Published in final edited form as:

Contemp Drug Probl. 2017 June ; 44(2): 147–158. doi:10.1177/0091450917710763.

The Effects of Acute Cannabis Use on Nontraffic Injury Risk: Reviewing the Available Literature and Identifying Ways Forward

Gabriel Andreuccetti, Ph.D.^{a,b}, Yu Ye, M.A.^a, Jaewook Kang, B.Sc.^c, Rachael Korcha, M.A.^a, Jane A. Witbrodt, Ph.D.^a, Heraclito B. Carvalho, Ph.D.^b, and Cheryl J. Cherpitel, Dr.P.H.^a

^aAlcohol Research Group, Emeryville, CA 94608, United States

^bUniversity of Sao Paulo Medical School, SP 01246-903, Brazil

^cUniversity of Sahmyook, Seoul, South Korea

Abstract

Recent evidence has indicated that cannabis use before driving is associated with a modest but increased risk for traffic-related injuries. However, the question of whether recent cannabis use is associated with a greater risk for other types of injuries remains unanswered. Aiming to understand better how acute cannabis use might affect the risk for all causes of injury, we have summarized the limited data available in the literature on the risk of non-traffic injuries associated with recent cannabis use. Very few studies were able to provide estimate risks for all injuries or injuries other than those related to road traffic injuries, with the limited evidence available showing mixed findings. The only significant risk found (in only one study) suggests an inverse association between all injuries and cannabis use. Study designs are limited, and the majority of studies have neither data on acute cannabis use among injured individuals nor a valid control group for estimating injury risk attributable to cannabis. In conclusion, studies of the association between cannabis and non-traffic injuries present several limitations, particularly regarding sampling strategies, injury risk assessment for different causes of injury, and a dose-response risk relationship with injury. Further studies, incorporating better design for different causes of injury and drug testing, are required to reach firmer conclusions on the association between cannabis use and non-traffic injury risk.

Keywords

cannabis; injuries; non-traffic injuries; risk; review; violence

Introduction

Although cannabis (or marijuana) is not a new drug, it was only by the end of the 20th century that we better understood how the endocannabinoid system (ECS) mediates the psychoactive effects of cannabis in the brain (Alger, 2013). Moreover, being the most

---

Correspondence to: Alcohol Research Group, 6001 Shellmound St, Suite 450, Emeryville, CA 94608, United States. Tel: +1 510 898 5800; Fax: +1 510 985 6459. gabriel.biousp@gmail.com (Andreuccetti G).

Conflicts of interest: None to declare.

consumed illicit drug in the world, its effects are being constantly mimicked by new synthetic cannabinoids for both recreational and therapeutic purposes (Addy & Cyril D'Souza, 2013; Di Marzo, Bifulco, & De Petrocellis, 2004), making marijuana one of the substances with the greatest potential to become a common commodity such as alcohol and tobacco (Room, 2010).

Currently, cannabis accounts for the majority of all illicit drug use worldwide. It is estimated that 8.4% of people aged 15-64 years old have used cannabis at least once in the last year in the Americas, with data showing an increasing trend in the prevalence of use in the U.S. (United Nations Office on Drugs and Crime, 2015). While the scientific literature on the therapeutic properties and health-related harms of cannabis use has been increasing, little is known about the association between cannabis use and the burden of different diseases (Hall & Lynskey, 2016).

While cannabis-attributable disease burden is considered to be lower than other common substances such as alcohol and opioids, findings suggest that cannabis-attributable mortality is mostly represented by road traffic injuries and lung cancer, while morbidity derives mainly from cannabis use disorders (Degenhardt et al., 2013; Imtiaz et al., 2016). Evidence also reinforces the notion that cannabis use before driving is associated with a modest but increased risk for traffic-related injuries (Rogeberg & Elvik, 2016). However, the question of whether cannabis consumption, particularly acute use, is associated with a greater risk for other types of injuries remains unanswered.

Injuries are defined as an acute exposure to physical agents, including both fatal and non-fatal events (Baker, O'Neill, & Karpf, 1984), and currently account for 8.5% of all deaths globally (GBD 2015 Mortality and Causes of Death Collaborators, 2016). The literature reporting non-traffic injuries associated with cannabis use makes no distinction by injury type, and methods used for inferring recent use and establishing control groups vary extensively, with recent epidemiological studies showing mixed findings for injury risk in general attributed to cannabis (World Health Organization, 2015). Although studies have indicated an impairment effect attributed to marijuana on psychomotor abilities that might affect driving performance (Asbridge, Hayden, & Cartwright, 2012; Kelly, Darke, & Ross, 2004) and be one of the factors influencing violent behavior (Moore & Stuart, 2005), there is also evidence suggesting that cannabis may be a protective factor for the occurrence of injuries presenting in the emergency room (ER) setting (Gmel, Kuendig, Rehm, Schreyer, & Daeppen, 2009).

Nonetheless, more than half of homicide victims and at least one-third of ER patients have used some kind of illicit substance before the injury event, with cannabis being the most prevalent (Darke, 2010; Vitale & van de Mheen, 2006). Individuals presenting withdrawal symptoms from cannabis dependence have also been found to act more aggressively (Hoaken & Stewart, 2003), and ER presentations from multiple causes related to cannabis use have been on the increase in the U.S. (Volkow, Baler, Compton, & Weiss, 2014). Therefore, the association between cannabis use and the risk for injuries in general or non-traffic injuries continues to be unclear, with evidence varying from a positive to a negative association (Macdonald et al., 2003; World Health Organization, 2015).

Due to the need for better research on how cannabis use might affect the risk for all causes of injury, and not only those related to traffic accidents, we present here a discussion of the limited evidence available in the literature. This research provides risk estimates for non-traffic injuries following acute use of cannabis. The aim of this scoping study is to identify some of the findings and limitations of the existing literature, and make recommendations for improving future research on this public health issue.

Methods

Two main criteria for the search of original articles from peer reviewed journals published in English were established: a) that the articles included individual-level data on acute cannabis use (i.e. less than six hours before an injury event), alone or in combination with other drugs among non-traffic injuries; and b) they applied a valid case-control or similar study design with risk estimates for injury following cannabis use before the injury event.

The definition of injury we have used is the same as that established by Baker, O'Neill, & Karpf (1984), including both fatal and non-fatal events, but excluding those involving only motor vehicles because our review focused on non-traffic injuries. Studies that reported only cannabis use prevalence estimates without any risk assessments for injury or were based solely on chronic use of cannabis were not included, as well as studies that did not detail the period of cannabis use assessment or did not specify the exact cause of the cannabis-related event (e.g. ER visits related to cannabis use which did not discriminate between injured and non-injured outcomes).

A literature search compiling six databases (PubMed, Web of Science, Scopus, EBSCOhost, PsycINFO, Medline, and Google Scholar) was conducted for articles published from January 2000 to December 2015 using the following descriptor terms: (*cannabis OR marijuana OR THC*) AND (*accident OR violence OR injury/injuries OR trauma*). Only original articles were selected for the purpose of this review. Reviews, brief reports, editorials and other types of publications obtained from search findings and the researchers' personal libraries were reviewed for additional articles that would meet the inclusion criteria. Two different researchers reviewed all the processes involved in the literature search, as well as the selection of full-text articles included in the final review.

Details about the type of injury studied, the study design, and the sampling method applied were compared among studies. Additionally, measures of effect for cannabis use were extracted or calculated from each article (e.g. odds ratios based on prevalence rates obtained from case and control groups) when possible.

Assessment of injury risk attributed to cannabis use among traffic-related and non-traffic injuries

The vast majority of studies on harmful outcomes of cannabis use have focused on motor vehicle crashes, many of which do not result in injury. One of the most recent studies, which matched crash and non-crash involved drivers on the location of the crash, time of day, day of week, and direction of travel, found the risk of a crash from cannabis use was significant

(odds ratio - OR of 1.25, CI95%), but this significance was reduced when the analysis controlled for demographic characteristics. In this study, one-third of the crashes did not result in an injury and less than 1% was composed of fatal injuries (National Highway Traffic Safety Administration, 2016).

Moreover, the literature regarding a dose-response relationship between cannabis use and injury risk from motor vehicle accidents has reported inconsistent findings. Experimental studies have demonstrated that even low doses of the main psychoactive compound, THC (9-tetrahydrocannabinol), affect cognitive and psychomotor performance associated with driving, while epidemiological studies have not provided enough evidence to support a THC concentration threshold linked to risk for crashes (Strand, Gjerde, & Morland, 2016).

Nonetheless, many countries, including the US, have established a *per se* or presumptive limit of cannabis for driving that varies between 3-5ng/ml of whole blood which would be equivalent to the impairment produced by a blood alcohol concentration (BAC) of 0.5g/l (Vindenes et al., 2012). However, since levels of THC decline much faster in blood than those of alcohol, it is more difficult to conclude that the level measured at the time of sampling is the same as that at the time of the driving or injury event, imposing serious difficulties in measuring a dose-response relationship for impairment assessment based on THC blood levels (Logan & Beirness, 2016).

On the other hand, the association of cannabis use with non-traffic injury is a neglected topic in the literature, with findings suggesting that violent injuries are more likely to involve acute cannabis use compared to non-violent injuries. For instance, homicides have demonstrated a greater association with acute cannabis use than suicides (Darke, Duflou, & Torok, 2009; Sheehan, Rogers, Williams, & Boardman, 2012), and a greater prevalence of cannabis use has been found for violence-related injuries in the ER setting than for non-violent injuries (Korcha et al., 2014).

Conversely, a reduced, but non-significant, risk for unintentional falls at home was found for cannabis recent use (Thornley, Kool, Marshall, & Ameratunga, 2014). A recent study has also found that while alcohol use was significantly associated with suicide attempt in ER samples, neither cannabis use nor co-use with alcohol were significantly predictive (Bagge & Borges, 2017).

Although it has been shown that occasional cannabis users present more impairment signs than frequent users (Desrosiers, Ramaekers, Chauchard, Gorelick, & Huestis, 2015), effects on aggressive behavior and cognitive performances, which may affect the risk for injuries, is not as well established as for alcohol, with evidence suggesting a shorter detection window for impairment such as driving under the influence of cannabis (Himes et al., 2013). Therefore, there is ample room for the improvement of studies aiming to address which context and cannabis use patterns are related to a greater risk for injuries in general.

Additionally, the use of cannabis in combination with alcohol and/or other drugs is an important consideration in understanding risk of non-traffic injuries. The combined use of alcohol and cannabis has been found to result in greater risk for traffic crashes than use of either substance alone (Drummer et al., 2004; Dubois, Mullen, Weaver, & Bedard, 2015),

and alcohol combined with cannabis has also been found to result in a greater risk of violent-related injuries compared to non-violent injuries than cannabis use alone (Korcha et al., 2014). Nevertheless, the evidence on the synergistic effects of cannabis combined with alcohol (or other drugs) remains underdeveloped, particularly for non-traffic injuries.

The need to assess generalized cannabis-related injury risk

Despite the research suggesting an increased risk of motor vehicle crashes related to recent cannabis use, the same effect has not been observed for non-traffic injuries or all injuries grouped together. For instance, a review of adverse health effects of cannabis use cites impaired motor coordination resulting in increased risk of injury, but no mention is made of injuries other than those sustained in motor vehicle crashes (Volkow et al., 2014).

In addition to the scarce information on this issue for all injuries, data on injury risk to date has included only fatal injuries or non-injury crashes (World Health Organization, 2015). It is expected that the risk of injury from cannabis use would not be the same across all causes, as most of the studies on injury risk attributed to alcohol use using probability samples have found significant variation (Kuendig, Hasselberg, Laflamme, Daeppen, & Gmel, 2008; Macdonald et al., 2006).

Furthermore, the risk of injury attributed to recent cannabis use should be evaluated separately from usual use, given variation in impairment following acute use compared to chronic use. For instance, most of the earlier studies on the association between cannabis and motor vehicle crashes have shown that acute cannabis use may modestly increase crash risk, whereas chronic cannabis use does not (Ramaekers, Berghaus, van Laar, & Drummer, 2004).

Taking into account this extreme variation in findings related to the association of cannabis use and risk of non-fatal, non-traffic injuries, a more comprehensive understanding of risks of injuries other than those related to road traffic injuries attributed to cannabis use is necessary. In an attempt to summarize the studies available in the literature presenting individual-level risk data on acute cannabis use among all injuries, we discuss here only those studies that have applied a valid case-control or similar study design with risk estimates including non-traffic injuries following cannabis use.

Summary of the studies with risk estimates for non-traffic injury

The table presents the details and the measures of effect for cannabis use extracted or calculated from the three articles retrieved from the literature that included the criteria described above (i.e. risks estimates based on acute use of cannabis only and derived from case-control or a similar study design). These studies were conducted in ER settings and information on recent cannabis use was derived from self-reported use within the six hours before injury. The prevalence of cannabis use ranged from 1.7 to 4.3% among injury cases and 1.3 to 4.9% among control subjects investigated, with all studies including only non-fatal injuries.

One study conducted in the U.S. using non-injured as controls found an increased, but non-significant, risk for all injuries combined following cannabis use (OR 1.33; CI95% 0.37-4.03) (Cherpitel & Borges, 2002). Another recent study in Canada (Cherpitel et al., 2017) used both case-control (injured vs. non-injured) and case-crossover designs (in which the individual presenting an injury is used as his or her own control in a past period). It also showed an increased, but again non-significant, risk for all injuries after cannabis use for the case-control design (OR 1.21; CI95% 0.59-1.21), while the case-crossover design yielded a reduced, and also non-significant, risk of injury (OR 0.83; CI95% 0.30-2.30).

On the other hand, in a study conducted in Switzerland using the same case-crossover design used in the Canadian study (Gmel et al., 2009), a significant reduced risk was found for all injuries attributed to recent cannabis use (relative risk - RR 0.33; CI95% 0.12-0.92). Moreover, the study found an inverse dose-response relationship between cannabis use and injury as measured by the number of joints consumed.

Two of the three studies also provided a risk estimate for cannabis use in combination with alcohol. The Swiss study found that alcohol combined with cannabis presented a greater but non-significant risk for injury (RR 0.71; CI95% 0.12-4.26) than cannabis use alone (Gmel et al., 2009), while the Canadian study found that cannabis combined with alcohol was marginally significant in case-control analysis (OR 4.42; CI 95% 0.80-24.4; $p=0.088$) but not significant in case-crossover analysis (Cherpitel et al., 2017).

Assessment of risk for cannabis-related non-traffic injuries

The findings presented here demonstrate that, unlike the extensive literature on motor vehicle injuries, there is a limited literature using valid controls to support definitive conclusions about the relationship between cannabis and non-traffic injuries. Only the Swiss study suggests a reduced risk for all injuries attributed to cannabis use (Gmel et al., 2009), while the Canadian study found a marginally significant association of cannabis when combined with alcohol on risk of injury (Cherpitel et al., 2017). In addition, none of these studies provided data on biological specimens to assess cannabis use prior to injury, relying only on self-report from both cases and controls. The prevalence of cannabis use found in the studies reviewed here was relatively low compared with previous reviews on illicit drug use by ER injured patients using blood and urine toxicology (9.2-34.2%) (Vitale & van de Mheen, 2006). The Swiss study reviewed here provided evidence on a dose-response relationship between cannabis use and injury risk, with a decreased relative risk for all injuries observed with increasing levels of use, as measured by the number of pipes or joints reported before injury, but the number of patients reporting cannabis use prior to injury was small ($n=14$) (Gmel et al., 2009).

In conclusion, further studies, using designs with valid control groups such as the ones discussed here, are warranted in order to elucidate the risk for all injuries or specific causes of non-traffic injuries following acute cannabis use, and for which at present there is insufficient support to suggest either a protective or detrimental effect attributed to cannabis. This is similar to the conclusion of a recent study: that there is insufficient evidence to support or refute a statistical association between cannabis use and both all-cause mortality

and injuries in general (The National Academies on Sciences, Engineering and Medicine, 2017). This uncertainty suggests the need for further studies, particularly those using longitudinal designs and including different individual lifetime use patterns, which may vary over time (Calabria, Degenhardt, Hall, & Lynskey, 2010).

Barriers and limitations

The limited options for study designs able to provide risk estimates based on valid control groups, as well as the heterogeneity in measurements used to estimate acute cannabis use available in the scientific literature, are significant barriers to any attempt to review the topic examined here. As a consequence, the majority of the studies including injuries other than those related to road traffic injuries present only prevalence rates of cannabis use rather than risk estimates for injury. Additionally, for the studies included here that do present risk estimates for all injuries combined, it was not possible to disentangle traffic-related injuries from other injury types. Moreover, the majority of the prevalence estimates for cannabis use across the three studies discussed here might have been underestimated, since all studies provided only self-report measures of use. These measures may not have been accurate and have been found to be particularly inaccurate when the amount of cannabis used is ascertained (van der Pol et al., 2013).

When risk of injury is analyzed using the case-control design, non-injured ED patients serving as quasi-controls (Cherpitel, 2007) may not represent the best control subjects. This is because some conditions treated in the ER may be linked to long-term chronic effects of alcohol and/or illicit drugs, thus resulting in a greater likelihood of using substances on the part of the non-injured patient compared to the source population (Cherpitel, 1993). Especially important in this regard are those medical patients who may be using medical marijuana, which would provide more conservative estimates of risk of injury from cannabis use. Conversely, individuals may choose to abstain from using alcohol and other drugs due to health problems, the so-called “sick quitter” effect (Shaper, 1990).

The case-crossover approach may also be subject to selection bias due to the context of injury (i.e., the place where the injured occurred and the patient’s activity at the time). Context may be independently correlated with cannabis use and risk of injury, and bias may occur if context is represented unequally in case and control periods. Furthermore, none of the studies available included information on social context both at the individual or aggregate level. The injury-related activity has been virtually ignored in studies on this topic, even though research has indicated that cannabis use and related harms vary according to different social contexts and cannabis control systems (Pacula, Powell, Heaton, & Sevigny, 2015).

Finally, the vast majority of the studies reported in the literature, as well as those reviewed here, included only victims of injuries and not the perpetrators (in the case of intentional injuries). Although evidence suggests that both victims and perpetrators tend to have similar prevalence rates of substance use at the time of an intentional injury event (Chervyakov, Shkolnikov, Pridemore, & McKee, 2002), future research should aim to investigate the influence of cannabis use for both victims and offenders.

Conclusions and future directions

In the U.S., 28 states and the District of Columbia (DC) have enacted legislation to decriminalize marijuana for medical use, while eight of those states and the DC have legalized marijuana for recreational use, with many other states considering similar legislation (Pacula, Jacobson, & Maksabedian, 2015). The increasing prevalence of cannabis use, not only in the U.S. but also in Canada as well as many other countries, suggests that increased efforts to better understand the role of cannabis in all injuries, and not just those related to traffic crashes, are required.

Contrary to what has been observed for traffic-related injuries, this review suggests there is insufficient evidence to support the association between acute cannabis use and injuries in general or specific causes of non-traffic injuries. Thus, rather than reaching a definitive conclusion, the present review demonstrates that the current state of knowledge regarding the effects of cannabis use on injuries looks more like a puzzle with missing pieces.

Society has already paid a high health and social price for not following evidence-based principles and public health-oriented policies when addressing the use of drugs such as alcohol and tobacco. Thus, the development of further evidence on cannabis-attributable harms is imperative to help inform cannabis policies worldwide, a process that may depend heavily on evidence being readily available to inform stakeholders creating policies related to cannabis use.

This article has reviewed the most recent evidence available on non-traffic injury risk attributed to cannabis use, but also serves as a call for more coordinated action in monitoring the health impacts of a substance that is likely to become a common and legal commodity. To understand better how cannabis might affect injury risk for all causes combined or specific causes of non-traffic injuries, our recommendation is that future studies should aim to address the many caveats presented by earlier studies, as well as provide answers to research questions that are relevant for concluding whether cannabis use is related to non-traffic injury risk. These recommendations are detailed below:

- Include both self-report and drug testing for evaluating the validity of measures to estimate the short-term effects of cannabis use on all injuries and specific causes of non-traffic injuries separately from road-traffic injuries, using probability sampling methods and improved observational study designs, including longitudinal data;
- Examine the influence of cannabis consumption patterns on injury risk aiming to provide better estimates of the dose-response relationship, which has been rarely addressed due to lack of methods available to accurately quantify cannabis or evaluate cannabis potency across different cannabis products, including how users titrate their use based on different forms of consumption (e.g., smoking, dabbing, vaping, etc.);
- Assess concurrent and simultaneous use of cannabis with other drugs, particularly alcohol which has demonstrated a synergistic effect in motor vehicle crash studies;

- Evaluate cannabis use and injury context for different injury types and settings (e.g. prohibition vs. legalization policy options) in addition to controlling for covariates such as chronic cannabis use that might affect risk estimates.

Acknowledgments

The authors wish to thank the Alcohol Research Group and the University of Sao Paulo Medical School for their research cooperation that made this study possible.

Funding: This work was supported by Sao Paulo Research Foundation (FAPESP) (#2015/01265-3) and by a grant from the U.S. National Institute on Alcohol Abuse and Alcoholism (NIAAA) (5 R01 AA013750).

Biographies

Gabriel Andreuccetti, Ph.D.

Dr. Andreuccetti completed his Ph.D. in Epidemiology at the Department of Preventive Medicine from the University of São Paulo Medical School in Brazil and the School of Public Health, University of California, Berkeley. He also has a B.Sc. in Biological Sciences and a M.Sc. in Epidemiology from the University of São Paulo. He is currently a Research Associate at the Department of Preventive Medicine from the University of Sao Paulo Medical School and a Postdoctoral Fellow at the Public Health School, University of California at Berkeley, where he develops his research at the Alcohol Research Group (ARG).

He has been working as a scientist during the last ten years in different research projects in the areas of Forensic Toxicology and Epidemiology of Alcohol and Other Drug Use. His current research interests include the development of strategies for drunk and drugged driving in Brazil, and the prevention of alcohol- and drug-related injuries in Latin America.

Yu Ye, M.A.

Mr. Ye is a biostatistician at the National Alcohol Research Center, Alcohol Research Group, Public Health Institute in California. He holds a Master degree in Economics and has worked in the alcohol research field for 15 years. His research interests cover a variety of statistical and epidemiological methods applied in substance abuse research, including causal inference, panel data modeling and risk estimation for alcohol and injury relationship.

Mr. Ye is currently the biostatistician on multiple grants through the US National Institute of Health, including the study of alcohol and injury in Emergency Room patients and the US National Alcohol Surveys. He is also a team member on the WHO Collaborating Centre on Alcohol Epidemiology and Injury.

Jaewook Kang, B.Sc.

He has graduated in Health Management from the University of Sahmyook, Korea and he is currently a Master's student in Community Health Promotion at the Graduate School of Public Health from the Seoul National University.

Mr. Kang has experience in the area of urban neighborhood environment for physical activity of older adults in Seoul, Korea. His recent work is about the effects of an educational management programme on the knowledge of medications and medication misuse behaviours among the elderly in a local community in Korea.

Rachael Korcha, M.A.

Ms. Korcha has conducted epidemiologic and psycho-social substance abuse research on a variety of topics including alcohol and injury, substance abuse therapies, and alternatives treatments to substance abuse recovery. As a team member on the WHO Collaborating Centre on Alcohol Epidemiology and Injury, she has published work on injury and alcohol use in relation to gender, violence, and international alcohol policy.

Ms. Korcha is currently a co-investigator on multiple grants through the US National Institutes of Health examining therapeutic interventions for alcohol abuse and HIV risk reduction and study of substance use patterns among sexual minority women in the United States. Ms. Korcha holds a Master's Degree in Psychological Research.

Jane Withbrodt, Ph.D.

Ms. Withbrodt is an Associate Scientist at National Alcohol Research Center, Alcohol Research Group, Public Health Institute. She has worked at this Institute for more than 20 years and prior to that she worked in substance abuse treatment as a counselor and program director. Her published research has focused primarily on identifying interventions associated with the reduction of substance use problems.

Ms. Withbrodt currently serves as an analyst and team member on multiple projects funded through National Institute of Health grants. These projects mainly use large national and international datasets. She received her Ph.D. from the Karolinska Institute, Stockholm Sweden.

Heraclito B. Carvalho, Ph.D.

Graduated in Medicine from the Federal University of São Paulo in 1982, and completed his Doctorate in Sciences in 1995 at the University of Sao Paulo, where he initiated his Professor Tenure Track Faculty position in 1999. Since 2011, he is an Associate Professor at the Department of Preventive Medicine from the same institution. He attended as a Visiting Professor at the Public Health School from the University of California, Berkeley (2001-2002). He has experience in the area of Public Health, with emphasis on Epidemiology. He develops research on the following topics: AIDS, illicit drug use, behavior, populations at risk of HIV infection and hepatitis, and also with children and adolescents in the area of lifestyle, diet, physical activity, and cardiovascular risks.

During his professional career, he has tutored more than 20 postgraduate and graduate medical students, with more than 100 collaborators in co-authorship of scientific works. He is from the editorial board of the São Paulo Medical Journal and an ad hoc consultant of the

Revista de Saude Publica, Brazilian Journal of Epidemiology, the International Journal of Drug Policy, and financial support agencies such as FAPESP, CNPq, among others.

Cheryl J. Cherpitel, Dr.P.H.

Dr. Cherpitel is a Senior Scientist at the National Alcohol Research Center, Alcohol Research Group, Public Health Institute in Berkeley, CA and Director of the World Health Organization Collaborating Centre on Alcohol Epidemiology and Injury. She has a B.S. degree in nursing from the University of California Medical Center, San Francisco and a Dr. P.H. in epidemiology and bio-statistics from the University of California, Berkeley, School of Public Health. She has been a scientist at the Alcohol Research Group for the past 32 years, where her area of research has included the epidemiology of drinking patterns and problems, with a special focus on injuries, the identification of alcohol use disorders in emergency room (ER) and primary care settings and in the general population, and brief intervention in the ER. This work has resulted in the development of two brief screening instruments, the Rapid Alcohol Problems Screen (RAPS) and Rapid Drug Problems Screen (RDPS). Dr. Cherpitel's research has included a special emphasis on gender, ethnic and regional differences in drinking, including Mexican-origin individuals on both sides the U.S. Mexico border, and cross-cultural comparisons of emergency rooms across the eight countries comprising the Emergency Room Collaborative Alcohol Analysis Project (ERCAAP), 12 countries comprising the WHO Collaborative Study on Alcohol and Injuries and studies included in the National Institute of Alcohol Abuse (NIAAA) and Pan American Health Organization (PAHO) Collaborative Studies on Alcohol and Injury. This international ER data set is continuing to expand to other countries under Dr. Cherpitel's leadership, data from which have been instrumental in calculating the attributable fraction of injury morbidity to alcohol in estimates of the Global Burden of Disease. These data have also been used to establish safe drinking guidelines for Canada and Australia and in the formulation of DSM-V classification for alcohol abuse and dependence. Dr. Cherpitel has served as a consultant for NIH, WHO and PAHO, and is lead editor of a book, Alcohol and Injuries: Emergency Department Studies in an International Perspective, published by WHO, 2010, and Prevention of Alcohol-related Injuries in the Americas: From Evidence to Policy Action, published by PAHO in 2013. Dr. Cherpitel has also served on the NIAAA Initial Review Group of the Committee on Psychosocial Research, Clinical and Treatment Subcommittee, and the NIAAA National Advisory Council.

References

- Addy PH, Cyril D'Souza D. Commentary on Hermanns-Clausen et al. (2013): Spicing things up—the emerging phenomenon of synthetic cannabinoid use. *Addiction*. 2013; 108:545–546. [PubMed: 23418659]
- Alger, BE. Cerebrum: the Dana forum on brain science. Dana Foundation; 2013. Getting high on the endocannabinoid system.
- Asbridge M, Hayden JA, Cartwright JL. Acute cannabis consumption and motor vehicle collision risk: systematic review of observational studies and meta-analysis. *BMJ (Online)*. 2012; 344:e536.
- Bagge CL, Borges G. Acute substance use as a warning sign for suicide attempts: a case-crossover examination of the 48 hours prior to a recent suicide attempt. *Journal of Clinical Psychiatry*. 2017 (in press).
- Baker, S., O'Neill, B., Karpf, R. The injury fact book. Lexington Books; Lexington: 1984.

- Calabria B, Degenhardt L, Hall W, Lynskey M. Does cannabis use increase the risk of death? Systematic review of epidemiological evidence on adverse effects of cannabis use. *Drug and Alcohol Review*. 2010; 29:318–330. [PubMed: 20565525]
- Cherpitel CJ. Alcohol consumption among emergency room patients: comparison of county/ community hospitals and an HMO. *Journal of Studies on Alcohol*. 1993; 54:432–440. [PubMed: 8341045]
- Cherpitel CJ. Alcohol and injuries: a review of international emergency room studies since 1995. *Drug and Alcohol Review*. 2007; 26:201–214. [PubMed: 17364856]
- Cherpitel CJ, Borges G. Substance use among emergency room patients: An exploratory analysis by ethnicity and a cculturation. *American Journal of Drug and Alcohol Abuse*. 2002; 28:287–305. [PubMed: 12014817]
- Cherpitel C, Ye Y, Andreuccetti G, Stockwell T, Vallance K, Chow C, Brubacher JR. Risk of injury from alcohol, marijuana and other drug use among emergency department patients. *Drug and Alcohol Dependence*. 2017 (in press).
- Chervyakov VV, Shkolnikov VM, Pridemore WA, McKee M. The changing nature of murder in Russia. *Social Science & Medicine*. 2002; 55:1713–1724. [PubMed: 12383457]
- Darke S. The toxicology of homicide offenders and victims: a review. *Drug and Alcohol Review*. 2010; 29:202–215. [PubMed: 20447230]
- Darke S, Duflou J, Torok M. Drugs and violent death: comparative toxicology of homicide and non-substance toxicity suicide victims. *Addiction*. 2009; 104:1000–1005. [PubMed: 19466923]
- Degenhardt L, Whiteford HA, Ferrari AJ, Baxter AJ, Charlson FJ, Hall WD, Freedman G, Burstein R, Johns N, Engell RE. Global burden of disease attributable to illicit drug use and dependence: findings from the Global Burden of Disease Study 2010. *Lancet*. 2013; 382:1564–1574. [PubMed: 23993281]
- Desrosiers NA, Ramaekers JG, Chauchard E, Gorelick DA, Huestis MA. Smoked cannabis' psychomotor and neurocognitive effects in occasional and frequent smokers. *Journal of Analytical Toxicology*. 2015; 39:251–261. [PubMed: 25745105]
- Di Marzo V, Bifulco M, De Petrocellis L. The endocannabinoid system and its therapeutic exploitation. *Nature Reviews Drug Discovery*. 2004; 3:771–784. [PubMed: 15340387]
- Drummer OH, Gerostamoulos J, Batziris H, Chu M, Caplehorn J, Robertson MD, Swann P. The involvement of drugs in drivers of motor vehicles killed in Australian road traffic crashes. *Accident Analysis & Prevention*. 2004; 36:239–248. [PubMed: 14642878]
- Dubois S, Mullen N, Weaver B, Bedard M. The combined effects of alcohol and cannabis on driving: Impact on crash risk. *Forensic Science International*. 2015; 248:94–100. [PubMed: 25612879]
- GBD 2015 Mortality and Causes of Death Collaborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016; 388:1459–1544. [PubMed: 27733281]
- Gmel G, Kuendig H, Rehm J, Schreyer N, Daeppen JB. Alcohol and cannabis use as risk factors for injury—a case-crossover analysis in a Swiss hospital emergency department. *BMC Public Health*. 2009; 9:1–9. [PubMed: 19121216]
- Hall W, Lynskey M. Evaluating the public health impacts of legalizing recreational cannabis use in the USA. *Addiction*. 2016; 111:1764–1773. [PubMed: 27082374]
- Himes SK, Scheidweiler KB, Beck O, Gorelick DA, Desrosiers NA, Huestis MA. Cannabinoids in exhaled breath following controlled administration of smoked cannabis. *Clinical Chemistry*. 2013; 59:1780–1789. [PubMed: 24046200]
- Hoaken PNS, Stewart SH. Drugs of abuse and the elicitation of human aggressive behavior. *Addictive Behaviors*. 2003; 28:1533–1554. [PubMed: 14656544]
- Imtiaz S, Shield KD, Roerecke M, Cheng J, Popova S, Kurdyak P, Fischer B, Rehm J. The burden of disease attributable to cannabis use in Canada in 2012. *Addiction*. 2016; 111:653–662. [PubMed: 26598973]
- Kelly E, Darke S, Ross J. A review of drug use and driving: epidemiology, impairment, risk factors and risk perceptions. *Drug and Alcohol Review*. 2004; 23:319–344. [PubMed: 15370012]

- Korcha RA, Cherpitel CJ, Witbrodt J, Borges G, Hejazi-Bazargan S, Bond JC, Ye Y, Gmel G. Violence-related injury and gender: the role of alcohol and alcohol combined with illicit drugs. *Drug and Alcohol Review*. 2014; 33:43–50. [PubMed: 24261437]
- Kuendig H, Hasselberg M, Laflamme L, Daeppen JB, Gmel G. Acute alcohol consumption and injury: risk associations and attributable fractions for different injury mechanisms. *Journal of Studies on Alcohol and Drugs*. 2008; 69:218–226. [PubMed: 18299762]
- Logan, B., SL, K., Beirmess, DJ. AAA Foundation for Traffic Safety. Washington, D.C: 2016. An evaluation of data from drivers arrested for driving under the influence in relation to per se limits for cannabis.
- Macdonald S, Anglin-Bodrug K, Mann RE, Erickson P, Hathaway A, Chipman M, Rylett M. Injury risk associated with cannabis and cocaine use. *Drug and Alcohol Dependence*. 2003; 72:99–115. [PubMed: 14636965]
- Macdonald S, Cherpitel CJ, DeSouza A, Stockwell T, Borges G, Giesbrecht N. Variations of alcohol impairment in different types, causes and contexts of injuries: results of emergency room studies from 16 countries. *Accident Analysis & Prevention*. 2006; 38:1107–1112. [PubMed: 16828047]
- Moore TM, Stuart GL. A review of the literature on marijuana and interpersonal violence. *Aggression and Violent Behavior*. 2005; 10(2):171–192.
- National Highway Traffic Safety Administration (NHTSA). NHTSA. Washington, D.C: 2016. Drug and alcohol crash risk: a case-control study.
- Pacula R, Jacobson M, Maksabedian EJ. In the weeds: a baseline view of cannabis use among legalizing states and their neighbours. *Addiction*. 2015; 111:973–980.
- Pacula RL, Powell D, Heaton P, Sevigny EL. Assessing the effects of medical marijuana laws on marijuana use: the devil is in the details. *Journal of Policy Analysis and Management*. 2015; 34:7–31. [PubMed: 25558490]
- Ramaekers JG, Berghaus G, van Laar M, Drummer OH. Dose related risk of motor vehicle crashes after cannabis use. *Drug and Alcohol Dependence*. 2004; 73:109–119. [PubMed: 14725950]
- Rogeberg O, Elvik R. The effects of cannabis intoxication on motor vehicle collision revisited and revised. *Addiction*. 2016; 111:1348–59. [PubMed: 26878835]
- Room, R. Cannabis policy: moving beyond stalemate. Oxford University Press; USA: 2010.
- Shaper AG. Alcohol and mortality: a review of prospective studies. *British Journal of Addiction*. 1990; 85:837–847. [PubMed: 2204454]
- Sheehan CM, Rogers RG, Williams GW, Boardman JD. Gender differences in the presence of drugs in violent deaths. *Addiction*. 2013; 108:547–555. [PubMed: 23017242]
- Strand MC, Gjerde H, Morland J. Driving under the influence of non-alcohol drugs — an update. Part II: experimental studies. *Forensic Science Review*. 2016; 28:79–101. [PubMed: 27257716]
- The National Academies on Sciences, Engineering and Medicine. The health effects of cannabis and cannabinoids: the current state of evidence and recommendations for research. Washington, D.C: 2017.
- Thornley S, Kool B, Marshall RJ, Ameratunga S. Alcohol intake, marijuana use, and sleep deprivation on the risk of falls occurring at home among young and middle-aged adults: A case-crossover study. *New Zealand Medical Journal*. 2014; 127:32–38.
- United Nations Office on Drugs and Crime (UNODC). World Drug Report 2015. UNODC; Vienna: 2015.
- van der Pol P, Liebrechts N, de Graaf R, Korf DJ, van den Brink W, van Laar M. Validation of self-reported cannabis dose and potency: an ecological study. *Addiction*. 2013; 108:1801–1808. [PubMed: 23627816]
- Vindenes V, Jordbru D, Knapskog AB, Kvan E, Mathisrud G, Slørdal L, Mørland J. Impairment based legislative limits for driving under the influence of non-alcohol drugs in Norway. *Forensic Science International*. 2012; 219:1–11. [PubMed: 22118917]
- Vitale S, van de Mheen D. Illicit drug use and injuries: A review of emergency room studies. *Drug and Alcohol Dependence*. 2006; 82:1–9. [PubMed: 16183213]
- Volkow ND, Baler RD, Compton WM, Weiss SR. Adverse health effects of marijuana use. *New England Journal of Medicine*. 2014; 370:2219–2227. [PubMed: 24897085]

World Health Organization (WHO). The health and social effects of nonmedical cannabis use. WHO; Vienna: 2015.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table

Summary of the main findings from articles that have applied a valid control group in order to estimate injury risk from all causes attributed to recent cannabis use

Study (year)	Location	Subjects (N)	Study design	Period of data collection	Sampling method	Type of injury	Acute cannabis measure	Control group	Cannabis risk assessment measure
Cherpitel et al., 2002	1 ED in San Jose, CA, USA	ED patients 18 yrs. (1,429)	Case-control	14-week (Nov, 1995-Feb, 1996)	Probability	All	Self-report (6h before injury)	Non-injured	OR 1.33 (CI95% 0.37-4.03) ¹
Gmel et al., 2009	1 ED in Lausanne, Switzerland	ED injured patients 16 yrs. (486)	Case-crossover	11-month (Sep, 2005-Jul, 2006)	Probability	All	Self-report (6h before injury)	Same individuals (same 6h one week prior to injury)	RR 0.33 (CI95% 0.12-0.92)
Cherpitel et al., 2017	2 EDs in British Columbia, BC, Canada	ED patients 18 yrs. (2,747)	Case-control and case-crossover	16-month (Dec, 2013-Mar, 2015)	Probability	All	Self-report (6h before injury)	Non-injured and same individuals (same 6h one week prior to injury)	OR 1.21 (CI95% 0.59-2.49) ² OR 0.83 (CI95% 0.30-2.30) ²

¹Odds ratios were calculated based on prevalence rates obtained from case and control groups, thus controlling for covariates was not possible for the estimates showed here.

²Controlled for covariates and alcohol use.