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Characteristics associated with alcohol consumption among emergency department patients presenting with road traffic injuries in Hyderabad, India☆

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ABSTRACT

Introduction: Each year in India, road traffic crashes lead to more than 200,000 deaths and the country has seen an unprecedented rate of roadway fatalities in recent years. At the same time, alcohol consumption per capita among Indians is rising. Despite these increasing trends of road traffic injuries (RTIs) and alcohol use, alcohol is not routinely assessed as a risk factor for RTIs. This study aims to examine the involvement of alcohol among emergency department patients presenting with RTIs in the Indian city of Hyderabad.

Patients and methods: As part of a prospective study, data were collected from 3366 patients (88.0% male) presenting with RTIs at an emergency department in Hyderabad, India, from September 2013 to February 2014. Logistic regression models were used to assess individual-level and road traffic crash characteristics associated with suspected or reported alcohol consumption six hours prior to the RTI.

Results: Alcohol was suspected or reported among 17.9% of the patients with RTIs. Adjusting for confounders, males experienced 9.8 times greater odds of alcohol-related RTIs than females. Compared to 15–24 year-olds, the odds of alcohol consumption was 1.4 times greater among 25–34 year-olds and 1.7 times greater among 35–44 year-olds, adjusting for confounding factors. Patients who were passengers in vehicles other than motorized two-wheelers had 90% reduced odds of an alcohol-related RTI than motorized two-wheeler drivers. Drivers of non-two-wheelers, passengers on two-wheelers, and pedestrians did not have significantly different odds of an alcohol-related RTI compared to two-wheeler drivers. Nighttime crashes were associated with nearly a threefold increase in the odds of alcohol consumption.

Conclusions: Given that alcohol was suspected or reported in more than one in six injured ED patients with RTIs, it is clear that alcohol is a serious risk factor for RTIs; this evidence can guide prevention efforts. These findings suggest that evidence-based interventions to reduce drink-driving, such as random breath testing (where law enforcement officials stop drivers on the road to test them for alcohol use), could be more widespread in India. Future studies should assess the effectiveness of greater implementation and enforcement of policies to decrease alcohol's availability to reduce RTIs.

Introduction

Each year in India, road traffic crashes lead to more than 200,000 deaths and are associated with 15 million disability-adjusted life years [1]. Road traffic fatalities accounted for more than one-third of the country's unnatural causes of deaths in 2013 [2]. Despite the unprecedented and increasing rate of roadway fatalities [3], relatively little attention has been given to alcohol as a risk factor in road crashes in India, where alcohol consumption is becoming increasingly popular [4]. As of 2010, the World Health Organization (WHO) estimated that among drinkers, per capita consumption of alcohol in India was more than 1.5 times greater than the global average [5]. The national prevalence of current drinking is 32%

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among men and 2% among women, though patterns of alcohol consumption vary widely by other socio-demographic characteristics and state [6]. For example, alcohol use is uncommon among women in northern states and in Tamil Nadu (≤0.2%) and highly prevalent among men in Arunachal Pradesh (61%).

Alcohol's involvement in various types of injuries, including road traffic injuries (RTIs), is well-established among emergency department (ED) patients, internationally [7,8], and has also been documented in India [9,10]. However, in India, there is no national ED injury surveillance system [3] or another procedure to systematically collect data on alcohol, such as through police [11]. The validity of police data that do exist for road traffic crashes in India is questionable and of limited usefulness, particularly in regards to alcohol as a risk factor [12]. With the growing burden of RTIs in India [13] and the increasing proportion of Indians' consuming alcohol [14], it is critical to examine the factors associated with alcohol use among RTI patients in order to better understand the problem and to inform the development of preventive interventions. In 2013, RTIs accounted for 49% of the deaths due to unnatural causes in the state of Andhra Pradesh [2]; however, there is a paucity of evidence on alcohol's involvement in these fatalities.

As part of the Global Road Safety Program – previously known as Road Safety in Ten Countries – funded by Bloomberg Philanthropies [15], a prospective hospital injury surveillance system was established in Hyderabad. Hyderabad is now located in Telangana but it was the capital of Andhra Pradesh during the data collection period. The hospital-based surveillance was designed to improve the monitoring of RTIs and risk factors, including alcohol. With the lack of systematic surveillance on alcohol as a factor in RTIs in India, our primary objective was to assess the involvement of alcohol among ED patients presenting with RTIs in Hyderabad to generate evidence that can support the use of more effective interventions to reduce the problem. We aimed to examine individual-level and road traffic crash characteristics associated with suspected or reported alcohol consumption six hours prior to the injury. We discuss policy implications and offer recommendations for preventing alcohol-related RTIs.

Patients and methods

Data for this study were collected prospectively from September 2013 through February 2014 in an ED/Casualty Ward of a large (i.e., 1500 beds), government-run tertiary care teaching hospital in Hyderabad, Telangana State. Hyderabad city had a population of 6.8 million and 3 million registered vehicles in 2011 [16,17]. However, the hospital has an even more extensive catchment area, including five districts with a combined population of 19.9 million, in addition to referred cases from the remaining 22 districts [18]. The hospital is one of the state's largest public hospitals, with approximately 43,000 admissions per year and 85,000 outpatients. Being a government funded hospital; it mostly caters to people who cannot afford to seek care in private hospitals.

Trained data collectors were based round-the-clock (24/7) in the ED, with one supporting supervisor who ensured data quality. The data collection team received classroom training on care of the patient, assessment of the Glasgow Coma Scale (GCS), patient flow, injury anatomy and pathology, and the data collection tool and process. Patient confidentiality and consent procedures were also covered during training. Classroom training was followed by induction training in the ED of the hospital. This study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board and the Ethics Committee of the Indian Institute of Public Health, Hyderabad.

A structured tool was developed and paper-forms were used for data collection. All patients presenting to the ED following a road traffic crash were eligible to participate in the study. RTI patients were identified by ED staff or from the medicolegal register (RTI are medicolegal cases in India and EDs are required to maintain a separate register). Trained data collectors conducted interviews with patients or their relatives after obtaining verbal informed consent. Data on demographics, pre-hospital care, injury event factors and risk factors were collected from interviewing patients or a relative; while data on vitals, injury anatomy, injury pathology, treatment and outcomes were collected from patients' medical records. Data were restricted to patients aged 15 and older, consistent with the WHO's methodology for assessing the drinking population [5]. In our surveillance, data were collected from consenting patients and data are not available on the total number of patients that presented to the ED following a RTI, and thus, a response rate cannot be calculated; however, response rates are typically very high (>95%) in Indian health studies [19–22].

Measures

Patients, if conscious, were asked to indicate whether they had consumed alcohol within six hours prior to the injury. Response options were 'yes' or 'no.' If the patient could not be asked, it was recorded as 'unknown.' Alcohol consumption information was then cross-checked for each patient with the doctor's notes recorded on the case-sheet. While assessing the patient, demographics were recorded, as well as data on the road traffic crash, including the type of road user and their type of vehicle at the time of injury. We combined data on vehicle type into a single variable with the type of road user. Due to sample size limitations, patients who were drivers or passengers in non-two-wheelers (i.e. motorized three-wheelers, cars, buses, mini-buses, vans, bicycles, trucks, and lorries) were collapsed into categories of 'other driver' and 'other passenger.' Patients with missing or unknown data on any of these variables were excluded from analyses ($n = 214$).

The initial GCS score was used to evaluate the severity of injuries [23]. Based on three aspects of behavioural response (eyes opening, verbal response, and motor response), the GCS ranges from 3 to 15, with three indicating the most severe injury. Consistent with the United States Centers for Disease Control and Prevention's classifications, injuries were categorized as severe (score: 3–8), moderate (score: 9–12), and mild (score: 13–15) [24]. The GCS is a reliable measure of injury severity when used by trained evaluators [25] and assessments of injury severity do not need to be modified for intoxicated patients [26,27].

Analysis

The prevalence of individual-level characteristics (sex, age, education, occupational status, and injury severity) and road traffic crash characteristics (type of road user and time of crash) were assessed for the entire study population and by alcohol consumption status. Binary logistic regression was conducted to determine the odds ratios and 95% confidence intervals (CI) of alcohol-related RTIs as a function of each individual-level and road traffic crash characteristic [28]. Dummy variables were created for variables with more than two levels.

Multiple logistic regression was performed [28], and we controlled for the following confounding variables that have been shown to be associated with alcohol-related RTIs in previous scientific studies: sex, age, type of road user, and time of crash [29–32,33(p. 45)]. Data were analyzed using Stata 12.1 [34]. A p-value of <0.05 was used as the cut-point to determine statistical significance, although we indicate actual p-values.

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Results

The majority of the 3366 patients included in the study sample were males (88.0%), with 57.9% between the ages of 15 and 34 (Table 1). Nearly half (49.4%) of the RTIs occurred among drivers of motorized two-wheeled vehicles and 20.2% of the patients were pedestrians at the time of the crash.

Alcohol use within six hours prior to the road traffic crash was suspected or reported among 17.9% of patients with a RTI (Table 1). Individual-level characteristics associated with the highest percentages of suspected or reported alcohol consumption included being male (20.1%) and being aged 25–34 (21.7%) or 35–44 years-old (21.2%). The corresponding crash characteristics included being a driver of a motorized two-wheeler (23.0%) or a driver of another type of vehicle (18.4%). Approximately 16% of RTI patients who were pedestrians at the time of the injury were suspected of or reported consuming alcohol in the six hours prior. One-fourth of nighttime crashes involved alcohol.

Males had 12.5 times greater odds of experiencing an alcohol-related RTI than females (Table 1). After controlling for age group, type of road user, and time of crash, males experienced 9.8 times greater odds of alcohol-related RTIs than females (Table 2). Compared to 15–24 year-olds, the odds of alcohol consumption was 1.4 times greater among 25–34 year-olds and 1.7 times greater among 35–44 year-olds, adjusting for confounding variables.

Of the 437 patients with moderate or severe injuries, as measured by the GCS score, 32.0% were suspected or reported to have consumed alcohol compared to 14.8% among mildly injured patients (Table 2). Compared to mildly injured patients, being severely injured was associated with 1.3 times greater odds of alcohol use (not statistically significant) and being moderately injured was associated with 3.3 times greater odds (95% CI: 2.5, 4.3), adjusting for sex, age group, type of road user, and time of crash.

Patients who were passengers in vehicles other than motorized two-wheelers had 90% reduced odds of having an alcohol-related RTI compared to drivers of motorized two-wheelers. Drivers of non-two-wheelers, passengers on two-wheelers, and pedestrians did not have significantly different odds of having an alcohol-related RTI compared to two-wheeler drivers, after controlling for sex, age group, and time of crash (Table 2). Adjusting for confounding factors, nighttime crashes were associated with nearly a threefold increase in the odds of involving alcohol compared to daytime crashes (95% CI: 2.2, 3.3).

Table 1
Individual-level and road traffic crash characteristics overall and by alcohol consumption status.

Characteristics	Overall *n* (%)	Alcohol consumed 6 h prior to injury[a] n (%)	Binary logistic regression[b]	
			Odds ratio (95% CI)	*p*-value
Overall	3366	604 (17.9)		
Individual-level				
Sex				
Females	404 (12.0)	8 (2.0)	Ref.	
Males	2962 (88.0)	596 (20.1)	12.5 (6.2, 25.3)***	<0.001
Age group, in years				
15–24	937 (27.9)	155 (16.5)	Ref.	
25–34	1010 (30.0)	219 (21.7)	1.4 (1.1, 1.8)**	0.004
35–44	666 (19.8)	141 (21.2)	1.4 (1.1, 1.7)*	0.019
≥45	749 (22.3)	88 (11.8)	0.7 (0.5, 0.9)*	0.006
Education attained				
No formal education	1417 (42.2)	240 (16.9)	Ref.	
≤Secondary/High school	952 (28.4)	166 (17.4)	1.0 (0.8, 1.3)	0.752
≥College	987 (29.4)	192 (19.5)	1.2 (1.0, 1.5)	0.114
Occupational status				
Daily-wage labourer	943 (28.1)	175 (18.6)	Ref.	
Salary	895 (26.7)	175 (19.6)	1.1 (0.8, 1.3)	0.587
Self-employed/Business	645 (19.2)	131 (20.3)	1.1 (0.9, 1.4)	0.385
Student	426 (12.7)	73 (17.1)	0.9 (0.7, 1.2)	0.527
Other[c]	449 (13.4)	45 (10.0)	0.5 (0.3, 0.7)***	<0.001
Injury severity[d]				
Mild	2646 (85.8)	391 (14.8)	Ref.	
Moderate	327 (10.6)	117 (35.8)	3.2 (2.5, 4.1)***	<0.001
Severe	110 (3.6)	23 (20.9)	1.5 (1.0, 2.4)	0.080
Road traffic crash				
Type of road user				
Motorized two-wheeler driver (motorcycle)	1662 (49.4)	382 (23.0)	Ref.	
Motorized two-wheeler passenger (motorcycle)	333 (9.9)	49 (14.7)	0.6 (0.4, 0.8)**	0.001
Other driver[e]	278 (8.3)	51 (18.4)	0.8 (0.5, 1.0)	0.086
Other passenger[f]	414 (12.3)	13 (3.1)	0.1 (0.1, 0.2)***	<0.001
Pedestrian	679 (20.2)	109 (16.1)	0.6 (0.5, 0.8)***	<0.001
Time of crash				
7:00 am–6:59 pm (day)	1605 (47.7)	161 (10.0)	Ref.	
7:00 pm–6:59 am (night)	1759 (52.3)	443 (25.2)	3.06 (2.5, 3.7)***	<0.001

CI = confidence interval.
[a] Reported or suspected alcohol use within 6 h prior to time of injury.
[b] Binary logistic regression odds ratio of reported or suspected alcohol use within 6 h prior to time of injury comparing sub-group characteristics versus reference group.
[c] Includes unemployed, beggar, housewife, or retired.
[d] Glasgow Coma Scale scores of 13–15 indicate mild injury, scores of 9–12 indicate moderate injury, and scores of 3–8 indicate severe injury.
[e] Includes drivers of motorized three-wheelers, cars, buses, mini-buses, vans, bicycles, trucks, and lorries.
[f] Includes passengers of motorized three-wheelers, buses, mini-buses, vans, bicycles, trucks, and lorries.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

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Table 2
Adjusted odds of alcohol consumption 6 h prior to road traffic injury by individual-level and road traffic crash characteristics.

Characteristics	Multiple logistic regression[a]	
	Odds ratio (95% CI)	*p*-value
Sex		
Females	Ref.	
Males	9.8 (4.7, 20.2)***	<0.001
Age group, in years		
15–24	Ref.	
25–34	1.4 (1.1, 1.8)**	0.004
35–44	1.7 (1.3, 2.2)***	<0.001
≥45	1.0 (0.7, 1.3)	0.877
Injury severity[b]		
Mild	Ref.	
Moderate	3.3 (2.5, 4.3)***	<0.001
Severe	1.3 (0.8, 2.2)	0.265
Type of road user		
Motorized two-wheeler driver (motorcycle)	Ref.	
Motorized two-wheeler passenger (motorcycle)	0.9 (0.7, 1.3)	0.772
Other driver[c]	0.7 (0.5, 1.1)	0.167
Other passenger[d]	0.1 (0.07, 0.3)***	<0.001
Pedestrian	0.8 (0.6, 1.2)	0.369
Time of crash		
7:00 am–6:59 pm (day)	Ref.	
7:00 pm–6:59 am (night)	2.7 (2.2, 3.3)***	<0.001

CI = confidence interval.
[a] Multiple logistic regression odds ratio of reported or suspected alcohol use within 6 h prior to time of injury comparing sub-group characteristics versus reference group, controlling for sex, age group, type of road user, and time of crash.
[b] Glasgow Coma Scale scores of 13–15 indicate mild injury, scores of 9–12 indicate moderate injury, and scores of 3–8 indicate severe injury.
[c] Includes drivers of motorized three-wheelers, cars, buses, mini-buses, vans, bicycles, trucks, and lorries.
[d] Includes passengers of motorized three-wheelers, buses, mini-buses, vans, bicycles, trucks, and lorries.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Discussion

This study found an increased odds of alcohol-related RTIs among males and adults aged 25–44, and in crashes at nighttime. Alcohol consumption was suspected or reported in 20% of male patients and 25% of nighttime crashes. The prevalence of alcohol consumption among RTI patients in the current study is comparable to the estimates of 14–23% found in previous Indian studies [30,35,36] and to the median of 15% reported in a recent systematic review of Indian RTI studies [37]. The positive relationship with alcohol-related RTIs and being male, aged 25–44, and nighttime found in this study is also consistent with other Indian studies [29,32,33(p. 45)]. These findings represent injured patients who reported to one of the large tertiary care government hospitals in Hyderabad. Given that RTIs are medico legal cases in India, injured – especially severely injured – are more likely to access services at government facilities as they cannot be denied care and this can explain the large catchment area recorded in our study [38]. Also, government health services in India are mostly either free or highly subsidized and most of the ED patients may be from low socioeconomic class [38]. However, some patients in this study also may have reported to this ED to get a medico legal certificate despite having sought care at a private health facility.

Alcohol use was more strongly associated with severely and moderately injured patients compared to those with mild injuries, although only the latter was statistically significant. The lack of a significant difference in alcohol use between severely and mildly injured patients may be due to the small proportion of severely injured patients in this study. The low proportion of severely injured patients may partially be a result of the inadequate pre-hospital emergency medical services in India [39] – some victims may have died at the scene or during transit. Other severely injured victims may have been transferred to other facilities.

When looking at the combination of moderate and severe injuries, alcohol use was more than twice as common compared to those with milder injuries. ED-based studies in several countries have found that alcohol is associated with increased injury severity [40–43] and GCS scores have been found to be correlated with blood alcohol concentration levels [44]. One study in India assessed the relationship between alcohol use and brain injury severity (measured by GCS scores) among brain-injured patients in seven hospitals and found that a greater prevalence of alcohol users (24%) had severe brain injuries compared to non-alcohol users (17%) [10].

Compared to other types of road users, prior to being injured, the greatest proportion of drivers of motorized two-wheelers had suspected or reported alcohol-related RTIs, with alcohol involved in 23% of RTIs among them. At the national level, India has a maximum blood alcohol concentration limit of 0.03 g/dl, which is low compared to the majority of countries in the world [5]. However, the perceived enforcement of the drink-driving laws in India is poor – with a score of 3, on a 1–10 scale, in which lower scores indicate lower levels of perceived enforcement [3]. Enhanced enforcement of drink-driving policies may therefore help to reduce alcohol-related RTIs.

Alcohol-related RTIs were common among pedestrians as well as drivers; 16% of pedestrians were suspected of or reported consuming alcohol. This finding suggests that prevention strategies to reduce RTIs injuries should not be limited to drink-driving policies. In conjunction with well-enforced drink-driving policies, the implementation and enforcement of population level alcohol control policies that decrease alcohol's availability in the general population may effectively reduce alcohol-related RTIs, including enhanced regulations of alcohol outlet density [45] and limits on days and hours of alcohol sales [46,47]. The steady growth of alcohol consumption per capita in India [5], coupled with the country's rapidly increasing motorization [48] highlights the need for multi-level alcohol control policies to tackle alcohol-related RTIs [49].

This study has several limitations. First, the study sample comprised ED patients, and thus, the study sample is not representative of the general population injured in a road crash in the Hyderabad area or those who do not seek emergency care. It is likely that the injuries sustained by the patients in this study were more severe than injuries sustained by those in crashes that do not necessitate emergency care; therefore, the characteristics that we found to be associated with alcohol-related RTIs may differ from those of individuals sustaining alcohol-related RTIs in the general population. Second, the study sample is also affected by the type of ED (e.g. large, government run) and the proximity to other EDs and trauma centres since these factors influence the type of patients presenting at the ED and the catchment area [50]. Moreover, alcohol may contribute to a larger proportion of fatal crashes compared to those resulting in RTIs [37] but alcohol's role in RTI fatalities prior to reaching the hospital was not assessed. In this light, our study represents a population of patients who did not need to be transferred to a specialized trauma centre for more extensive care and did not die prior to arrival at the hospital. Therefore, it is possible that alcohol was a factor in a greater proportion of crashes than measured here.

Third, precise measures of alcohol consumption were unavailable. The alcohol indicator used pertained to suspected (by the doctor or data collector) or reported (patient self-report) consumption within six hours prior to the injury, without differentiating between the two, and no data were available on quantity consumed.

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Fourth, we excluded 6% of the RTI patients from our analyses due to unknown or missing data so it is unknown whether alcohol was a factor in the RTIs. Fifth, no income related data were collected from the patients and hence it is difficult to comment on the socioeconomic status of the patient population.

Lastly, GCS has limitations in determining injury severity especially in non-neurological injuries. Many scales exist to determine injury severity, such as the Injury Severity Scale (ISS); the Revised Trauma Score (RTS); and the Trauma and Injury Severity Score (TRISS) that combines both RTS and ISS, and are often used to study injury severity and outcome [51]. ISS uses the Abbreviated Injury Scale (AIS) to assign a score to the injured body region and this requires injury anatomy and pathology to be confirmed through investigations, and detailed review of patient records [51,52]. Medical records in developing countries, including India, are paper-based and often not this detailed [52,53]. In our surveillance, while injury anatomy and pathology on three major injuries were collected, this was not collected in as much detail to assign an accurate AIS score. Given this limitation, we conservatively estimate the injury severity score [52], as our data are more conducive to calculate physiological scores, such as the GCS.

In spite of these limitations, this study provides much needed data on characteristics associated with suspected or reported alcohol-related RTIs. This evidence can be used to support the implementation of interventions that have been found to be effective in reducing alcohol-related RTIs among people with similar characteristics and also suggests the need for stronger enforcement of existing drink-driving countermeasures. Data were from 24 h hospital surveillance, avoiding potential day and time data collection biases. These findings highlight the importance of including alcohol indicators as part of injury surveillance systems in low- and middle-income countries. Hospital-based studies such as this are a valuable source of reliable and valid information on the extent to which alcohol is involved in RTIs in India, especially in a country where there are no other systems in place to systematically monitor alcohol use as a factor in injuries [3,11].

Conclusions

Given that alcohol was suspected or reported in more than one in six injured ED patients with RTIs, it is clear that alcohol is a serious risk factor for RTIs; this evidence can guide prevention efforts. To specifically target drink-driving, random breath testing, where law enforcement officials stop drivers on the road to test them for alcohol use, could be more widespread [49,54,55]. Random breath testing is legal in India but is an underutilized strategy in Hyderabad. Increased use of other evidence-based policy interventions that have been found to be effective for reducing alcohol-related motor vehicle crashes, such as those that aim to reduce the availability of alcohol (e.g., regulating alcohol outlet density, or restricting days and hours of alcohol sales) [5,49], may also lead to reductions in alcohol-related RTIs in Hyderabad. Future studies should use a more objective measure of alcohol consumption prior to the injury (e.g., breath testing) and assess how the strength of alcohol control policies impacts the incidence of alcohol-related RTIs. This study provides evidence about the magnitude of the burden of alcohol-related RTIs in Hyderabad and enhanced surveillance of alcohol's involvement in RTIs in India is crucial to monitor changes over time, in order to provide further support for the implementation and enforcement of more effective alcohol control policies.

Conflict of interest statement

None of the authors have any conflict of interest to declare and no author sought external assistance in writing the paper.

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