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RISK OF INJURY FROM ALCOHOL, MARIJUANA AND OTHER DRUG USE AMONG EMERGENCY DEPARTMENT PATIENTS

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Abstract

Background—Alcohol is known to be associated with injury, but little is known of combined use of alcohol and other drugs on injury; especially important for marijuana, given increasing legalization of use in the U.S. and Canada.

Methods—Probability samples of patients 18 and older were interviewed in the emergency department at two sites in Vancouver and one in Victoria, BC (n=1191 injured and 1613 non-injured patients). Case-control and case-crossover analyses were used to analyze risk of injury, based on self-reported alcohol and drug use (marijuana, stimulants, depressants) prior to injury.

Results—Risk of injury was significantly elevated ($p<0.001$) for alcohol use alone in both case-control (OR=2.72) and case-crossover analyses (OR=2.80) but not for any of the three drug classes. The interaction of alcohol with each class of drug was tested, and marginally significant only for marijuana in case-control analysis (OR=4.42; p=0.088). The interaction of alcohol and two or more drugs was also significant in case-control analysis (OR=03; p=0.035). The volume of alcohol consumed prior to injury was greater for those also using drugs during this time and positively associated with the number of drugs reported.

Conclusion—Given the potential issues involved with both case-control and case-crossover study designs, the inconsistent findings suggest caution in reaching any definite conclusion regarding whether there is extra risk related to combined use of alcohol and marijuana, and is an important area for future research.

Keywords

injury risk; alcohol; drug use; emergency department

INTRODUCTION

Studies on self-reported alcohol use and injury in the emergency department (ED) have found alcohol is a significant risk factor for injury using both case-control methodology with non-injured patients as quasi-controls (Cherpitel, 1993a, 2007; Romelsjö, 1995), and case-crossover methodology with injured patients used as their own controls (Borges et al., 2004; Vinson et al., 1995). However, less is known of the interaction of alcohol with other drugs and injury, although the prevalence of concurrent use of alcohol and other drugs is substantial (Vitale and van de Mheen, 2006). Importantly, is a better understanding of alcohol in combination with marijuana, given that recreational marijuana is now legal in eight U.S. states and the District of Columbia.

There is greater impairment in psychomotor performance when alcohol is combined with other drugs, not an uncommon occurrence, than when either substance is used alone (Longo et al., 2001; Stoller et al., 2001). One recent study in British Columbia (BC), Canada found that 40% of moderately injured drivers tested positive for alcohol or at least one impairing drug (including medications) and 13% tested positive for more than one substance (Brubacher et al., 2016). A review of the literature found that 25% of crash-involved drivers were positive for multiple drugs (Kelly et al., 2004), and these drivers were five times more likely to be culpable for the crash than those positive for alcohol alone (House of Representatives Standing Committee on Family and Community and Affairs, 2002). One of the few ED studies of substance use and injury across all causes found relative risk (RR) of injury was three times greater for alcohol use in the six hours prior to injury and similar for alcohol combined with other drug use, but was not significant for drug use alone (Cherpitel et al., 2012). This same study found that alcohol in combination with other drugs was 18 times more predictive of intentional injury than alcohol use alone (Cherpitel et al., 2013). These numbers were too small, however, for analysis by drug class, and the effects of alcohol in combination would not be expected to be the same for all classes of drugs (Martin, 2008).

Marijuana is of special interest, as noted above, since to date, 29 states and the District of Columbia have enacted legislation to decriminalize marijuana for medical use, and eight of those states and the District have legalized marijuana for recreational use. The principal active component of marijuana, delta-9-tetra-hydrocannabinol (THC), has been found to significantly impair attention, reaction time, hand-eye coordination, decision making and concentration, and impairment is dose-related (Ashton, 2001; Kelly et al., 2004; O'Kane et al., 2002). In Colorado, one of the first two states to legalize both medical (2009) and recreational (2014) use of marijuana, ED visits related to marijuana increased over 50% between 2007 and 2012. Large increases in marijuana-related ED visits have also been found in those states where marijuana is legal only for medical use: Hawaii (55%), New Jersey (49%), Arizona (32%), or not legal for any purpose, e.g., Texas (43%) (Brauser,

2014). Meta-analyses of marijuana and crash risk have found pooled odds significantly elevated (Li et al., 2012; Asbridge et al., 2012; Rogeberg and Elvik, 2016), controlling for confounding variables, including alcohol. Marijuana and alcohol may interact to impair psychomotor function more than either substance alone (Sewell et al., 2009), and this combination of drugs has been found to result in greater risk for a vehicle crash (Brault et al., 2004; Drummer et al., 2004; Dubois et al., 2015), with those positive for both substances at 15 times higher risk, compared to 12 times higher for drivers positive for alcohol alone (House of Representatives Standing Committee on Family and Community and Affairs, 2002).

Other drugs are also of interest. Stimulant and depressant drugs used in combination with alcohol have been found to potentiate alcohol's impairing effects, increasing risk of injury due to their pharmacological properties which act on the central nervous system (CNS) (Cami et al., 2000; Gouzoulis-Mayfrank et al., 2000). Amphetamines impair perception, memory and psychomotor function (Kelly et al., 2004). Cocaine, when used with alcohol, forms a new metabolite, cocaethylene, which lasts three to five times longer than cocaine and produces synergistic impairment of judgement (Hart et al., 2000; Laizure et al., 2003; Pennings et al., 2002). Opioids and other CNS depressants have been found to alter mood with 'mental clouding' and drowsiness, including diminished reaction time, information processing, and visual acuity (European Monitoring Centre for Drugs and Drug Addiction, 1999; Robbe and O'Hanlon, 1999). Nearly half of the drug-related ED visits in 2011 involved nonmedical use of prescription drugs, primarily opioids, which increased 183% between 2004–2011, and 25% of these also involved alcohol (Substance Abuse and Mental Health Services Administration, 2013).

While studies have demonstrated an elevated risk of injury due to self-reported alcohol use in ED samples (Cherpitel, 2007), we do not know whether the same patients who had been drinking prior to injury were also using other drugs, and if so, how much of their elevated risk for injury is due to the other drug(s), possibly in a synergistic interaction with alcohol. To fill this gap in the literature, the risk of injury due to alcohol use alone is compared to risk, separately, from marijuana, CNS stimulants and CNS depressants, and to alcohol in combination with each of these drugs, in a probability sample of patients seeking treatment in two EDs in Vancouver, BC and one ED in Victoria, BC. Since prior research has found risk of injury from self-reported alcohol use is larger in case-control than in case-crossover studies (Cherpitel et al., 2014), both types of analysis are conducted here. Aims of the paper are to examine: 1) whether self-reported drug use elevates the risk of injury; and, 2) whether self-reported alcohol use in combination with drug use elevates risk of injury beyond the independent effect of both substances. We hypothesize that alcohol in combination with each type of drug will significantly elevate risk of injury beyond their independent effects in both case-control and case-crossover analysis.

METHODS

Samples

The hospitals were selected because of the diverse clientele they serve in the two largest metropolitan areas in BC, Vancouver and Victoria, and because patients in these hospitals

have higher drug use rates compared to other emergency service facilities in the two cities. All were teaching hospitals serving both inner-city and suburban populations. Data were collected simultaneously at each site over a period of 16 months (December 2013-March 2015) on probability samples of all patients (injured and non-injured) 18 years and older seeking emergency services within six hours of the that event brought them to the ED. Exclusion criteria included those less than 18 years of age, patients who could not speak English, and patients who were not assessed as competent to participate.

Injured and non-injured patients were sampled, simultaneously, from computerized admission logs that reflected consecutive arrival to the hospital. Injury included both unintentional (any bodily harm occurring from an outside force) and intentional (violence-related or suicide attempt). To maximize the opportunity of including alcohol and drug users, sampling at all three sites occurred from 8:30 pm to 4:30 am one weekend in every month, with the equivalent of one week of round-the-clock sampling at each site three times a year. Sampling frames differed by times of day and site, depending on patient flow. Sampling ratios were higher for injured than for non-injured patients to assure an adequate number of injured patients for analysis, e.g., every injured to every 5th injured patient was sampled depending on time of day and site, while every 2nd to every 12th non-injured patient was sampled. Data were weighted to provide a representative sample of all patients for all shifts and days of the week at each of the three EDs. The sampling scheme yielded a total sample of 1191 injured patients and 1613 non-injured patients across the three sites, reflecting an overall response rate of 76%. Non-interviews were primarily due to the patient refusing to participate (17%), and the remainder due to the patient's medical condition, not being able to locate the patient, or the patient being discharged before the interview could be completed. Responders and non-responders were not significantly different on age or gender.

Data Collection

Interviewers were trained and supervised by research staff from the Centre for Addictions Research of BC. Patients were approached with written informed consent to participate in the study and were interviewed as soon as possible after registering for treatment. A $10 gift card was offered to participants. Interviews were conducted in a private area to ensure confidentiality of responses, and carried out prior to treatment, if time permitted; otherwise the interview was completed after the examination. Patients who were too severely injured to be interviewed at that time, but who were hospitalized, were interviewed after their condition had stabilized.

Instruments

Data were collected using a 25-minute interviewer-administered questionnaire (Cherpitel et al., 2003), adapted from the WHO Collaborative Study on Alcohol and Injury (http://www.who.int/substance_abuse/activities/en/InjuriesInstrumentEnglish), with additional questions on use of drugs across classes. The questionnaire obtained data, among other items, on the reason for the ED visit (type of medical problem or injury), and drinking and drug use within six hours prior to the event that brought the patient to the ED, and during the same six-hour period the previous week. Injuries included those related to falls (37%), traffic crashes (8%), violence (8%) and other causes (47%), while medical conditions included

cardio-pulmonary (29%), gastro-intestinal/digestive (17%), and other conditions (54%). Data were also collected on demographic characteristics and risk taking disposition, using the risk-taking/impulsivity scale constructed from six items (Eysenck and Eysenck, 1977; Jackson, 1974) and the sensation seeking scale from four questions on novelty and thrill seeking (Zuckerman, 1979). The risk taking scale was generated by taking the average of the 10 items, each of which ranged from 0 (lowest) to 3 (highest) (Cherpitel, 1993c).

Patients were asked, “In the 6 hours before and up to you [having your injury/accident/noticing your illness/medical problem], did you have any alcohol to drink – even one drink?” The same question was then asked for the same 6-hour period the previous week. Similar questions were asked for drug use for both time periods: “In the 6 hours before and up to you [having your injury/accident/noticing your illness/medical problem], did you take any prescription or non-prescriptions medications or any other drugs?” Those answering positively were then asked about taking any of the following (with examples provided in each group): 1) drugs that reduce anxiety or make you sleepy, 2) drugs which make you more alert or give you energy, 3) heroin, 4) other drugs used to relieve pain, 5) drugs that cause visual hallucinations, 6) methadone, 7) marijuana, hash, THC, 8) any other drugs prescribed for a physical illness, 9) an other drugs, specified. For these analyses, drugs were categorized into three classes: marijuana, CNS stimulants (amphetamines, methamphetamine, cocaine, ecstasy) and CNS depressants (sedatives, heroin, opiates, analgesics, and methadone).

Data Analysis

Both case-control analysis, using non-injured patients as control subjects, and case-crossover analysis (Maclure, 1991; Mittleman et al., 1993), were used to estimate the risk of injury associated with drinking and drug use within the six hours prior to the event.

Case-control analysis—In case-control analysis, odds ratios (ORs) adjusted for age, gender, education, income, marital status, employment status and risk taking disposition are estimated from logistic regressions comparing alcohol consumption and drug use by type (marijuana, stimulants, depressants), during the six hours prior to the event between injured and non-injured patients. Non-injured patients who reported alcohol or drug intoxication/withdrawal as the reason for the ED visit (n=57) were excluded from analyses. In sensitivity analysis those non-injured who reported decreasing their alcohol and/or drug use during the preceding month as a result of illness or a medical problem (sick quitters) (n=225), were also excluded, as this “sick quitter” effect (Shaper, 1991) could lead to an overestimation of the risk of injury.

Case-crossover analysis—In case-crossover analysis, using the pair-matched approach, alcohol and other drug use in the six-hour period prior to the injury event for each patient was compared to use during the same six-hour period the week prior to injury. Conditional logistic regression was used to calculate the ORs for matched pairs and 95% confidence intervals (CIs) (Maclure, 1991).

RESULTS

Table 1 shows demographic characteristics for the injured and non-injured patients. Injured patients were younger than non-injured patients, had more education, a higher income and were more likely to be employed, but less likely to be married. They were also higher on risk taking/impulsivity disposition than the non-injured.

Table 2 shows the prevalence of drinking, drug use and combined use six hours prior to the event for injured and non-injured patients (for case-control analysis) and for the injured, for the same six-hour period the previous week (for case-crossover analysis). Injured patients were more likely than non-injured patients to report alcohol use, marijuana use and alcohol in combination with any other drug in the six hours preceding the event. Of injured patients who reported marijuana use (n=77), 52% (n=40) also reported using alcohol in combination. In comparison, of the 39 non-injured patients who used marijuana, only 13% also reported using alcohol.

Table 3 reports ORs for alcohol and drug use, alone and in combination, derived from the case-control and case-crossover analyses. Models 1a-5a are fitted with alcohol and drug use variables entered as main effects simultaneously, while Models 1b-5b examine the effects from both alcohol and drug use and their interaction. Specifically, the OR for the interaction term (e.g. alcohol * marijuana) estimates the magnitude of the effect from both alcohol and drugs together in excess of the product of the effects of alcohol and drug considered separately.

As seen in Model 1a-3a, among all the substances, only alcohol significantly predicted injury, while none of the three types of drugs were significantly associated with injury. We then examined the interaction between alcohol and each class of drug, separately (Model 1b-3b). Only the interaction between alcohol and marijuana was marginally significant (p=0.088) from the case-control analysis, with odds of injury risk from the combined use 4.4 times that of the independent effect of the two substances separately. To better illustrate the interpretation of the interaction term, using Model 1b of the case-control analysis as an example, the OR of injury for combined alcohol and marijuana use versus use of neither substance as the reference is 13.2 (=2.46*1.21*4.42), 4.4 times higher than the OR for the product of alcohol and marijuana effect separately if there *were* no excess risk from the combined use (=2.46*1.21). The estimate of their interaction from the case-crossover analysis was not significant, however (OR=1.5). No significant elevated risk of injury was observed for combined use of alcohol with either stimulants or depressants compared with use of alcohol and that drug.

Model 4a showed no significant effect on injury for any drug use alone, nor was a significant interaction effect found for alcohol and any drug use (Model 4b) in either case-control or case-crossover analysis. The use of more than one drug was also not found to significantly predict injury (Model 5a). However, the interaction between alcohol and more than one drug was significant in case-control analysis (OR=12.0, p=0.035), but not in case-crossover analysis (OR=1.5, p=0.715).

In case-control sensitivity analysis, which excluded non-injured control patients who reported decreasing their alcohol and/or drug use during the preceding month as a result of illness (not shown), little difference in risk of injury was found with the exception of the interaction between alcohol and marijuana, for which the OR increased from 4.42 to 11.48 ($p<0.001$), and the interaction between alcohol and two or more drugs, for which the OR decreased from 12.03 to 7.61 ($p=0.092$).

DISCUSSION

Substantial literature demonstrates a strong association between alcohol use and injury, and the findings here support this. The OR of injury from alcohol use in this study was 2.6–2.8 from either the case-control analysis or the case-crossover analysis (including other drugs in the model). This is similar to the risk from a prior case-crossover study which multiple-matched drinking both the day before injury and the week before, from the same two EDs in Vancouver (OR=3.3) (Cherpitel et al., 2012), as well as from other case-crossover studies in the ED (Borges et al., 2004; Borges et al., 2006; Vinson et al., 1995; Vinson et al., 2003).

In addition to confirming the risk of injury from alcohol use, this study focused on two aims related to risk of injury from drug use: 1) whether there is elevated risk of injury related to drug use, 2) whether combined use of alcohol and drugs further increases the risk of injury beyond that of the independent effects of both substances. For the first aim, this study shows that risk of injury was not found to be elevated for drug use alone. For the second aim, the interaction between alcohol and drugs was only marginally significant for alcohol combined with marijuana and significant for alcohol combined with two or more drugs, both based on case-control analysis. In sensitivity analysis, however, which theoretically provides a more conservative estimate, risk of injury based on the interaction of alcohol and marijuana increased. The numbers of patients reporting use of stimulants or depressants in combination with alcohol were small, and preclude any definitive statements regarding their joint effect on injury risk.

Confounding an evaluation of the risk relationship of combined use of alcohol and drugs with injury is the likelihood that those who use alcohol and drugs together may drink larger amounts of alcohol than those using only alcohol. If so, the larger ORs observed for combined use of alcohol and drugs compared to alcohol use alone may be the result of consuming larger amounts of alcohol, rather than an added risk from drug use. In this study, the average volume of consumption in the six hours prior to injury was 4.4 drinks for those using only alcohol, 7.0 drinks for those using alcohol and only one drug, and 12.7 drinks for those using alcohol and two or more drugs. The amount of alcohol consumed also varied by drug class, with 9.4 drinks for those reporting marijuana use, 12.3 drinks for those reporting stimulant use and 4.8 drinks for those reporting depressant use (not shown). The prior Vancouver ED study also found the number of drinks consumed prior to injury was greater among those who used alcohol in combination with other drugs than those who used alcohol alone (Cherpitel et al., 2012). Given the small prevalence of those reporting combined use of alcohol and drugs, the statistical power was insufficient to fully examine the interaction effect of alcohol volume and drug use in order to disentangle the added effect of drug use at a given level of alcohol consumption, particularly given that the dose-response relationship

of alcohol volume to injury risk is normally non-linear (Cherpitel et al., 2015) and this is a topic for future exploration.

While previous analyses of the risk of injury from stimulants and depressants among ED patients have not been reported, one ED study found that neither marijuana use alone, nor in combination with alcohol, elevated risk of injury (Gmel et al., 2009). That study, however, was limited by the small number of patients reporting marijuana use. In the present study, risk of injury from marijuana combined with alcohol use was similar to that for stimulants and depressants combined with alcohol, based on case-crossover analysis, but risk was higher for the combination of marijuana with alcohol than for the other substances in combination with alcohol based on the case-control analysis. These data are only suggestive, however, due to the small number of those reporting either stimulant or depressant use in combination with alcohol.

Limitations

As noted above, we were not able to conduct a dose-response analysis of the interaction between levels of alcohol use and use of other drugs, due to an insufficient number of patients. A prior study in the same two Vancouver EDs found, using a case-crossover analysis, an OR of 1.77 for 1 or 2 drinks, 5.84 for 3 to 4 drinks, and 13.8 for more than 5 drinks in the six hours prior to injury (Cherpitel et al., 2012), and similar dose-response relationships have been found in other ED studies (Borges et al., 2004; Borges et al., 2006; Vinson et al., 1995; Vinson et al., 2003), using case-crossover analysis.

One of the most challenging methodological issues when estimating risk of injury from acute substance use using ED patients is the choice of controls. In this study we compared results from two types of controls (medical emergency patients and injury patients matched to their own substance use the prior week), two approaches commonly used in similar studies, yet both having their own limitations (Gmel and Daeppen, 2009). Medical patients may not represent well the source population from which the injuries arise. Earlier studies found medical patients had higher rates of usual alcohol use and alcohol-related problems than were found in the same general population (Cherpitel, 1993b). No similar investigation has been made on marijuana or and other drug use however. Additionally, some conditions treated in the ED may be directly linked to long-term heavy drinking (e.g., liver cirrhosis), which would lead to more conservative estimates of risk of injury from alcohol use. On the contrary, medical patients may refrain from substance due to health problems, the sick quitter effect (Shaper, 1991), which would result in overestimation of the risk of injury from substance use. In the present study we made an effort to adjust for the “sick quitter” effect in sensitivity analysis by excluding medical patients who reported decreasing their alcohol and/or drug use during the preceding month as a result of illness. Since no substantial decrease in relative risk estimates was observed, potential “sick quitter” effects from recent illness may not be a large concern. Despite these potential issues, there are also some advantages to using medical patients as controls, including the fact that they are usually sampled at the same time as injury cases, and from the same catchment area, leading to the conclusion by Gmel & Daeppen (2009) that “household controls may not necessarily be better controls than non-injured ED patients”.

The case-crossover design, in which individuals serve as their own controls using a pre-determined time-period, which theoretically reduces confounding of the substance use-injury relationship from stable risk factors, is also not without potential biases in risk estimates. While the same time last week as the control period can account for the weekly drinking pattern often observed among drinkers, the design is subject to potential recall bias. Mixed results have been found in the literature. A study of effectiveness of brief intervention in the ED found that reported consumption decreased by length of the recall period for the seven-day recall (Gmel and Daeppen, 2007). Design of that study was different than other ED studies on risk of injury from alcohol consumption, however, with total consumption obtained for a 24-hour period, rather than a 6-hour period, and measured by a 7-day retrospective diary. An ED study examining recall bias for the day prior to injury compared to the week prior found no difference between the two six-hour control periods, however (Ye et al., 2013). In the current study, since no significant elevated risk was found for any drug use other than alcohol using the case-crossover design, recall bias for these substances may be less an issue, given that recall bias tends to overestimate the relative risk. Relatedly, both case-control and case-crossover designs are based solely on patients' self-report of alcohol and drug use. Self-report has been found to be valid, however, in previous ED studies where only about .5% of those testing positive on the breathalyzer deny drinking prior to the injury event (although over 40% reported drinking while registering negative on the breathalyzer due to the time lag between the event and arrival/breath testing in the ED (Cherpitel et al., 1992). Considering the limitations related to using either medical patient controls or self-controls, results from both study designs are provided to assess the robustness of the findings, which can also be compared to earlier results using similar designs.

As noted, the prevalence of acute substance use other than alcohol is very low, resulting in small sample sizes of those reporting use, particularly for those reporting use of alcohol with other drugs. This is especially true for stimulants and depressants, and for control samples or during control periods, as shown in Table 2. These small positive cell sizes could have subjected our findings to sampling bias and lead to some very large confidence intervals for OR estimation.

Other caveats also apply. Injury risk may vary by cause of injury (e.g., those involved in vehicle crashes may be less likely to report substance use while those sustaining violence-related injuries may be more likely to do so), as well as by injury severity, but due to limited numbers we were not able to take this heterogeneity in injury cases into account. Additionally, while patient samples were representative of their respective EDs, they are not necessarily representative of a broader area or jurisdiction, nor are they representative of those whom may have had injuries but did not seek treatment in an ED.

Conclusions

Drug use, especially marijuana, is becoming increasingly more prevalent in the U.S. and Canada, with a higher prevalence in BC than elsewhere in Canada (Health Canada, 2013) but little research has been reported which examines the risk of injury at which drug use alone, or in combination with alcohol, places the individual. In attempting to fill this gap, the present study found an elevated risk for injury from alcohol use alone, but not for drug use.

Only the interaction of alcohol with marijuana use was marginally significant based on the case-control analysis, while no significant interaction was found from the case-crossover analysis. Given the potential issues involved with both study designs, the inconsistent findings suggest caution in reaching any definite conclusion regarding whether there is extra risk related to combined use of alcohol and marijuana.

Nevertheless, it remains that marijuana is the drug most likely to be used with alcohol, with 52% of the injured patients using marijuana also reporting using alcohol in combination in the present study. In light of recent legislation decriminalizing marijuana use, future research is needed to further elucidate the effects of marijuana used in combination with alcohol, which may have implications for public health policies and programs impacting and reducing harms, as well as for future intervention and prevention strategies in the ED.

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Table 1

Demographic characteristics of ED patients, by injury and non-injury status (%)

	Injured N=1,191	Non-injured[1] N=1,556	Total N=2,747
Gender male	57.5	48.6**	52.4
Age			
18–29	30.4	21.8***	25.5
30–49	36.1	28.8	31.9
50+	33.5	49.2	42.6
White	73.4	74.3	73.9
Education			
Less than HS grad	7.8	12.5*	10.5
HS grad	17.8	18.0	17.9
Some college	36.4	37.3	36.9
College grad or above	37.9	32.2	34.6
Monthly income			
<$1000	14.9	20.0***	17.8
$1000–$2499	26.1	26.8	26.5
$2500–$3999	21.2	18.2	19.4
≥4000	26.5	19.5	22.5
Missing	11.2	15.5	13.7
Employment status			
Full time employed	54.9	39.3***	45.9
Part time employed	11.7	10.9	11.3
Unemployed	5.8	9.3	7.8
Retired	16.6	24.3	21.1
Others	10.9	16.2	14.0
Marital status			
Married/Living together	40.8	43.4*	42.3
Separate/Divorced/Widowed	15.1	19.8	17.8
Never married	44.1	36.8	39.9
Risk taking mean (range 0–3)	1.12	0.92***	1.00

[1] Excludes 57 patients who reported alcohol/drug intoxication/overdose as main cause of ED admission

* p<0.05,

** p<0.01,

*** p<0.001, tests between injured and non-injured

Table 2

Substance use prevalence among injured and non-injured patients by substance group

	Injured patients 6-hour prevalence		Non-Injured patients 6-hour prevalence		Injured patients Last week Prevalence	
	N	%	N	%	N	%
Alcohol	325	14.68	140	5.52	210	8.67
Marijuana	77	4.33	39	2.66	74	3.94
Stimulants	25	0.85	21	1.11	19	0.62
Depressants	54	4.85	127	7.21	54	4.51
Alcohol + Marijuana	40	1.70	5	0.15	36	1.27
Alcohol + Stimulants	16	0.53	6	0.26	10	0.19
Alcohol + Depressants	16	0.80	10	0.37	11	0.44
Any drug	140	9.25	169	10.13	130	8.15
One drug	118	8.13	140	8.46	111	7.24
Two or more drugs	22	1.12	29	1.68	19	0.91
Alcohol + any drug	61	2.60	21	0.78	49	1.72
Alcohol + one drug	50	2.14	20	0.75	38	1.47
Alcohol + ≥ two drugs	11	0.45	1	0.03	11	0.25

Table 3

Odds Ratios (ORs) of injury related to alcohol and drug use from case-control and case-crossover analysis

	Case-control analysis		Case-crossover analysis	
	OR (95% CI)	**P**	**OR (95% CI)**	**P**
Model 1a				
Alcohol use	2.67 (1.86, 3.82)	<0.001	2.81 (1.66, 4.76)	<0.001
Marijuana	1.52 (0.82, 2.82)	0.186	0.95 (0.44, 2.03)	0.894
Model 1b				
Alcohol use	2.46 (1.70, 3.57)	<0.001	2.76 (1.62, 4.72)	<0.001
Marijuana	1.21 (0.59, 2.49)	0.609	0.83 (0.30, 2.30)	0.727
Alcohol * Marijuana	4.42 (0.80, 24.40)	0.088	1.54 (0.39, 6.18)	0.540
Model 2a				
Alcohol use	2.76 (1.93, 3.97)	<0.001	2.80 (1.65, 4.74)	<0.001
Stimulants	0.56 (0.24, 1.30)	0.177	1.53 (0.47, 4.99)	0.483
Model 2b				
Alcohol use	2.75 (1.90, 3.97)	<0.001	2.76 (1.62, 4.70)	<0.001
Stimulants	0.51 (0.16, 1.60)	0.246	0.96 (0.15, 6.07)	0.965
Alcohol * Stimulants	1.26 (0.23, 6.78)	0.789	2.08 (0.30, 14.36)	0.456
Model 3a				
Alcohol use	2.72 (1.90, 3.89)	<0.001	2.83 (1.67, 4.78)	<0.001
Depressants	0.82 (0.51, 1.32)	0.414	2.15 (0.57, 8.09)	0.259
Model 3b				
Alcohol use	2.64 (1.82, 3.85)	<0.001	2.81 (1.64, 4.80)	<0.001
Depressants	0.78 (0.46, 1.33)	0.366	2.04 (0.50, 8.34)	0.319
Alcohol * Depressants	1.53 (0.48, 4.88)	0.471	1.24 (0.26, 6.02)	0.789
Model 4a				
Alcohol use	2.72 (1.89, 3.90)	<0.001	2.80 (1.65, 4.74)	<0.001
Any drug	0.99 (0.67, 1.47)	0.969	1.38 (0.69, 2.73)	0.362
Model 4b				
Alcohol use	2.49 (1.67, 3.70)	<0.001	2.75 (1.58, 4.77)	<0.001
Any drug	0.91 (0.59, 1.42)	0.693	1.30 (0.58, 2.92)	0.528
Alcohol * Any drug	1.77 (0.71, 4.39)	0.221	1.25 (0.46, 3.34)	0.663
Model 5a				
Alcohol use	2.71 (1.89, 3.89)	<0.001	2.80 (1.66, 4.75)	<0.001
1 drug	1.05 (0.69, 1.59)	0.829	1.32 (0.66, 2.67)	0.432
2+ drug	0.71 (0.33, 1.53)	0.379	2.55 (0.51, 12.83)	0.257
Model 5b				
Alcohol only	2.49 (1.67, 3.70)	<0.001	2.75 (1.58, 4.79)	<0.001
1 drug	1.00 (0.62, 1.63)	0.995	1.27 (0.55, 2.90)	0.577
2+ drug	0.52 (0.19, 1.41)	0.202	2.20 (0.27, 17.99)	0.461
Alcohol * 1 drug	1.42 (0.54, 3.76)	0.475	1.19 (0.42, 3.36)	0.742
Alcohol * 2+ drug	12.03 (1.19, 121.45)	0.035	1.47 (0.18, 11.84)	0.715