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ALCOHOL AND DRUG USE AS PREDICTORS OF INTENTIONAL INJURIES IN TWO EMERGENCY DEPARTMENTS IN BRITISH COLUMBIA

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Abstract

The risk of intentional injury due to alcohol and other drug use prior to injury is analyzed in a sample of emergency department patients in Vancouver, BC (n=436). Those reporting only alcohol use were close to 4 times more likely (OR = 3.73) to report an intentional injury, and those reporting alcohol combined with other drug(s) almost 18 times more likely (OR = 17.75) than those reporting no substance use. Those reporting both alcohol and drug use reported drinking significantly more alcohol (15.7 drinks) than those reporting alcohol use alone (5 drinks). While these data suggest that alcohol in combination with other drugs may be more strongly associated with intentional injury than alcohol alone, this may be due to the increased amount of alcohol consumed by those using both substances, and is an area requiring more research with larger samples of intentional injury patients.

INTRODUCTION

While a substantial literature exists demonstrating a strong association of alcohol and violence-related (intentional, not including self-inflicted) injury, much of which has come from studies of emergency department (ED) patients (1, 2), less is known about the association of intentional injury with recreational drug use, either alone, or in combination with alcohol. Previous studies have suggested that many of those who have used alcohol have also used other drugs prior to the ED admission, and that use of either alcohol or other drugs is associated with a 40% higher rate of use of the other substance (3, 4), with rates for

drug use in combination with alcohol higher than for drug use alone, across all classes of drugs (5).

Most ED studies examining the association of drug use with injury have measured the prevalence of positive toxicology screens (which may remain positive for days to weeks after the last use, depending on the specific drug and pattern of use) in injured patients at the time of the ED visit (reviewed in el-Guebaly (6)). In these studies, cocaine and cannabis had the highest prevalence rates (5, 7–9). The majority of these studies, however, unlike studies of alcohol and injury, have not used representative samples of ED patients, nor have they determined the timing of drug use relative to injury. These limitations preclude estimation of the prevalence of drug involvement in the injury event, or of the risk of injury associated with drug use.

Those few epidemiologic studies examining the acute effects of drug use and the likelihood of intentional injury in the ED have found that drug use may be more closely associated with intentional injuries than with other types of injury (10), as has been found for alcohol (1, 2, 11, 12). One study found that patients with intentional injuries are more likely than those with unintentional injuries to test positive for drugs in combination with alcohol, and for drugs alone, as well as for life-time and last-12-month drug dependence (36%) (13). An ED study in Mexico, however, found no relationship between drug use six hours prior to the event and intentional injuries (14), while a review of illicit drug use and injuries in ED studies found drug use strongly associated with violence-related injuries (15).

Different classes of drugs have different pharmacological effects, either alone, or in combination with alcohol. This may account for the mixed findings reported. However, the small amount of available literature suggests that drugs may be important to consider alongside alcohol in injury occurrence, especially for intentional injuries. Cocaine, a central nervous system stimulant (16), has been particularly implicated in intentional injuries (9, 17–19), and while disagreement continues over the exact nature of the relationship (20), there is growing consensus that acute alcohol and cocaine effects are at least partially causally related to violence (9, 21). A review of the experimental literature on alcohol and cocaine concluded that simultaneous use of the two substances may be synergistic in terms of the number and intensity of psychomotor effects, including agitation and feelings of paranoia (22, 23), and that the enhanced and prolonged euphoria following simultaneous use of the two substances may increase the craving for both, resulting in increased likelihood of severe outcomes including intentional injuries (24).

Studies of the relationship between intentional injuries and cannabis have also yielded mixed results (9), and little research exists on other types of drugs.

Recreational drug use is becoming more prevalent in the U.S., in Canada and elsewhere, and is especially common in heavy drinkers (25, 26). The 2008 National Survey on Drug Use and Health (27) found that 29% of heavy drinkers reported illicit drug use in the last month (compared to only 3% among those not reporting alcohol use). Data from the National Epidemiology Survey on Alcohol and Related Conditions (NESARC) found past year frequency of reporting 5 or more drinks on an occasion was an accurate screener for past year cannabis or cocaine use (28), and a drug use disorder (primarily cannabis and cocaine) was more prevalent among those with a past year alcohol use disorder than among those without (29). Rates for both cannabis and cocaine use are higher in Canada than in the U.S., and in Canada are highest in British Columbia (BC) (30). Despite the marked increase in drug use in general, little research has examined whether an association exists between drug use alone, or in combination with alcohol, and intentional injury.

To address this issue, we compared the odds of substance use (alcohol use alone, drug use alone, or alcohol combined with drug use) in intentionally injured patients (not including those with self-inflicted injury) versus unintentionally injured patients who sought treatment in two EDs in Vancouver, British Columbia (BC). The two hospitals were chosen because both receive patients from the downtown Vancouver catchment area which includes the entertainment districts as well as drug using venues. In this study, we define drug use as illicit drug use or non-prescription use of psychotropic medications such as prescription opioids.

METHODS

Samples

Data were collected over an 18-week period (April to August 2009) on probability samples of injured patients 18 years and older at the two Vancouver EDs. Samples were drawn from computerized admission logs that reflected consecutive arrival to the ED, and provided equal proportional representation of each shift for each day of the week. The sampling scheme yielded a total sample of 443 interviewed patients, which reflected a 69% response rate (27% refused to participate in the study and 4% were unable to provide informed consent due to medical reasons). The non-interviewed were no different on gender than those interviewed, but were older (over 65). Patients were approached with written informed consent to participate in the study and were interviewed as soon as possible after registration. Interviews were conducted in a private area to ensure confidentiality of responses. When possible, interviews were carried out prior to the patient's examination; otherwise the interview was completed after the examination. Patients who were too severely injured to be interviewed while in the ED were interviewed in the hospital after their condition had stabilized.

Instruments

A cadre of interviewers were trained by the authors and supervised by survey research staff from the Centre for Addictions Research, BC to administer a 25-minute questionnaire, adapted from the WHO Collaborative Study on Alcohol and Injury (31), with additional questions on drug use. The questionnaire obtained data, among other items, on the type and cause of injury that brought the patient to the ED, and whether violence was involved (an intentional injury), taken from the following question: "Why were you injured? Did you get into a fight, were you beaten, attacked or raped?" Data were also obtained on drinking and drug use within six hours prior to the injury, the number of drinks consumed in the six hours, and demographic characteristics. Participants also provided a breathe sample which was analyzed for alcohol using the Alco-Sensor IV breathalyzer (Intoximeters, Inc, St.Louis, MO).

Drug data were obtained from a series of questions on use in any of the following categories of drugs in the six hours prior to injury: 1) methamphetamines, 2) other amphetamines, 3) cocaine, 4) sedatives including barbiturates, 5) methadone, 6) heroin, 7) other opiates including codeine, 8) psychedelics, 9) cannabis, 10) other drugs not including medicinal use of prescription or over the counter medications.

Patients who reported drinking or using drugs prior to the injury event were also asked whether they believed the injury would have happened if they had not been drinking or using drugs, respectively (causal attribution of injury to alcohol or drug use).

Data Analysis

Data were analyzed comparing population proportions for percents, and t-tests for means, on demographic and substance characteristics between those with intentional and those with unintentional injuries (Table 1). Logistic regression analysis was used to examine the predictive value of substance use (alcohol only, drugs only, both alcohol and drugs) in the six hours prior to injury on the likelihood of reporting to the ED with an intentional versus an unintentional injury, controlling for age and gender (Table 2). Odds ratios (ORs) are reported for variables simultaneously entered in the model, and 95% confidence intervals (CIs) for those found to be significant predictors. For those reporting alcohol use in the six hours prior to injury, the mean number of drinks consumed was compared between those reporting only alcohol use and those reporting both alcohol and drug use. Number of drinks was calculated by dividing the total amount of absolute alcohol consumed by the patient by 16ml (the amount of absolute alcohol in a normal beer) (Table 3). For those reporting drug use in the previous six hours, the mean number of drug categories reported was compared between those reporting only drug use and those reporting drug use combined with alcohol (Table 3). Independent t-tests were used to examine significance differences in the mean number of drinks reported and the mean number of drug categories reported between those using either substance alone compared to combined use of substances.

RESULTS

Table 1 shows demographic and substance use characteristics for those with intentional injuries (n=36) compared to those with unintentional injuries (n=400). Compared to patients with unintentional injury, those reporting intentional injuries were significantly more likely to be male, to report alcohol use alone (30.6% vs 17.8%), and to report combined alcohol and other drug use (27.8 % vs. 3.3%), but no difference was found for drug use alone.

Table 2 shows ORs and 95% CIs for substance use prior to injury for patients with an intentional vs. those with an unintentional injury, controlling for age and gender. Both alcohol use alone, and alcohol used with other drugs were significantly predictive of an intentional injury. Injured patients reporting alcohol use alone were close to 4 times more likely to have a violence-related injury than those reporting no substance use, and those reporting alcohol combined with other drug(s) were almost 18 times more likely to be admitted for a violence-related injury. When compared to the alcohol only group (not shown), those reporting both alcohol and drug use were close to 5 times more likely (OR=4.76; CI= 3.73–17.75) to be admitted with an intentional injury (Wald statistic=8.6, p=0.003). Drug use alone was not found to be predictive of intentionality.

It is possible that the larger association seen in Table 2 between intentional injury and alcohol in combination with other drugs compared to alcohol alone (or to drug use alone), may be because patients who used both substances consumed more alcohol (or more drugs) than those reporting only alcohol use (or only drug use). The mean number of drinks reported for the alcohol only group compared to the alcohol in combination group, and the mean number of drug categories reported for the drug only group compared to the combination group can be seen in Table 3. Overall, those reporting both alcohol and drug use prior to injury reported a significantly larger number of drinks during the six-hour period (mean of 15.7) compared to those reporting alcohol use alone (mean of 5.0). The difference was significant (at p=.06) for unintentional injuries, but not for intentional injuries (although in the same direction), likely due to the small number of those with intentional injuries. The opposite trend was found for drug use, however, with those reporting drug use alone reporting use in more drug categories than those reporting drug use in combination with alcohol, although this difference was not significant. Estimated blood alcohol content (BAC) was also compared between those reporting alcohol alone and those reporting alcohol in

combination with other drug use, with similar results to that found for self-reported consumption (not shown). Overall, mean BAC was lower for those reporting only alcohol use (.04 mg%) compared to those reporting alcohol in combination with other drugs (.10 mg %; $p=.03$), but the difference was not significant by intentionality, mostly like due to small numbers (.039 mg% vs. .077 mg%, respectively, for unintentional injuries and .059 mg% vs. .12 mg%, respectively, for intentional injuries).

Patients were also asked if they believed the event would still have happened had they not been drinking or using drugs (causal attribution). Among those with intentional injury, a larger proportion (although not significant; most likely due to small numbers attributed a causal association between their drinking and the injury than between their drug use and injury (24% vs. 8%), while little difference was found in casual attribution of injury to alcohol compared to drugs among those with unintentional injury (29% vs. 22%, respectively) (not shown).

DISCUSSION

While a substantial literature documents a strong association of alcohol and intentional injury (1, 11), little data have been reported on the association of intentional injury with other drug use, or with alcohol in combination with other drugs, although both substances have been found to be used together frequently (3, 4). To fill this gap, the risk of intentional injury due to alcohol alone was compared to that due to alcohol in combination with other drug use, in a sample of ED patients. While alcohol use prior to injury was predictive of intentional injury, alcohol combined with drug use was significantly more predictive of intentional injury, and may be more attributable to heavier alcohol use in the group using both substances, than to a synergistic effect between alcohol and drug use. A study of alcohol and violence-related injuries in ED patients in Mexico, Brazil and Argentina found a stronger dose-response relationship (higher levels of self-reported drinking prior to injury associated with greater relative risk) for violence-related injuries compare to injuries from other causes (32), and a six country survey of ED patients also found a significant dose-response relationship between BAC level and intentional injuries (11). These findings suggest that other mechanisms may be important for intentional injury, over and above those associated with impaired psycho-motor coordination; for example, alcohol reduces inhibitions and may lead to more aggressive behavior, resulting in increased likelihood of a violence-related event resulting in injury. It is important to note, however, based on data reported here as well as those from other studies, that it is not possible to determine whether a patient's drinking, per se, led to the violent-related injury, or whether other factors, such as context of drinking and the event may have been responsible, and this is an area requiring further research. Additionally, the magnitude of alcohol's contribution to intentional injuries is likely an underestimate when based on comparison with alcohol use in patients sustaining unintentional injuries, since these latter patients are more likely to be alcohol involved than both non-injury control patients and those from the general population (33).

Drug use alone was not found to predict intentional (or unintentional) injury. Patients also tended to be more likely (although not significant) to attribute a causal association of intentional injury to their drinking than to their drug use prior to the event. One possible explanation for lack of findings regarding drug use is that not all drugs would be expected to act in a similar manner to one another, or in combination with alcohol, across all types and causes of injury. For example, cocaine used with alcohol forms a new metabolite, cocaethylene, that has different pharmacological properties with greater and longer lasting behavioral effects than those from either substance used alone (22, 34–36), potentiating an increased likelihood of injury. On the other hand, while cannabis use has been found to be predictive of injury in an ED study of injured problem drinkers, it was not predictive of

intentional injury, (25). In another study of treatment clients, however, cocaine and alcohol, but not cannabis, was predictive of a previous intentional injury (21). While cannabis and cocaine are the drugs most commonly found among injured patients in emergency department studies (15), some few other studies have implicated other drugs, for example benzodiazepines (37) and opium (Hebert et al., 2007) in motor vehicle crashes.

Given the differing pharmacological effects across classes of drugs, as well as their varying effects when combined with alcohol, one might expect an elevated risk of injury due to specific drugs, and alcohol in combination with certain drugs (possibly a synergistic effect) but not with others, for specific types of injury. However, relatively small numbers of patients with intentional injuries here (n=36) precluded analyses of alcohol in combination with other drugs by specific drug categories. Small numbers also likely affected observed significance in differences found in the number of drinks consumed between those using only alcohol compared to those using alcohol in combination with other drugs, and in casual attribution of intentional injury to alcohol compared to other drugs.

Drug use, especially cannabis and cocaine, is becoming increasingly more prevalent in North America and elsewhere, and is particularly common in heavy drinkers (25–28). The debate on whether the combination of alcohol and drugs may produce a synergistic effect (increasing the likelihood of violence) still remains, due in part to challenges such as achieving sufficient statistical power in analyzing drug effects, given they are used relatively infrequently in the population, and the difficulty of measuring drug quantity and impairment. Nevertheless, since injuries, especially intentional injuries, have been found to be strongly associated with alcohol in combination with other drugs (especially with cocaine and cannabis) (15), this is an area of important need in future research on intentional injuries, utilizing larger samples of substance using patients.

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Table 1

Characteristics of patients with intentional (i.e. violent) and unintentional injuries (percent or mean)

	Total (436)	Intentional (36)	Unintentional (400)
Male	64.3	77.8	63.0*
Age	40.1	37.9	40.6
Years of education	17.6	15.9	17.6
Number of ED visits last year	1.8	1.6	1.8
No alcohol or drugs	71.4	36.1	75.2**
Only alcohol	19.3	30.6	17.8**
Only Drugs	3.9	5.6	3.8
Both alcohol and drugs	5.4	27.8	3.3**

*p<0.05 (comparison of independent proportions)

**p<0.01 (comparison of independent proportions)

Table 2

Odds ratios (ORs) and 95% confidence intervals (CIs) for self-reported use of alcohol and/or other drugs in the 6 hours prior to the event on intentional (coded 1) versus unintentional (coded 0) injuries

Variables	OR	CI	OR	CI
No drugs/alcohol				
Alcohol only	3.73	1.60–8.69	3.63	1.54–8.57
Drugs only	3.08		2.86	
Both alcohol/drugs	17.75	6.57–47.96	16.10	5.83–44.58
Male			1.67	
Age			.999	

Table 3

Mean number of drinks and mean number of drug categories reported in the 6 hours prior to injury

Alcohol Group	Total Sample	Unintentional	Intentional
Alcohol only	5.08	4.88	6.25
Both alcohol and drugs	15.74 (p=.01)	16.22 (p=.06)	11.93 (p=.24)
Drug Group			
Drugs only	1.65	1.60	2.00
Both drugs and alcohol	1.54 (p=.79)	1.38 (p=.53)	1.60 (p=.53)

*Independent t-tests