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# Alcohol and violence in the emergency department: a regional report from the WHO collaborative study on alcohol and injuries

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## Abstract

**Objective.** To determine the relative risk (RR) of non-fatal unintentional and violence-related injury associated with alcohol consumption in three emergency departments in Latin America (2001-2002). **Material and Methods.** Pair-matched case-crossover was used to obtain RR estimates for alcohol in non-fatal injuries among 447 patients in Argentina (A), 489 in Brazil (B) and 455 in Mexico (M). Intentional (violence) or unintentional (non-violence) injury status were the main outcomes. **Results.** About 46% of violence-related cases involved alcohol (versus 11.5% for non-violence related cases). The risk of violence-related injury increased with drinking and had an OR= 15.0 (95% confidence interval (CI), 5.8-39.1), with an OR= 4.2 (CI= 2.7-6.5) for unintentional injuries. **Conclusions.** Increasing amounts of drinking may have pronounced consequences on the risk of triggering an injury, especially for a violence-related injury. The RR estimates provided here can be useful for new estimates on alcohol and the burden of disease.

Key words: alcohol intoxication; epidemiology; methods; Latin America; emergency service

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## Resumen

**Objetivo.** Determinar el riesgo relativo (RR) de lesiones no intencionales y relacionadas con la violencia, asociadas al consumo de alcohol en tres Servicios de Urgencia de América Latina (2001-2002). **Material y métodos.** Se usó un diseño case-crossover en 447 pacientes de Argentina (A), 489 de Brasil (B) y 455 de México (M). **Resultados.** El 46% de los casos relacionados a la violencia consumieron alcohol (vs. 11.5% de los no-violentos). El riesgo de una lesión relacionada con la violencia se incrementó con el consumo, y tuvo una RM= 15.0, intervalo de confianza al 95% (IC= 5.8-39.1), pero correspondió a 4.2 (IC= 2.7-6.5) para las lesiones no-intencionales. **Conclusiones.** Mayores cantidades de alcohol tienen consecuencias en el riesgo de desencadenar una lesión, especialmente en lesiones relacionadas con la violencia. Los estimadores del RR que se presentan pueden ser usados como nuevas fuentes para estimadores de la carga de la enfermedad asociada al consumo de alcohol.

Palabras clave: intoxicación alcohólica; epidemiología; métodos; América Latina; servicio de urgencia

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Injuries, especially violence-related injuries, are a key component of the burden of disease in the Latin American region;<sup>1-3</sup> alcohol was associated with 33% of intentional accidents and 26% of non-intentional accidents. It was also estimated that 24% of homicides, 11% of suicides and 20% of traffic accidents in the area were associated with alcohol.<sup>4</sup>

Although it is well-accepted that alcohol use is related to injury and violence, the mechanisms for this relationship remains largely uncertain.<sup>5,6</sup> Some studies have provided evidence that drinking prior to the event seems to be more important than habitual alcohol consumption,<sup>7,8</sup> but most studies have not tried to differentiate the risk of injury associated with long-term habitual alcohol consumption from the risk of short, acute and intermittent alcohol use. This difference may be crucial for targeting the at-risk population. Another limitation of prior studies is that non-violent injuries are sometimes used as a comparison group for the violence-related injuries, precluding a direct comparison of relative risks across type of injuries.

New methodological approaches have been proposed. For example, an association between emergency department usage due to violence-related injuries and both habitual alcohol consumption and drinking prior to the event has been reported by simultaneously using case-control and case-crossover analyses.<sup>9</sup> The case-crossover design provides estimates of intermittent alcohol use over and above the baseline risk associated with long-term alcohol consumption and is especially relevant for differentiating between the role of chronic and acute alcohol use. The case-crossover also seems especially appropriate for studying differences in risk across mode of injury (violent vs. non-violent). The goal of this research was to determine the relative risk (RR) of non-fatal unintentional and violence-related injury associated with alcohol consumption in three emergency departments (EDs) in Latin America during the period 2001 to 2002.

## Material and Methods

Data from the WHO Collaborative Study on Alcohol and Injuries were collected from 2001 to 2002 from emergency rooms in Argentina, Brazil, Belarus, Canada, China, Czech Republic, India, Mexico, Mozambique, New Zealand, South Africa, and Sweden. Study methodology across sites was similar to that used previously in ED studies in a number of countries.<sup>8,10</sup> Probability samples of patients admitted for an injury within six hours of the event at each of the ED sites were drawn (with equal representation of each shift for each day of the week), with a target sample size of about 500

patients from each site. Patients were approached as soon as possible with informed consent to participate in the study. Ethics committee approval from each country was secured for the study, and all procedures were monitored centrally by the WHO to guarantee ethical standards across study sites. The total sample across all sites of those 18 years and older was 5 243 patients, and represented a 91% completion rate. For this report, data was used from the three Latin-American countries that participated in the project, which included 1 391 injured patients admitted to three EDs: 447 patients in Argentina, 489 in Brazil and 455 in Mexico. Patients were given a 25-minute interviewer-administered standard questionnaire. A group of interviewers in each setting were trained and supervised by study collaborators in their respective locations. Further details on the sample have been presented elsewhere.<sup>11</sup>

## Patient Interview

The interviewer schedule was translated and back-translated in each language and included, among other items, whether the patient reported drinking within six hours prior to injury, alcohol use during the same six hour period the week prior and the number of drinks consumed in each time period.

Mode of injury was assessed with a single question. In this paper, this variable was categorized as either unintentional injury (non-violent) or intentional self-inflicted and intentional by someone else (violence related injury).

## Data Analysis

Following a prior report by our group,<sup>12</sup> a pair-matched analysis was performed. For each patient, he or she reported their use of alcohol during the six hours prior to injury, during the same time period on the day prior to injury, on the same day of the previous week, and on the same day of the previous month. For alcohol use during the six hours prior to injury, the question posed was: "In the six hours before and up to your having your injury / accident, did you have any alcohol to drink, even one drink?" (yes/no). Information on alcohol use at the same time during the previous week was elicited as follows: "In this next section, I am going to ask you about what you were doing exactly one week ago. Think about the time you had your accident (today) and remember the same time a week ago. Last week at the same time, did you have any alcohol to drink in the six hours leading up to this time?" (yes/no). The volume of alcohol consumed during each six-hour period was analyzed by converting the number and size of drinks to pure ethanol, using a

standard drink of 16ml as a common volume measure across beverages and analyzed as a categorical variable. Conditional logistic regression was used to calculate the matched-pair odds ratio (OR) and 95% confidence intervals (CIs).<sup>13,14</sup> Variation in the magnitude of the OR across study sites and mode of injury was examined using the chi-square test for homogeneity (Hom).<sup>14</sup>

## Results

Table I shows the distribution of the samples according to violence and non-violence related injuries. Prevalence of a violence-related injury in the ED was 13.5% for the total sample (Argentina= 12.5%, Brazil= 10.2%, Mexico= 18.0%). About 46% of violence-related cases used alcohol (versus 12.5 non-violence), 80% were males (versus 63% females), and 67% were under 30 years of age (versus 47%). In additional descriptive data (not shown) for the total sample and for both types of injuries, most injuries occurred on the street or highway, while the patients were commuting, traveling or walking. In all EDs, non-violent injuries were predominantly due to a falling/ tripping event. For violent injury, about 60% of the patients in the three EDs reported that the perpetrator was an unknown person and about 33% reported that this person was "definitively intoxicated."

Table II shows the results for the matched-pair analyses. The risk of a violence-related injury was found to increase with drinking [(15.0- (5.8-39.1)], ranging from 12.0 in Brazil to 18.0 in Mexico. On the other hand, patients with unintentional injury had a lower OR [(4.2- (2.7-6.5)], ranging from 3.8 in Argentina to 5.2 in Brazil. The test for homogeneity of these OR estimates suggests that the OR is homogenous across countries for both violence (Hom  $\chi^2(2)=0.137$ ;  $p=0.934$ ) and non-violence (Hom  $\chi^2(2)=0.321$ ;  $p=0.852$ ); that is, alcohol is equally related to violent and non-violent injuries among all sites. The homogeneity test for the total sample also

shows that there are differences across mode of injury, and the OR for violence is larger than that for non-violence (Hom  $\chi^2(1)=5.597$ ;  $p=0.018$ ).

A dose-response analysis was also performed by mode of injury for the total sample (Table III). As is evident from this table, the risk of a violence-related injury increased sharply with increasing amounts of alcohol consumed. The increase was not as steep for a non-violence related injury, but in both cases a statistical trend of increased OR with increased amounts consumed was found. The homogeneity tests suggest that the risk is of equal magnitude for violent and non-violent injury at low levels of consumption, i.e. 1-3 drinks, (Hom  $\chi^2(1)=2.229$ ;  $p=0.135$ ) but at high levels of consumption the OR is larger for violent than for non-violent injuries (Hom  $\chi^2(1)=5.270$ ;  $p=0.022$ ).

## Discussion

In this sample of non-fatal injury patients admitted to three EDs across Latin America, it was found that the risk of a violence-related injury increased with drinking and that patients with unintentional injury also showed a lower but also significant OR. A dose-response relationship for the number of drinks and risk for both violence and non-violence related injuries was evident, with increased risks even at low levels of alcohol use (1-3 drinks). Higher levels of drinking were associated with a much higher elevation in the OR for violence-related injuries than for non-violent injuries. If subjects decided to drink, increased amounts may have pronounced consequences in their risk for triggering an injury, specially a violence-related injury.

This work confirms prior reports in Argentina,<sup>15,16</sup> Brazil<sup>17-21</sup> and Mexico<sup>7,12,22</sup> showing the impact of alcohol consumption on violence. Alcohol was present in almost 50% of all patients with a violence-related injury, substantiating a common view in EDs across the region

**Table I**  
**SELECTED CHARACTERISTICS OF LATIN AMERICAN SITES IN THE WHO-ER STUDY POPULATION BY VIOLENCE RELATED INJURY (N\*=1391). MAR DEL PLATA, ARGENTINA 2001; SAO PAULO, BRAZIL 2001; MEXICO CITY, MEXICO, 2002**

	Violence n (%)	Alcohol use six hours prior %	Male %	<30 years %	No violence n (%)	Alcohol use six hours prior %	Male %	<30 years %
Argentina*	56 (12.5)	48.1	69.0	57.5	391 (87.5)	17.5	68.9	46.4
Brazil	50 (10.2)	36.0	84.0	63.3	439 (89.8)	10.3	65.2	47.8
Mexico	82 (18.0)	51.2	84.2	75.6	373 (82.0)	9.7	54.4	46.9
Total*	188 (13.5)	46.2	79.6	67.1	1 203 (86.5)	12.5	63.1	47.1

\* Data weighted

**Table II**  
**LATIN AMERICAN SITES IN THE WHO-ER. ALCOHOL USE**  
**SIX HOURS PRIOR AND ONE WEEK PRIOR TO THE INJURY.**  
**MATCHED-PAIR ANALYSIS BY VIOLENCE-RELATED INJURY. MAR**  
**DEL PLATA, ARGENTINA 2001; SAO PAULO, BRAZIL 2001;**  
**MEXICO CITY, MEXICO, 2002**

	Violence		No violence	
	OR	CI (95%)	OR	CI (95%)
Argentina*	13.0	(2.4 - 69.5)	3.8	(1.9 - 7.5)
Brazil	12.0	(1.6 - 92.3)	5.2	(2.2 - 12.4)
Mexico	18.0	(4.3 - 74.8)	4.0	(1.8 - 8.7)
Total	15.0	(5.8 - 39.1)	4.2	(2.7 - 6.5)
	Hom $\chi^2(2)=0.137$ ; $p=0.934$		Hom $\chi^2(2)=0.321$ ; $p=0.852$	Hom $\chi^2(1)=5.597$ ; $p=0.018$

\* Data weighted

that alcohol consumption is a main problem among these patients. Furthermore, our data on the relationship between alcohol and unintentional injury is important given the impact of injuries in these nations<sup>23</sup> and current research showing the high prevalence of drinking and driving among youths in these countries.<sup>24-27</sup> Large differences were found between acute alcohol use and intentional and unintentional injuries, with larger risks found for intentional injuries. Interestingly, no differ-

ences were found in OR estimates across countries, suggesting that even if these countries differ in their alcohol consumption patterns, with Argentina showing a more "Mediterranean-like" consumption, alcohol has a similar impact on injuries seen in EDs. Strong evidence was found for a dose-response relationship between the amount of alcohol and the increase in the OR for both types of injury. Nevertheless, with larger amounts of drinking, the OR increased more sharply for intentional than for non-intentional injury. The stronger relationship found between alcohol and violence compared to other modes of injury is suggestive that additional mechanisms than simply reduced psychomotor capabilities might explain the elevated RR found. One possible causal explanation is that alcohol reduces inhibitions and increases the sense of power for some people.<sup>28</sup> Another possible non-causal explanation is that people who drink are more likely to be aggressive, while drinking and aggression helps to explain the elevated risks found. Alternatively, people tend to drink in social situations, and such situations might increase the possibility of violence. More research is needed to better understand competing hypotheses for the relationship between acute alcohol consumption and violence.

This study is limited to non-fatal injury cases that are presented in ED facilities and although the study design provides a representative sample of patients from this facility, patients may not be representative of other ED facilities in the city or the country that participated.

**Table III**  
**LATIN AMERICAN SITES IN THE WHO-ER. ALCOHOL USE SIX HOURS PRIOR AND ONE WEEK PRIOR TO THE INJURY.**  
**MATCHED-PAIR ANALYSIS BY VIOLENCE-RELATED INJURY AND NUMBER OF DRINKS. MAR DEL PLATA, ARGENTINA 2001;**  
**SAO PAULO, BRAZIL 2001; MEXICO CITY, MEXICO, 2002**

Alcohol use six hours prior to injury Number of drinks (categorical)	Violence					
	Alcohol use one week prior to injury			OR	CI (95%)	
	0	1-3	4+			
0	96	1	3	1.0	-	
1-3	25	1	1	10.2	(3.3 - 31.6)	Hom $\chi^2(1)= 2.229$ ; $p= 0.135$
4+	42	6	7	20.2	(6.4 - 63.3)	Hom $\chi^2(1)= 5.270$ ; $p= 0.022$
				$\chi^2(2)= 66.94$	$p<0.001$	
Alcohol use six hours prior to injury Number of drinks (categorical)	No violence					
	Alcohol use one week prior to injury			OR	CI (95%)	
	0	1-3	4+			
0	1 018	12	12	1.0	-	
1-3	48	12	4	3.9	(2.2 - 6.8)	
4+	54	6	21	4.5	(2.6 - 8.0)	
				$\chi^2(2)=51.14$	$p<0.001$	

As is common with other emergency department studies, cases also cannot be assumed to be representative of those with injuries who do not seek medical attention. All analyses reported here are based on the patient's self-reported alcohol consumption for differing time frames, and it is possible that patients were more likely to better recall their consumption immediately prior to an injury event than for any previous period. Differential recall may lead to an overestimate of the association between alcohol and injury if patients are more likely to remember and report alcohol on a short-term basis. Prior case-crossover research on alcohol and injury has used other control periods<sup>29-32</sup> that ranged from a day to a year, suggesting that the findings reported here are nevertheless robust. Legal or other issues, however, may prompt patients to minimize drinking prior to an injury event, such as a traffic accident. On the other hand, it is also possible that patients may overestimate their drinking prior to an injury event; for example, those with violence-related injuries may over-report alcohol use as an excuse for otherwise socially unacceptable behavior.<sup>33</sup> Clearly, more research on the validity of methods for eliciting alcohol use for case-crossover analyses is needed. Finally, despite the fact that case-crossover studies are well-suited for controlling for between-person confounders, they do not remove the possibility that within-person confounders exist. For example, in the present study it is possible that a patient may have been suffering from a transient depressive episode that gave rise to an increase in alcohol consumption. This co-occurrence of depression and alcohol use, or any other psychiatric disorder or substance use, could confound odds ratios estimates. Because measurements for other acute variables that vary over time are lacking as well as those that could be considered possible confounders of the relationship between acute alcohol use and injury, this bias cannot be quantified and the results cannot be adjusted accordingly.

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