

Published in final edited form as:

*Int J Drug Policy*. 2010 January ; 21(1): 64–69. doi:10.1016/j.drugpo.2009.02.003.

## Cross-national comparison of adolescent drinking and cannabis use in the United States, Canada, and the Netherlands

Bruce Simons-Morton, EdD, MPH<sup>1</sup>, William Pickett, PhD<sup>2</sup>, Will Boyce, PhD<sup>2</sup>, Tom F.M. ter Bogt, PhD<sup>3</sup>, and Wilma Vollebergh, PhD<sup>4</sup>

<sup>1</sup>Prevention Research Branch, Division of Epidemiology, Statistics and Prevention Research, Eunice Shriver National Institute of Child Health and Human Development, Bethesda, MD 20892, Mortonb@mail.nih.gov, Telephone: 301-496-5674, Fax: 301-402-2084

<sup>2</sup>Department of Community Health and Epidemiology, Queen's University, c/o Emergency Medicine Research, Angada 3, Kingston General Hospital, 76 Stuart St., Kingston, ON, Canada, K7M 2V7, Pickettw@post.queensu.ca

<sup>3</sup>Faculty of Education, Social Program Evaluation Group, Queen's University, 99 University Ave, Kingston Ontario, K7L 3N6, Canada

<sup>4</sup>Department of Interdisciplinary Social Sciences, Utrecht University, p.o.box 80140, 3508 TC Utrecht, The Netherlands, t.f.m.terbogat@uu.nl, w.a.m.vollebergh@uu.nl

### Abstract

**Background**—This research examined the prevalence of drinking and cannabis use among adolescents in the United States, Canada, and the Netherlands, countries with substantially different laws and policies relating to these substances.

**Method**—Laws regarding drinking and marijuana use were rated for each country. Substance use prevalence data among 10<sup>th</sup> graders from the Health Behavior in School-Aged Children Survey conducted in each country in 2005–06 were examined.

**Results**—Laws regarding alcohol and cannabis were found to be strictest in the United States, somewhat less strict in Canada, and least strict in the Netherlands. On most measures of drinking, rates were lower in the United States than in Canada or the Netherlands. With United States as the referent, relative risks (RR) for monthly drinking were 1.30 (1.11–1.53) for Canadian boys and 1.55 (1.31–1.83) for girls, and 2.0 (1.73–2.31) for Dutch boys and 1.92 (1.62–2.27) for Dutch girls. Drunkenness was also higher among Canadian boys and girls and Dutch boys. However, rates of cannabis use did not differ between the countries, except that Dutch girls were less likely to use cannabis in the past year (RR= .67; 0.46–0.96).

**Conclusions**—The lower prevalence of adolescent drinking and drunkenness (except among Dutch girls) in the United States is consistent with the contention that strict drinking policies may limit drinking among 10<sup>th</sup> graders. However, the finding that marijuana use rates did not differ across countries is not consistent with the contention that prohibition-oriented policies deter use or that liberal marijuana policies are associated with elevated adolescent use. Based on these findings, the case for strict laws and policies is considerably weaker for marijuana than for alcohol.

---

Conflict of Interest Statement: The authors have no financial or personal relationships with other people or organizations that could inappropriately influence or bias this work.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## INTRODUCTION

Adolescent use of alcohol and cannabis are major public health and legal concerns in all Western countries, given the evidence of association with concurrent and future harm (Baumeister & Tossman, 2005; Blows et al., 2005; Ellickson et al., 2004; Hingston et al., 2000; Monshouwer et al., 2006). Despite health and safety concerns and societal restrictions on availability, alcohol and marijuana use are relatively prevalent during adolescence, with substantial minorities in Western countries reporting regular use, despite declines over the past decade (Adlaf et al., 2005; Andersson et al., 2007; Centers for Disease Control and Prevention, 2006; Hibell et al., 2004; Johnston et al., 2007). However, it has been difficult for countries to develop laws and implement policies that limit drinking and marijuana use among adolescents while minimizing economic and social costs.

Laws and policies are in place in most Western countries to limit access and restrict use of substances (Brand et al., 2007; MacCoun & Reuter, 2001). However, drug laws tend to be complicated, subject to interpretation, and enforced and adjudicated variably. National laws and policies tend to range between strict penalty-and-punishment and harm-minimization (Brand et al., 2007; Grube & Nygaard, 2001; Lenton, 2003; Toumbourou et al., 2007). One basis for penalty approaches is the notion from demand theory that use should decline as the cost of the drug and penalties increase (Desimone & Farrelly, 2003). Accordingly, penalty approaches seek to make drug use difficult and expensive, with strict and certain consequences of arrest. However, the relationship between cost and prevalence is not consistent and penalty approaches can result in substantial negative social and economic consequences (King & Mauer, 2006). In contrast, harm-minimization/harm-reduction approaches focus on reducing higher-risk use like drinking and driving and drug trafficking (Grube & Nygaard, 2001; Stockwell, 2001) and seek to minimize the costs to society of enforcement, adjudication, incarceration, and lost productivity (Lenton, 2003). While laws are slow to change, policy guidelines influence actual enforcement and adjudication practices (King & Mauer, 2006; Lenton, 2003).

In theory, laws designed to restrict the availability and use of alcohol and marijuana should influence adolescent prevalence (MacCoun & Reuter, 1997; Toumbourou, 2005), but research on the effectiveness of various policy approaches is limited (Giesbrecht & Greenfield, 1999; Lenton, 2003; MacCoun & Reuter, 1997), and enforcement, adjudication policy and other factors may also contribute to the variance in prevalence (Reuter, 2002; Toumbourou et al., 2007; Degenhardt et al., 2008). With respect to alcohol, one of the clearest findings is an inverse relationship between legal drinking age and alcohol-related motor vehicle injuries (Wagenaar & Toomey, 2002; Grube & Nygaard, 2001; Hingston et al., 2000; Toumbourou, 2005). With respect to marijuana, there is little evidence that criminalization reduces use (Senate of Canada, 2001). Notably, the prevalence of marijuana use among adults is no greater in the Netherlands than in the United States (MacCoun & Reuter, 1997; Abraham et al., 2002; Reinarmann, Cohen, & Kaal, 2004).

Surprisingly, no studies have compared the population prevalence of alcohol and marijuana use among adolescents in the United States, Canada, and the Netherlands, countries with quite different laws and policies regarding minimum age to purchase, jurisdiction, and criminal sanctions for possession and consumption and enforcement and adjudication policies (Brand et al., 2007; MacCoun & Router, 2001). U.S. laws and policies are relatively strict, enforcement is a priority, and strict penalties apply to both users and sellers (Grube & Nygaard, 2001; Lenton, 2003; Beyers et al., 2004). In contrast, the Netherlands employs a unique, harm-reduction policy approach that does not impose criminal sanctions for possession and use of small amounts and employs lax enforcement of possession laws (Lenton, 2003). Canadian policies

(Health Canada (2006), are somewhere in between, with federal laws that are similar to those in the United States, but with enforcement and judicial practices that are more consistent with harm reduction (Senate of Canada, 2001).

Notably, the legal age to drink in the United States is 21 (with some exceptions for drinking with parents) in all states, 19 in Canada (18 in three provinces), and no minimum age to drink in the Netherlands and 16 to purchase alcohol (Brand et al., 2007; World Health Organization, 2004a). Alcoholic beverage purchase, possession, and consumption (in some states) are criminal offenses in the United States, but not in Canada or the Netherlands where these are statutory offences involving fines at most. Except for legal age, jurisdiction of alcohol policies is somewhat decentralized in the United States, where national laws are sometimes preempted by local laws, which usually results in more strict policies (Wagenaar & Toomey, 2002). The legal drinking age in Canadian is determined provincially. In the Netherlands laws are national, with a few provincial or local exceptions.

Marijuana policies also vary across countries (MacCoun & Reuter, 2001; NORML, 2003). There is no legal age for purchase in the United States and Canada, but for decades the Netherlands has allowed regulated sales of small amounts of marijuana to those 18 and older. The jurisdiction of legislation is federal in Canada, but in the Netherlands and the United States some local or state policies are stricter than national policies (NORML, 2003; NORML, 2006). Purchase and possession (in some states) of marijuana are nominally criminal offences in the United States and Canada. In the United States most offenses are treated as criminal misdemeanors, resulting in a criminal record and incarceration or probation, but in Canada most offenses are treated as statutory offenses, resulting in a fine with no criminal record or incarceration. Only the United States requires mandatory sentencing (for all federal offences and in 23 states) for convictions of possession of relative small amounts (typically >.05 oz) of marijuana. In the United States marijuana laws are primary and enforcement is a priority, leading to hundreds of thousands of arrests annually for marijuana offenses, mostly for possession (King & Mauer, 2006). In Canada and the Netherlands marijuana possession and use are generally tolerated by police, with considerable local variability in enforcement. The complexity of policy is illustrated by the approach in the Netherlands, where the sale of marijuana in officially designed “coffee shops” to those over age 18 is regulated (and taxed), but it is not actually legal for coffee shop owners to purchase marijuana or to grow or sell it, even to coffee shop owners, although such transactions are tolerated (Abraham et al., 2002; MacCoun & Reuter, 2001).

A key indicator of the lower social costs of harm reduction approaches compared with penalty approaches is the number of arrests for drug-related offenses. Arrests of juveniles for drug-related offenses are extremely low in Canada, with only 2236 such cases in 2006 (Statistics Canada, 2008). Meanwhile, the same year in the United States there were 168,888 arrests of juveniles for drug abuse, most of which was for marijuana possession, and another 250,000 alcohol-related arrests of juveniles, mostly for underage possession (Federal Bureau of Investigation, 2008).

While drug related arrests are not uncommon in the Netherlands and Holland (Barclay & Tavares, 2003), arrests of juveniles for possession of alcohol or cannabis are virtually non-existent (Statistics Netherlands, 2008). While substance use policies change over time, most youth-directed alcohol and marijuana policies have been in place in the United States, Canada, and the Netherlands for at least a decade. If demand theory is correct, the prevalence in these countries should be related to the strictness of national policies (MacCoun & Reuter, 1997). The Health Behavior in School-Aged Children (HBSC) survey was conducted in the United States, Canada, and the Netherlands (and other countries) in 2005 (Roberts et al., 2007). The survey provided an unusual opportunity to compare alcohol and marijuana use rates in these

countries using national survey data with the same questionnaire items and participant ages. The purpose of this study is to examine the prevalence of drinking and marijuana use among 10<sup>th</sup> grade boys and girls in the United States, Canada, and the Netherlands.

## METHOD

The Health Behavior in School-Aged Children (HBSC) survey has been conducted every 4 years in many European countries since 1985, in Canada since 1989/1990, and in the United States since 1997/1998. In 2005–06, 41 countries participated in the survey. The survey is designed to assess a variety of variables, including health indicators and behaviors among 6<sup>th</sup>–10<sup>th</sup> grade students, including substance use of 10<sup>th</sup> graders. Each participating country must use approved survey methodology to provide a representative national, self-weighted sample of students selected from whole classes using a systematic single stage, cluster sample approach (Roberts et al., 2007).

### Sample

In the United States, the sample included 6<sup>th</sup>–10<sup>th</sup> graders drawn from public, private, and parochial school districts in urban, suburban, and rural districts from all nine United States national census divisions designed to provide an estimate of the national population percentage with a margin of error of plus or minus 3 percentage points. Of the original sample of 318 eligible schools, 168 (53%) consented, providing 317 classrooms and 4580 eligible students. Parental consent was required in schools in slightly less than half of the schools. Of eligible students, 412 were absent on the day of the survey and the make up date and 276 refused to complete the survey, yielding a final sample of 1559 10<sup>th</sup> graders representing 85% of the eligible students.

In Canada, the survey sample included children with active parent consent in grades 6–10 schools. Within each Canadian province, school districts and schools were sampled purposely to provide a representative sample of schools selected in proportion to jurisdiction, province, language of instruction, public/Roman Catholic designation, and community. The sample consisted of 167 school boards and 339 schools, of which 126 boards and 192 schools participated. Of eligible students, 74 percent participated, with 1/3 of the non-participants declining and the remainder failing to provide parental consent forms or absent. The final 10<sup>th</sup> grade sample included 1973 students.

In the Netherlands the sample included 6<sup>th</sup>–10<sup>th</sup> graders from schools in secondary education from all regions in the country stratified geographic region. The original sample of 150 schools contacted included 137 eligible schools, of which 64 (47%) consented, providing 255 classrooms and 5926 students. Three parents prohibited their children's participation, 400 (7%) students were absent, and 9 (>1%) refused to complete the survey, providing a final sample of 1326 10<sup>th</sup> graders representing 93% of eligible students.

### Legal Provisions

To enable cross-national comparisons, the legal provisions most relevant to possession and use of alcohol and marijuana by adolescents were obtained from national and international databases (Brand et al., 2007; Health Canada, 2006; National Research Council and Institute of Medicine, 2004; NORML, 2003; World Health Organization, 2004a). These provisions include the minimum age to purchase, offences for possession, consumption, and purchase, and the jurisdiction of legislation. The authors scored each provision in each country separately for each substance on a scale of 1 (least restrictive), 2 (intermediate), or 3 (most restrictive) on age of majority and policy jurisdiction and either 1 (no) or 2 (yes) on criminal offense for possession, consumption, and purchase. Where countries have similar laws, each received the

same rank. The purpose of the rating, provided in Table 1, is to provide a reference across policy categories and countries. The summary scores for alcohol provisions were 11 for the United States, 8 for Canada, and 5 for the Netherlands. This result is similar to that found in a recent analysis of alcohol laws in 30 countries, although in that study, Canadian laws were determined to be more strict than the United States due to Canada's very strict laws on drinking and driving (Brand et al., 2007). The resulting policy scores for marijuana were 11 for the United States, 9 for Canada, and 6 for the Netherlands.

### Substance Use Prevalence

Participants in each country were asked the same questions about substance use. Prevalence was assessed by the question "At present, how often do you drink anything alcoholic ... even those times when you only drink a small amount?" For each type of beverage, beer, wine, spirits/liquor, mixed drinks, any other drink that contains alcohol, the available responses were every day, every week, every month, rarely, or never. Youth were considered weekly drinkers if they reported drinking any of these beverages every week and monthly drinkers if they reported drinking any beverage every month. Onset of drinking was asked with the questions "At what age did you first drink alcohol (more than a small amount)?" and "At what age did you first get drunk?" Drunkenness was assessed with the question "Have you ever had so much alcohol that you were really drunk?" The response options were no, never; yes, once; yes, 2–3 times; yes, 4–10 times; yes, more than 10 times. Frequent drunkenness was operationally defined as 2–3 or more times. The substance use items and survey methods of similar to those used in other national and international surveys that have reported high reliability (Brener, Billy, and Grady, 2003). There is an element of subjectivity in reports of drunkenness, but the measure has been used with success in numerous papers (Kuntsche & Delgrande, 2006).

The analyses of the prevalence data for all three countries were done by the investigators in the United States and verified by the investigators in Canada and the Netherlands. A design effect of 1.2 inflated the standard error to adjust for the nested sampling strategy, as calculated by Roberts and colleagues (2007). The United States use rates served as the referents in all cases. For each variable, the rates were compared to obtain relative risks. Confidence intervals were developed by taking the natural logarithm of the RR to get the beta and the square root of the variance to obtain the standard error (SE) and adjusting for the design effect (DEFF). The lower limit was calculated as  $[\text{beta} - (1.96)(\text{SE})(\text{DEFF})]$  and the upper limit was  $[\text{beta} + (1.96)(\text{SE})(\text{DEFF})]$  (Hennekens & Buring, 1997).

## RESULTS

The samples of 10<sup>th</sup> graders in each study are shown in Table 2, including 1559 in the United States, 1973 in Canada, and 1326 in the Netherlands. The mean ages of the samples were 16.1 years in the United States, 15.8 years in Canada, and 16.0 years in the Netherlands.

Drinking prevalence for each measure is shown in Table 3, with relative risks calculated with the United States as the referent (significant differences are indicated in bold). On most measures, prevalence was higher in Canada and the Netherlands for boys and girls. Monthly drinking was reported by 34.0% of boys and 29.3% of girls in the United States, 44.2% (RR=1.30 (1.11–1.53)) of boys and 45.3% of girls (RR=1.55 (1.31–1.83)) in Canada, and 67.9% of boys (RR=2.0 (1.73–2.31)) and 56.2% of girls (RR=1.92 (1.62–2.27)) in the Netherlands. In the United States 27.7% of boys and 24.4% of girls reported frequent drunkenness, compared with 38.9% of Canadian boys (RR=1.41 (1.17–1.70)) and 39.2% of girls (RR=1.61 (1.33–1.95)), and 38.3% of Dutch boys (RR=1.38 (1.14–1.68)) and 25.9% of girls (RR=1.06 (.84–1.35)). Also, higher percentages of Canadian boys and girls reported getting drunk by age 14 compared with United States boys and girls.



Shown in Table 4, marijuana use rates were generally not different in the three countries, except that rates were lower among Dutch girls. Use in the past 12 months was 33.0% for boys and 26.0% for girls in the United States, 32.3% for boys (RR=.98 (.82–1.17)) and 31.3% for girls (RR=1.20 (.99–1.46)) in Canada, and 28.6% for boys (RR=.87 (.70–1.06)) and 19.8% of girls (RR=.76 (.59–.99)) in the Netherlands. Similarly, use in the past 30 days in the United States was 21.4% for boys and 15.8% for girls; 20.0% for Canadian boys (RR=.94 (.73–1.20)) and 17.5% for girls (RR=1.11 (.84–1.46)); and 18.8% for Dutch boys (RR=.88 (.67–1.15)) and 10.6% for girls (RR=.67 (.46–.96)).

## DISCUSSION

In this paper we report the prevalence of drinking and marijuana use among national samples of adolescents from the United States, Canada, and the Netherlands, countries with diverse substance use policy approaches. We identified those laws that would seem most important for adolescent access and use and scored them for strictness in each country. The ordinal system employed provided scores that were consistent with the general reputations of the countries, with the United States rated the most strict, consistent with its emphasis on criminal sanctions. While Canadian laws are nearly as strict as those in the United States, enforcement is not emphasized and adjudication is generally consistent with a harm reduction approach. The Netherlands has liberal laws for both alcohol and marijuana and de-emphasizes enforcement and legal action for juvenile possession of these substances. Alcohol and marijuana-related juvenile arrest rates are considerably lower in Canada and the Netherlands than in the United States (Federal Bureau of Investigation, 2008; Statistics Canada, 2008; Statistics Netherlands, 2008).

The HBSC survey results indicated that drinking prevalence and drunkenness were lower on all measures among both boys and girls in the United States compared with boys and girls in Canada and boys in the Netherlands, but there was no difference in drunkenness or age of first drunkenness between American and Dutch girls. The prevalence reported by youth in the United States, with monthly use of 34.0% for males and 29.3% for females, is consistent with other reports (Centers for Disease Control and Prevention, 2006; Johnston et al., 2007), and significantly lower than the prevalence reported by Canadian youth of about 45% for both boys and girls and Dutch youth of 67.9% for boys and 56.2% of girls. Of course, 10<sup>th</sup> grade Dutch students are close in age to the legal drinking age of 16 in the Netherlands. Also, despite higher drinking prevalence, Dutch girls were less likely to report having been drunk by age 14 suggesting that adolescent drinking and drunkenness do not correspond in all population groups. Overall, these cross-national differences in drinking prevalence are somewhat consistent with the hypothesis that higher legal age, more difficult access, and greater penalties for use may have discouraged adolescent drinking in the United States.

Surprisingly, there was little evidence of correspondence between marijuana prevalence and policy. Indeed, despite substantial legal and policy differences between countries, the only difference in prevalence was significantly lower marijuana use among Dutch girls. These data are consistent with reports showing that adult use of marijuana is no higher in the Netherlands than in the United States (Abraham et al., 2002; MacCoun & Reuter, 2001) and inconsistent with the demand theory idea that strict laws and enforcement prevent adolescent marijuana use, particularly if the drug remains highly prevalent and normative. More important, the data are inconsistent with the contention that decriminalization policies encourage adolescent marijuana use.

Policy can moderate adolescent substance use prevalence (Grube & Nygaard, 2001; Toumbourou, 2005; Wagenaar & Toomey, 2002), but both substance use and policy are complicated matters and many factors may attenuate correspondence between policy and use.

Laws and policies regarding adolescent drinking are particularly strict in the United States compared with the Netherlands, where the relatively young age of consent and lack of criminal sanctions against adolescent use reflects the generally tolerant and liberal nature of Dutch society. It may be that liberal policies toward adolescent substance use are possible in the Netherlands because of the generally low rates of crime (Barclay & Tavares, 2003) and alcohol-related injuries (World Health Organization, 2004b), the wide availability of public transportation, and a high level of civility. Canadian culture, on the other hand, is generally thought to be quite similar to the United States in most ways. However, Canadian policies regarding alcohol and marijuana are more liberal than those in the United States in terms of legal age, the lack of criminal sanctions, and low arrest rates. While Canada has more liberal laws with respect to adolescent drinking, it does have aggressive drinking and driving policies and enforcement, reflecting the Canadian focus on harm reduction (Health Canada, 2006). Research is needed to determine if strict prohibition of alcohol use during adolescents may lead to delayed drinking problems as suggested by Kuo et al., (2002).

The most surprising finding in the present study is the lower rates of marijuana use among Dutch girls. Notably, there were no differences in marijuana prevalence among boys in the three countries and significantly lower rates of use among Dutch girls compared to American girls.

## Conclusion

The prevalence rates for adolescent alcohol use for the three countries are consistent with the contention that strict policies may have the intended effect of limiting prevalence. However, the data provide no evidence that strict marijuana laws in the United States provide protective effects compared to the similarly restrictive but less vigorously enforced laws in place in Canada, and the regulated access approach in the Netherlands. Given the cross-sectional nature of the research, the data provide no evidence of causal association between national policies and adolescent substance use, suggesting the need for prospective policy evaluations. Moreover, factors that were not measured in this study, such as national culture and social norms, may partially explain both policy and prevalence. The data do provide evidence for the hypothesis that strict policies may be more effective in deterring adolescent alcohol use than adolescent marijuana use. The question remains for policy makers in each country to determine the extent to which policies regarding adolescent substance use maximize prevention benefits while minimizing negative social consequences.

## Acknowledgments

The authors wish to acknowledge Suzanne Dostaler for initial work on the analyses and Jeremy Luk for literature review and manuscript preparation. This research was supported [in part] by the Intramural Research Program of the NIH, contract # N01-HD-5-3401.

## Reference List

- Abraham, MD.; Hendrien, L.; Kaal, HL.; Peter, DA.; Cohen, PDA. Licit and Illicit Drug Use in the Netherlands, 2001. Amsterdam: CEDRO, Mets & Schilt; 2002.
- Adlaf, EM.; Begin, P.; Sawka, E. Canadian Addiction Survey (CAS): A national survey of Canadians' use of alcohol and other drugs: Prevalence of use and related harms: Detailed report. Ottawa: Canadian Centre on Substance Abuse; 2005.
- Andersson, B.; Hibell, B.; Beck, F.; Choquet, M.; Kokkevi, A.; Fotiou, A., et al. Alcohol and drug use among European 17–18 year old students: Data from the ESPAD project. Stockholm: The Swedish Council for Information on Alcohol and Other Drugs and the Pompidou Group at the Council of Europe; 2007.
- Barclay, G.; Tavares, C. International comparisons of criminal justice statistics 2001. London: Home Office Statistical Bulletin; 2003.

- Baumeister SE, Tossman P. Association between Early Onset of Cigarette, Alcohol and Cannabis Use and Later Drug Use Patterns: An Analysis of a Survey in European Metropolises. *European Addiction Research* 2005;11:92–98. [PubMed: 15785070]
- Beyers JM, Toumbourou JW, Catalano RF, Arthur MW, Hawkins JD. A cross-national comparison of risk and protective factors for adolescent substance use: The United States and Australia. *Journal of Adolescent Health* 2004;35:3–16. [PubMed: 15193569]
- Blows S, Ivers RQ, Connor J, Ameratunga S, Woodward M, Norton R. Marijuana use and car crash injury. *Addiction* 2005;100:605–611. [PubMed: 15847617]
- Brand DA, Saisana M, Rynn LA, Pennoni F, Lowenfels AB. Comparative analysis of alcohol control policies in 30 countries. *PLoS Med* 2007;4:e151–e159. [PubMed: 17455992]
- Brener ND, Billy JOG, Grady WR. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. *Journal of Adolescent Health* 2003;33:436–457. [PubMed: 14642706]
- Centers for Disease Control and Prevention. Youth risk behavior surveillance: United States, 2005. *Morbidity and Mortality Weekly Report* 2006;55
- Degenhardt L, Chiu WT, Sampson N, Kessler RC, et al. Toward a global view of alcohol, tobacco, cannabis, and cocaine use: Findings from the WHO World Mental Health Surveys. *PLoS Medicine* 2008;5:1053–1067.
- Desimone J, Farrelly MC. Price and enforcement effects on cocaine and marijuana demand. *Economic Inquiry*. 2003 January, 1–20;
- Ellickson PL, Tucker JS, Klein DS, Saner H. Antecedents and outcomes of marijuana use initiation during adolescence. *Journal of Preventative Medicine* 2004;39:976–984.
- Federal Bureau of Investigation. Crime in the United States, 2008: Uniform Crime Report. Washington, D.C.: U.S. Department of Justice; 2006.
- Giesbrecht N, Greenfield TK. Public opinions on alcohol policy issues: A comparison of American and Canadian surveys. *Addiction* 1999;94:521–531. [PubMed: 10605848]
- Grube JW, Nygaard P. Adolescent drinking and alcohol policy. *Contemporary Drug Problems* 2001;28:87–131.
- Health Canada. Canadian Addiction Survey: Public Opinion, Attitudes, and Knowledge. Canadian Ministry of Health; 2006.
- Hennekens, CH.; Buring, JE. *Epidemiology in Medicine*. Boston: Little, Brown and Company; 1997.
- Hibell, B.; Andersson, B.; Bjarnason, T.; Ahlstrom, S.; Balakireva, O.; Kokkevi, A., et al. The ESPAD Report 2003: Alcohol and other drug use among students in 35 European countries. Stockholm: The Swedish Council for Information on Alcohol and Other Drugs and the Pomidou Group at the Council of Europe; 2004.
- Hingston RW, Heeren T, Jamanka A, Howland J. Age of drinking onset and unintentional injury involvement after drinking. *Journal of American Medical Association* 2000;284:1527–1533.
- Johnston, LA.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future national survey results on drug use, 1975–2006: Volume I, secondary school students (Rep. No. NIH Publication No. 07-6205). Bethesda, MD: National Institute on Drug Abuse; 2007.
- King RS, Mauer M. War on marijuana: The transformation of the war on drugs in the 1990's. *Harm Reduction Journal*, 3 2006;6:1–17.
- Kuo M, Adlaf EM, Lee H, Gliksman L, Demers A, Wechsler H. More Canadian students drink but American students drink more: Comparing college alcohol use in two countries. *Addiction* 2002;97 (12):1583–1592. [PubMed: 12472642]
- Kuntsche E, Delgrande Jordan M. Adolescent alcohol and cannabis use in relation to peer and school factors. Results of multilevel analyses. *Drug and Alcohol Dependence* 2006;84(2):167–174. [PubMed: 16542799]
- Lenton S. Policy from a harm reduction perspective. *Current Opinion in Psychiatry* 2003;16:271–277.
- MacCoun R, Reuter P. Interpreting Dutch cannabis policy: Reasoning by analogy in the legalization debate. *Science* 1997;278:47–52. [PubMed: 9311925]
- MacCoun R, Reuter P. Evaluating alternative cannabis regimes. *British Journal of Psychiatry* 2001;178:123–128. [PubMed: 11157425]



- Monshouwer K, Van Dorsselaer S, Verdurmen J, Ter Bogt T, de Graaf R, Vollebergh W. Cannabis use and mental health in secondary school children: Findings from a Dutch study. *British Journal of Psychiatry* 2006;188:148–153. [PubMed: 16449702]
- National Research Council and Institute of Medicine. *Reducing Underage Drinking: A Collective Responsibility*. Washington, D.C.: The National Academies Press; 2004.
- NORML. European drug policy: 2002 legislative update. 2003. Retrieved 10<sup>th</sup> January, 2008 from [http://norml.org/index.cfm?Group\\_ID=5446](http://norml.org/index.cfm?Group_ID=5446)
- NORML. State by state laws. 2006. Retrieved 10<sup>th</sup> January, 2008 from [http://norml.org/index.cfm?Group\\_ID=4516](http://norml.org/index.cfm?Group_ID=4516)
- Reinarmann C, Cohen PDA, Kall HL. The limited relevance of drug policy: Cannabis in Amsterdam and in San Francisco. *American Journal of Public Health* 2004;94:836–842. [PubMed: 15117709]
- Reuter P. The first agenda for drug enforcement research. *Addiction* 2002;97:653–654. [PubMed: 12084128]
- Roberts C, Currie C, Samdal O, Currie D, Smith R, Maes L. Measuring the health and health behaviors of adolescents through cross-national survey research: Recent developments in the Health Behavior in School-Aged Children (HBSC) study. *Journal of Public Health* 2007;15:179–186.
- Senate of Canada. Cannabis: Our Position for a Canadian Public Policy: Report of the Senate Special Committee on Illegal Drugs. 2001 [accessed 01/05/2009]. [www.parl.gc.ca/common/committee\\_senrep](http://www.parl.gc.ca/common/committee_senrep)
- Statistics Canada. 2008. Retrieved September 19, 2008 at [www.statcan.org](http://www.statcan.org)
- Statistics Netherlands. 2008. Retrieved September 19, 2008 at [www.cbs.nl](http://www.cbs.nl)
- Stockwell T. Alcohol policy, harm reduction and the prevention paradox. *Promoting Health* 2001;15:22–25.
- Toumbourou, JW. Alcohol and drug use: theoretically intergrated interventions to prevent harm. In: Browning, C.; Thomas, S., editors. *Behavioural Change: An Evidence Based Handbook for Social and Public Health*. International: Esvier/Churchill Livingstone; 2005. p. 87-114.
- Toumbourou JW, Stockwell T, Neighbors C, Marlatt GA, Sturge J, Rehm J. Interventions to reduce harm associated with adolescent substance use. *Lancet* 2007;369:1391–1401. [PubMed: 17448826]
- Wagenaar AC, Toomey TL. Effects of minimum drinking age laws: Review and analyses of the literature from 1960 to 2000. *Journal of Studies on Alcohol, Sppl* 2002;14:206–225.
- World Health Organization. *Global Status Report: Alcohol Policy*. Geneva: Department of Mental Health and Substance Abuse; 2004a.
- World Health Organization. *Global status report on alcohol, 2004*. Geneva: Department of Mental Health and Substance Abuse; 2004b.

Table 1

Description of policies surrounding alcohol and cannabis use in 3 countries; higher scores are consistent with a penalty approach and lower scores are consistent with a harm reduction approach.

Indicator for children age 11–15	Country			Policy Score
	USA	Canada	Netherlands	
Policy (range)	Policy Score	Policy Score	Policy Score	Policy Score
<b>Alcohol</b>				
Minimum age to purchase (1–3)	21	19	16	1
Possession a criminal offense (1–2)	Yes	No	No	1
Consumption a criminal offense (1–2)	Most states <sup>a</sup>	No	No	1
Purchase a criminal offense (1–2)	Yes	Yes	No (fine)	1
Jurisdiction of legislation (1–3)	Federal; state; local	Federal; Provincial	National	1
<i>Subtotal</i>	<i>12</i>	<i>8</i>	<i>5</i>	
<b>Cannabis</b>				
Minimum Age (buy or use?) (1–2)	None	None	18	1
Possession of small amounts criminal offense? (1–2)	Yes <sup>b</sup>	Yes	No	1
Consumption a criminal offense (1–2)	Some states	No	No	1
Purchase a criminal offense (1–2)	Yes; mandatory sentencing	Yes	Yes <sup>c</sup>	1
Jurisdiction of legislation (1–3)	State & federal	Federal	Local; Federal	1
<i>Subtotal</i>	<i>11</i>	<i>9</i>	<i>6</i>	
<b>TOTAL</b>	<b>23</b>	<b>17</b>	<b>12</b>	

<sup>a</sup> Some states provide exceptions for private consumption with parent permission

<sup>b</sup> Mandatory sentencing for federal offense (e.g., transporting across state lines); state policies vary considerably – 38 states have less harsh penalties for possession of small amounts, defined variously as .5 oz to 2.2 lb (1 kilo); fines range from \$50–\$5000; however, incarceration for possession of amounts ranging from any to larger amounts is mandatory in 23 states and conditional in 23 states

<sup>c</sup> Authorized “coffee” shops can sell ≤5 grams of cannabis/customer at least 18 years of age; no prosecution for possession of ≤5 grams at any age.

**Table 2**

Description of sample of 15 year olds in 3 countries

Indicator	USA	Country Canada	Netherlands
Number of participants	1559	1973	1326
Age (mean and range)	16.1 (12.3–17.3)	15.8 (14.3–17.8)	16.0 11.3–18.3
Males - % (SE)	49.9 (1.3)	47.0 (1.1)	51.9 (1.4)

Table 3

Relative risks for alcohol use indicators among 10<sup>th</sup> grade boys and girls in 3 countries<sup>a</sup>

Indicator	Boys <sup>b</sup>			Girls <sup>b</sup>		
	USA	Canada	Netherlands	USA	Canada	Netherlands
Initiation at <14 years						
# users/# drinkers	176/772	313/928	404/688	156/775	337/1045	355/638
% (SE)	22.8(1.5)	33.7(1.6)	58.7(1.9)	20.1(1.4)	32.2(1.4)	55.6(2.0)
RR (95% CI)	1.0	1.48(1.20-1.82)	2.58(2.14-3.11)	1.0	1.60(1.29-1.99)	2.77(2.26-3.39)
Weekly drinking (M27-34)						
# users/# reporting	142/754	197/908	356/685	97/762	177/1037	212/635
% (SE)	18.8(1.4)	21.7(1.4)	52.0(1.9)	12.7(1.2)	17.1(1.2)	33.4(1.9)
RR (95% CI)	1.0	1.15(0.90-1.48)	2.76(2.23-3.42)	1.0	1.34(1.0-1.81)	2.63(1.99-3.48)
Monthly drinking (m27-34)						
# users/# reporting	256/754	401/908	465/685	223/762	470/1037	357/635
% (SE)	34.0(1.7)	44.2(1.6)	67.9(1.8)	29.3(1.7)	45.3(1.5)	56.2(2.0)
RR (95% CI)	1.0	1.30(1.11-1.53)	2.0(1.73-2.31)	1.0	1.55(1.31-1.83)	1.92(1.62-2.27)
First drunk <14 years						
# users/# ever drunk	89/772	148/928	83/688	60/775	137/1045	60/638
% (SE)	11.5(1.1)	15.9(1.2)	12.1(1.2)	7.7(1.0)	13.1(1.0)	9.4(1.2)
RR (95% CI)	1.0	1.39(1.01-1.91)	1.05(.73-1.51)	1.0	1.70(1.17-2.48)	1.22(.78-1.91)
Frequent drunkenness (M35)						
# users/# reporting	207/748	352/904	261/681	186/761	407/1037	164/632
% (SE)	27.7(1.6)	38.9(1.6)	38.3(1.9)	24.4(1.6)	39.2(1.5)	25.9(1.7)
RR (95% CI)	1.0	1.41(1.17-1.70)	1.38(1.14-1.68)	1.0	1.61(1.33-1.95)	1.06(.84-1.35)

<sup>a</sup> SE inflated by 1.2 (design effect); N's not the same for all measures due to missing data

<sup>b</sup> Data missing on sex or substance use variables included 43 (2.8%) in the US, 28 (1.4%) in Canada, and 6 (0.5%) in the Netherlands

Table 4

Relative risks for cannabis use indicators among 10<sup>th</sup> grade boys and girls in 3 countries<sup>a</sup>

Indicator	Boys			Girls		
	USA	Canada	Netherlands	USA	Canada	Netherlands
<i>Ever used cannabis in last 12 months</i>						
# users# reporting	245 743	289 896	191 669	196 755	321 1026	124 625
% (SE)	33.0(1.7)	32.3 (1.6)	28.6 (1.8)	26.0(1.6)	31.3 (1.4)	19.8 (1.6)
RR (95% CI)	1.0	0.98 (.82–1.17)	.87 (.70–1.06)	1.0	1.20 (.99–1.46)	.76 (.59–.99)
<i>Ever used cannabis in last 30 days</i>						
# users# reporting	159 743	180 898	126 670	119 753	180 1028	66 625
% (SE)	21.4(1.5)	20.0 (1.3)	18.8 (1.5)	15.8(1.3)	17.5 (1.2)	10.6 (1.2)
RR (95% CI)	1.0	0.94 (.73–1.20)	.88 (.67–1.15)	1.0	1.11 (.84–1.46)	.67 (.46–.96)

<sup>a</sup> SE inflated by 1.2 (design effect); N's not the same for all measures due to missing data