Research Report

European Addiction Research

Eur Addict Res 2010;16:202–207
DOI: 10.1159/000317249

Published online: July 2, 2010

Ranking the Harm of Alcohol, Tobacco and Illicit Drugs for the Individual and the Population

Jan van Amsterdam[a] Antoon Opperhuizen[a] Maarten Koeter[b, c]
Wim van den Brink[b, c]

[a]Laboratory for Health Protection Research, RIVM, Bilthoven; [b]Academic Medical Center University of Amsterdam, Department of Psychiatry, and [c]Amsterdam Institute for Addiction Research, Academic Medical Center, Amsterdam, The Netherlands

Key Words
Legal classification of drugs · Ranking illicit drugs · Recreational drugs

Abstract
Drug policy makers continuously face a changing pattern of drug use, i.e. new drugs appear on the market, the popularity of certain drugs changes or drugs are used in another way or another combination. For legislative purposes, drugs have mostly been classified according to their addictive potency. Such classifications, however, lack a scientific basis. The present study describes the results of a risk assessment study where 19 recreational drugs (17 illicit drugs plus alcohol and tobacco) used in the Netherlands have been ranked by a Dutch expert panel according to their harm based on the scientific state of the art. The study applies a similar approach as recently applied by Nutt et al. [Lancet 2007;369: 1047–1053], so that the results of both studies could be compared. The harm indicators scored are acute and chronic toxicity, addictive potency and social harm. The aim of this study is to evaluate whether the legal classification of drugs in the Netherlands corresponds with the ranking of the drugs according to their science-based ranking of harm. Based on the results, recommendations are formulated about the legal classification of recreational drugs at national and international level which serves a rational approach for drug control.

Introduction

Despite the fact that illicit drugs are known to retain adverse health effects on the user and to put a large burden on society, it is unrealistic to expect that recreational drug use will ever cease completely. Drug policy makers are facing a continuously changing pattern of drug use, i.e. new drugs appear on the market, the popularity of certain drugs changes or drugs are used in another way or another combination.

The aim of public health authorities and organizations is to limit the adverse health and social effects of drug use. Obviously, the policy measures to be taken should focus on the drugs that are most harmful for either the user or the society, or both. In the past, drugs have, therefore,

KARGER

Fax +41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

1022–6877/10/0164–0202$26.00/0

Accessible online at:
www.karger.com/ear

Dr. J.G.C. van Amsterdam
RIVM, PO Box 1
NL–3720 BA Bilthoven (The Netherlands)
E-Mail jan.van.amsterdam@rivm.nl

been legally classified according to their adverse health effects, notably their addictive potency. For example in the Netherlands, drugs have been classified into two groups, whereas in the UK drug legislation distinguishes three different groups of drugs with increasing harm. The major drawback of such classifications is that they lack a scientific basis. Recently, this became apparent in the study of Nutt et al. [1], which demonstrated for a variety of recreational drugs a poor relation between the legal classification and the science-based ranking of their harm.

The present study describes the ranking of 19 recreational drugs (17 illicit drugs plus alcohol and tobacco) used by the Dutch population according to their harm based on the scientific state of the art. The aim of this study is to evaluate whether the legal classification of drugs in the Netherlands corresponds with the ranking of the drugs according to their science-based ranking of harm. The study applies a very similar approach as Nutt et al. [1] so that the results of both studies can be compared. The harm indicators that were scored are acute and chronic toxicity, addictive potency and social harm. Based on the results, recommendations will be formulated about the legal classification of recreational drugs at national and international level which serves a rational approach for drug control.

Methods

The paper describes the assessment and ranking of the harmful effects of 19 recreational drugs, i.e. 17 illicit drugs plus alcohol and tobacco. The 17 illicit drugs were (in alphabetical order): amphetamine, anabolic steroids, benzodiazepines, buprenorphine, cannabis, cocaine, crack cocaine, ecstasy, GHB, heroin, ketamine, khat, LSD, magic mushrooms, methamphetamine, methadone, and methylphenidate. Based on the available data in the literature, fact sheets were written which described the state of the art on the following issues: acute and chronic toxicity, addictive potency, social harm, and the prevalence of use. Fact sheets included the publicly available data about criminal involvement, healthcare costs, global morbidity and mortality, and drug-related disease burden. Considering the size of the fact sheets (500–1,700 words), they cannot be part of this paper, but are available on request.

Nineteen Dutch experts with a variety in expertise were invited to assess the harmful effects of the 19 drugs. Experts that were involved in the preparation of the fact sheets could not participate as a member in the expert panel. The expert panel consisted of 7 basic scientists (5 toxicologists, 1 pharmacist and 1 pharmacologist), 8 clinicians (3 addiction psychiatrists, 4 addiction physicians, and 1 doping expert) and 4 experts from the social domain (2 policemen, 1 epidemiologist, 1 social scientist/anthropologist). Based on the data described in the fact sheets and their own scientific/professional experience, experts were asked to give on two occasions for all 19 drugs a score from 0.0 to 3.0 (one digit allowed) for each of the following four items: acute toxicity, chronic toxicity, addictive potency, and social harm. The scores for acute and chronic toxicity were averaged and defined as total physical harm so that three scores per drug were obtained. In a meeting with all experts, the scores given in the first round were reviewed and extreme values were discussed using the Delphi method. Following this procedure, the experts gave the second (and final) score. During the meeting, however, the experts noted that the score of social harm was not unequivocal, and expressed the need to give in the second (and final round) two separate scores for social harm: one social harm score at individual level, i.e. the social harm of the drug for the individual himself or herself, and one social harm score at the population level taking into account the prevalence of the use of the specific drug. As a result, four final scores were obtained for each drug: physical harm, addictive potency, social harm at individual level, and social harm at population level. Finally, the mean harm score is defined as the averaged value of the scores for physical harm, addictive potency and social harm. As social harm was scored twice, i.e. at individual and at population level, two mean harm scores were obtained, i.e. the mean harm score at individual (user) level and the mean harm score at population level. The experts gave their scores with one digit so that mean values are depicted in two digits.

The Dutch mean harm scores for the drugs were also compared with those obtained in the previous study of Nutt et al. [1]. Only 16 of the 19 drugs could be compared, because Nutt et al. did not assess the harm of magic mushrooms, crack cocaine and methamphetamine. To appropriately compare the data, the Dutch mean harm score at the individual level and the British mean harm score was calculated from the British dataset after deletion of the physical harm scores for intravenous use, because Dutch drug users hardly use this route of administration. The strength of the relation was quantified in the product moment correlation coefficient.

Results

Fact Sheets

The rating group, invited to give feedback about the content of the fact sheets to the authors, approved the fact sheets disseminated to all experts before the Delphi meeting. The only more relevant corrections communicated during the meeting concerned the overestimated cardiovascular harm of the steroids in the fact sheet about anabolic drugs, and the higher dependence liability of high GHB use.

Rating Process

As a result of the discussion of the first ratings during the Delphi meeting, the value of the harm scores increased slightly (plus 10–20%) as compared to the scores given in the first round. For all drugs the absolute difference between the first and second mean harm scores

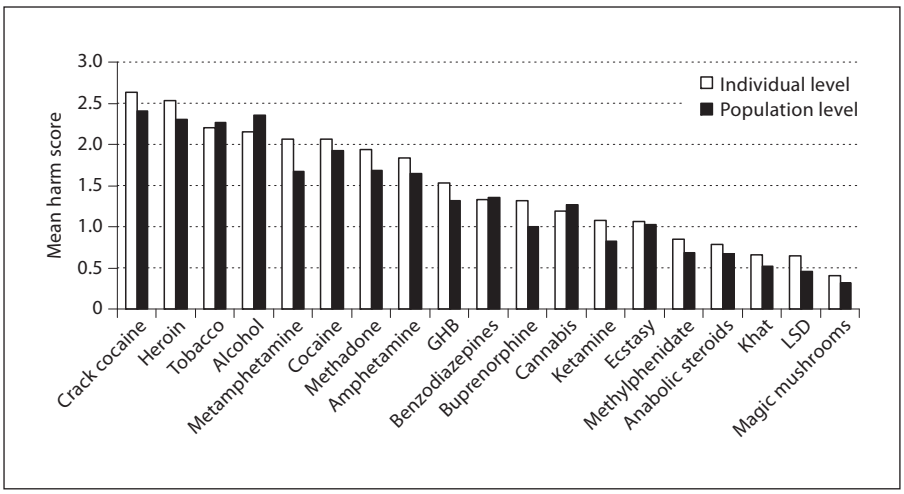

Fig. 1. Mean harm score of drugs at individual (user) level and population level. Mean harm is defined as the averaged value of the scores for toxicity, dependence and social harm (either at individual or population level) of the drugs.

Table 1. Mean score given by 19 experts to assess the harm of 19 drugs at individual and population level

	Mean harm score		Physical harm			Dependence	Social harm		
	individual level	population level	mean physical harm	acute toxicity	chronic toxicity		individual level	population level	difference
Crack cocaine	2.63	2.41	2.51	2.39	2.63	2.82	2.55	1.89	0.66
Heroin	2.53	2.30	2.20	2.37	2.03	2.89	2.50	1.78	0.72
Tobacco	2.20	2.27	1.71	0.53	2.89	2.82	2.06	2.28	–0.22
Alcohol	2.16	2.36	2.18	1.89	2.47	2.13	2.16	2.76	–0.61
Methamphetamine	2.06	1.67	2.11	2.03	2.18	2.24	1.84	0.56	1.29
Cocaine	2.06	1.93	2.00	1.95	2.05	2.13	2.05	1.66	0.39
Methadone	1.94	1.68	1.68	1.95	1.42	2.68	1.42	0.68	0.73
Amphetamine	1.84	1.64	1.80	1.71	1.89	1.95	1.76	1.18	0.58
GHB	1.53	1.32	1.32	1.84	0.79	1.71	1.55	0.92	0.63
Benzodiazepines	1.33	1.36	0.87	0.97	0.76	1.89	1.24	1.32	–0.08
Buprenorphine	1.31	1.00	0.99	1.21	0.76	1.71	1.24	0.29	0.95
Cannabis	1.19	1.26	1.18	0.84	1.53	1.13	1.26	1.47	–0.21
Ketamine	1.07	0.82	1.24	1.55	0.92	0.84	1.13	0.39	0.74
Ecstasy	1.06	1.03	1.34	1.34	1.34	0.61	1.24	1.13	0.11
Methylphenidate	0.85	0.69	0.88	0.92	0.83	0.86	0.81	0.33	0.47
Anabolic steroids	0.78	0.67	0.84	0.45	1.24	0.71	0.79	0.45	0.34
Khat	0.66	0.52	0.67	0.39	0.95	0.76	0.55	0.13	0.42
LSD	0.65	0.46	1.08	1.47	0.68	0.03	0.84	0.26	0.58
Magic mushrooms	0.40	0.31	0.51	0.89	0.13	0.03	0.66	0.39	0.26

The mean harm score is the averaged score of physical harm (toxicity), dependence and social harm. Drugs have been ranked according to the value of the mean harm score at individual level. Difference: social harm at individual level – social harm at population level.

ranged from –0.25 to +0.28 on the scale from 0 to 3 (mean change 0.07). Mean harm scores at individual and population level given by basic scientists were very similar to those given by clinicians (correlation coefficient of 0.97 and 0.96, respectively).

Dutch Ratings and Ranking

Figure 1 shows the Dutch ranking of the 19 recreational drugs (the mean harm scores are depicted in table 1). It appeared that alcohol, tobacco, heroin, crack cocaine, and (meth)amphetamine were rated as being most harm-

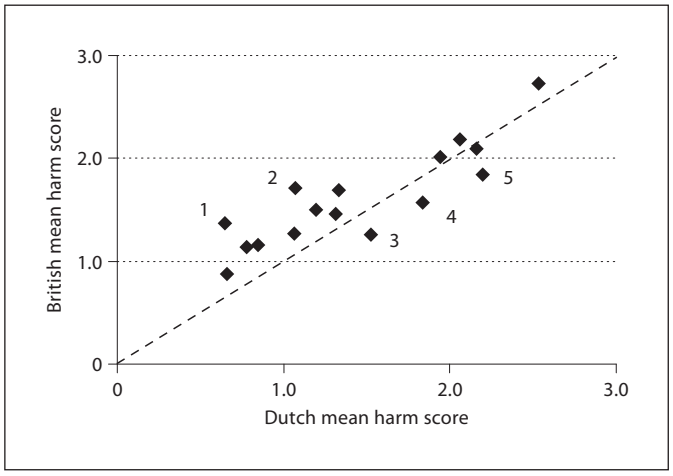

Fig. 2. Correlation between the mean harm scores of 16 drugs given by Dutch and British experts. Correlation coefficient is 0.87. Drugs which were scored differently by Dutch experts as compared with the British experts, i.e. deviating from the dashed reference line, were LSD (1), ketamine (2), GHB (3), amphetamine (4), and tobacco (5).

ful, that benzodiazepines, GHB, cannabis, ecstasy and ketamine scored in the moderately harmful range, and that magic mushrooms, LSD and khat were rated as least harmful. However, the ranking according to the mean harm score clearly depended on whether it was based on the social harm score at population level or at individual level. The comparison of both rankings results in some remarkable differences. The score for social harm at individual level appeared to be consistently higher than the social harm score at population level, except for ecstasy, benzodiazepines, cannabis, tobacco and alcohol. For the latter drugs the social harm score at user level (individual level) was about as high as (or even higher than) the social harm score at population level. As shown in figure 1, this resulted in similar scores for the mean harm at individual and population level of ecstasy, benzodiazepines, cannabis, tobacco and alcohol, in contrast to the other drugs, where the mean harm score at individual level was higher as compared to that at population level.

Comparison of the Dutch and British Rankings

It appeared that the Dutch assessment based on the harm of the drug for individual user resulted in a ranking that correlated very well to the one previously obtained by the British expert panel [1]. Figure 2 reflects this good correlation (correlation coefficient 0.87) between the Dutch and British (individual) mean harm scores of the drugs, although the Dutch experts gave in general somewhat lower scores than the British experts (1.49 ± 0.68 and 1.67 ± 0.45, respectively). The Dutch experts gave slightly higher scores (points below the dashed line in fig. 2) for tobacco (+0.35), amphetamine (+0.26), GHB (+0.26) and alcohol (+0.06). Remarkably, ketamine (+0.47) and LSD (+0.55) were judged by the British experts to be more harmful than according to the Dutch experts. The higher British score for LSD is mainly due to the much higher score of 1.23 given for the item 'dependence' (Dutch score 0.03), whereas for ketamine all items were scored higher by the British experts. Regarding the higher Dutch mean harm score of tobacco, it appeared that this was mainly due to higher score for the item 'dependence' (2.82 vs. 2.21) and social harm (2.06 vs. 1.42) as compared to the respective British scores.

Discussion

The main result of this study is a ranking of 19 recreational drugs according to their mean harm score, i.e. their overall potential harm, consisting of acute and chronic toxicity of the drugs, their addictive potency and their social harm (fig. 1, table 1). The main outcome is that alcohol, tobacco, heroin, crack cocaine, and (meth)amphetamine were rated as being most harmful, that benzodiazepines, GHB, cannabis, ecstasy and ketamine scored in the moderately harmful range, and that magic mushrooms, LSD and khat were regarded to be least harmful. This means that the 19 Dutch experts assessed the legal 'drugs' alcohol and tobacco as more harmful than many of the illegal drugs with the exception of heroin and crack. The highly debated listing of drugs like cannabis and ecstasy were ranked as being moderately harmful drugs.

Except for the study of Nutt et al. [1], no studies have ranked the harm of a similar set of recreational drugs using the four subscores physical harm, addictive potency, social harm at individual level, and social harm at population level. Previously, others have ranked or attempted to rank the adverse effects of recreational drugs based on drug-related disease and drug dependence [2], drug dependence [3], the ratio of effective dose and lethal toxicity [4, 5], toxicity profiles of the drugs [6] or a combination of these items [7]. Indeed, comparable results were obtained using our approach, although the previous studies assessed a lower number of drugs and resulted from different methodologies. Present results are in close agreement with those reported by the Strategy Unit of the

UK Cabinet Office from 2005 [8], which ranked a set of recreational drugs with respect their harm (i.e. acute and long-term harm, damage to social functioning, and potential addictiveness).

In contrast to the British study of Nutt et al. [1], standard fact sheets describing the state of the art were provided to all experts prior to the assessment, in order to secure the availability of adequate up-to-date information to all judges and to increase the transparency of the assessment. In addition, the Dutch experts gave two scores for social harm which results in a more balanced ranking of the drugs. Nevertheless, it appeared that the ranking performed at population and individual level generally led to the same ranking (correlation coefficient of 0.98).

The ranking procedure applied has two important limitations. The physical harm of drugs consisting of acute and chronic toxicity and addictive potency are well defined and known properties of the drugs. In contrast, the spectrum of social harm is very broad and its items are relatively ill defined, which hampers an objective rating of the social harm of drugs, especially when a variety of drugs are to be compared. For instance, a social harmful effect, like the aggression induced by alcohol, is not relevant for sedative drugs. In conclusion, many social harmful effects are only applicable to some but not all drugs. Despite this limitation, the score for social harm must be included in procedures where the harm of drugs is compared. Moreover, agreement between experts on social harm ratings and rankings was good, i.e. basic scientists and clinicians gave comparable ratings of social harm at individual and population level (correlation coefficients 0.93 and 0.95, respectively). Secondly, the simple adding (or calculation of the mean value) of the ratings given for the different items (table 1) is arbitrary, and implies that all items have an equal contributing value to total harm. However, to assign weight factors to each item is difficult to determine and highly arbitrary, as well. Finally, for the 19 drugs, remarkable differences between the two social harm scores are observed (see right panel of table 1). For instance, the difference between the two social harm scores for methamphetamine (1.29) and that for magic mushrooms (0.26) has a positive value which implicates that the social harm at an individual level is assessed as being higher than the social harm at the population level and probably this difference is mainly due to the low prevalence of use of both methamphetamine and magic mushrooms in the Netherlands. Moreover, the fact that this difference is larger for methamphetamine than for magic mushrooms indicates that a higher rate of magic mushrooms use would probably not result in large social harms at population level (because of the small difference between the two social harm scores for magic mushrooms), whereas one may expect so if methamphetamine use would become more prevalent in the Netherlands. It is of more interest when the difference has a negative value, as it is for tobacco, alcohol and cannabis, because this implicates that the social harm at the population level is assessed as higher than the social harm of these substances at an individual level.

The present results largely confirm previous results obtained by a panel of British experts [1], though some small but remarkable differences became apparent. Ketamine and LSD were scored by the British experts as relatively more harmful than according to the Dutch experts. This is probably explained by the very low prevalence of use of these two drugs in the Netherlands: ketamine is hardly used and magic mushrooms were, until recently, legally and widely available as an alternative for the hallucinogenic drug LSD. The Dutch experts gave relatively high scores for the harm of tobacco, GHB and amphetamine. Only recently, it appeared that GHB seems to give much more problems in the drug scene and drug clinics than observed in the previous years in the Netherlands. The growing attention in the media for the health hazards of tobacco and environmental tobacco smoke, and the public interest in anti-smoking campaigns, date from the last 5 years. This recent increased awareness may have led to a higher (social harm) score by the Dutch experts as compared to the British scores which were obtained some years earlier. It thus seems that between the Dutch and British experts no differences with respect to geographical experiences or opinions are apparent other than those mentioned.

One of the most striking results of the assessment using the two ways to score social harm was the higher value of the harm at population level as compared to the harm score at individual level for tobacco, alcohol, ecstasy, cannabis and benzodiazepines, whereas the reverse was true for the other 14 drugs. The first five drugs either have a relatively high prevalence of use, are legally available, or both. This observation implies that the harm of a drug at population level increases when it is used more frequently or by more people. Obviously, a higher prevalence of use does not affect the harm of the drug at individual level, but certainly has a major impact on public health, and leads to a higher social and financial burden for society. This observation is important for policy measures directed at demand reduction. It should, however, be noted that the legal status of a drug is only one of the

many determinants of its prevalence of use. Secondly, irrespective of whether the score was based on use at either individual or population level, the more toxic drugs with a relatively low prevalence of use were rated with high mean harm scores. This implicates that the present ranking procedure secures that very toxic drugs remain to be considered as drugs with the highest harm, i.e. dangerous drugs.

Though none of the drugs can be regarded completely safe, the public (and some politicians) seems disproportionately concerned about the risk of illegal drugs relative to that of legal drugs. The legal status of alcohol and tobacco is the result of decisions taken in and policies from the past, and not science-based, i.e. based on a pharmaco-toxicological profile, like limited or low side effects. Mainly for economic reasons tobacco and alcohol probably will preserve the legal status in future. Based on the high level of harm of tobacco varying from serious physical harm (e.g. lung cancer and cardiovascular risk), the high addictive potency and the social harm represented by the toxicity and annoyance of side stream smoke, this drug cannot be regarded as a safe drug any longer. Similarly, alcohol is associated with a large number of diseases (e.g. liver cirrhosis and cancer, cardiovascular disease), is clearly addictive and has a plethora of social side effects, e.g. aggression, impaired car driving and sick leave. As such, alcohol is not a safe drug and causes a large social and financial burden to society. It can thus be concluded that from a scientific perspective, tobacco and alcohol are misclassified as legal (non-harmful) drugs. In addition, the present ranking of the illegal drugs is not in concordance with the Dutch (and international) legal classification of drugs. It seems, therefore, that the present legal classification needs to be revised, especially with regard to LSD and ecstasy which are now on list I of the Dutch Opium Act (cf. Appendix I) containing drugs with an unacceptable high risk.

The results of this ranking should be used for a rational legal classification of the drugs, and policy measures in drug control. It is advocated that the European Monitoring Centre of Drugs and Drug Addiction (EMCDDA) should take the lead to perform a similar science-based ranking in all member states of the European Union to facilitate a revision of their present legal classification of drugs which currently is, as acknowledged before by Nutt et al. [1], from a scientific point of view largely arbitrary.

Acknowledgements

The present study was funded by the Dutch Ministry of Health, Welfare and Sport. We thank the experts T. Malesevic, F.A. de Wolff, W. van den Brink, B.J.M. van de Wetering, M.W. van Laar, R. Kerssemakers, E.J.M. Pennings, M. Boonstra, R.J.M. Niesink, L.A.G. van Aerts, K. Valk, A. Elissen, W. Best, G.H.A. van Brussel, R.A. Knibbe, I. de Vries, F. Hartgens, A.L.W. Nabben, D.J. Korf, A.J.H. van Riel and P.J. Geerlings for the willingness to take part in the assessment procedure.

References

1 Nutt D, King LA, Saulsbury W, Blakemore C: Development of a rational scale to assess the harm of drugs of potential misuse. Lancet 2007;369:1047–1053.

2 Hall W, Room R, Bondy S: Comparing the health and psychological risks of alcohol, cannabis, nicotine and opiate use; in Kalant H, Corrigal W, Hall W, Smart R (eds): The Health Effects of Cannabis. Toronto, Addiction Research Foundation, 1999.

3 Warner AJ, Kessler R: Comparative epidemiology of dependence on tobacco, alcohol, controlled substances, and inhalants: basic findings from the National Comorbidity Survey. Exp Clin Psychopharmacol 1994;2: 244–268.

4 Gable RS: Comparison of acute lethal toxicity of commonly abused psychoactive substances. Addiction 2004;99:686–696.

5 UNODC: United Nations Office on Drugs and Crime. World drug report, Chapter 4: Towards the creation of an illicit drug index. http://www.unodc.org/pdf/WDR_2005/volume_1_chap4.pdf (2005).

6 Goldstein A, Kalant H: Drug policy: striking the right balance. Science 1990;249:1513–1521.

7 Reynaud M, et al.: Usage nocif de substances psychoactives. Part 1. Paris, La Documentation française, 2002, p 277.

8 Strategy Unit: SU Drugs Project. Phase 1 Report: Understanding the issues. http://www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/drugs_report.pdf (2005).