INTRODUCTION

In Korea, the socioeconomic cost of drinking has been increasing annually. The total social cost of drinking was about 3.0% of the gross domestic product (GDP) in 2004, and this has since increased. The drinking problem is becoming grave, as drinking consumes 0.5%-2.7% of the GDP in most countries. There is a strong association between alcohol consumption and injuries leading patients to visit the emergency department (ED). Recently, the World Health Organization (WHO) reported that in 12 countries, 6%-45% of injuries in the ED were associated with alcohol (1). Korean culture has a generous attitude toward alcohol; hence, the drinking population exceeds 60% of the total. More than 40% of people drink more than once a week, and the drinking rate in women and teenagers has increased (2). Therefore, we predict that the incidence of injuries resulting from alcohol will increase. However, there has been little systematic collection and analysis of data on alcohol and injuries in Korea, so it is difficult to investigate the actual conditions of adolescent drinking.

The Statistics Korea reported officially that motor vehicle accidents and suicide are major causes of deaths in juvenile population (3). Comprehending the cause of injury is important for reducing these deaths, particularly among teenagers. However, as mentioned, the systematic collection of data on alcohol-related injuries is insufficient in general and is nonexistent for teens in Korea.

We investigated the epidemiologic characteristics of alcohol-related injuries and confirmed the severity of injuries in adolescents with the goal of preventing alcohol-related injuries in adolescents.

MATERIALS AND METHODS

We obtained data from the ‘Development of a model for an in-depth injury surveillance system based on the emergency department’. This surveillance has been conducted under the supervision of the Korea Center for Disease Control and Prevention (KCDCP) to gather injury-related statistics and to establish policies regarding injury prevention. The emergency departments of six institutions, all tertiary, university-affiliated hospitals, were first designated in 2007, including three EDs located in Seoul, two in Gyeonggi-do, and one in Gangwon-do district. We investigated the epidemiologic characteristics of injured pa-
tients who visited these six EDs throughout 2007. We gathered basic information, such as sex, age, day and time of visit, and injury-related information, such as place, activity, mechanism, association with alcohol, and intent and result of emergency care. Self-reporting and the physician’s diagnosis based on the smell of alcohol were both used to assess alcohol ingestion by the ED patients. We excluded an analysis of socioeconomic indices because of many omissions in the data.

In Korea, adolescence is legally defined as younger than 19 yr old. Pubs are restricted areas, and the sale of alcoholic beverages to adolescents is prohibited. Therefore, we compared injured patients from 13 to 18 yr of age with adults aged 19 yr and older.

Continuous variables are described as the mean and standard deviation and were compared using the t-test. Categorical variables were compared using the chi-square test, using SPSS 12.0. Logistic regression analysis was performed to examine the relationship between alcohol and the severity of injury. Differences were accepted as statistically significant if the $P$ value was lower than 0.05.

**Ethics statement**

This study was approved by the Institutional Review Board of Ewha Womans University Mok Dong Hospital (ECT 231-2-47). Informed consent was exempted for review by the board because this study enrolled anonymous electronic data.

**RESULTS**

**Demographic characteristics**

During the study period, 70,523 injured patients were seen at the six EDs. We excluded patients whose alcohol-related information was unknown and children younger than 12 yr (Fig. 1). There were 4,729 (11.0%) juvenile patients, with a mean age of 15.7 ± 1.9 yr. Of these, 236 (5.0%) were intoxicated, and their mean age was 17.2 ± 1.3 yr, which was significantly higher than that of the non-drinking group ($P < 0.001$).

For both adolescents and adults, the proportion of male patients was significantly higher than that of females. But in teenagers, unlike adults, similar proportions of male and female patients had been drinking ($P = 0.14$). This showed that the alcohol behavior of girls is the points to be specially considered to formulate policy for alcohol prevention in adolescents (Table 1).

**Factors associated with alcohol-related injuries**

Alcohol-related injuries in adolescents were more numerous in summer, on weekends and holidays, and after midnight (Table 2). Traffic accidents, falls, and poisoning were significant mechanisms of injury associated with juvenile alcohol consumption. Among traffic accidents, motorcycle injuries were highly related to alcohol in adolescents (odds ratio [OR] 2.52, 95% confidence interval [CI] 1.09-5.83), unlike in adults, for whom pedestrian injuries were the most common injuries associated with alcohol (Table 3). A more detailed analysis of traffic accidents showed that alcohol-related passenger injuries increased gradually from 16 yr of age and steeply after 20 and were highest in patients in their 20s and 30s. In comparison, alcohol-related motorcycle injuries increased gradually from 14 yr and were highest in late teens and the early 20s (Fig. 2).

The roadway (public highways, streets, or roads), outdoors, and commercial areas were the main sites of alcohol-related injuries. In addition, alcohol-related injuries occurred when teenagers were working or traveling or during their leisure hours. Intentional injuries associated with alcohol, especially self-injury and suicide, increased disproportionally compared with unintentional injuries (Table 4).

**Table 1. Demographic characteristics**

| Age (yr) | Adolescents (n = 4,729) | $P$ | Adults (n = 38,426) | $P$ |
|----------|------------------------|-----|------------------|-----|
|          | Non-drinking No. (%)   |     | Non-drinking No. (%) | |
|          | Drinking No. (%)       |     | Drinking No. (%)   |     |
|          | 15.6 ± 1.8             |     | 43.7 ± 16.9       | |
|          | 17.2 ± 1.3             |     | 38.5 ± 13.0       |     |
| Sex      |                        |     |                  |     |
| Male     | 3,119 (95.3)           |     | 17.283 (74.8)     |     |
|          | 153 (4.7)              |     | 5,814 (25.2)      | < 0.001 |
| Female   | 1,374 (94.3)           |     | 13,521 (88.2)     |     |
|          | 83 (5.7)               |     | 1,808 (11.8)      |     |
| Total    | 4,493 (95.0)           |     | 30,804 (80.2)     |     |
|          | 236 (5.0)              |     | 7,622 (19.8)      |     |
Injury severity associated with alcohol
Based on the ED disposition, 4,061 (86.0%) mild and 473 (10.0%) moderate injuries occurred among adolescent patients. Of these, 187 (4.0%) adolescents were severely injured, including those who were admitted to the intensive care unit, underwent emergency surgery or died in the ED. This rate was lower than that in adults (Table 5).

A significant difference in severity was observed between the drinking and nondrinking groups in adolescents and adults. The relationship with alcohol was lower in cases of moderate injury (OR 0.78 and 0.64 in adults and adolescents, respectively) and higher in cases of severe injury, especially in adolescents (OR 1.39 and 2.47 in adults and adolescents, respectively) (Table 5). The relationship between alcohol and severity was still high after adjusting for other factors (OR 1.42 and 2.36 in adults and adolescents, respectively) (Table 6).

DISCUSSION
Previous studies have reported an association between alcohol consumption and patients visiting the ED; the mechanisms of injury include traffic accidents, falls, burns, and assaults (4, 5).

Table 2. Epidemiological characteristics associated with alcohol-related injuries

| Factors | Adolescents | | | | Adults | | | |
|---------|-------------|-----------|--------|-----------|-------------|-----------|--------|-----------|
|         | Total No. | Drinking No. (%) | OR | 95% CI | Total No. | Drinking No. (%) | OR | 95% CI |
| Sex†‡   | Male | 3,272 | (4.7) | 0.81 | 0.62-1.07 | 23,097 | (25.2) | 2.52 | 2.38-2.66 |
|         | Female | 1,457 | (5.7) | 1.00 | - | 15,329 | (11.8) | 1.00 | - |
| Season† | Spring | 979 | (5.1) | 1.00 | - | 8,650 | (21.1) | 1.00 | - |
|         | Summer | 1,300 | (6.0) | 1.14 | 0.79-1.63 | 10,924 | (19.4) | 0.90 | 0.84-0.97 |
|         | Autumn | 1,386 | (3.8) | 0.69 | 0.47-1.03 | 10,672 | (18.4) | 0.85 | 0.79-0.91 |
|         | Winter | 1,047 | (5.1) | 0.95 | 0.64-1.40 | 8,179 | (21.0) | 0.99 | 0.93-1.07 |
| Day of visit | Weekday | 2,975 | (4.4) | 1.00 | - | 21,934 | (19.9) | 1.00 | - |
|         | Saturday | 693 | (6.2) | 1.45 | 1.02-2.07 | 6,570 | (21.1) | 1.07 | 1.00-1.15 |
|         | Sunday | 816 | (6.1) | 1.43 | 1.02-1.99 | 7,708 | (19.1) | 0.95 | 0.89-1.01 |
|         | Holiday | 245 | (5.3) | 1.23 | 0.68-2.20 | 2,214 | (17.8) | 0.87 | 0.77-0.97 |
| Time of visit | 07:00-17:59 | 2,156 | (2.9) | 1.00 | - | 16,960 | (9.7) | 1.00 | - |
|         | 18:00-20:59 | 870 | (1.6) | 0.54 | 0.30-0.98 | 5,755 | (10.1) | 1.04 | 0.94-1.15 |
|         | 21:00-23:59 | 927 | (3.0) | 1.04 | 0.66-1.63 | 6,330 | (22.0) | 2.63 | 2.43-2.84 |
|         | 24:00-06:59 | 774 | (16.9) | 6.78 | 4.95-9.27 | 9,360 | (42.8) | 6.95 | 6.51-7.42 |

*Significant differences between the non-drinking and drinking groups were found for all patients (P < 0.001), except for the sex differences in adolescents (P = 0.14); †No information on season was available for 17 adolescent patients and one adult patient. Among these, three and zero patients drank alcohol, respectively; ‡We could not obtain information about the time of visit for two adolescents and 21 adults. These included zero and six patients who drank alcohol, respectively.

Table 3. Mechanism associated with the alcohol-related injuries

| Factors | Adolescents | | | | Adults | | | |
|---------|-------------|-----------|--------|-----------|-------------|-----------|--------|-----------|
|         | Total No. | Drinking No. (%) | OR | 95% CI | Total No. | Drinking No. (%) | OR | 95% CI |
| Injury mechanism | Struck by person or object | 1,650 | (4.7) | 1.00 | - | 8,868 | (27.9) | 1.00 | - |
| Traffic accident | 959 | (5.8) | 1.25 | 0.88-1.78 | 7,501 | (11.8) | 0.35 | 0.32-0.38 |
| Fall | 176 | (6.3) | 1.35 | 0.70-2.58 | 2,415 | (43.8) | 0.60 | 0.53-0.67 |
| Slipped | 577 | (3.1) | 0.65 | 0.39-1.10 | 6,085 | (22.5) | 0.75 | 0.70-0.81 |
| Cut or pierced | 464 | (5.4) | 1.15 | 0.72-1.83 | 4,825 | (20.0) | 0.65 | 0.59-0.70 |
| Machine/firearm/burn | 99 | (0.0) | - | - | 1,424 | (5.3) | 0.14 | 0.11-0.18 |
| Submergence | 5 | (0.0) | - | - | 21 | (28.6) | 1.03 | 0.40-2.67 |
| Poisoning | 76 | (7.2) | 2.05 | 0.91-4.61 | 1,070 | (37.2) | 1.53 | 1.34-1.75 |
| Choking or hanging | 5 | (0.0) | - | - | 107 | (21.5) | 0.71 | 0.45-1.13 |
| Other/unspefied | 718 | (5.7) | 1.23 | 0.83-1.81 | 6,110 | (15.9) | 0.49 | 0.45-0.53 |
| Traffic accidents | Passenger | 187 | (3.7) | 1.00 | - | 4,335 | (9.3) | 1.00 | - |
| | Pedestrian | 212 | (4.7) | 1.27 | 0.48-3.41 | 1,390 | (17.6) | 2.07 | 1.74-2.45 |
| | Bicycle | 200 | (4.0) | 1.07 | 0.38-3.02 | 690 | (10.0) | 1.08 | 0.82-1.41 |
| | Motorcycle | 348 | (8.9) | 2.52 | 1.09-5.83 | 984 | (15.7) | 1.80 | 1.47-2.20 |
| | Other/unspefied | 12 | (0.0) | - | - | 102 | (14.7) | 1.67 | 0.96-2.92 |

*P < 0.001.
Further studies of injuries to adolescents reported that alcohol was associated not only with death, but also with health risk behavior. Teenagers who drink heavily commit sex crimes, smoke, and fight more frequently than nondrinking teenagers (6).

In our series, the proportion of adolescents visiting the ED with injuries who had been drinking was 5.0%; this proportion was similar in boys and girls. This differed from the percentages for adults, in whom the proportion of men was twice that of women. Other studies have also found no gender difference in drinking by teenagers (6, 7). Consequently, these distinct features of adolescent behavior compared with adult behavior should be considered when planning education programs for students designed to reduce alcohol consumption.

Many studies have reported that specific mechanisms of injury, such as motor vehicle accidents, falls, and fire injuries, were strongly associated with alcohol (8-11). Nevertheless, the relationship between alcohol consumption and injury severity is controversial, and some studies have found no association between alcohol ingestion and severity or outcome (12-15), whereas others emphasize the impact of alcohol on the severity and mortality of injuries (16-20). In our investigation, juvenile drinking was linked to several mechanisms of injury: motor vehicle accidents, falls, poisoning, and cutting or piercing. Of these mechanisms, traffic accidents associated with alcohol resulted in severe injuries, and constituted the most common cause of juvenile death. Therefore, prevention of traffic accidents under the influence of alcohol should be a focus as a measure for preventing injuries to juveniles. From our data, however, we could not obtain information about the activity for 23 adult patients. This included nine patients who drank alcohol.

In our study, the proportion of adolescents visiting the ED with injuries who had been drinking was 5.0%; this proportion was similar in boys and girls. This differed from the percentages for adults, in whom the proportion of men was twice that of women. Other studies have also found no gender difference in drinking by teenagers (6, 7). Consequently, these distinct features of adolescent behavior compared with adult behavior should be considered when planning education programs for students designed to reduce alcohol consumption.

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Table 4. Event characteristics associated with alcohol-related injuries*

| Factors | Adolescents | | | Adults | | |
| --- | --- | --- | --- | --- | --- |
| | Total No. | Drinking No. (%) | OR 95% CI | Total No. | Drinking No. (%) | OR 95% CI |
| **Place of occurrence** | | | | | | |
| Home/Place of residence | 1,376 | 42 (3.1) | 1.00 | - | 14,360 | 2,132 (14.8) | 1.00 | - |
| School | 938 | 8 (0.9) | 0.27 | 0.13-0.59 | 437 | 38 (8.7) | 0.55 | 0.39-0.76 |
| Sports area | 314 | 4 (1.3) | 0.41 | 0.15-1.15 | 1,391 | 44 (3.2) | 0.19 | 0.14-0.25 |
| Roadway/Outdoors | 1,734 | 120 (6.9) | 2.36 | 1.65-3.38 | 13,799 | 2,922 (21.2) | 1.54 | 1.45-1.64 |
| Working area | 41 | 1 (2.4) | 0.79 | 0.11-5.91 | 2,492 | 84 (3.4) | 0.20 | 0.16-0.25 |
| Commercial area | 292 | 59 (20.2) | 8.04 | 5.29-12.23 | 5,350 | 2,242 (41.9) | 4.14 | 3.85-4.44 |
| Other/unspecified | 34 | 2 (5.9) | 1.99 | 0.46-8.56 | 597 | 160 (26.8) | 2.10 | 1.74-2.53 |
| **Activity when injured** | | | | | | |
| Vital activity | 2,543 | 94 (3.7) | 1.00 | - | 20,891 | 3,708 (17.7) | 1.00 | - |
| Work | 459 | 43 (9.4) | 2.69 | 1.85-3.92 | 9,982 | 1,736 (17.4) | 0.97 | 0.92-1.04 |
| Education | 438 | 1 (0.2) | 0.06 | 0.00-0.43 | 128 | 18 (14.1) | 0.76 | 0.46-1.25 |
| Sports & Exercise | 314 | 1 (0.3) | 0.08 | 0.01-0.60 | 1,213 | 41 (3.4) | 0.16 | 0.120-0.22 |
| Leisure/Traveling | 946 | 91 (9.6) | 2.77 | 2.06-3.74 | 5,741 | 1,946 (33.9) | 2.37 | 2.22-2.53 |
| Other/unspecified | 29 | 6 (20.7) | 6.80 | 2.70-17.09 | 471 | 173 (36.7) | 2.67 | 2.20-2.95 |
| **Intent** | | | | | | |
| Unintentional | 3,985 | 154 (3.9) | 1.00 | - | 33,716 | 5,213 (15.5) | 1.00 | - |
| Self-injury/suicide | 104 | 15 (14.4) | 4.19 | 2.37-7.42 | 1,211 | 555 (45.8) | 4.62 | 4.11-5.20 |
| Assault/homicide | 598 | 65 (10.9) | 3.03 | 2.24-4.21 | 3,004 | 1,660 (55.3) | 6.75 | 6.25-7.30 |
| Other/unspecified | 42 | 2 (4.9) | 1.24 | 0.30-5.19 | 495 | 194 (39.2) | 3.50 | 2.91-4.21 |

*P < 0.001; †We could not obtain information about the activity for 23 adult patients. This included nine patients who drank alcohol.

Table 5. Bivariate logistic regression of injury severity associated with alcohol among adolescents and adults*

| Severity | Adolescents | | | Adults | | |
| --- | --- | --- | --- | --- | --- |
| | Total No. | Drinking No. (%) | OR 95% CI | Total No. | Drinking No. (%) | OR 95% CI |
| Mild | 4,061 | 198 (4.9) | 1.00 | 31,152 | 6,224 (20.0) | 1.00 |
| Moderate | 473 | 15 (3.2) | 0.64 | 0.38-1.09 | 5,070 | 822 (16.2) | 0.78 | 0.72-0.84 |
| Severe | 187 | 21 (11.2) | 2.47 | 1.53-3.97 | 2,115 | 546 (25.8) | 1.39 | 1.26-1.54 |

*P < 0.001; †We could not obtain information about the ED results for eight adolescents and 89 adults. This included two and 30 patients who drank alcohol, respectively.
not determine the diagnosis or anatomical findings of the patients. Therefore, we cannot comment on any association between juvenile alcohol consumption and detailed indices of severity, such as the Glasgow Coma Scale (GCS), Injury Severity Score (ISS), or Revised Trauma Score (RTS).

Among traffic accident injuries, motorcycle accidents showed a marked relationship with alcohol in adolescents. In Korea, a person must be 16 yr old to get a motorcycle license, but 18 yr to get an automobile driver’s license. As the percentage of traffic accidents involving alcohol is constant, the age requirements for obtaining a license should be raised. Williams et al. (21) investigated the variation in the rate of traffic accidents from state to state and reported that the accident rate for all passenger bicycle, and pedestrian accidents was 6.5 times lower in Connecticut, which has an age requirement of 17 yr for a driver’s license, than in New Jersey, where the requirement is 16 yr. They reported that simply raising the age limit from 16 to 17 yr old resulted in an approximately 65 to 75% reduction in traffic accidents.

We surveyed intentional injuries linked to alcohol. Intentional injuries were more strongly associated with alcohol than were unintentional injuries in both teens and adults. This was especially remarkable in juveniles for intentional injuries such as self-injury and suicide. Our results showed that injuries grouped as self-injury and suicide (OR = 4.19) were strongly associated with alcohol use in teens than were those categorized as assault and homicide (OR = 3.03), whereas the latter were more strongly associated with alcohol in adults. A recent international study of adolescent alcohol consumption and self-harm reported that teens with moderate- or high-risk alcohol behavior had a greater risk of self-injury and suicide (22). Similarly, juvenile intentional injuries that are not severe could result in more dangerous outcomes in the future. Therefore, any alcohol prevention education program for teenagers should include an examination of the motivation and methods underlying injuries and interventions focused on risky behaviors.

We also examined the relationship between alcohol and the severity of injury based on the disposition in the ED. Overall, severe injuries constituted a small percentage of all injuries, but the percentage was greater in adolescents than in adults. Because many injuries to adolescents were caused in traffic accidents, especially motorcycle accidents, more of the outcomes were likely fatal. Recent research on blunt trauma related to juvenile alcohol consumption reported that drunken patients tended to have lower GCS scores and higher ISS, a greater need for emergency surgery or admissions to the intensive care unit, longer hospital stays, and higher mortality compared with non-drinking adolescents (23). Like a previous report, we found that juvenile injuries had poorer outcomes, although they were similar to injuries in adults, because teens lack a sense of mortality and perform more risky behavior, such as ignoring regulations or failing to wear protective devices (24-26).

This study had some limitations because the data were obtained from the ‘Development of a model for an in-depth injury surveillance system based on the emergency department.’ First, the final outcomes and information on socioeconomic status, such as occupation, educational background, and economic levels, were not identified due to deficiency in the records. Therefore, we could not examine the associations between alcohol and socioeconomic status reported in previous studies. Second, the rate of “others” and “unspecified” was quite high for each survey item, so considerable amounts of data were missing. Finally, we could not analyze the link between alcohol behavior and injury because typical alcohol behavior, in contrast to drinking that was reported or observed at the time of injury, was not investigated. Despite these limitations, however, it is important to note that our study investigated the characteristics and severity of adolescent alcohol-related injuries in nearly 5,000 cases involving injured juveniles. Future research should include a broader analysis of the risks of alcohol, including the association between alcohol behavior and injury and that between alcohol-related injuries and socioeconomic factors.

We investigate adolescent alcohol-related injuries and associated factors for injured teenagers visiting six emergency departments. We found that juvenile alcohol-related injuries had unique features. First, there were no significant alcohol-related differences between injuries in male and female adolescents, unlike the case in adults, for whom male patients showed higher rates of alcohol consumption. Second, among traffic accidents, motorcycle-related injuries were closely associated with alcohol consumption in adolescents. Perhaps for this reason, alcohol-related injuries in adolescents had poorer outcomes compared with injuries in adults. In conclusion, the preventive strategy on alcohol-related injuries in adolescents should focus on reducing motorcycle accidents.

Table 6. Multivariate logistic regression of the injury severity associated with alcohol among adolescents and adults* † ‡

| Severity | Adolescents | | | Adults | | |
|----------|-------------|---|---|--------|---|---|
| Total No.| Drinking No. (%) | OR | 95% CI | Total No. | Drinking No. (%) | OR | 95% CI |
| Mild     | 4,061       | 198 (4.9) | 1.00 | 31,152   | 6,224 (20.0) | 1.00 |
| Moderate | 473         | 15 (2.2)  | 0.37 | 0.33-0.98 | 5,070 | 822 (16.2) | 0.94 | 0.85-1.03 |
| Severe   | 187         | 21 (11.2) | 2.36 | 1.47-3.81 | 2,115 | 546 (25.8) | 1.42 | 1.26-1.59 |

*P < 0.001; †Adjusted for sex, season, day and time of visit, injury mechanism, place where injury occurred, activity when injured, and intent; ‡We could not obtain information about the ED results for eight adolescents and 89 adults. This included two and 30 patients who drank alcohol, respectively.
REFERENCES

1. World Health Organization. Collaborative study on alcohol and injuries: final report. Geneva: Department of Mental Health and Substance Abuse, WHO; 2007.

2. Korea National Statistical Office. Report on the social survey. 2008. Available at http://kostat.go.kr/portal/korea/kor_nw/2/6/3/index.board?bnmode=read&Seq=67832 [accessed on 1 Dec 2009].

3. Korea National Statistical Office. Annual report on the cause of death statistics. 2008. Available at http://epic.kdi.re.kr/epic/epic_view.jsp?num=102999&menu=1 [accessed on 1 Dec 2009].

4. Cherpitel CJ. Alcohol and injuries: a review of international emergency room studies. Addiction 1993; 88: 923-37.

5. World Health Organization. International guide for monitoring alcohol consumption and related harm. Geneva: Department of Mental Health and Substance Abuse, WHO; 2000.

6. Miller JW, Naimi TS, Brewer RD, Jones SE. Binge drinking and associated health risk behaviors among high school students. Pediatrics 2007; 119: 76-85.

7. Li YM, Tsai SY, Hu SC, Wang CT. Alcohol-related injuries at an emergency department in eastern Taiwan. J Formos Med Assoc 2006; 105: 481-8.

8. Li G, Keey PM, Smith GS, Baker SP. Alcohol and injury severity: reappraisal of the continuing controversy. J Trauma 1997; 42: 562-9.

9. Cherpitel CJ. Drinking patterns and problems and drinking in the event: an analysis of injury by cause among casualty patients. Alcohol Clin Exp Res 1996; 20: 1130-7.

10. Warda L, Tenenbein M, Moffatt ME. House fire injury prevention update. Part I. A review of risk factors for fatal and non-fatal house fire injury. Inj Prev 1999; 5: 145-50.

11. Waller PF, Hill EM, Maio RF, Blow FC. Alcohol effects on motor vehicle crash injury. Alcohol Clin Exp Res 2003; 27: 695-703.

12. Brickley MR, Shepherd JP. The relationship between alcohol intoxication, injury severity and Glasgow Coma Score in assault patients. Injury 1995; 26: 311-4.

13. Fuller MG. Alcohol use and injury severity in trauma patients. J Addict Dis 1995; 14: 47-54.

14. Jurkovich GJ, Rivara FP, Gurney JG, Fligner C, Ries R, Mueller BA, Copass M. The effect of acute alcohol intoxication and chronic alcohol abuse on outcome from trauma. JAMA 1993; 270: 51-6.

15. Lee EJ, Kim TY, Kim SC, Park HS, Suh GJ, Shin SD, You EY. Effect of alcohol consumption on the severity of blunt injury. J Korean Soc Emerg Med 2005; 16: 339-45.

16. Choi YH, Kim GB, Lee DH, Eo EK, Jung KY, Kim JS, Shin DW, Kim SE, Lee MJ. Effect of alcohol ingestion on the severity and outcome in trauma patients. J Korean Soc Emerg Med 2006; 17: 231-7.

17. Cherpitel CJ. Alcohol in fatal and nonfatal injuries: a comparison of coroner and emergency room data from the same country. Alcohol Clin Exp Res 1996; 20: 338-42.

18. Spaite DW, Criss EA, Weist DJ, Valenzuela TD, Judkins D, Melelin HW. A prospective investigation of the impact of alcohol consumption on helmet use, injury severity, medical resource utilization, and health care costs in bicycle-related trauma. J Trauma 1995; 38: 287-90.

19. Kim K, Nitz L, Richardson J, Li L. Personal and behavioral predictors of automobile crash and injury severity. Accid Anal Prev 1995; 27: 469-81.

20. Deutch SR, Christian C, Hoyer S, Christensen EF, Dragsholt C, Hansen AC, Kristensen IB, Hougaard K. Drug and alcohol use among patients admitted to a Danish trauma centre: a prospective study from a regional trauma centre in Scandinavia. Eur J Emerg Med 2004; 11: 318-22.

21. Williams AE, Karpf RS, Zador PL. Variations in minimum licensing age and fatal motor vehicle crashes. Am J Public Health 1983; 73: 1401-3.

22. Rossow I, Ystgaard M, Hawton K, Madge N, Heeringen K, de Wilde EI, DeLeo D, Fekete S, Morey C. Cross-national comparisons of the association between alcohol consumption and deliberate self-harm in adolescents. Suicide Life Threat Behav 2007; 37: 605-15.

23. Draus JM Jr, Santos AP, Franklin GA, Foley DS. Drug and alcohol use among adolescent blunt trauma patients: dying to get high? J Pediatr Surg 2008; 43: 208-11.

24. Petridou E, Zavitsanos X, Dessypris N, Francakis M, Mandra M, Doxiadis S, Trichopoulos D. Adolescents in high-risk trajectory: clustering of risky behavior and the origins of socioeconomic health differentials. Prev Med 1997; 26: 215-9.

25. Williams AE, Shabanova VI. Situational factors in seat belt use by teenage drivers and passengers. Traffic Inj Prev 2002; 3: 201-4.

26. Mo E, Turner MC, Krewski D, Merrick J. Adolescent injuries in Canada: findings from the Canadian community health survey, 2000-2001. Int J Inj Contr Saf Promot 2006; 13: 235-44.
AUTHOR SUMMARY

Characteristics of Alcohol-related Injuries in Adolescents Visiting the Emergency Department

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Alcohol drinking-associated accident is one of the most frequent causes of emergency cases. We compared the characteristics and severity of alcohol-related injuries in adolescents and adults. All injured patients seen at six EDs throughout 2007 were included. We obtained data from the ‘Development of a model for an in-depth injury surveillance system based on the emergency department’ surveillance. The proportion of adolescents who drank was 5.0%. No significant alcohol-related difference in injuries was found between male and female adolescents ($P = 0.14$), whereas in adults, being male was strongly related to alcohol consumption ($P < 0.001$). Among traffic accidents, motorcycle-related injuries were strongly associated with alcohol use in adolescents (odds ratio [OR] 2.52, 95% confidence interval [CI] 1.09–5.83). Results also indicated that alcohol-related injuries in adolescents showed poor outcomes (OR 2.36, 95% CI 1.47–3.81) as compared with those in adults (OR 1.42, 95% CI 1.26–1.59). Preventive strategy on alcohol-related injuries in adolescents should focus on reducing motorcycle accidents.