Acute and chronic substance use among patients with a road traffic injury in Mexico City

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Abstract

Objective. To report on the prevalence acute and chronic substance use among patients attending an emergency department (ED) in Mexico City because of a road traffic injury (RTI) and possible effect modifiers for the relationship between acute alcohol and *cannabis* use and RTI. **Materials and methods.** Adult RTI patients, admitted to an ED (January to April 2022). Breath Alcohol Concentration and six types of drugs were assessed using a saliva screen test. Patients also self-reported their alcohol and drug use. **Results.** 13.9% reported an alcohol use disorder in the last 12 months. Acute alcohol use was frequent, with 18.9% being positive. We found a large association between habitual and acute substance use. In a case-crossover analysis, there was no significant effect modification. **Conclusion.** Patients positive for substance use at entry to the ED should have a comprehensive evaluation of their substance abuse habits and a referral to a mental health specialist.

Keywords: injury; epidemiology; substance use; acute use; case-crossover

Resumen

Objetivo. Informar sobre la prevalencia del uso agudo y crónico de sustancias en pacientes que asistieron a un departamento de emergencias (DE) en la Ciudad de México debido a una lesión relacionada con el tráfico (LRT) y los posibles modificadores del efecto de la relación entre el uso agudo de alcohol, *cannabis* y la LRT. **Material y métodos.** Pacientes adultos con LRT, admitidos en un DE (de enero a abril de 2022). Se midió la concentración de alcohol en el aliento utilizando un alcoholímetro y se evaluaron seis tipos de drogas mediante una prueba de detección en saliva. Los pacientes también informaron su consumo de alcohol y drogas. **Resultados.** El 13.9% reportó un trastorno por uso de alcohol en los últimos 12 meses. El uso agudo de alcohol fue frecuente, con 18.9% siendo positivo. Se encontró una gran asociación entre el uso habitual y agudo de sustancias. En un análisis de casos cruzados, no hubo una modificación significativa del efecto. **Conclusión.** Los pacientes positivos por uso de sustancias al ingresar al DE deben tener una evaluación integral de sus hábitos de abuso de sustancias y una referencia a un especialista en salud mental.

Palabras clave: lesiones; epidemiología; consumo de sustancias; uso agudo; caso cruzado

Alcohol and drug use are key risk factors for the burden of disease in Mexico, with alcohol being the seventh and drug use the 15th most important risk factors according to the Global Burden of Disease Study 2021.[1] Substance use has a large impact on non-intentional injuries in the country, particularly for traffic-

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related injuries. These injuries are the 4th main cause of death due to its percentage on the disability-adjusted life year in Mexico among those 15-49 years old.[2]

There is now ample research on the effect of acute alcohol use on traffic-related injuries in Mexico[3] and elsewhere[4] and chronic alcohol use and patterns of heavy episodic drinking have also been related to death by transport injuries (including road traffic accidents).[5] It has been suggested that both dimensions of alcohol use, acute and habitual use, are not independent among victims of injuries attending the emergency department (ED),[6] but we do not have this information for victims of road traffic injuries (RTIs). This is relevant since if those attending an ED because of an RTI are both prone to acute use and habitual heavy drinking, then interventions for substance use in the ED are necessary to reduce alcohol use and its consequences on a long-term basis. While several drugs have been associated with RTI and death[7] the dimensions of both acute and chronic use among victims of traffic-related injuries in Mexico has not been studied previously. Thereby, the goal of this report is to provide data on the possible relationship between acute and chronic substance use (alcohol and six types of drugs) among 433 patients attending a large ED in Mexico City because of an RTI. We also explore whether chronic use is an effect modifier for the relationship between acute alcohol and acute cannabis use and an RTI, by using a case-crossover study.

Materials and methods

Data source

The sample comprised of 433 adult RTI patients (79% response rate from 846 candidates), admitted to the ED of a public general hospital in Mexico City (January to April 2022), surveyed during the 24 hours and seven days of the week. Details are available elsewhere.[8,9] Patients gave informed consent for a breath test measuring breath alcohol concentration (BAC), a saliva screening test for six classes of drugs (amphetamines, barbiturates, benzodiazepines, *cannabis*, cocaine, and methamphetamine) and self-report of substance use. Self-reported alcohol and drug use in two control periods were used for the case-crossover analyses as described by Maclure.[10] The two most recent days on which they were also drivers, passengers, or pedestrians at approximately the same time as when the injury

happened, and where they were considered at risk for an RTI, were used as control periods. The frequency of habitual at risk-drinking (+four drinks for women and five+ drinks for men in a single episode) and the frequency of drug use within the last 12 months were obtained by means of self-report. Patients also reported a full scale for alcohol use disorders[11] and a series of screening questions to assess drug use disorders that evaluated the presence of several problems: cravings, social/health/financial problems, failure to fulfill obligations, concern from family or friends, and attempts to reduce or control the use of substance.

All study procedures were approved by the Ethics Committee of the Mexico City Ministry of Health (ID 101-011-024-21) and by the Ethics Committee of the National Institute of Psychiatry.

Statistical analysis

Descriptive data for habitual substance use and disorder/screening in the sample, frequencies, and percentages, with breakdown by acute substance use six hours prior by self-report or biological sample, *p*–values computed from ordinal logistic models adjusted for sex, age, education, and type of RTI are presented.

Estimates for the case-crossover analyses used a multiple pair matching comparison, in which for each patient, their reported use of alcohol or cannabis during the hazard period was compared with their use of alcohol/cannabis during the two days prior to injury (control periods) as detailed previously.[8] Following Asbridge and colleagues,[12] we reported a model in which exposure during the hazard period was considered positive for a biological measure (breath for alcohol or saliva for drugs) if available or through self-reports of substance use six hours prior to the RTI, if no biological sample was available. The analyses of a possible effect modifier in the relationship between acute use and RTI by key modifiers, including usual substance use/problems, follow a prior report from our group.[13] Multivariate matched odds ratios, confidence intervals and *p*-values from conditional logistic regression models are presented. Variations in the magnitude of ORs across levels of fixed characteristics, such as sex, was examined using the χ^2 test for homogeneity.

Results

Among the 433 participants, 73.9% were male and 26.1% females. Most patients were young (78.1% were aged 18-39 years) and single (56.4%). Most cases occurred on weekdays/nights (66%), with motorcycle drivers comprising most of the sample (49.9%).

Table I shows the sample's distribution for habitual and acute substance use. For example, in the total sample, 69.7% used alcohol in the last 12 months, 39.1% reported risk-drinking and 13.9% reported a DSM-5 alcohol use disorder in the last 12 months. Acute alcohol use was frequent, with 18.9% being positive. For all four types of substances there was a large association between habitual and acute use of the substance, judging by the *p*-values from our multiple ordinal logistic regression models. For example, one or more problems were reported by 14.6% of those negative to *cannabis* prior to the RTI but this percentage rose to 58.6% among those that used *cannabis* prior to the RTI. Among those that did not use any drug prior to the RTI (85.0% of the sample), 14.4% reported one or more problems, but this percentage rose to 47.6% for the patients that reported acute use prior to the RTI (15.0% of the sample).

Table I

Substance (alcohol and drugs) use frequency* and problems during the past 12 months, by substance use prior to injury (n= 433). Mexico City, January to April 2022

		Substance use prior-BAC/oral fluid, or self-report if missing		
		Alcohol		
	Total (%)	No (%)	Yes (%)[‡]	p-value[§]
	433 (100.0)	351 (81.1)	82 (18.9)	
Alcohol use frequency				
Not in the past year/never	130 (30.2)	128 (36.6)	2 (2.5)	<0.001
At least once a year	225 (52.3)	177 (50.6)	48 (60.0)	
At least once a month	75 (17.4)	45 (12.9)	30 (37.5)	
Risky alcohol use (4+/5+)[#]				
No/never	258 (60.8)	225 (64.8)	33 (42.9)	0.001
Less than once a month	51 (12.0)	44 (12.7)	7 (9.1)	
Al least once a month	115 (27.1)	78 (22.5)	37 (48.1)	
DSM-5 alcohol use disorder				
None	370 (86.0)	316 (90.3)	54 (67.5)	<0.001
Mild	32 (7.4)	21 (6.0)	11 (13.8)	
Moderate/severe	28 (6.5)	13 (3.7)	15 (18.8)	
		Cannabis		
	Total (%)	No (%)	Yes (%)[&]	p-value
	433 (100.0)	404 (93.3)	29 (6.7)	
Cannabis frequency				
No/never	326 (76.0)	316 (79.0)	10 (34.5)	<0.001
At least once a year	44 (10.3)	39 (9.8)	5 (17.2)	
At least weekly	59 (13.8)	45 (11.2)	14 (48.3)	
Cannabis number of problems[≍]				
No	357 (82.4)	345 (85.4)	12 (41.4)	<0.001
1	23 (5.3)	17 (4.2)	6 (20.7)	
2+	53 (12.2)	42 (10.4)	11 (37.9)	
		Any stimulant[ø]		
	Total (%)	No (%)	Yes (%)[&]	p-value
	433 (100.0)	386 (89.1)	47 (10.9)	
Any stimulant frequency				
No/never	402 (93.1)	366 (95.1)	36 (76.6)	<0.001
At least once a year	26 (6.0)	18 (4.7)	8 (17.0)	
At least weekly	4 (0.9)	1 (0.3)	3 (6.4)	

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Any stimulant number of problems[∞]

No	416 (96.3)	375 (97.4)	41 (87.2)	0.013
I	10 (2.3)	7 (1.8)	3 (6.4)	
2+	6 (1.4)	3 (0.8)	3 (6.4)	

	Any depressant[◊]			
	Total (%)	*No (%)*	*Yes (%)[&]*	*p-value*
	433 (100.0)	420 (97.0)	13 (3.0)	
Any depressant frequency				
No/never	415 (96.1)	408 (97.4)	7 (53.8)	<0.001
At least once a year	12 (2.8)	10 (2.4)	2 (15.4)	
At least weekly	5 (1.2)	1 (0.2)	4 (30.8)	
Any depressant number of problems[∞]				
No	421 (97.5)	414 (98.8)	7 (53.8)	<0.001
I	5 (1.2)	3 (0.7)	2 (15.4)	
2+	6 (1.4)	2 (0.5)	4 (30.8)	

	Any drug[€]			
	Total (%)	*No (%)*	*Yes (%)[&]*	*p-value*
	433 (100.0)	368 (85.0)	65 (15.0)	
Any drug number of problems[∞]				
No	348 (80.6)	314 (85.6)	34 (52.3)	<0.001
I	29 (6.7)	20 (5.4)	9 (13.8)	
2+	55 (12.7)	33 (9.0)	22 (33.8)	

BAC: breath alcohol concentration
* Some frequencies do not add up to the total sample size due to missing values
‡ BAC positive (at least 0.001) or self-report if BAC is missing
§ *p*-values from ordinal logistic models controlling for sex, age, education, and type of road traffic injury
# Risky alcohol use is 4+ standard drinks for females and 5+ for males
& Positive test (oral fluid) or self-report if test is missing
∞ Number of problems includes: craving, social/health/financial problems, failure to fulfill obligations, concern from family or friends, attempt to reduce or control the use of substance
º Any stimulants include stimulants, cocaine, and synthetic drugs
◊ Any depressants include sedatives, analgesics, heroine, and inhalants
€ Any drug includes any stimulants, any depressants, hallucinogens, and other drugs

Estimates of risk of an RTI for alcohol and *cannabis* use, the only substances with sample size large enough, by key possible effect modifiers (demographics and habitual substance use) are presented in tables II and III. As apparent from table II, there was no significant effect modification for any of the demographics examined here nor for habitual risk drinking or DSM-5 alcohol use disorder. That is, alcohol use six hours prior to the RTI increased 3.43 times the likelihood of an RTI, regardless of other demographics and 12-month alcohol use patterns/disorder. For *cannabis*, there was no association between *cannabis* use six hours prior and the likelihood of a RTI (OR= 0.83), regardless of other demographics and cannabis frequency/screening.

Discussion

This study shows the large prevalence of acute alcohol use prior to an RTI in an ED department in Mexico City (18.9%). It also adds novel information on the prevalence of acute use of drugs (15.0%). Importantly, it shows that those acute users are also more likely to be habitual frequent users of alcohol and drugs, and more likely to have a 12-month alcohol use disorder and to screen positively for problems related to drug use disorders. Heavy drinking among the general population of adults in Mexico City was 40% in 2016[14] and *cannabis* use in the last 12 months was 4.6%[15] and similar lower prevalences were reported for other drugs in Mexico City.

Table II
MATCHED PAIRS ANALYSES OF ALCOHOL CONSUMPTION PRIOR TO INJURY (BAC OR SELF-REPORT),*
BY POSSIBLE KEY EFFECT MODIFIERS. MEXICO CITY, JANUARY TO APRIL 2022

	Obs‡	OR§	95%CI	X^2(d.f.)	p
Total	967	3.43	2.02,5.83	-	-
Sex					
Female	246	2.00	0.58,6.91	0.88 (1)	0.348
Male	721	3.86	2.14,6.99		
Age group					
18 to 30	565	3.66	1.97,6.79	0.16 (1)	0.693
31+	402	2.87	1.03,8.01		
College education					
No	764	3.87	2.14,7.01	0.89 (1)	0.346
Yes	197	2.03	0.60,6.78		
Type of RTI					
Pedestrian	123	1.76	0.45,6.86	1.10 (2)	0.578
Driver	657	3.72	1.87,7.40		
Passenger	187	4.13	1.43,11.98		
DSM-5 alcohol use disorder					
None	840	3.20	1.73,5.91	0.38 (2)	0.826
Mild	67	5.47	1.11,26.88		
Moderate/Severe	60	3.31	0.81,13.54		
Risky alcohol use (4+/5+)					
No/never	584	5.68	2.25,14.30	2.46 (2)	0.293
Less than once a month	109	1.59	0.31,8.05		
Al least once a month	266	2.64	1.27,5.48		

RTI: road traffic injury
95%CI: 95% confidence interval
BAC: breath alcohol concentration
* BAC positive (at least 0.001) or self-report if BAC is missing
‡ Obs are the number of case and control periods used in each model (i.e., each person contributed with a maximum of three observed case and control periods for the multiple matching models)
§ Odds ratio (OR) estimated by multiple matching (1:2 matched pairs) conditional logistic regression

Comparatively, we found much higher prevalence of habitual substance use in this sample of ED patients. This information is likely to be of relevance for ED professionals. This means that people under the acute effects of substances, who suffer an RTI, are also more likely to be heavy users throughout the year. These patients should have a comprehensive evaluation of their substance abuse habits beyond just prior to the accident and, among those likely to be affected for a substance use disorder, a referral to a mental health specialist could have important consequences. Unfortunately, in Mexico we lack standard procedures in the ED to screen for substance use and even those that are identified from high levels of intoxication are not commonly sent to a mental health specialist. While advances have been made to incorporate new legislation to address drunk-driving in Mexico, much more work needs to be done to increase compliance with this legislation. Counseling on the use of preventive measures, such as helmet/seat belt use should also be provided, especially for intoxicated patients.

While it is important to have accessible tools in the ED for identifying and treating those in need because of their excess drinking, public health policies aimed to control alcohol use and harms are sorely needed in Mexico. Areas for improvement in alcohol policies include, among others, increased taxation, restriction on availability and a ban on advertising and marketing.[16]

Table III
Matched pairs analyses of cannabis consumption six hours prior to injury (oral fluid or
self-report),* by possible key effect modifiers. Mexico City, January to April 2022

	Obs‡	OR§	95%CI	X^2(d.f.)	p
Total	962	0.83	0.41,1.76	-	-
Sex					
Female	246	1.00	0.16,6.42	0.05 (1)	0.827
Male	716	0.80	0.37,1.72		
Age group					
18 to 30	562	0.65	0.29,1.45	1.68 (1)	0.195
31+	400	2.04	0.44,9.48		
College education					
No	759	0.67	0.31,1.46	1.96 (1)	0.161
Yes	197	3.88	0.38,39.48		
Type of RTI					
Pedestrian#	123	-	-	0.57 (2)	0.750
Driver	652	0.94	0.42,2.13		
Passenger	187	2.06	0.33,13.05		
Cannabis number of problems&					
No	794	2.31	0.71,7.47	7.78 (2)	0.020
1	46	1.54	0.38,6.30		
2+	113	0.21	0.06,0.78		

RTI: road traffic injury
95%CI: 95% confidence interval
* Positive test (oral fluid) or self-report if test is missing
‡ Obs are the number of case and control periods used in each model (i.e., each person contributed with a maximum of three observed case and control periods for the multiple matching models)
§ Odds ratio (OR) estimated by multiple matching (1:2 matched pairs) conditional logistic regression
# The estimate for the pedestrian type of RTI was not computed due to cells with zero counts
& Number of problems includes: craving, social/health/financial problems, failure to fulfill obligations, concern from family or friends, attempt to reduce or control the use of substance

It has been shown that the consistent implementation of strict alcohol policies in Lithuania during a 15-year period, that also included restrictions on alcohol availability, including minimum purchasing age regulations, drunk driving legislations and advertisement bans, reduced alcohol-related collisions and crashes, injury and TRI mortality.[17] Unfortunately, low and middle-income countries, such as Mexico, are far behind in implementing a comprehensible and long-lasting policy for alcohol control, but a proposal for the prioritization of research relevant to lower-and middle-income countries has been put forward.[18]

Public health measures aimed to impact the rates of RTIs by targeting the consumption of other substances are still to be formulated and implemented, in Mexico and elsewhere. The World Health Organization (WHO) did not include specific recommendations on *cannabis* and RTIs in their report on the health and social effects of nonmedical cannabis use,[19] but a broader WHO report on substance use and RTI suggested areas in need for improvement, such as developing and establishing thresholds for drug impairment, drug-driving laws and regulations and integrating drug-driving policies with public health oriented drug policy frameworks.[20]

We confirmed prior results on a set of cases of injury showing that basic demographic variables (such as age, sex, education) did not act as an effect modifier for the relationship between acute alcohol use and RTI. The lack of effect modification for being positive to alcohol use disorders or heavy alcohol involvement among RTI cases was not similar to a prior work on cases of injury and a screening measure of heavy alcohol involvement.[13] Reasons for this discrepancy should be further investigated. As reported previously,[8] acute *cannabis* use was not related to RTI when exposure during the hazard period was a combination of saliva sample and self-

report data, which was similar to a prior work among RTI cases in Canada. This lack of association between cannabis and RTI did not vary among possible effect modifiers, which has not been reported before.

Limitations

This study is limited to a data analysis of a representative sample of patients with RTI drawn from a specific ED during a short time frame (three months) in the Covid-19 pandemic in Mexico. Cases cannot be assumed to be representative of other individuals experiencing an RTI who did not seek medical care. Our response-rate of 79% is within the scope of other studies with similar methodology carried out in the region.[21] While our sample size of 433 patients allowed us to report accurate estimations for the prevalence and risk of an RTI associated with the two most common substances (alcohol and *cannabis*), the small prevalence of other drugs precluded us to perform more specific case-crossover analyses. Case-crossover studies are well suited to control for between-person confounders (such as age and sex), but they do not remove the possibility that within-person confounders exist. Because we lack measures of other acute variables that vary over time, besides alcohol and *cannabis*, and that could be considered possible confounders of the relationship between acute alcohol use and RTI, we cannot quantify this bias or adjust our results accordingly.

In conclusion, both acute and habitual alcohol and drug use was common among ED patients suffering an RTI in Mexico City. Public health policies coupled with efforts to identify and treat these patients is much needed.

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Contributors

The initial draft of this paper was prepared by Guilherme Borges in collaboration with Ricardo Orozco and Rebeca Borges-Monroy. Borges confirms that he had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Borges and Orozco were responsible for obtaining funding, they participated in the study concept and design, and in the analysis and interpretation of data. All authors reviewed initial drafts for substantive inputs and approved the final version of the article. Borges accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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