000-202,000) or 27% of the total burden of RTI was attributed to DUI. Males accounted for 82% (144,000 DALY, 95% UI 122,000-170,000) of the total burden of alcohol-related RTIs. Victims aged 15-29 years-old and 30-44 years-old accounted for 53% and 28% of the total burden of alcohol-related road traffic injuries respectively.

Cost-effectiveness analysis [Second-level Header]

Current practice, with high coverage of mass media campaigns and a very low frequency of checkpoints, is cost effective and more efficient than sobriety checkpoints alone (Table 5). When only intervention costs are included, mass media campaigns are very cost effective with an ICER of 10,300 Baht/DALY averted. Sobriety checkpoints, mass media campaigns, and the combination have a 100% probability of being cost-effective against a threshold of one times GDP per capita. All interventions and their combination are cost saving if potential cost-savings due to avoided injury treatments are also included.

The combination of a mass media campaign and SBT or RBT yielded the highest gain in health, avoiding 24% (95% UI 19%-29%) and 22% (95% UI 19%-26%) of the burden of alcohol-related RTI (Table 5). SBT or RBT alone averted 15% (95% UI 10% to 21%) to 14% (95% UI 10% to 17%) of this burden. Mass media campaigns reduced it by 10% (95% UI 6% to 14%) while current practice reduced the number of DALYs related to DUI by 11% (95% UI 7% to 14%).

INSERT FIGURE 1 HERE

INSERT TABLE 5 HERE

Discussion [First-level Header]

Against a willingness to pay threshold of one time gross domestic product per capita (110,000 Baht) in 2004 (Bank of Thailand, 2009), all interventions are very cost-effective and are cost saving if avoided injury treatment costs are included.

Current practice is cost effective compared to doing nothing. Most of the DALYs currently averted (93.5%) resulted from mass media campaigns against DUI; current practice is characterised by well-funded mass media campaigns and every low frequency and coverage of sobriety checkpoints. Recently, only 9% of people expressed concern about being stopped by police for a BAC test, which shows the deterrent effect at current implementation levels is very low [48]. In Thailand, mass media campaigns were very cost effective and can reduce burden of alcohol-related RTI by 17,300 DALYs (95% UI 10,600-28,100) at a cost of 10,300 Baht/DALY averted. These results were calculated based on the expenditure on mass media that was 6 times higher than during the study in Khon Kaen that we used as a benchmark. In addition, in a survey in 2008 93% of Thais aged 15 or over reported exposure to content of mass media anti drinking and driving [46]. This suggests that mass media campaigns might already provide their maximum benefit, for enough money was allocated and high coverage was achieved. Continued investment to maintain current effectiveness levels of mass media campaigns seems prudent [49].

Sobriety checkpoints are also highly cost-effective compared to doing nothing. At full coverage, sobriety checkpoints could avert about 15% (26,500 DALYs) of the total burden of alcohol-related RTI. The international evidence showed that SBT and RBT provide similar effects [14,34]. In this study, the same operation cost was assumed, and as a consequence similar cost effectiveness ratios were found. Thailand can obtain more benefits if the frequency of checkpoints is increased. Checkpoints are currently implemented at a low frequency and have little impact on the toll of road traffic injuries [35,51]. A potential barrier to increasing the intensity of checkpoints is that police may be reluctant to cooperate unless they are given incentives or clear directions [52]. Furthermore, corruption could reduce the effectiveness of the intervention but we assume that the lower effectiveness in the Khon Kaen study compared to the international literature captures the impact of corruption.

The combined effect of mass media campaigns and sobriety checkpoints can potentially more than double compared to current practice and avert 24% (41,700 DALYs) of the burden of alcohol-related RTI. To gain more health, Thailand must focus on sobriety checkpoints.

Some limitations exist in this study. First, the Khon Kaen study implemented a high frequency of checkpoints and intensive mass media campaigns and the study was conducted under close collaboration between police, public health and local government using 'chief executive officer' management [37]. This intensity of this intervention regarding sobriety checkpoints may not be easily replicated countrywide. Thus we may have overestimated effects by assuming same effectiveness if the intervention were replicated in the whole country. Second, we assumed a lower effectiveness in Thailand compared to findings in developed countries. However, this lower effectiveness is based on the assumed imperfect implementation practice in Thailand. Greater effects may be reached if implementation practices in Thailand improve.

The cost of a mass media campaign was obtained from the Thai Health Foundation, which is the main funder that provides money to other organizations that carry out mass media campaigns. This may have led to underestimation of the current investment in media campaigns because other organizations such as the 'Drunk Don't Drive club' runs campaigns with funds from motor vehicle companies, but we could not obtain cost estimates from them. However, even without this additional expenditure, more is spent on mass media campaigns than in Khon Kaen between 2000 and 2002 during intensive mass media campaigns. This only strengthens the conclusion that expenditure on mass media campaigns is sufficient.

This study may have overestimated treatment costs of RTI because treatment costs and cost-offsets were obtained from a study that collected data from tertiary hospitals. These hospitals are considered injury centres in Thailand and more serious RTI victims are referred there by community and provincial hospitals. Treatment costs in Thailand are known to vary by type of hospital, consequences and severity

of injury [53]. For this reason, we present our results with and without the expected savings in treatment costs.

The last limitation relates to the perspective. We used the health sector perspective with the inclusion of intervention costs (on the basis that they are made with the aim of improving health), as this best allows our results to be compared with those for other diseases in the SPICE project [21,22]. A more appropriate perspective for the evaluation of interventions that prevent traffic injuries, however, would be a societal perspective. This would include all loss due to road traffic injury, including e.g. loss of future income, loss to family members caring for disabled individuals, damaged property and cost of judiciary [7]. The use of a societal perspective would only improve the ICERs for the interventions in this study and therefore not alter our conclusions, while the data requirements would be large.

A strength of our study is its use of local parameters to estimate the burden of alcohol-related RTI by age and sex, actual local costs of running police checkpoints, and costs of mass media campaigns. In addition, we adjusted the effectiveness of interventions using a local study. We obtained most of the data with their degree of uncertainty, and incorporated this into our analysis. Our findings are supported by a recent study by WHO, which found that drink-driving legislation with enforcement via breath testing campaigns is cost-effective in south-east Asia [50].

Conclusions [First-level Header]

Thailand has already implemented both sobriety checkpoints and mass media campaigns; however the current coverage of checkpoints is low. Increased implementation of sobriety checkpoints can generate significant health gains in a cost-effective manner. However, without increases in workforce capacity, it may be difficult for police stations to undertake a checkpoint at least once a week. In the past, police have declined to participate in increasing sobriety checkpoint coverage [52,54]. Until staffing issues can be resolved, organising checkpoints once every two weeks and reducing the number of police officers at a checkpoint from five to three could be a temporary alternative [55].

Increasing the frequency and coverage of sobriety checkpoints requires a greater budget allocation. In 2003-2007, 6.6% (186 million Baht per year) of the total annual budget (2,150 million Baht) that the Thai Health Foundation received from taxes related to alcohol and cigarette sales was spent on mass media and alcohol-related road traffic injury prevention [32]. Reaching the maximum benefit would require an extra 329 million Baht for sobriety checkpoints. While this would almost triple the current budget, compared to the income the government is receiving from alcohol taxation, the cost is modest (15.3% of total budget). Based on our results, increasing coverage of sobriety checkpoints is the first priority. In addition, other interventions such as increasing the price or decreasing the availability of alcohol during holidays should be considered to further reduce the burden of RTI [34,44,56].

Acknowledgements [First-level Header]

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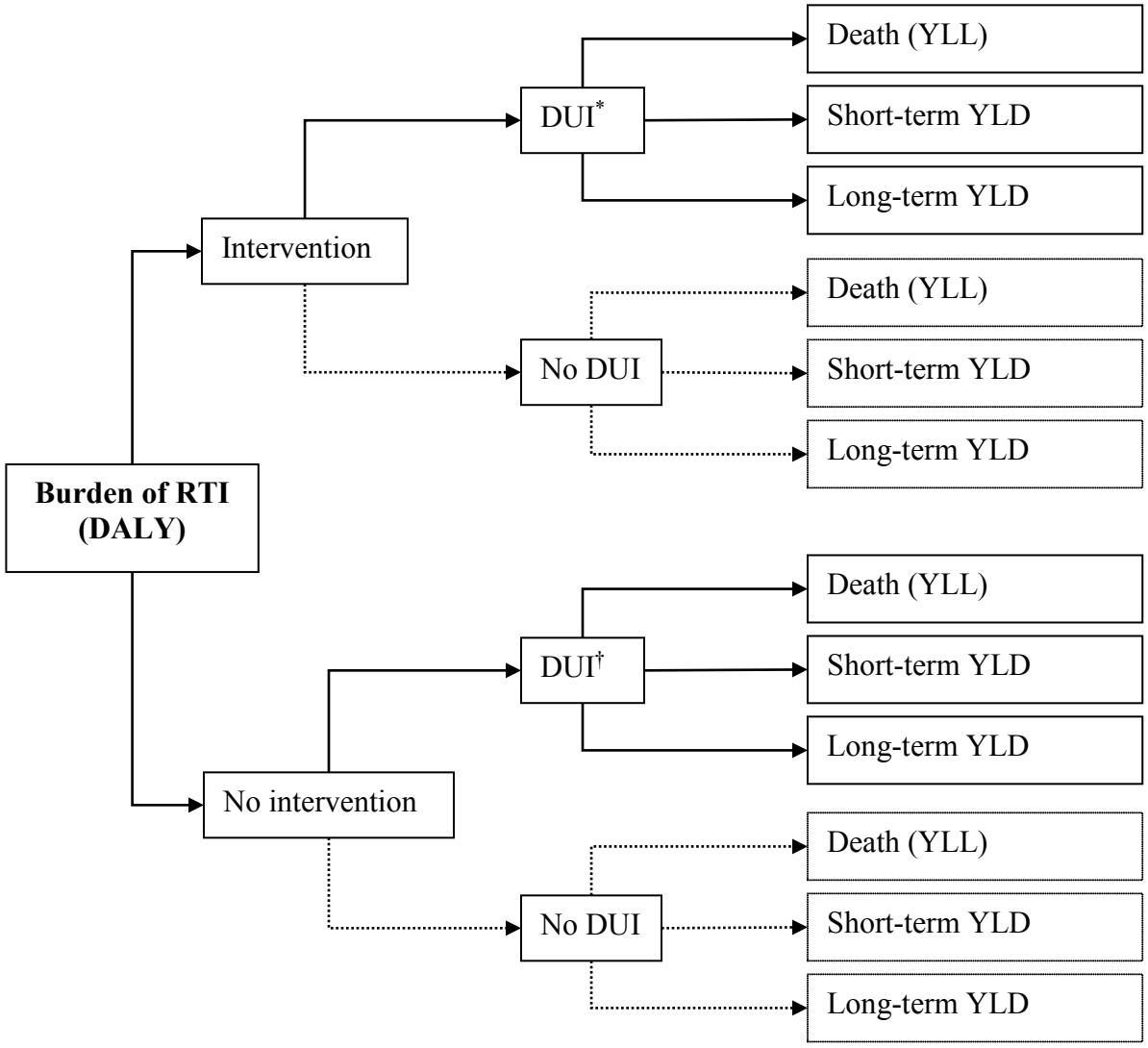

* Intervention scenario
† Null scenario
YLL is year of life lost from premature death.
YLD is year of live with disability.

Figure 1: Schematic diagram of the decision tree used to measure health outcomes (disability adjusted life year averted; DALY) associated with drinking and driving.

Table 1 Health care costs per RTI victim in 2004

Health care cost	Unit cost (Baht)*	95% Uncertainty interval
1. Fatal case [7] †		
Medical cost	9,000	7,500-10,200
Emergency medical service cost	1,100	700-1,600
2. Disability case‡ [7]		
Medical cost	11,000	10,400-11,600
Emergency medical service cost	1,100	700-1,600
Long-term care cost	600,000	505,000-724,000
3. Admitted case [7]		
Medical cost	18,000	17,000-20,000
Emergency medical service cost	1,100	700-1,600
4. Non-admitted case [7]		
Medical cost	570	540-610
Emergency medical service cost	1,100	700-1,600

More detail related to this table were discussed in the text under 'Health care costs avoided '

* 55.4% was paid under the universal coverage, 6.7% under the Civil Servants Medical Benefit Scheme, 12.2% under the Civil Servants Medical Benefit Scheme, 26.6% was out-of-pocket, and 0.1% under the Motor Vehicle Accident Victim Protection Insurance.

† Data from the Royal Thai Police in 2004 showed that 45.1% fatal RTIs died at the scene. For these we assumed no treatment cost applied.

‡ In the literature, disability was diagnosed before RTI victims were discharge from hospital and most of cases were physical limitation or disability.

Table 3 Effects of interventions for reducing alcohol-related RTI

Intervention	Effectiveness	
	International literature	Adjusted effectiveness Thailand *
1. Sobriety checkpoints		
SBT [14, 34]	Reduction DUI-related fatalities/injuries 20% (13%-27%)	15% (10%-21%)
RBT [14, 34]	Reduction DUI-related fatalities/injuries 18% (13%-22%)	14% (10%-17%)
2. Mass media campaigns [13] †	Reducing road traffic crashes 13% (6%-14%)	10% (5%-11%)
3. RBT with mass media‡	29% (18%-32%)	22% (15%-26%)
4. SBT with mass media‡	30% (18%-37%)	24% (15%-29%)
5. Current practice §		10.6% (5.1%-11.6%)

* 76.9% is maximum effect and adjusted factor of intervention if it is implemented in Thailand. The assumption is based on effectiveness of mixed interventions from Khon Kaen (23.4%) and international literatures (30.4%).

† In fact, several checkpoints and mass media campaigns usually found more reducing sever crashes than less sever crashes, but some study no different in reducing fatal- and non-fatal alcohol-related were reported, while in this study, we assumed that both interventions produce the same reduction in fatality and injury.

‡ Effectiveness of combined interventions was calculated multiplicatively.

§ Current coverage of sobriety checkpoints was 4.6% and mass media was estimated at 100%.

Table 2 Total intervention costs of current and intervention scenarios in 2004

Intervention	Cost* (Baht in one year)	
	Current scenario (range)	Intervention scenario (range)
1. Sobriety checkpoints (SBT or RBT)		
Metropolitan police†	775,000 (770,000-811,000) Bath	17,649,985 million
Traffic police †	15.1 (15.0-15.8) million	344,293,922 million
2. Mass media campaigns per year [32]	186 (87-250) million	186 (87-250) million

* In 2004, 41 Thai Baht was equal to one international dollar.

† Cost in 2004 was calculated defining one checkpoint per week per police station (88 metro police and 1,369 traffic police stations) as ‘full coverage’ (each police station must conduct sobriety checkpoint once a week) and a current coverage level of 4.6%.

Table 4 Input parameters, descriptions and distributions

Parameter	Source	Distribution
1. Fatal RTIs [5]	Result from sampling uncertainty analysis of RTI death in Thai VA study 2004-05: 24,815 cases (22,408-27,248)	Lognormal
2. Cases of non-fatal RTI	Hospital data (DRG-2004), Health Welfare Survey (HWS-2003), and Injury Surveillance data (1999-2004)	Poisson
3. Long-term disability weights [4]	Adopted from our analysis of Thai study on long-term health consequences from road traffic injuries in 2006: DW 0.57 (0.51, 0.65)	Beta
4. Proportion of long-term disability	Adopted from Thai study on long-term health consequences from road traffic injuries in 2006*	Binomial
5. Proportion of alcohol-related road traffic crashes	Injury Surveillance data 1999-2004†	Binomial
6. Effectiveness of interventions	Effectiveness of SBT, RBT, and mass media from interventional literature (see table 3)	Beta
7. Current coverage of sobriety checkpoints [35]	Coverage of sobriety checkpoints was obtained from metro police (in Bangkok in 2004) 4.6%	Binomial
8. Costs	See table 1 and 2	Lognormal

* Percentage with long-term disability from RTI in admitted patients (by age group and gender; M/F): 0-4 (8.11/7.5), 5-14 (2.31/3.73), 15-29 (4.59/3.07), 30-44(4.99/3.58), 45-59 (5.81/6.02), 60-69 (10.61/2.08), 70-79 (4.12/6.67), and 80+ (15.38/0.00).

† Proportion of fatal-alcohol-related RTI (by age group and gender; M/F) 0-4 (3.85/0.86), 5-14 (3.38/0.78), 15-29 (28.03/3.72), 30-44(32.48/6.12), 45-59 (31.18/5.18), 60-69 (20.11/3.19), 70-79 (9.45/1.91), and 80+ (10.20/1.69). Proportion of non-fatal-alcohol-related RTI (by age groups and gender; M/F) 0-4 (3.27/0.36),

5-14(2.30/0.71), 15-29 (46.95/7.97), 30-44 (54.57/10.09), 45-59 (45.12/6.65), 60-69 (29.37/3.19), 70-79 (16.65/2.41), and 80+ (9.89/2.73)