

Relationship between Traffic Fatalities and Drunk Driving in Japan

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Objective. The present study was performed to clarify the relation between alcohol use and traffic fatalities in accidents involving motor vehicles in Japan.

Methods. Data on traffic accidents were collected from Fukuoka Prefectural Police records of traffic accidents which occurred in that prefecture between 1987 and 1996. Multiple logistic regression models were used to assess the effect of alcohol use on the risk of traffic-accident death.

Results. The data showed that 58,421 male drivers were involved in traffic accidents during the 10-year study period, and that 271 of these were killed as a result of the accident. Alcohol use was significantly associated with speed, seat belt use, time, and road form. Among male motorcar drivers, the odds ratio of alcohol use before driving, after adjusting for age, calendar year, time, and road form, was 4.08 (95% confidence interval, 3.08–5.40), which means that about 75% of fatalities (attributable risk percent among exposed) might have been prevented if drivers had not drunk before driving.

Conclusions. Alcohol use before driving resulted in a 4.08-fold increase in the risk of death in a traffic accident. It is suggested that alcohol use is considered an important risk factor for fatality in traffic accidents.

Keywords Alcohol; Speed; Seat Belt; Motorcar; Accident; Japan

In Japan, the mortality rate for deaths from external causes (unexpected accident, suicide, murder, etc.) accounted for 7.7% of the overall mortality, and was the fifth leading cause of death in 2002. The age adjusted mortality rate for traffic accidents is about 13 (per 100,000 population) for men and five (per 100,000 population) for women, according to data from the Ministry of Health, Labor, and Welfare (Health and Welfare Statistics Association, 2002). This mortality rate cannot be considered low. The number of traffic accidents (deaths and injuries) that occurred in Fukuoka prefecture is 1,809.8 (per 100,000 people with driving licenses) and was the second worst record in Japan.

There are many risk factors associated with traffic fatalities. One important risk factor is drunk driving. Although driving under the influence of alcohol is against the law, some people still drive after drinking alcohol, and accidents caused by drunk driving continue to occur. According to statistics of the Metropolitan Police Department on traffic accidents in Japan, percentages of traffic accident fatalities involving alcohol ranged from 12.9% to 14.1% of all traffic fatalities during 1995–2001, and the percentages were considerably smaller than those in the 2001 National Highway Traffic Safety Administration (NHTSA) report (Jones & Lacey, 2001). There are few epidemiological studies on risk

factors of fatality in traffic accidents in Japan, but many epidemiological studies in other countries have demonstrated the deleterious effect of alcohol in increasing the risk of traffic fatalities (Cohen et al., 2002; Desapriya et al., 2003; Otero, 1998; Reynaud et al., 2002; Zador et al., 2000).

The present study used statistical analyses to estimate the relation between alcohol use and traffic fatalities in accidents involving motor vehicles. To achieve the stated aim of the study, we would have had to compare alcohol use of drivers in fatal crashes with alcohol use of drivers who were not involved in crashes. However, there are no data on drivers who are not involved in crashes. We therefore compared alcohol use of drivers in fatal crashes with alcohol use of drivers in crashes which did not involve injuries.

METHODS

The total population of Fukuoka prefecture in 1987, 1990, and 1996 (three points within the study period) was about 4.73 million (2.27 million men, 2.46 million women), 4.78 million (2.29 million men, 2.49 million women), and 4.92 million (2.35 million men, 2.57 million women), respectively. The number of licensed drivers in Fukuoka prefecture in 1994 was about 2.54 million. The number of deaths or injuries (per 100,000 licensed drivers) was 1,809.8, which was the second worst record in Japan. Information on all traffic accidents that occur in Fukuoka Prefecture is assembled by the Fukuoka Prefectural Police. By courtesy of the Traffic Department of Fukuoka Prefectural

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Table I Age distribution of severity of injury and alcohol use among male and female motorcar drivers during the period 1987 to 1996

		Age group											
		-19	%	20-29	%	30-39	%	40-49	%	50-59	%	60+	%
Severity of injury	Death	37	0.6	115	0.5	43	0.5	37	0.4	23	0.3	16	0.3
	No injury	6553	99.4	21284	99.5	9172	99.5	9418	99.6	7160	99.7	4563	99.7
	Total	6590	100.0	21399	100.0	9215	100.0	9455	100.0	7183	100.0	4579	100.0
Alcohol use	Drinker	137	2.1	293	6.0	896	9.7	838	8.9	431	6.0	170	3.7
	Non-drinker	6453	97.9	20106	94.0	8319	90.3	8617	91.1	6752	94.0	4409	96.3
	Total	6590	100.0	21399	100.0	9215	100.0	9455	100.0	7183	100.0	4579	100.0

Police, data on the features of traffic accidents that occurred between 1987 and 1996 were obtained. A total of 366,082 accidents were reported to the Fukuoka Prefectural Police during this period. In this study we utilized data from accidents in which the primary parties concerned were passenger cars and the secondary parties were either passenger cars or other objects. Also, female drivers were eliminated from this analysis because there were few female drivers involved in traffic accidents. In the end, there were 58,421 subjects.

Outcomes of the crashes were categorized into "Death" and "No injury." "Death" was defined as a fatality occurring within 24 hours after the time of the accident as reported in police records. Subjects were divided according to alcohol use into "Non-drinkers," who had not taken any alcoholic beverage before the accident, and "Drinkers," who are classified into four categories according to the Japanese Road Traffic Law during 1987-1996. "Drunk driving," which is not strictly related to blood alcohol concentration and is related to the state in which it is difficult for the driver to properly drive a car under the influence of alcohol, "shukiobi" (in Japanese), which refers to an alcohol concentration greater than or equal to 0.25 mg/l in expiration, which is a "standard level" of alcohol, corresponding to a blood alcohol concentration (BAC) greater than or equal to 0.5 mg/ml, which equals BAC of 0.05 according to its definition, "less than standard level," which refers to an alcohol concentration less than 0.25 mg/l in expiration corresponding to a blood alcohol concentration less than 0.5 mg/ml, and "unable to detect," which refers to a person involved in a traffic accident who was confirmed to have drunk from circumstantial evidence but no alcohol could be detected. Unfortunately, since we did not obtain permission for using these categories of alcohol from the Traffic Department of Fukuoka Prefectural Police, alcohol use was divided into only two categories, "non-drinker" and "drinker" in the present analyses. The seat-belt category was divided into "Did not use" or "Used" at the time of the accident. Time of day (hour) was categorized as "06:00-17:59" and "18:00-05:59." Road form was divided into "straight" and "curve." The category of speed (at the time of the accident) was divided into less than or equal to 50 km/hour (≤ 50 km/hour) and greater than 50 km/hour (50 km/hour <).

To determine whether alcohol use was associated with traffic-accident death, the odds ratios (OR) with 95% confidence interval (95% CI) of death were calculated by adjusting for age, calendar year, time, and road form using a multivariate logistic regression analysis. In this analysis, the reference was "No

injury." The software used for these statistical calculations was SPSS, version 11.5 (SPSS Inc., Chicago).

RESULTS

Table I shows the age distribution by severity of injury and by alcohol use for male drivers involved in traffic accidents during the period from 1987 to 1996. Regarding the drivers of the vehicles found to be the primary parties to the accidents, 58,421 were men, and 3,765 of them had consumed alcohol before driving. Table II shows the association of alcohol use with speed, seat-belt use, time, and road form. Alcohol use was significantly associated with these factors, and in particular with time at the accident (OR = 10.8). However, drunk drivers may have driven faster than other drivers and may not have worn seat belts. If so, these two factors may have been on the causal pathway between alcohol use and fatality, and adjustment for these factors would have resulted in an improperly decreased odds ratio for alcohol use. Therefore, only time and road form were included in the logistic regression model as confounders in addition to age and year. The odds ratio for alcohol use was 7.65 (95%CI: 5.89-9.93) after adjustment for age and year, and although it was considerably decreased, the strong effect of alcohol use on fatality (OR = 4.08, 95%CI: 3.08-5.40) still remained after adding time and road form as confounders in the model (Table III).

DISCUSSION

So far, there have been few studies on the association between traffic-accident fatality and its relevant risk factors in Japan. By courtesy of the Traffic Department of Fukuoka Prefectural Police, we had an opportunity to analyze the association using data of traffic accidents that occurred in 1987-1996 in Fukuoka Prefecture. From our analyses, higher speed, alcohol use, driving

Table II Odds ratios and 95% confidence intervals for driving conditions associated with alcohol use among male motorcar drivers

Factors		Drinker	Non-drinker	OR	95.0% CI
Speed	≤ 50 km/h	3124	50606	1.00	
	50 km/h <	641	4050	2.56	2.34-2.81
Seat belt	Used	2884	51398	1.00	
	Didn't use	881	3258	4.82	4.43-5.24
Time of day	06:00-17:59	470	32234	1.00	
	18:00-05:59	3295	22422	10.80	9.14-11.12
Road form	Straight	3374	50902	1.00	
	Curved	391	3754	1.57	1.41-1.75

Table III Odds ratios and 95% confidence intervals for fatalities associated with alcohol use among male motorcar drivers

Factor		Death	No injury	OR ¹	95.0% CI	OR ²	95.0% CI
Alcohol use	Non-drinker	182	54474	1.00		1.00	
	Drinker	89	3676	7.65	5.89–9.93	4.08	3.08–5.40

¹Adjusted for age and year.

²Adjusted for age, year, time of day, and road form.

at night-time, road form, and driving without a license were significantly related to a higher risk of fatality, while seat-belt use had a protective effect on fatality. According to a study in the United States (Bedard et al., 2002), speeds in excess of 111 km/h at impact were related to higher fatality odds (OR = 2.64 99% CI 1.82–3.93) than speeds of less than 56 km/h. Moore et al. (1995) reported that within 60 km/hour speed zones, compared with vehicles traveling at about the posted limit, vehicles traveling at 75–84 km/h had an OR of 7.8 (95% CI = 1.4–38.8) for a severe crash, whereas vehicles with speeds in excess of 84 km/hour had an OR of 39.0 (95% CI = 9.3–170.5). Other studies have also reported the effect of speed (Ossiander & Cummings, 2002). In our multivariate analyses, speed in excess of 50 km/h had an odds ratio of 25.5 compared with that at less than or equal to 50 km/h.

On the contrary, seat-belt use has been suggested to be protective against traffic-accident fatality. A matched case-control design study in the United States (Crandall et al., 2001) reported that the use of seat belts lowered mortality (OR = 0.25, 95% CI 0.22–0.29). In a study using U.S. data for 1986–1988 fatal crashes (Cummings et al., 2003), the relative risk of death among belted compared with unbelted occupants was 0.39 (95% CI 0.37–0.41). Most other studies (Petridou, 1998; Cummings, 2002) reported similar findings. The odds ratio for seat-belt use was about 0.03 as compared with non-users in our analyses. However, our estimates for traffic-accident fatality appeared to be somewhat greater than those in other countries. This may be partly due to the comparison groups; i.e. those who died at the time of the accident vs. those who were uninjured as mentioned in the introduction section.

As suggested in the above discussion, speed and seat-belt use have been confirmed to be major contributors to traffic-accident fatalities in Japan, as well as in other countries. However, alcohol use has also been suggested as another important risk factor of fatality and we mainly focused on this topic in the present analyses. The NHTSA report (Jones & Lacey, 2001) and another review paper (Desapriya et al., 2003) on alcohol use stress the need for strict law enforcement of the Road Traffic Act, in particular, laws reducing the legal BAC limit in addition to the need for education. In Japan, the “standard level” of alcohol concentration mentioned in the materials and methods section was in effect until May, 2002. From June, 2002 the revised Road Traffic Law has been enforced and the “standard level” of alcohol concentration was reduced from 0.25 mg/l in expiration to 0.15 mg/l, corresponding to a BAC of 0.3 mg/ml (BAC of 0.03). Although, as mentioned in the introduction section, the alcohol-related percentages ranged from 12.9% to 14.1% of all traffic fatalities during 1995–2001, after revision of the Road Traffic Law, an apparently decreased trend was found:

12.0% in 2002, 10.1% in 2003, 9.7% in 2004, and 10.3% in 2005.

In conclusion, deterrence of drunk driving is important to reduce traffic-accident fatality in addition to education in Japan and other motorized countries.

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