

Characteristics of alcohol-related trauma: a retrospective analysis of 1997 cases

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Abstract

Objective

To analyze and summarize the epidemiological characteristics of patients with alcohol-related trauma through a large dataset.

Methods

The medical records of 46338 patients with pre-hospital trauma in 2019 were exported from Suzhou pre-hospital first aid information system. The medical history was matched by regular expression, and the trauma cases including "drinking", "drunk driving" and "alcoholism" were defined as alcohol-related trauma (ART). Statistical analysis was performed from the respects of age distribution, sex composition, injury mechanism, onset time and injury condition.

Results

1997 patients with alcohol-related trauma were screened, including 1791 males, accounting for 89.68%. The age in the male group was older than that in the female group [median (IQR)]: 39 (16) vs. 31 (15), $p < 0.001$. The top three injury mechanisms were fall down (32%), violence (28.49%) and traffic accidents (24.89%). In terms of time distribution, alcohol-related injuries mostly occurred at from 20:00 to 00:00 and Friday, Saturday and Sunday. The shock risk of violent was significantly higher than that of other types of trauma. Taking traffic accidents as a reference baseline, we calculated the crude OR and the adjusted OR with the adjustment for sex and age, which were 2.57, 95%(1.54–4.30), $p < 0.001$; 2.39, 95%CI(1.42–4.01), $p = 0.001$, respectively.

Conclusion

ART mainly occurs in male population and the average age of male is higher than that of female, and it is more common in falls, violence and traffic accidents, especially from 20:00 to 00:00 at night and on weekends. Violence can more easily lead to shock than other types of trauma, which suggests more serious injury and worse outcome.

Introduction

Trauma is a worldwide public health problem, which causes great social and economic burden. Internationally, a research that estimates that 10–18% of trauma are related to alcohol[1]. Studies have shown that acute drinking, even in small amounts, can significantly increase the risk of injury[2]. Alcohol is an important risk factor for trauma[3] and its contribution to trauma is particularly obvious among patients who go to the emergency department to seek doctor[4].

Previous studies have reported that there are differences in the prevalence of alcohol-related trauma between different regions[1, 5, 6], strengthening the need for regional emergency department research. These studies provide a opportunity to identify gender and age differences, causes of trauma among alcohol-related trauma population in different regions, which helps to screen out high-risk groups [7]. This will help doctors to better establish services for alcohol-related trauma population and provide a basis for local governments to formulate relevant policies.

Although alcohol causes serious public health problems, epidemiological studies on alcohol-related trauma are limited in China, and similar studies are more performed by countries such as American and Australia. The aim of this study was to analyzed and summarized the epidemiological characteristics of alcohol-related trauma patients through a large dataset of Suzhou in China.

Methods

Study design and participants

This was a retrospective study using data from pre-hospital first aid information system of Suzhou. Data from 1 January 2019 to 31 December 2019 were export from the database system. Patients' characteristics, including sex, age, vital signs, injury mechanism, onset time and short medical history were recorded in the pre-hospital first aid information system. Informed consent was not required because the data were collected without identifiable personal information. We used regular expressions to match the text of the present medical history and the trauma cases including "drinking", "drunk driving" and "alcoholism " were retrieved and defined as alcohol-related trauma (ART). Shock index (SI), a ratio of heart rate to systolic blood pressure, > 1 was defined as shock state.

The study was approved by the Ethics Committees of the First Affiliated Hospital of Soochow University (Suzhou, China) and all data of patients were collected without identifiable personal information and the Institutional Review Boards (the Ethics Committees of the First Affiliated Hospital of Soochow University) waived the need for informed consent before analysis due to the retrospective nature of the data. This study conforms to the principles outlined in the Declaration of Helsinki.

Statistical analysis

Continuous variables were tested for normality using Shapiro–Wilk test. Continuous variables in the current study, failing to conform to normality, were expressed as median (inter quartile range, IQR) and compared using Mann-Whitney test. Categorical variables were expressed as frequencies and percentages and compared using Likelihood-ratio Chi-squared test. Logistic regressions were performed to calculate the Odds ratios (ORs) of variables for risk of shock, including crude ORs and adjusted ORs with the adjustment for sex and age. Statistical analyses and graphics were completed with STATA 15.0. Two-tailed $P < 0.05$ was considered to be statistically significant.

Result

A total of 1997 patients with alcohol-related trauma were screened and evaluated in this study, including 1791 (89.68%) males and 206 (10.32%) females. There were significant differences between two groups in age and injury mechanism ($P < 0.001$) and the age in the male group was significantly older than that of female group (median (IQR): 39 (16) vs. 31 (15), $p < 0.001$) (Table 1).

Table 1
Baseline characteristics of sex, age and injury mechanism

Variables	Female	Male	<i>P</i> value
	206(10.32)	1791(89.68)	
Age (year)	31(15)	39(16)	< 0.001
Injury mechanism			< 0.001
Traffic accident	34(6.84)	463(93.16)	
	497(24.89)		
Violence incident	66(11.6)	503(88.4)	
	569(28.49)		
Fall down	53(8.29)	586(91.71)	
	639(32.00)		
Falling high	6(14.29)	36(85.71)	
	42(2.10)		
Others	47(18.8)	203(81.2)	
	250(12.52)		

Variables failed to conform to normality were expressed as median (IQR) and compared using Mann-Whitney test; Categorical variables were expressed as frequencies and percentages and compared using Likelihood-ratio Chi squared test. Bold numbers: percentages by column.

Figure 1 depicted the age distribution of the two sex subgroups. The age of male group showed bimodal distribution while that of female group presented unimodal distribution.

Figure 2 showed that more common injuries after drinking were fall down (32%), violence (28.49%) and traffic accidents (24.89%), while falling high and others only account for a small fraction of all population.

In terms of time distribution, we observed that alcohol-related trauma mostly occurred at from 20:00 to 00:00 and Friday, Saturday and Sunday (Figs 3 and 4).

Figure 5 illustrated that the risk of shock caused by violence was significantly higher than that of other types. Taking traffic accidents as a reference baseline, we calculated the crude OR and the adjusted OR

with the adjustment for sex and age, which were 2.57, 95%CI(1.54-4.30), $p < 0.001$; 2.39, 95%CI(1.42-4.01), $p = 0.001$, respectively. It suggested that the risk of shock is more than twice as high as that of traffic accidents.

Discussion

This study described the epidemiological characteristics of patients with ART in Suzhou city of China, which indicated that ART patients were mainly male and more likely to occur on weekends (Friday-Sunday) and at night (20:00 to 00:00). The most common injury mechanism of ART was fall down, followed by violence incident and traffic accident, and the risk of shock caused by violence incident was significantly higher than other types of trauma.

ART is often not an one-off event and the proportion of trauma recidivism related to alcohol is not low. It is reported that approximately 41% of trauma recidivism is related to alcohol use and it may be an underestimated numerical value[8]. There is no doubt that alcohol-related trauma and trauma recidivism have caused harm to themselves and their families, while increasing medical and social burdens. In previous studies, the differences in the prevalence rate of alcohol-related trauma in different regions were observed, indicating that it is necessary to study alcohol-related trauma regionally[5]. Therefore, this study investigated the characteristics of alcohol-related trauma population in Suzhou, which provide information support for strengthening treatment and prevention decisions for specific groups of patients.

The mean age of participant was 38 years old, which is generally higher than previous studies[5, 9–12], which may be due to differences in inclusion and exclusion criteria. This study have found that the proportion of male population in alcohol-related trauma is significantly higher than that of female population, which is consistent with the published literatures[5, 9, 12–16].

Some scholars have shown that drinking increases the risk of falls by three to four times among young and middle-aged people[17], which may explain that trauma involving alcohol caused by falls tend to account for a large proportion of alcohol-related injuries. This study showed that fall accounted for 32% (639/1997), the leading cause of trauma, which was consistent with the study from New Zealand[5]. In these published studies, it can be observed that more than half of the patients have had drinking behavior within six hours before the injury in the violence-related trauma population[5, 18, 19]. As a psychomotor stimulant, drinking has been shown to increase aggressive behavior[20], which may be associated with a fact that the proportion of alcohol-related trauma caused by violence is always high, not only in this study, but also in previous studies[5, 10–12]. In the current study, 24.89% of trauma involving alcohol resulted from traffic accidents, this was higher than the 4.8% reported by Kool[5] and 16% by Humphrey[21] and lower than the 47.4% by Nweze[11] and 44.7% by Browne[9]. There is different incidence of alcohol-related trauma caused by traffic accidents in different countries and regions, which may be related to the local highest legal blood alcohol concentration (BAC), drunk driving punishment policy and so on.

Examination of presentations by day of week illustrated that alcohol-related trauma patients mostly presented over the weekend (Friday–Sunday) and night(20:00 to 00:00), which was similar to previous studies conducted by Kool[5], Noh[22], and Bogstrand[16]. The high frequency of trauma is the time when most people participate t in social activities or do not work. If hospital departments continue to reduce staff work on weekends, especially emergency department, this may increase the burden on staff who works on the job.

When facing trauma patients, a rapid and effective injury assessment is essential. In previous studies, it is observed that the injury severity of trauma patients can be assessed by a variety of methods, such as shock index (SI), the Injury Severity Score (ISS), the Revised Trauma Score (RTS), Glasgow Coma Scale (GCS) and so on. Considering that the data in our study came from the medical history in the pre-hospital first aid system, which is simple, we would use the most readily available vital signs to calculate SI (the ratio of heart rate to systolic pressure) to evaluate the severity of the trauma. SI is a classic indicator of shock, which is more sensitive than traditional vital signs. In recent decades, there have been a large number of studies on the practical value of SI in trauma patients, which shows that SI is an indicator of the severity and prognosis of trauma patients, and its abnormal increase often indicates worse outcome[23]. In this study, shock index was calculated according to vital signs in pre-hospital history. $SI > 1$ was defined as shock state and it was used to evaluate the severity of alcohol-related trauma. We could find that the risk of violent shock was significantly higher than that of other types of trauma in the forest images. Taking traffic accidents as the reference baseline, crude OR and adjusted OR were 2.57 and 2.39, suggesting that the risk of shock was more than twice as high as that of traffic accidents. A higher risk of shock suggests a more severe condition and a worse prognosis. Therefore, alcohol-related trauma caused by violence are more serious than other types of trauma, which deserves more attention in the clinical treatment.

It is reported that drunken patients are more likely to require a high level of in-patient care[24], which can put a heavy burden on the emergency department. As an important cause of preventable trauma, alcohol should receive more attention and it is necessary to reduce the incidence of alcohol-related trauma. Alcohol-related trauma are associated with individual's usual drinking habits, and it is also affected by some external social influences, such as the availability of alcohol, the drinking pattern and alcohol control policy measures including legal drinking age, legal driving blood alcohol concentration (BAC), drunk driving punishment policy and so on[25]. The methods of reducing availability of alcohol usually include increasing the price of alcohol, limiting the time of sale and the density of points of sale and so on. The previous studies indicate that raising price of alcohol has been found to be associated with alcohol consumption, alcohol-related trauma, alcohol-related morbidity and mortality[26–28]. As for alcohol sales, studies have shown that restrictions on alcohol point-of-sale density and time of sale contribute to decrease alcohol-related trauma and may promote population health[29]. The alcohol control policy measures were developed by WHO to call for a reduction of the harmful use of alcohol in 2010 [30]. The European Region has introduced these alcohol control policy measures and translated them into the WHO European Region Action Plan[31], which triggered a obvious reduction in both consumption[32] and harm when alcohol use has not decreased in other regions of the world[33]. There

are studies have indicated that drinking patterns are associated with alcohol-related trauma, especially harmful drinking patterns have a greater risk of trauma[11, 25]. Countries with higher harmful drinking patterns are characterized by higher alcohol consumption at a time, drinking to drunkenness, drinking on holidays and drinking in public places, and less likely to drink alcohol every day and during meals. Unfortunately, harmful drinking pattern is a background variable and less likely to be affected by preventive measures aimed at reducing alcohol-related trauma[25]. These studies mentioned above have concluded that countries with easier access to alcohol, with looser alcohol control policy and with harmful drinking patterns would have a higher risk of alcohol-related trauma. Alcohol control measures such as improving alcohol price, increasing the blood alcohol concentration(BAC) of legal driving, public education on the harm of alcohol all contribute to the reduction of alcohol-related trauma. Therefore, the burden of alcohol-related trauma on medical resources can be reduced to some extent through public strategies.

Although there are serious problems in public health about alcohol-related trauma, there are not as many epidemiological studies in China as cancer or cardiovascular disease. In our country, the relationship between traffic accidents and alcohol, the harm of drunk driving and severe punishment for drunk driving are widely publicized in China, but there is a lack of social awareness of other type injuries caused by alcohol, such as fall and violence incident. It is worth pointing out that fall accounts for the largest proportion of alcohol-related trauma in our study and violent incident has a greater risk of causing shock than traffic accidents, suggesting a more serious injury. Therefore, we couldn't confine our attention to the type of traffic accident about alcohol-related trauma, others are also worthy of attention.

The limitation of this study is that these patient samples do not necessarily represent traumatic people who do not seek medical treatment and patients in other areas. In addition, there are regional differences in the prevalence and characteristics of alcohol-related trauma[6]. Therefore, the results of our research only provide information support for the knowledge and comparison of alcohol-related trauma in different regions and the extrapolation of the results to other regions is limited. Another limitation is related to the fact that the study is a cross-sectional study with all inherent limitations.

Conclusion:

ART mainly occurs in male population and the average age of male is higher than that of female, and it is more common in falls, violence and traffic accidents, especially from 20:00 to 00:00 at night and on weekends. Violence can more easily lead to shock than other types of trauma, which suggests more serious injury and worse outcome.

Although there were some limitations in the study, it still could introduce us to find out the demographic characteristics of alcohol-related trauma in Suzhou, identify high-risk age and gender group, as well as the types of trauma mechanism and severity of trauma they experience, which provide reference information for medical service, public health initiatives and alcohol control policy.

Abbreviations

ART: alcohol-related trauma; SI: Shock index; ISS: the Injury Severity Score; RTS: the Revised Trauma Score; GCS: Glasgow Coma Scale; BAC: blood alcohol concentration; WTO: World Health Organization

Declarations

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Authors' contributions

JFQ, QL, LB, FX and DC contributed to the manuscript conception and draft of the manuscript, critically revised the manuscript, contributed with important scientific knowledge, and gave the final approval. All authors read and approved the final manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All relevant data underlying the findings are within the manuscript and its Supporting Information files.

Ethics approval and consent to participate

The study was approved by the Ethics Committees of the First Affiliated Hospital of Soochow University (Suzhou, China). The need for informed consent was waived because of the retrospective nature of the data.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

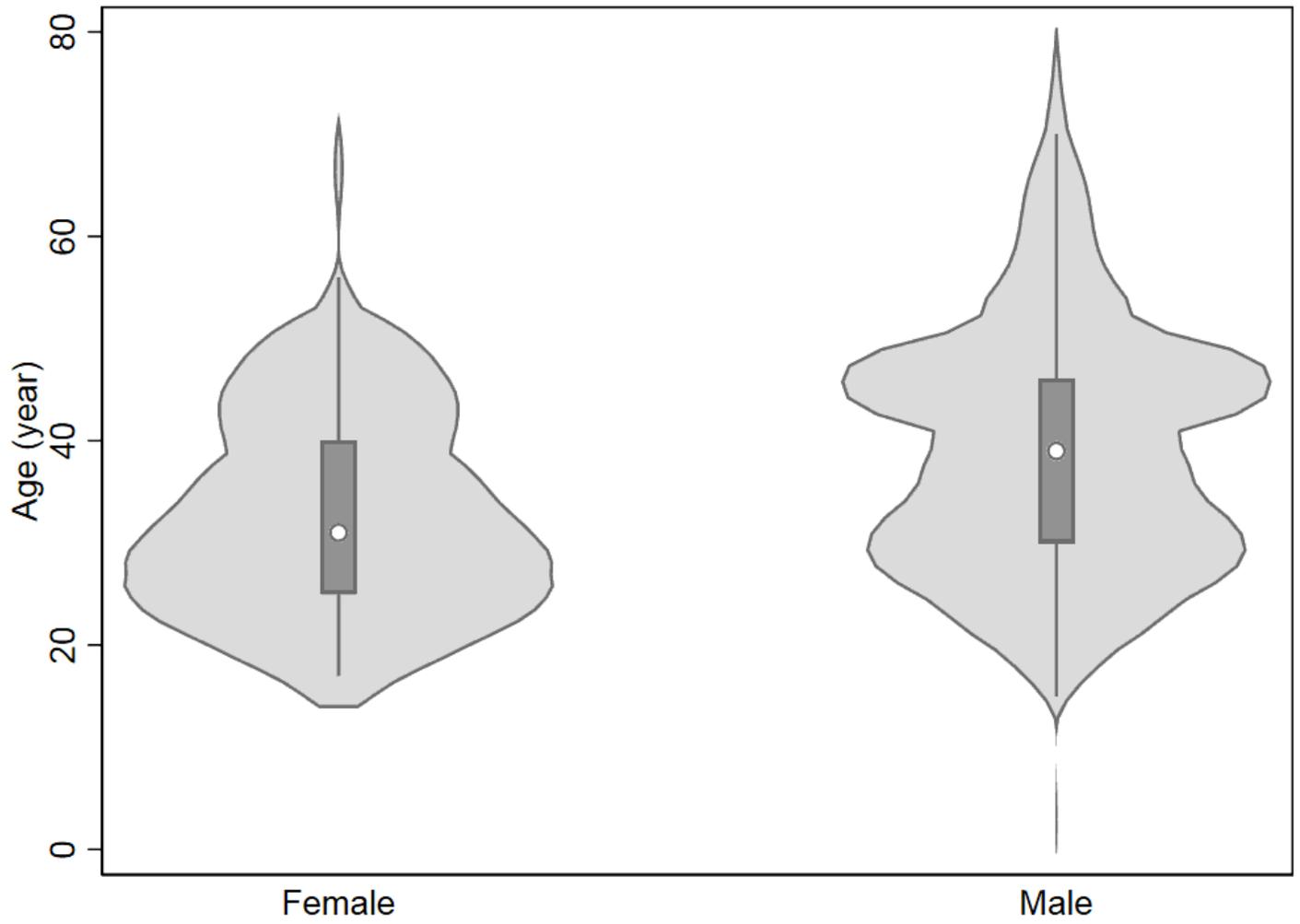


Figure 1

Violin chart for age distribution of the two sex subgroups

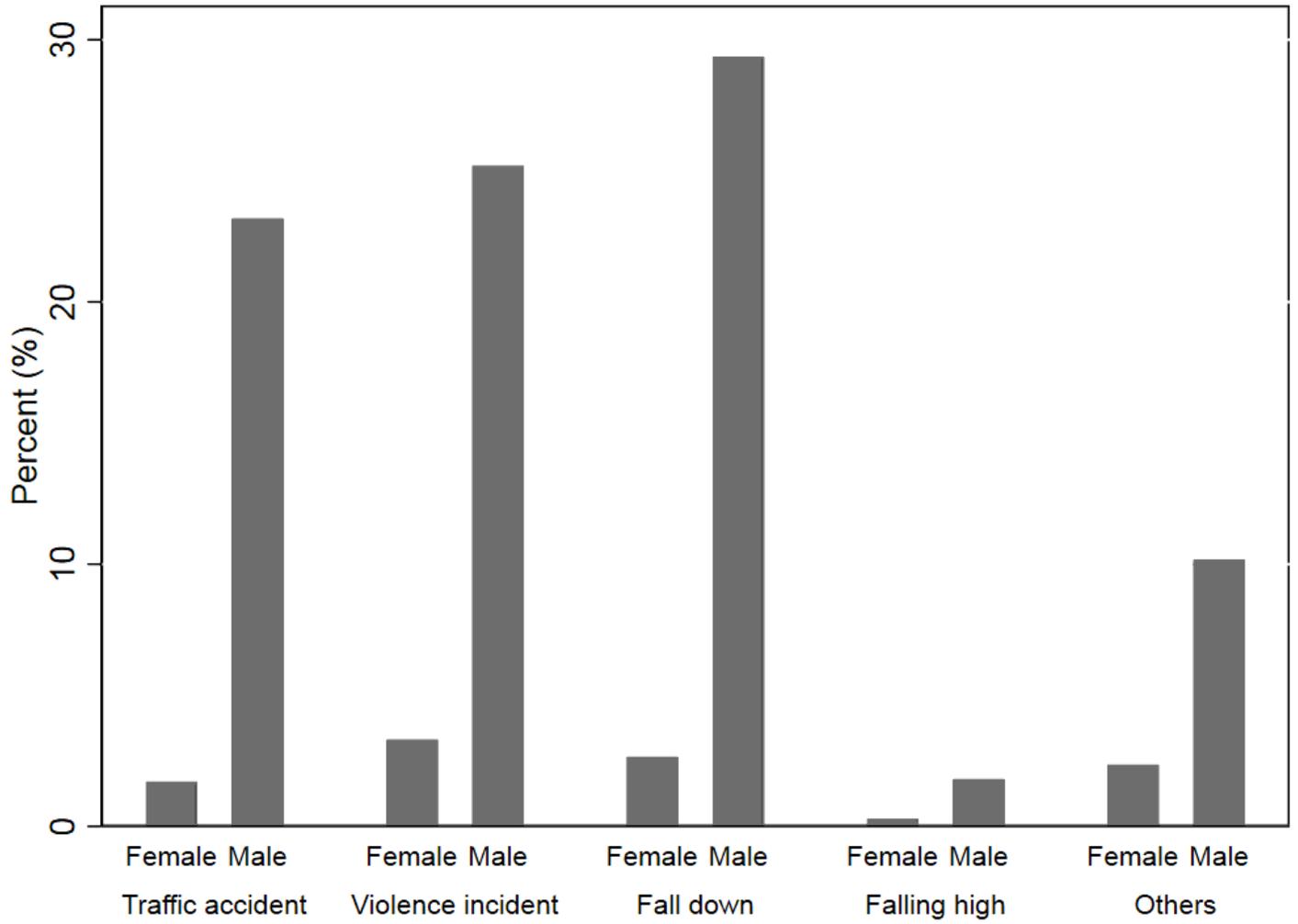


Figure 2

Bar chart of proportions grouped by sex and injury mechanism

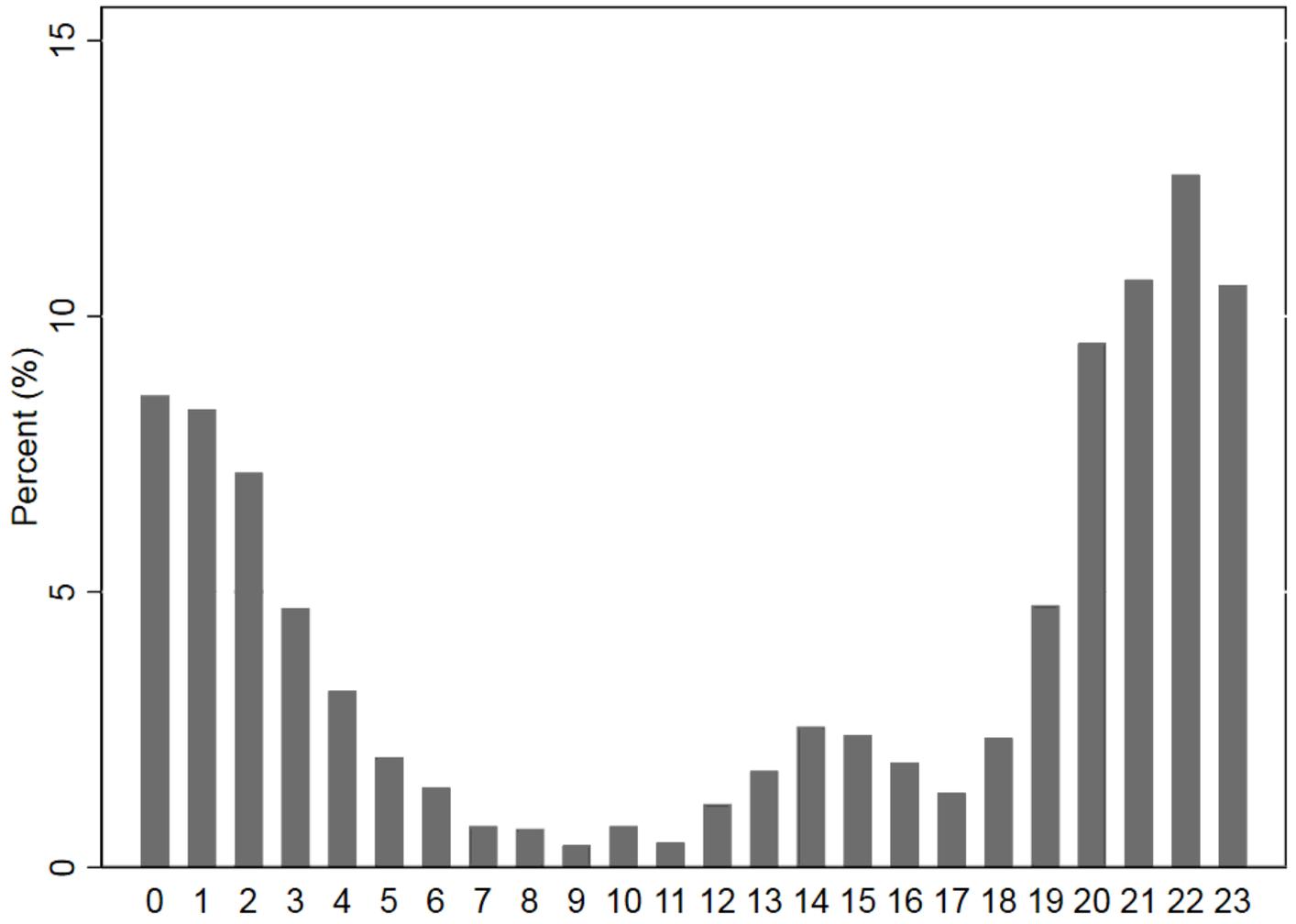


Figure 3

Bar chart of patients distribution in 24 hours

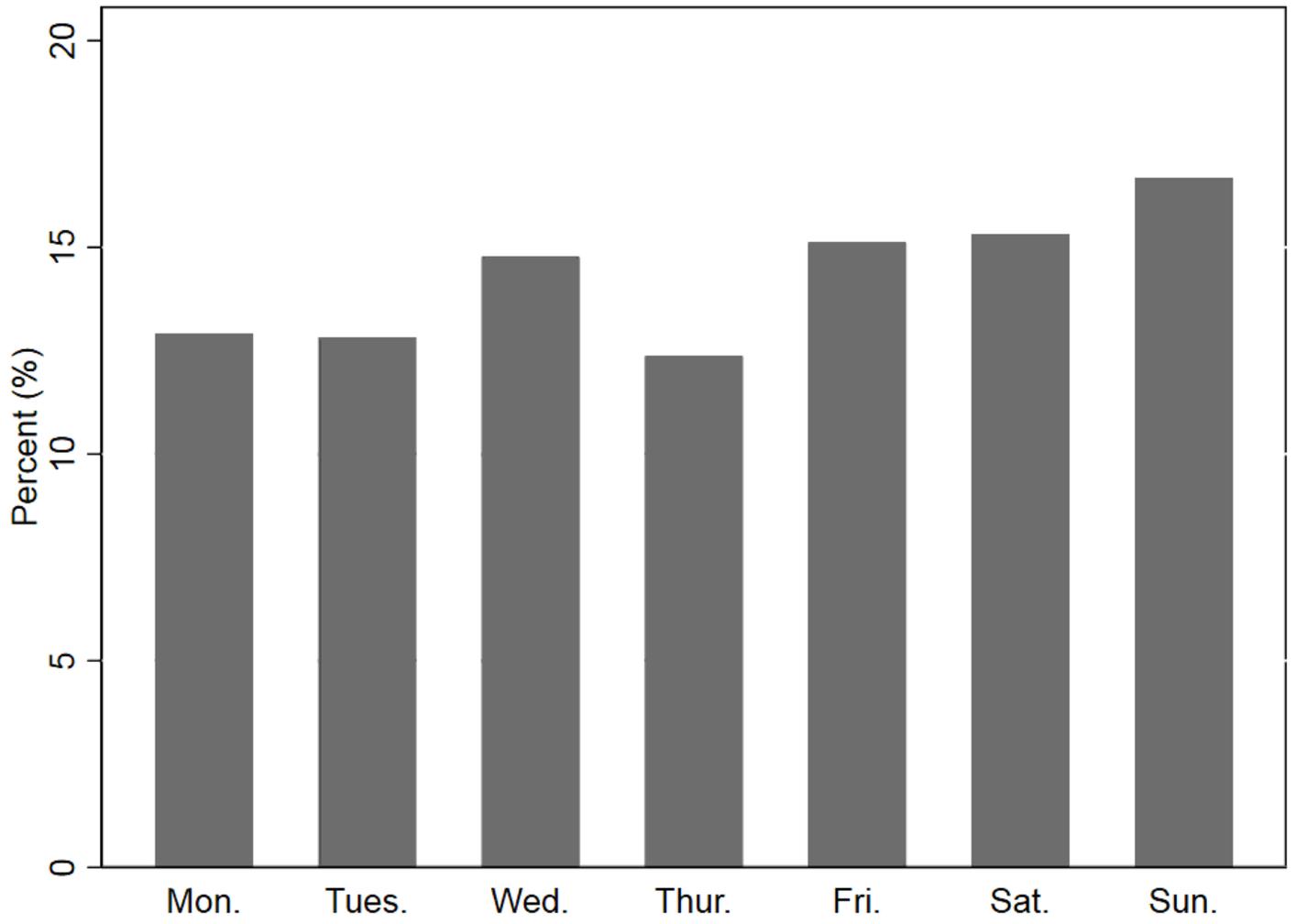


Figure 4

Bar chart of patients distribution during a week

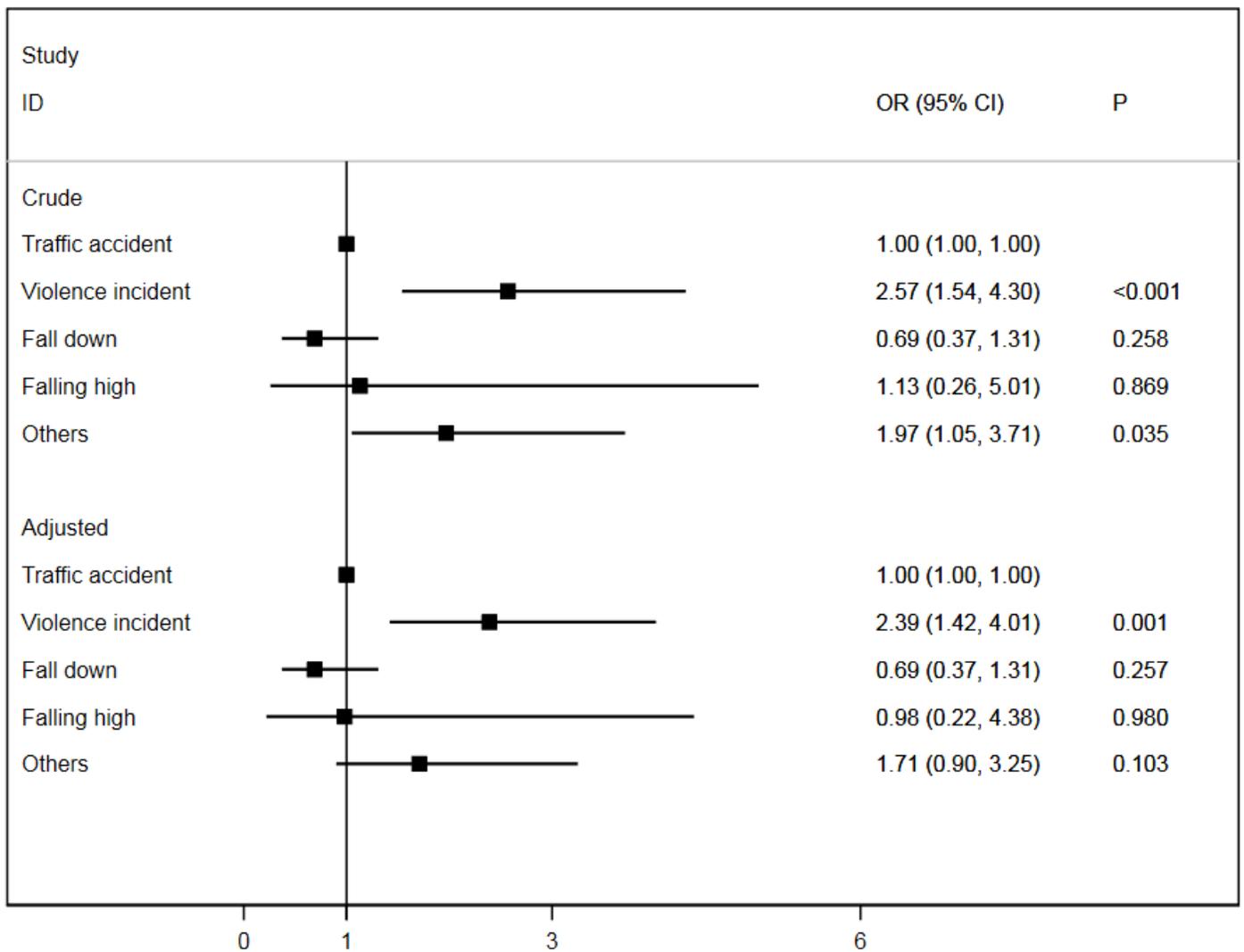


Figure 5

Forest plot for odds ratios of other injury mechanisms with traffic accident referenced

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