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Jan van Amsterdam¹, Gjalt-Jorn Ygram Peters², Ed Pennings³,
Tom Blickman⁴, Kaj Hollemans⁵, Joost J Jacobus Breeksema⁶,
Johannes G Ramaekers⁷, Cees Maris⁸, Floor van Bakkum⁹,
Ton Nabben¹⁰, Willem Scholten¹¹, Tjibbe Reitsma¹², Judith Noijen⁹,
Raoul Koning⁹ and Wim van den Brink¹

Abstract

Background: Ecstasy (3,4-methylenedioxymethamphetamine (MDMA)) has a relatively low harm and low dependence liability but is scheduled on List I of the Dutch Opium Act ('hard drugs'). Concerns surrounding increasing MDMA-related criminality coupled with the possibly inappropriate scheduling of MDMA initiated a debate to revise the current Dutch ecstasy policy.

Methods: An interdisciplinary group of 18 experts on health, social harms and drug criminality and law enforcement reformulated the science-based Dutch MDMA policy using multi-decision multi-criterion decision analysis (MD-MCDA). The experts collectively formulated policy instruments and rated their effects on 25 outcome criteria, including health, criminality, law enforcement and financial issues, thematically grouped in six clusters.

Results: The experts scored the effect of 22 policy instruments, each with between two and seven different mutually exclusive options, on 25 outcome criteria. The optimal policy model was defined by the set of 22 policy instrument options which gave the highest overall score on the 25 outcome criteria. Implementation of the optimal policy model, including regulated MDMA sales, decreases health harms, MDMA-related organised crime and environmental damage, as well as increases state revenues and quality of MDMA products and user information. This model was slightly modified to increase its political feasibility. Sensitivity analyses showed that the outcomes of the current MD-MCDA are robust and independent of variability in weight values.

Conclusion: The present results provide a feasible and realistic set of policy instrument options to revise the legislation towards a rational MDMA policy that is likely to reduce both adverse (public) health risks and MDMA-related criminal burden.

Keywords

Ecstasy, XTC, MDMA, risk assessment, MCDA, adverse effects, criminality

Introduction

Ecstasy (3,4-methylenedioxymethamphetamine (MDMA)) is a widely used drug, mainly by urban, higher educated, young adults at dance events and house parties (Nabben, 2010). Typically, ecstasy is used only a few times a year (Nabben et al., 2018; Szigeti et al., 2018; Van Laar and Van Ooyen-Houben, 2017). In the Netherlands, MDMA was placed on List I of the Dutch Opium Act ('hard drugs'; Schedule A in the UK) in 1988, that is, three years after the World Health Organization (WHO) Expert Committee on Drug Dependence had recommended that MDMA should be included in Schedule I of the 1971 Convention on Psychotropic Substances. The basis for this decision was unclear, and still is. The WHO technical report stated that at that time, there were no data 'available concerning its clinical abuse liability, nature and magnitude of associated public health or social problems, or epidemiology of its use and abuse' (WHO, 1985). Therefore, it remains unclear why MDMA was classified as a substance 'whose liability to abuse constitutes an especially serious risk to public health' (WHO, 2003). One argument for 'scheduling' MDMA in Schedule I was that there was insufficient evidence for any therapeutic benefit. In The Netherlands, MDMA was scheduled on List I of the Opium Act because of concerns about large-scale trade and production of ecstasy, not

¹Department of Psychiatry, Amsterdam University Medical Center, University of Amsterdam, Amsterdam, The Netherlands

²Faculty of Psychology, Open University of the Netherlands, Heerlen, Netherlands

³The Maastricht Forensic Institute, Maastricht, The Netherlands

⁴TNI, Amsterdam, The Netherlands

⁵KH Legal Advice, Den Haag, The Netherlands

⁶Department of Psychiatry, Leiden University Medical Center, Leiden, The Netherlands; University Centre of Psychiatry, University Medical Centre Groningen, Groningen, The Netherlands

⁷Department of Neuropsychology and Psychopharmacology, Faculty of Neuroscience and Psychology, Maastricht University, Maastricht, The Netherlands

⁸Faculty of Law, University of Amsterdam, Amsterdam, The Netherlands

⁹Jellinek, Amsterdam, The Netherlands

¹⁰Department of Urban Management, Faculty Society and Law, Amsterdam University of Applied Sciences, Amsterdam, The Netherlands

¹¹Willem Scholten Consultancy, Lopik, The Netherlands

¹²Stichting Drugsbeleid, Haarlem, The Netherlands

Corresponding author:

Jan van Amsterdam, AMC, P.O. Box 75867, Amsterdam, 1070AW, The Netherlands.

Email: jan.van.amsterdam@amc.uva.nl

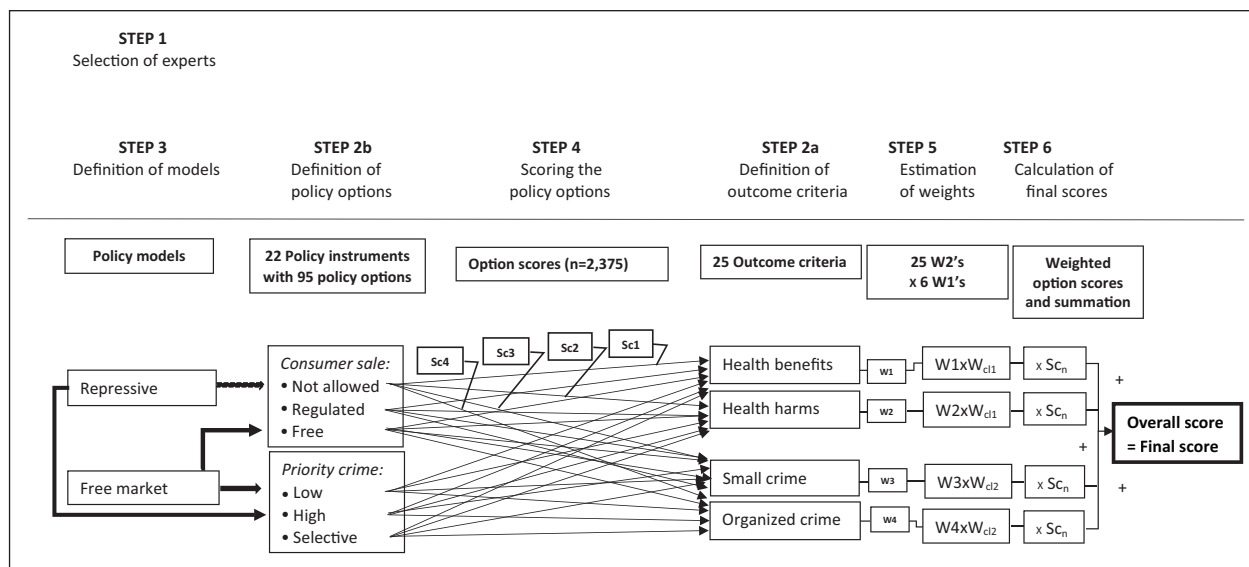


Figure 1. The six steps of the multi-decision multi-criterion decision analysis. Wcl1 to Wcl6 represent the six cluster weight factors; $W1 \times Wcl1$ (in Table 3 described as $W1 \times W2$): 25 overall weight factors; Sc_n to Sc_{n+1} are the scores for the policy options obtained in step 4; multiplication of the overall weight factor of the criterion with Sc_n gives the weighted option score. Summation of 22 weighted selected policy options gives the overall score (final score) of a constructed model.

because of emerging health concerns. Despite this listing, last-year prevalence of ecstasy use has steadily increased ever since, but stabilised in recent years at around 3% of the adult population (Van Laar et al., 2019). Another issue is that MDMA has meanwhile been recognized as a promising pharmacological add-on to psychotherapy of patients with PTSD. Such benefits, as well as the adverse effects and health risks of MDMA, have been recently reviewed (Van Amsterdam et al., 2020a, 2020b).

The dependence liability of MDMA is low, and its use is generally less harmful than other List I drugs (e.g. amphetamine, cocaine and heroin; Nutt et al., 2010; Van Amsterdam et al., 2010). One may therefore question whether the current scheduling of MDMA is justified. Despite being a List I substance, MDMA is illegally produced in The Netherlands in large quantities and further distributed worldwide. The illegal MDMA production in The Netherlands has been accompanied by a steady increase in serious crime, including the dumping of chemical waste by clandestine drug laboratories, money laundering, threats to civil servants and the penetration of criminal interests in the 'upper world' in the last two decades (Tops et al., 2018; Tops and Tromp, 2019). Faced with increasing public awareness of a possibly inappropriate scheduling of MDMA and the growing concerns about MDMA-related crime, many Dutch policymakers and influencers are currently considering a revision of the national MDMA policy.

To provide a rational basis for this challenging task, a multi-disciplinary group of 18 experts was invited to participate in decision meetings to develop a science-based and politically feasible MDMA policy (Hall and Lynskey, 2009). Using the multi-decision multi-criteria decision analysis (MD-MCDA) approach, a more extensive variant of MCDA (Nutt et al., 2010; Rogeberg et al., 2018), the experts formulated 95 policy instrument options and scored their effects on 25 outcome criteria. The experts' final

aim was to identify the optimal MDMA policy model, that is, a policy model with the highest gain and the lowest damage in terms of public health, criminality, financial burden and other factors. In MD-MCDA, weighting factors are assigned to the outcome criteria which allow subsequent summation of effects on a set of unrelated outcomes (e.g. health harms plus crime-related costs). The MCDA approach was previously successfully applied to rank four policy models for alcohol and cannabis (Rogeberg et al., 2018) and the relative harm of some 20 drugs (Van Amsterdam et al., 2015a, 2015b).

In the current report, we describe the MD-MCDA-facilitated definition of the rational and optimal MDMA policy model which was slightly fine-tuned to increase the political feasibility. The present results may guide the development of feasible and realistic instruments to revise the legislation of a rational MDMA policy that considers both adverse (public) health risks and MDMA-related criminal burden.

Methods

MD-MCDA assessment procedure

A consensus procedure using MD-MCDA was applied with different iterations, considering previously obtained information to reach the next rating; that is, with each iteration, this information is passed on to the next iteration. The different steps in this process are outlined below (see also Figure 1).

Step 1: Selection of experts

The steering group (J.v.A., G.J.P., F.B., T.N. and J.N.) invited 18 experts to participate in the expert panel. The prerequisite for selection was that every expert had a specific expertise and was independent or acted independently, that is, they were not bound

Table 1. Description of the 95 policy instrument options sorted per policy instrument ($n=22$). The 22 options with the description ‘not applicable’ (always scored as zero) are not included.

Policy instruments		Policy instrument options	
Nr.	Name	N	Description
1	Possession	4	Tolerate user quantity, user quantity is legal and large possession tolerated, prohibit all or allow all
2	Packaging	4	Plain message, prevention message, both messages or no requirements
3	Advertising	5	Age-related advertising, advertising on the packaging, only business to business, prohibit all or allow all
4	Sales (companies)	5	Trade in ecstasy between companies: regulated, in analogy with commodity legislation, in analogy with pharmaceutical legislation, prohibit or allow
5	Sales (to users)	5	Sales of ecstasy to consumers: regulated, in analogy with commodity legislation, in analogy with pharmaceutical legislation, prohibit or allow
6	Age limit	3	For purchase and/or use of legalised ecstasy: none, 18 or >18years
7	Penalisation	3	Sanctioning of consumer, seller or none of the two in case of violation of age limit
8	Legal requirements for selling	2	For sellers of legalised ecstasy: no criminal record and high drug education level or no requirements
9	Pricing policy	2	Pricing policy of legalised ecstasy: minimum price or no restrictions
10	Quality rules	2	To be set for ecstasy products: yes or no
11	Sanctioning QA rules ^a	3	Sanctioning for violation of quality rules (none, light, heavy)
12	Monitoring	3	Level of monitoring product quality, prevalence and incidents: none, selective, regularly
13	Health education	3	Subsidising health education about ecstasy (not, minimally, largely)
14	Control prevention	3	Drug control primarily by the government (not, weak, strong)
15	Health information	2	Focus on abstinence or harm reduction
16	Type of government	4	National, regional, municipality or no governmental body is responsible for drug policy
17	Production	5	Production of MDMA ^b : regulated, in analogy with commodity legislation, in analogy with pharmaceutical legislation, prohibit or allow
18	Export	2	Legalise or not
19	International treaties	6	The Dutch position is an exceptional position, compliant, adjusted, tolerating, violating, inter se
20	Fighting crime	3	Prioritisation of fighting crime: low, selective for serious crime, high
21	Maximum penalty	2	Increase for illegal production and trafficking of MDMA or not
22	Confiscation	2	Increase efforts to seize profits gained through MDMA production and trading or not
Sum 1–22		73	

^aQA: Quality assurance

^bMDMA: 3,4-methylenedioxyamphetamine.

by or accountable to political parties or ministries involved in either drug policy or drug enforcement. The expertise represented in the expert panel included the following domains: pharmacology, toxicology, pharmacy, philosophy, ethics, anthropology, drug enforcement, epidemiology, neurobiology, medicine, philosophy of law, criminology, law, national and international drug policy, drug prevention and behavioral sciences.

Step 2: Definition of policy instruments and outcomes

Every drug policy consists of a set of policy instruments with an impact on predefined outcomes. In step 2a, the experts selected 25 outcome criteria (e.g. prevalence of use, health and social harms, criminal burden, crime costs and stigmatisation) grouped in the following six clusters: (a) use, (b) user health, (c) crime, (d) financial, (e) international and (f) environment (cf. Table 1, upper panel). A seventh outcome cluster – (g) ‘consistent with either conservative or liberal values’ – was included, but the scores were excluded from the analysis because of their high level of

subjectivity. In step 2b, the expert group formulated 22 policy instruments, each having between two and seven options, thus resulting in 95 policy instrument options (cf. Table 1).

Step 3: Definition of five policy models

A policy model is defined as a set of distinct choices for each of the 22 policy instruments, and the purpose of the MD-MCDA process is to identify the policy model that achieves the highest overall weighted score on the policy outcomes: the optimal model. To compare this optimal model to other commonly referenced policy proposals, we also defined four drug policy models by identifying how these would be defined in terms of our 22 instruments. These comparison models were (a) the coffee-shop model, (b) the adapted coffee-shop model, (c) the free market and (d) the repressive model. Models (a) and (b) reflect two drug models described in the current Dutch legislation: the coffee-shop model and the adapted coffee-shop model with legal production and delivery of cannabis to the coffee shop (Commission Knottnerus, 2018; Dutch Government, 2019c). Similarly, the free

Table 2. Preset anchor values of outcome criteria if different from -100 or +100 (12 of 25 outcomes).

Nr.	Outcome	Maximal negative effect	Maximal positive effect
2	Magnitude of use (frequency and dose)	-100	50
3	Use by vulnerable groups	-50	100
8	Shift to other (more harmful) drugs	-100	25
11	Criminalisation of users	-100	50
12	Small crime	-100	50
15	International trafficking of MDMA	-10	100
17	State revenue through VAT	0	100
18	State revenues through other taxes	0	100
19	Health-related costs	-100	50
23	Damage due to international economic boycotts	-100	0
24	Damage due to international legal counter measures	-100	0
25	Environmental damage (ethical consideration)	-40	100

market and the repressive model (models (c) and (d)) with their typical characteristics were constructed by assembling the applicable policy options.

After the scoring of all policy options and the weight factors (see below), the optimal policy model was automatically generated by combining the 22 highest rated options per policy instrument. In a similar way, the worst policy model was assembled by combining the 22 lowest rated options. In some cases, two to three instrument options with the same score were applicable. The optimal model was slightly modified/tweaked to a so-called X-shop model to increase the political feasibility of the optimal model, and because it contained some mutually incompatible options. The X-shop model was constructed by selecting the applicable set of instrument options which legally impose regulated distribution and sales of ecstasy. The overall score of the five policy models was compared with that of the optimal and worst policy model.

Step 4: Scoring the effects of policy instrument options

Based on their own expertise, the selected experts rated the effect of the policy instrument options on the outcome criteria. In addition, experts shared their expert information with the other members of the panel, and they were provided with an extensive state-of-the-art document, covering the published and grey literature about the 25 outcomes related to ecstasy (Van Amsterdam et al. 2020a, 2020b).

Each of the 22 policy instruments has several (2-7) possible options resulting in 95 policy instrument options, each of which may have a different impact on each of the 25 policy outcomes. Prior to scoring the 95 policy instrument options, consensus anchor values were set by the experts for each of the 25 outcomes, which represent the estimated maximal negative and maximal positive impact (effect) that a specific policy instrument can have on the outcome. As a rule, the anchors were set at zero for the current legal situation (i.e. MDMA on List I of the Dutch Opium Law), at -100 for a maximal negative impact and at +100 for a maximal positive impact compared to the current situation. However, for 12 of the 25 outcomes, the status quo more closely

approximated the worst or best possible situation. In such cases, the anchors were adjusted to reflect this (cf. Table 2; e.g. there are currently no economic boycotts so that the situation can only deteriorate, leading to a maximum anchor value of zero).

Guided by a moderator (who did not participate in the scoring), the experts rated the (relative) impact of each of the 95 policy instrument options on all 25 outcomes yielding 2375 (95×25) scores, where the score of the policy option reflecting the current situation was set to zero. Scoring was conducted over three days in two parallel groups of experts. To attain a good balance between the ratings, every set of the 22 policy instrument options was scored groupwise (i.e. per cluster in one session), and the rating of all sets of policy instrument options was successively completed per cluster. After the exchange of arguments and new information, consensus about the ratings was usually attained. If not, the average of the individual scores was set as the final score. Following each rating session, group members were asked to rate their confidence in the set of scores just given on a scale from 0 to 100. Finally, experts were given the opportunity in plenary sessions to challenge and adjust the obtained scores at the end of the day.

Steps 5 and 6: Weighting factors and final scores

According to MC-MCDA, every outcome criterion within the outcome cluster and the six outcome clusters must be weighed against each other to account for their relative impact on the overall (final) score of the policy models per se, as well as to adjust for clusters with relatively many outcomes (i.e. a cluster containing six outcomes adds up threefold more scores than a cluster containing two outcomes). First, every expert selected the most important outcome in each cluster and set its weight on 100. Next, every expert assigned per cluster a weight value to the remaining criteria in that cluster, relative to the just designated most important outcome of that cluster ($n=25$ W2s; on a scale of 0-100). Finally, the same procedure was applied for the six weight values (W1) of clusters A-F. The mean value of each experts' weight values (W1s and W2s) was calculated (cf. Table 3). The weighting factor of the cluster with the highest mean value was set at 100, and the residual five cluster weights (W1s) were

Table 3. Weighing factors (W1) of the six outcome clusters in the upper panel and the 25 outcome criteria with their mean weighing factor (W2) and their overall weighing factor (W1 × W2) in the lower panel.

Cluster	Outcome cluster	W1 (as rated)	W1 (%)
A	Use	69	18
B	User health	100	26
C	Crime	89	24
D	Financial	36	10
E	International	25	7
F	Environmental damage (ethical consideration)	58	15
Sum A–F			100

Nr.	Cluster	Outcome criterion (cluster item)	W2 ^a	Overall weight ^b
1	A	Prevalence in the general population	74	3.9
2	A	Magnitude of use (frequency and dose)	100	5.3
3	A	Use by vulnerable groups	96	5.1
4	B	Health harms	100	7.6
5	B	Health benefits	45	3.5
6	B	Social harms	69	5.3
7	B	Social benefits	47	3.6
8	B	Shift to other (more harmful) drugs	69	5.2
9	B	Drug quality and use information	91	7.0
10	B	Stigmatisation of users	72	5.5
11	C	Criminalisation of users	76	5.2
12	C	Small crime	33	2.2
13	C	Organised crime related to MDMA	100	6.8
14	C	Organised crime not related to MDMA	81	5.6
15	C	International trafficking of MDMA	65	4.4
16	C	Targeting of vulnerable groups by organised crime	80	5.5
17	D	State revenue through VAT ^c	47	1.3
18	D	State revenues through other taxes	41	1.1
19	D	Health costs	100	2.8
20	D	Crime costs	87	2.4
21	D	Costs due to environmental pollution	73	2.0
22	E	Damage to the Dutch Image	51	1.0
23	E	Damage due to international economic boycotts	77	1.5
24	E	Damage due to international legal counter measures	100	1.9
25	F	Environmental damage (ethical consideration)	100	4.4
Sum 1–25				100

^aAs rated, but rescaled between 0 and 100.

^bOverall weight factor based on W2 × rescaled W1 (for details, see Methods).

^cIn the EU, illegal goods, including illegal drugs, are not subject to VAT.

rescaled accordingly (related to 100). The mean W2 values were multiplied by the rescaled W1 of the corresponding cluster. Using the sum of the 25 W2 values, the overall weight factor of each outcome criterion (W1 × W2) was rescaled to proportions (sum of the 25 overall weight factors = 100). The final scores per policy option were obtained by multiplying the option score by the corresponding overall weight factor (cf. Table 1). Summation of the 550 (22 × 25) weighted final option scores gives the overall score (final score) of the model.

Results

According to MDMA's scheduling on List I of the Dutch Opium Law, the production, import, export, possession, advertising, trade

and sales to consumers related to MDMA are currently prohibited in The Netherlands. Consumption of MDMA is not prohibited. The following issues related to MDMA have not been described in Dutch legislation: packaging requirements, age limit for users, price, quality requirements and management and licenses for sale.

The experts collectively rated the effect of the 95 policy instrument options on the 22 outcomes ($n=2375$ scores) and individually attributed a weight value for each of the 25 outcomes and the six outcome clusters. The mean values of the overall weighting factors are depicted in Table 3. Based on these final scores per policy option, the overall scores of the different policy models were obtained by summation of the appropriate 25 final scores (see below for results).

Obviously, the worst model and the optimal model reflect the bounds that all possible models will always fall between

Table 4. The 22 policy instrument options that collectively lead to the optimal model (i.e. options giving the highest overall score for the 25 outcomes) and the improvement/deterioration compared to the current situation.

Instrument	Best instrument option	Score ^a
Legal requirements for selling	Only license holders may sell	1611
Monitoring	Extensive	1538
Quality rules	Quality requirements are laid down by law	1412
Production	Similar to pharmaceutical legislation	1161
Health education	The government largely subsidises	1027
Confiscation	More expertise and effort needed	914
Sanctioning QA rules	Violation is punished severely	907
Sales to users	Regulated	896
Sales between companies	Similar to pharmaceutical legislation	881
Punishable	Seller is punishable if not adhering to the age limit	729
Health information	Harm reduction	609
Packaging	'Plain packaging' + prevention message	520
Pricing policy for sale to users	A legally determined minimum price	435
Age limit	No age limits	290
Advertising	All advertising is allowed	203
Priority crime fighting	Selective (high priority for serious MDMA-related crime, but low priority for that of consumers)	88
Export	Export is legalised	48
Maximum penalty	Increase current maximum penalty	27
International treaties	Inter se	5
Control prevention policy	Predominantly by prevention organisations	0
Which government ^b	National and regional government	0
Possession	Tolerate user quantity	-29
Sum		13,270

^aA positive/negative number indicates an improvement/deterioration compared to the current situation.

^bResponsible for prevention policy.

Table 5. The final overall score of six policy models, the optimal model and the worst possible model compared to the current situation (set as zero). Worst score (minimum score) was -7252.

Policy model	Overall score
Optimal (maximum score)	+13,270
X-shop	+12,834
Adapted coffee shop	+10,721
Coffee shop	+5,528
Free market	-2,244
Repressive	-2,778

(i.e. the window). The higher the overall score, the better the model. The optimal (best possible) policy model scored 13,270 points higher/better than the current situation, which was set at zero (cf. Tables 4 and 5). The worst possible model scored 7252 points lower/worse than the current situation (cf. Table 5). Figure 2 shows the benefits of the optimal model per outcome compared to the current situation. In particular, the main benefits of the optimal model are gains in health and social benefits, better prevention of MDMA-related organized crime, as well as increased state revenues. These benefits are accomplished by selecting policy instrument options from those described in Table 4 (see Supplemental Table S2 for the 22 selected options), including legal requirements for selling ecstasy, monitoring and

quality requirements for ecstasy. In the worst possible model, certain policy instrument options had a strong negative impact on the overall score, whereas other options had little or no effect or even a small positive effect on the overall score (heat maps are available in the Open Science Framework repository for this project). In particular, repressive policy options such as 'possession prohibited', 'high priority for fighting serious crime', 'no subsidy for health education', 'abstinence as prevention perspective' and 'no monitoring' strongly decreased the overall score, indicating that – based on the available scientific evidence – experts rated those options as having a (very) negative impact on important outcomes.

In order to position the optimal model, the characteristics of the optimal model and two legal drug models in The Netherlands (the coffee-shop model and the adapted coffee-shop model) were compared in terms of policy instrument options and overall scores. The characteristics of the three policy models with their applicable instrument options are depicted in Supplemental Table S1. Table 5 depicts the overall score of the optimal model and the two legal policy models, and shows that the optimal model scores better than the adapted coffee-shop model and the coffee-shop model. The characteristics of the optimal model and the X-shop model are described in Table 6.

To accommodate both political feasibility and social acceptance of regulated ecstasy sales, the optimal model was slightly adjusted at six minor points to construct a new, a nearly optimal and a politically more feasible model: the X-shop model. Of the

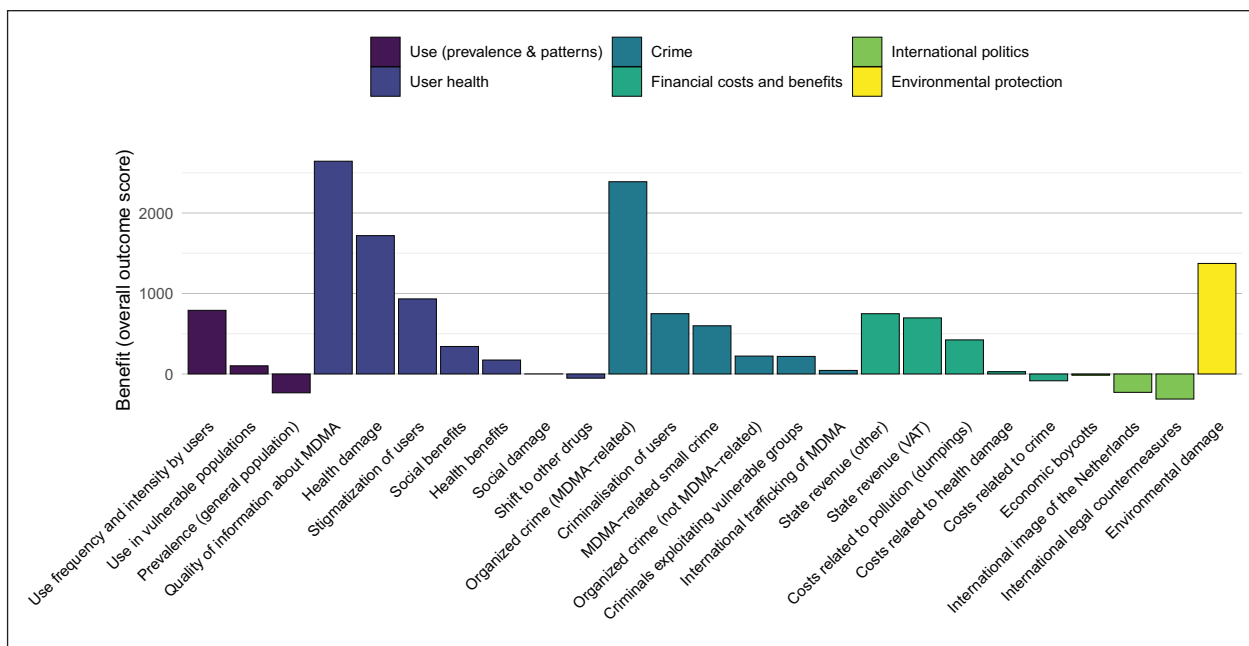


Figure 2. Effects of the optimal policy, consisting of the best-scoring policy instrument options, on the 25 outcomes.

Table 6. Characteristics of the optimal model and the X-shop model.

Optimal model

- Sales of MDMA to users is legally regulated, whereas that between companies complies with pharmaceutical legislation. Only license holders may sell MDMA to users. There are no user age limits, but MDMA must be sold at a fixed minimum price, ‘plain’ packaged with a prevention message and meet quality requirements as imposed by law; violation of QA rules is severely punished. Possession of a user quantity of MDMA is tolerated and all advertising is allowed.
- MDMA production is legalised but is subjected to licensing and production rules similar to pharmaceutical legislation.
- Fighting serious MDMA-related crime is prioritised (but low for consumers), whereby the current maximum penalty is increased and more expertise and effort is generated to confiscate illegitimately obtained properties. Export of MDMA is legalised and an inter se position for the new model within international drug treaties will be applied for.
- The national/regional government is responsible for the prevention policy and subsidises health education. Predominantly prevention organisations supply of information about health effects and is focused on harm reduction. Adverse effects of MDMA use will be extensively monitored.

X-shop model

Specifications deviating from the optimal model: (a) user quantity is legal and larger quantities tolerated, (b) all advertising is prohibited, (c) sales of MDMA to users is subjected to pharmaceutical legislation (d) age limit is 18 years, (e) export is illegal and (f) all governmental bodies are responsible for prevention policy.

six adjustments (see Supplemental Table S2), the change in the possession option from ‘tolerate user quantity’ to ‘user quantity is legal and a large quantity is tolerated’ and the advertising option from ‘allowed’ to ‘prohibited’ had the strongest negative impact on the overall score compared to the optimal model (decreases in overall score by 148 and 203 points, respectively). The other four adjustments, such as the sales to users option from ‘regulated’ to a ‘pharmaceutical legislation regime’ and the government responsible for prevention policy option from ‘national/regional’ to ‘all governmental bodies’, had much smaller effects on the overall score of the optimal model (see Supplemental Table S2 for a detailed description of the policy options of the X-shop model). Figure 3 summarizes the differences in outcomes between the X-shop model, the optimal model and the other four policy models at cluster level. It shows that the optimal model is superior at all cluster levels, except in

some cases for international status. Furthermore, despite the six minor changes introduced, the scores at cluster level of the optimal model and X-shop model are virtually the same which is agreement with minor difference in overall score (cf. Table 5).

Sensitivity analyses

Two types of sensitivity analyses were conducted to assess the robustness of the findings to changes in the scores and the weights that were employed. To explore the first, all the scores with a confidence rating lower than a given threshold were replaced by the highest possible score for each policy option, zero or the lowest possible score for each policy option. Next, we repeated this procedure stepwise with steps of 0.1 points for all confidence thresholds between 0 and 1. This procedure revealed

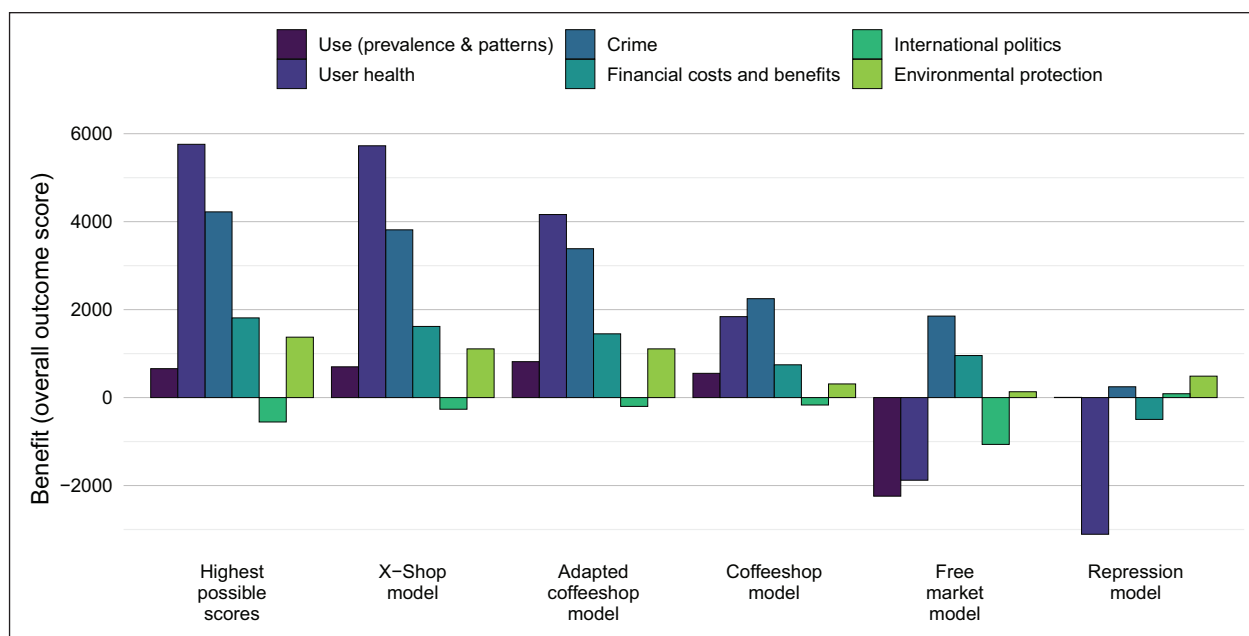


Figure 3. Effect of six policy models on the six cluster outcomes. Highest possible scores refers to the optimal model.

two clusters: a high scoring (better outcome) cluster containing the optimal model, the X-shop model, the coffee-shop model and the adapted coffee-shop model, and a low scoring (worse outcome) cluster containing the free market model and the repression model. The models sometimes changed rank order within their cluster when many estimates were replaced by the highest and lowest possible estimates, but the models in the high cluster never scored equal to or lower than models in the low cluster (and vice versa). Robustness against changes in weight factors was assessed by computing each model's scores using the weight values given by the experts individually instead of the average weights. As a result, the same stable clustering of the six models as described above in a "high" scoring and "low" scoring cluster was obtained, that is, the same stable clustering of the six models as described above was obtained when the weightings factors of each expert were applied. Inspection of the individual weighting factors shows that the experts ranked all six models in (virtually) the same way (cf. Supplemental Figures S1 and S2).

Discussion

The current MD-MCDA based on experts ratings of 95 policy options on 25 policy outcomes has led to the development and description of an optimal model with the overall best outcome as basis for a new and science-based MDMA policy in The Netherlands. The optimal model proposes regulated MDMA sales and predicts decrements in health harms, MDMA-related organized crime and environmental damage, as well as increments in state revenues, quality of MDMA products and user information. The optional model was then slightly modified into the X-shop model – a model that is considered to be politically more feasible and will presumably lead to health and social benefits, although with a minor increase in the prevalence of use. Presumably, user health is most improved by legal obligations to formulate legal requirements for selling ecstasy, to monitor and

to control the quality of ecstasy pills (cf. Table 4). Another important element of the optimal model is the firm decrease in the level of MDMA-related organised crime (cf. Figure 2). The latter is crucial to obtain societal and political support from the so-called law-and-order political parties that value reductions in crime highly, in particular crime intertwined with Dutch ecstasy production and consumption. Furthermore, the proposed X-shop model provides – based on the ratings given in the assessment – better protection of vulnerable users, although the incrimination of users will slightly increase due to stricter regulation under the optimal regime. According to the proposed X-shop model, the prevalence of ecstasy use will slightly increase because of the higher availability and the implicit governmental legitimization of ecstasy use. On the other hand, better pill quality rules and improved health education will in our view counterbalance the slight increase in ecstasy use and lead to a safer use of ecstasy with an overall reduction in adverse health effects. Moreover, the seven outcome criteria in the cluster 'user health' collectively indicate a profound improvement in user's benefits and risks compared to the current situation (cf. Figure 3). Despite a slight increase in prevalence of use, an increase in the level of ecstasy dependence is not expected mainly because of the low dependence potential of ecstasy (Alderliefste and Damen, 2018; EMCDDA, 2019; Van Laar et al., 2019). A specific advantage of regulated ecstasy sales in the X-shop model is the modest generation of state revenues consisting of VAT, income tax, fees of license holders and excise duties. More relevant, however, are the financial benefits resulting from a reduction in costs of health care, environmental pollution and crime, including lower expenses for drug enforcement (see below).

The optimal model includes the inter se option for treaty modification, as provided by Article 41 of the 1969 Vienna Convention on the Law of Treaties. The inter se modification is a procedure specifically designed to find a balance between treaty regime stability and the need for change in the absence of consensus,

whereby a group of two or more like-minded states could reach agreements among themselves that permit the production, trade and consumption of scheduled substances for non-medical and non-scientific purposes, while minimising the impact on other states and on the goals of the drug conventions (Boister and Jelsma, 2018). Following international consultations and negotiations through the *inter se* option, neighboring countries may implement comparable legislation. Legal producers in The Netherlands can then supply high quality MDMA products to consumers in those countries (and vice versa). The more countries adapting such legislation, the more effectively MDMA-related organised crime is sidelined. One of the proposed elements of the optimal model is more efficient confiscation of goods and finances obtained by the illegal production of and trade in MDMA, including better coordination with foreign partners. An even more important element of this regime is prioritisation of fighting crime intertwined with the production of and trade in MDMA. However, it is beyond the scope of this investigation to outline initiatives in the frame of more efficient and smarter investigation methods in drug enforcement. Moreover, a number of innovative targets have already been mentioned by the Minister of Finance and the Minister of Justice and Security in their letter to the Dutch parliament describing initial contours of the broad-based offensive against organized, subversive crime (Dutch Government 2019a, 2019b, 2019d).

Strengths and limitations

The main strength of the current study is that the expert panel consisted of experts from a broad range of expertise domains. Their specific expertise was extended by supplying them with an extensive state-of-the-art literature review about ecstasy, covering all outcome criteria (Van Amsterdam et al., 2020a, 2020b). Moreover, rating of the policy options was performed in an efficient manner using a structured decision-making model with a broad range of policy instruments and outcomes as the building blocks for a revised national ecstasy policy model. Compared to some other consensus models, the current approach is fully transparent. The judgements and weights currently used by the expert panel can be varied, so that the effects of these variations on the outcome (best model) can be easily tested (a publicly available website fully disclosing the data facilitates such testing). Moreover, the sensitivity analyses performed indicated the high robustness of the outcomes. For instance, the outcomes of the current MD-MCDA exercise were robust against (extreme) changes in judgements and weights. The main limitation of this project is the selection of the experts and their individual assessments, both of which may suffer from subjectivism that arises from personal, ethical and/or political views. However, the impact of this potential bias has been mitigated by (a) deliberately including experts from law enforcement agencies and experts with a relatively conservative attitude towards the liberalisation of drug laws, and (b) regularly challenging the experts during the rating sessions to give science-based arguments for their rating. Furthermore, the selection of policy instruments and outcomes was not idiosyncratic but rather based on previous studies on similar issues (Nutt et al., 2007, 2010; Rogeberg et al., 2018; Van Amsterdam et al., 2015a, 2015b). Finally, sensitivity analyses showed that the outcomes of the current MD-MCDA are robust and independent of both the uncertainty of the ratings and

any extreme position(s) taken by individual experts. Therefore, we believe that the proposed models represent the currently most adequate evidence-based estimation of benefits and risks of different national ecstasy policies, including The Netherlands and other countries.

Conclusion

Using MD-MCDA, the optimal MDMA policy model, as well as its slightly fine-tuned variant (i.e. the X-shop model), can serve as a new initiative to adjust the legal basis of the Dutch MDMA policy because it predicts a major health benefit and takes into account the current criminal burden. Given the robustness of these models, it is likely that this will also be true for the MDMA policy in other countries.

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ORCID iDs

Jan van Amsterdam  <https://orcid.org/0000-0002-8847-4387>

Gjalt-Jorn Ygram Peters  <https://orcid.org/0000-0002-0336-9589>

Joost J Jacobus Breeksema  <https://orcid.org/0000-0002-8787-4610>

Judith Noijen  <https://orcid.org/0000-0003-0684-2527>

Raoul Koning  <https://orcid.org/0000-0003-1833-5696>

Supplemental material

Supplemental material for this article is available online.

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