Published in final edited form as:
Medicina (B Aires). 2014 ; 74(4): 287–292.

ALCOHOL INTAKE AND RISK OF INJURY

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Abstract

Injuries constitute a leading cause of morbidity and mortality in the world, with intentional injuries and those related to traffic most important, due to their social impact and high prevalence. Although alcohol consumption has been identified as a risk factor for injuries, few studies have assessed risk separately for intentional injuries and unintentional injuries caused by traffic, and by other causes. The objective of this paper was to estimate the risk of injuries after acute alcohol consumption for intentional injuries and unintentional traffic and non-traffic injuries, using, alternatively, two exposure measures: self-reported drinking prior to the event and blood alcohol concentration. A probability sample was collected of 540 patients from the emergency department of a hospital in Argentina. Logistic regressions were performed, with and without adjusting for gender, age and drinking pattern. Higher risks were found when blood alcohol concentration was used as a measure of consumption, compared to self-report. The highest risk estimates were obtained for intentional injuries, followed by unintentional traffic and, lastly, by unintentional non-traffic injuries. After controlling for confounders, risks for intentional and unintentional traffic injuries appeared similar for those above and below the legal limit. Results point to a significant involvement of alcohol in the regional context.

Keywords

alcohol drinking; injury; traffic; violence; Argentina

Injuries are one of the leading causes of death in the world; however, they not only take a toll on death but also on disability, affecting especially young people[1]. Furthermore, injuries are not evenly distributed in the world; industrialized nations have a significantly smaller proportion while the poorest countries account for 90% of the world's injuries leading to death[2]. In Argentina, injuries constitute the first cause of death from the age of one through 44 and remain within the top ten causes across the life span[3]; they also account for 21% of the Daily Adjusted Life Years (DALYS)[4]. Injuries are usually classified as unintentional when they occur without intent of harm, (also called accidents, such as those caused by motor vehicle crashes) or intentional, when they are the result of interpersonal violence or

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Conflict of interest: None to declare.

self harm (such as a those caused by beatings and suicides). Injuries can also be classified by their specific cause (the reason the injury occurred), for instance a car crash, a fire, or a fall.

As in many other countries, reliable data on non-fatal injuries is less available than data on fatal injuries. At a national level in Argentina, a surveillance system operates through volunteer sentinel units providing a much needed description of the circumstances surrounding non-fatal injuries. Preliminary analysis of the data for the 2004–2007 period indicate that the most common causes of injury are traffic events, followed by falls and blunt-force events. Intentional injuries represent 14% of the total, and most are caused by beatings. Alcohol consumption or intoxication when evaluated, was suspected in 7% of all injured and in 28% of those intentionally injured. Although the system was designed to evaluate through clinical observation the involvement of alcohol and other substances in injury, these data have largely been absent[5].

Acute alcohol drinking has been identified as an important risk factor for injuries[6]. However, given the complex pathway between alcohol drinking and the resulting injury, the magnitude of the risk has been found to vary significantly among different countries or even regions within a country[7,8]. These variations are likely the result of distinct drinking practices, exposures, and contexts. Previous studies in Argentina have found a four-fold increase in the risk of sustaining an injury requiring emergency care for those self-reporting alcohol use in the six hours prior to injury[9], and more than a seven-fold increase in the risk of violence, accidents and drug use, for those with increased blood alcohol levels[10]. Although not distinguishing among specific causes of injuries, these results point to a significant involvement of alcohol in the region.

Because road traffic crashes are the most prevalent cause of injuries, the Pan American Health Organization recently announced a Plan of Action on Road Safety[11] to address this critical public health problem. Among recommended policies to reduce alcohol-related injuries are drink driving laws. In Argentina a law was passed in 2008 stipulating a maximum blood alcohol level of 0.05% (50mg/dl) for non-professional drivers. Similar laws have been adopted in neighboring countries. Most prominent are those in Brazil and Chile, which are zero tolerance laws, in which no level of alcohol is considered legal when driving. The legislative change in Brazil was successful in reducing non fatal and fatal road traffic injuries[12].

Although a number of studies have addressed the role of alcohol in injury and provided estimates of risk, few studies have provided estimates separately for injuries caused by traffic and by other causes, with multiple measures of acute consumption and levels of intake.

The purpose of this paper is to examine the alcohol-injury relationship, by (a) presenting risk estimates separately for three groups of causes: intentional injuries, unintentional traffic injuries and other unintentional injuries; and (b) basing the estimates on two measures of acute consumption, self- report drinking within six hours prior to the event and blood alcohol concentration (BAC), disaggregated by BAC level – above the legal limit and below.

Materials and Methods

Data were collected from patients admitted to the Emergency Department (ED) of a large public hospital, Hospital Interzonal General de Agudos Oscar Alende, in Mar del Plata, Argentina. The ED receives a large number of patients and provides care for most of the injuries occurring within the city and surrounding areas. A probability sample was obtained on both injured and non-injured patients, who were breathalyzed and interviewed immediately after their arrival at the ED. The criteria for inclusion were that the patient was 18 years or older, the attendance was a first visit for that condition, and informed consent was provided. Patients not able to provide informed consent were breathalyzed with the consent of a relative or companion, and interviewed later with consent, after their condition had stabilized. If consent was later denied by the patient, the breathalyzer result was destroyed. The response rate was 92%. The final sample included 540 patients, of which 207 were admitted for an injury and 333 for a medical condition. The data sampling period lasted from January to November of 2001. A description of socio-demographic, drinking and injury characteristics of participants is presented in Table 1.

Patients were breathalyzed as soon as possible after their arrival in the ED with an Alcosensor III breathalyzer (*Intoxicometers Inc*.). The Alcosensor III has been found to have a high correlation with blood alcohol level[13]. Patients were also administered a 25-minute questionnaire by interviewers (trained by the authors). The questionnaire[14] contained among others, items regarding the reason for the ED visit (injury or non-injury condition); if injured, the type and cause of injury and whether the injury was in any way related to violence; alcohol consumption in the six hours prior to the event prompting the ED admission; quantity and frequency of usual consumption during the last twelve months; and demographic characteristics. Additional information regarding the questionnaire and methodology can be found in Cherpitel et al.[6]. Patients were excluded from analyses if they arrived more than six hours after the event that prompted the ED admission, reported drinking after the event, or were admitted due to alcohol intoxication or withdrawal.

To estimate the risk of injury after acute alcohol consumption, logistic regression analyses were performed on the likelihood of, separately, an intentional injury (coded 1) vs. medical condition (coded 0), traffic-related injury (coded 1) vs. medical condition (coded 0), and non-traffic unintentional injury (coded 1) vs. medical condition (coded 0). Separate multiple regressions were run for self-reported alcohol consumption within the six hours prior to the event as the predictor (with reporting no alcohol consumption as the reference category) and breathalyzer readings < 0.05 and ≥0.05 as predictors (with readings below 0.01 as the reference category). Both regressions were first run without any covariates, then controlling for age and gender, and finally for age, gender and usual alcohol consumption. To control usual alcohol consumption, six categories of drinking based on quantity and frequency were created and entered as such; then frequency and quantity of drinking were entered as a continuous measure, since no differences on estimates were observed, the latter are reported. The software Statistical Package for Social Sciences (SPSS) version 11.0 for Windows was used for data managing and analyses.

Results

Estimates of the risk of injury after acute alcohol consumption for intentional injuries, unintentional traffic injuries, and unintentional non traffic injuries, are presented in Tables 2, 3, and 4.

Estimates of risk for all causes of injury were consistently lower when self-report was used as a measure of acute consumption compared to BACs. Furthermore, using self-report as the exposure measure and after adjusting for confounders, only estimates for intentional injuries remained significant.

Risk estimates for intentional injuries were higher than those for unintentional injuries (both, traffic and non traffic), regardless of the measure used (self-report or BAC). In general, estimates for unintentional traffic injuries seemed to be higher than those for unintentional non traffic injuries.

Estimates for intentional and unintentional traffic injuries based on BACs were quite similar, regardless of whether they were above or below the legal limit. On the other hand, a different pattern emerged for unintentional non-traffic injuries, with estimates lower (and even showing no risk) for BACs above the legal limit compared to those below.

Most, but not all risk estimates appeared to diminish when gender, age, and usual alcohol consumption were controlled. Surprisingly, the risk for traffic injuries for those with BACs above the legal limit appeared to somewhat increase after controlling consumption pattern.

Discussion

As found here, acute alcohol consumption results in a significant increase in the risk of sustaining an injury requiring emergency care, for all three causes of injuries examined here (intentional, unintentional traffic and unintentional non-traffic injuries). Estimates of risk tended to be appreciably lower (even suggesting no risk), when self-report was used as a measure of acute consumption as opposed to BAC. Self-report has been shown to be a valid estimate of acute consumption[15], and at low levels of consumption, to have a high correspondence with BAC[16]. As such, it has been proposed as a preferable measure of consumption in alcohol and injury studies. The prevalence of positive self-reports has generally been greater than prevalence of positive BACs in ED studies[17], including here and in similar studies in Argentina[16], with many patients reporting consumption but presenting a negative BAC. Since frequent drinking is wide spread in Argentina self-report might reflect lighter drinking while a positive BAC might reflect a higher level of drinking. Severity of injury may also play a role in this finding[18]. Those with a positive BAC may have had more severe injuries prompting rapid admission to the ED, and thus have not had sufficient time lapsed for alcohol to be metabolized.

Findings here suggest a greater role of alcohol in intentional injuries compared to unintentional injuries (both, traffic and non-traffic). Although ample variation in the magnitude of risk has been found in ED studies across cultures and studies, a higher risk for intentional injuries is a well-established finding[9,18,19] and likely explained by the casual role

alcohol plays in physical assault perpetration and victimization. For both intentional and unintentional traffic injuries the estimates of risk based on BAC were similar regardless of whether the BAC was above or below the legal limit. This finding seems at odds with others in the literature showing a dose-response relationship[20,21]. Although the small number of patients in each category may have produced unstable estimates, other possible reasons for this similarity of risk above and below a 0.05 BAC may be a higher tolerance for those with high usual consumption leading to a diminished risk for injury from acute consumption which was not entirely accounted for when adjusting. In this study the usual quantity and frequency of drinking were controlled, and controlling for other drinking patterns (e.g., heavy episodic drinking) may yield different results.

Regarding the two types of unintentional injuries explored here (traffic and non traffic) a different pattern was observed for each. While similar risks were found for traffic injuries for those with BACs above and below the legal limit, a lower risk was found (with no risk observed when age, gender and usual drinking were controlled) for non-traffic injuries with BACs above the legal limit compared to those below. Few studies have presented risk estimates for these two groups of unintentional injuries (traffic and non-traffic). However, a meta-analysis separating motor vehicle injuries from non-motor vehicle injuries found a greater per drink increase in risk for motor vehicle injuries[21], a finding in consonance with that reported here, and possibly related to other factors leading to an injury.

In general, all risk estimates tended to decrease after controlling for confounders, as was expected. Oddly, the risk for traffic injuries for those with BACs above the legal limit appeared to slightly increase after controlling for usual consumption. This negative confounding between usual alcohol consumption pattern and acute alcohol injury risk has also been reported in an Australian study[22]. Findings regarding the role of usual consumption patterns in the alcohol-injury relationship may be due, partly, to the variability in individual drinking patterns. Highly irregular patterns may be difficult to capture when usual consumption (e.g. quantity consumed most frequently) is evaluated, and later used for adjusting. While some work has been done on the association of drinking patterns and alcohol-related injury[23], the relationship between usual consumption patterns, acute consumption and injury risk is an area in need of more research.

There are some limitations that apply to this study. First, the small number of patients in each injury category resulted in some overlapping confidence intervals making comparisons difficult, despite which some patterns of interest were observed. Second, the intentional and both unintentional categories (traffic and non-traffic) analyzed here included a heterogeneous group of causes that, individually, may be differentially related to alcohol. For instance, the unintentional non-traffic group included injuries caused by fires and falls, which have been found to have different associations with alcohol[18,24]. Similarly, the unintentional traffic injuries group, although including injuries by the same cause (road traffic crashes), was comprised of those injured as a pedestrian, driver or passenger. Alcohol may play a different role in the chain of events leading to a traffic injury in each case (for instance, affecting reaction time for a driver, and the decision to wear a seat belt for a passenger).

Although several methods have been proposed to estimate alcohol-injury risk, all have been found to be susceptible to potential bias, with the case control design used here providing conservative estimates[25]. Further strengths include controlling for potentially confounding factors (usual consumption and possibly risk taking behavior, indirectly, by controlling age and gender) and using two exposure measures of acute consumption[21]. Another methodological issue deserving comment and that may be related to differences in findings across studies, is the representativeness of the injuries sampled in the ED. In this study the sample was collected from a hospital's ED that serves the vast majority of injuries requiring emergency medical attention in the area[26]; consequently providing a potentially reasonable account of all injuries receiving care within a few hours of their occurrence.

The results presented here point to a substantial involvement of alcohol in injuries in the regional context. Furthermore, they highlight the need of public measures to reduce the impact of alcohol on injuries. These efforts should not only be directed towards road traffic, but to injuries from other causes as well. Since significant increases in the likelihood of an injury were found for traffic injuries for those with BACs above and below the legal limit, the findings presented lend support to zero tolerance drink and driving laws.

Acknowledgments

This work was carried out with the financial aid of CONICET, Universidad Nacional de Mar del Plata, Argentina; and supported by a grant from the U.S. National Institute on Alcohol Abuse and Alcoholism (R01 AA013750).

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TABLE 1

Socio-demographic, drinking and injury characteristics of participants (in percent)

			Injured n=207		
				Unintentional injured n=164	
		Not injured n=333	Intentional injured n=43	Traffic related n=52	Non-traffic related n=112
Age	Mean	39.44	32.98	31.39	35.07
Gender	Male	45.3	69.8	69.2	67.9
Consumption pattern					
Frequency	Never last 12 months	16.0	9.3	6.3	15.7
	1–5 year	14.9	11.6	8.3	4.9
	6–11 year	6.3	4.7	4.2	2.9
	Near 1 month	8.3	9.3	4.2	4.9
	2–3 month	10.1	--	10.4	10.8
	1–2 week	21.2	30.2	43.8	31.4
	3–4 week	4.2	4.7	8.3	7.8
	Near daily	6.3	7.0	4.2	2.0
	Daily	12.8	23.2	10.4	19.6
Quantity (drinks)	Mean	3.41	6.82	3.60	3.60
% Acute alcohol use					
Self reported drinking		12.2	47.7	29.6	22.8
BAC Negative		82.1	66.7	79.6	87.3
BAC ≤ 0.049		8.9	15.4	8.2	9.1
BAC ≥ 0.05		8.9	17.9	12.2	3.6

BAC: Blood alcohol concentration, Drink: a standar drink is estimated to have 11 gr of alcohol.

TABLE 2

Risk after acute alcohol consumption for intentional injuries, unintentional traffic related injuries, and unintentional non traffic related. Unadjusted (N=520)

Consumption measure		Intentional injury		Unintentional injury			
				Traffic related		Non-traffic related	
		OR **(95% CI)**	**p**	***OR*** **(95% CI)**	**p**	***OR*** **(95% CI)**	**p**
Self-report		6.59 (3.35–12.96)	.001	3.04 (1.56–5.94)	.001	2.13 (1.24–3.68)	.007
BAC	≤0.049	17.74 (4.74–67.40)	.000	7.94 (1.9–33.06)	.004	8.07 (2.47–26.32)	.001
	≥0.05	16.69 (4.95–56.28)	.000	9.53 (2.78–32.72)	.000	2.59 (.68–9.8)	.16

OR: Odds ratio,CI: confidence interval, BAC: Blood alcohol concentration, BAC≥0.05 and BAC≤0.049: reference category BAC≤0.001.

TABLE 3

Risk after acute alcohol consumption for intentional injuries, unintentional traffic related injuries, and unintentional non traffic related, adjusted by age and sex (N=520)

Consumption measure		Intentional injury		Unintentional injury			
				Traffic related		Non-traffic related	
		***OR* (95% CI)**	**p**	***OR* (95% CI)**	**p**	***OR* (95% CI)**	**p**
Self-report		4.86 (2.3–10.26)	.000	2.11 (1.01–4.44)	.047	1.5 (.81–2.7)	.19
BAC	≤0.049	11.30 (2.79–45.82)	.001	6.99 (1.53–31.86)	.012	4.85 (1.39–16.85)	.01
	≥0.05	11.94 (3.4–41.90)	.000	5.3 (1.41–19.90)	.013	1.85 (.47–7.2)	.37

OR: Odds ratio, CI: confidence interval, BAC: Blood alcohol concentration, BAC≥0.05 and BAC≤0.049: reference category BAC≤0.001.

TABLE 4

Risk after acute alcohol consumption for intentional injuries, unintentional traffic related injuries, and unintentional non traffic related, adjusted by age, sex, and consumption pattern (N=520)

Consumption measure		Intentional injury		Unintentional injury			
				Traffic related		Non-traffic related	
		***OR* (95% CI)**	**p**	***OR* (95% CI)**	**p**	***OR* (95% CI)**	**p**
Self-report		4.07 (1.75–9.49)	.001	2.19 (0.96–4.99)	.061	1.23 (0.63–2.4)	.53
BAC	≤ 0.049	9.18 (1.89–44.73)	.006	6.37 (1.10–36.87)	.039	4.40 (1.05– 18.47)	.04
	≥0.05	8.50 (2.24–32.20)	.002	6.45 (1.56–26.29)	.009	1.83 (.44–7.66)	.40

OR: Odds ratio, CI: confidence interval, BAC: Blood alcohol concentration, BAC≥0.05 and BAC≤0.049: reference category BAC≤0.001.

Medicina (B Aires). Author manuscript; available in PMC 2015 January 01.