Pergamon

Accid. Anal. and Prev., Vol. 26, No. 3, pp. 391–397, 1994

0001-4575/94 $6.00 + .00

RISK FACTORS OF FATALITY IN MOTOR VEHICLE TRAFFIC ACCIDENTS

AKIRA SHIBATA and KATSUHIRO FUKUDA

Department of Public Health, Kurume University School of Medicine, 67 Asahi-machi, Kurume, Fukuoka, 830, Japan

(*Accepted* 1 *August* 1993)

Abstract—The present study was conducted to evaluate the effect of potential risk factors—such as driving without a license, alcohol use, speed, seat belt, and helmet—use on fatality in motor vehicle traffic accidents. Unconditional multiple logistic regression analysis was employed to take these factors and age into account, simultaneously. The effect of driving without a license was not significant after controlling for other factors. The deleterious effect of alcohol use remained significant for male motorcar drivers after controlling for speed and seat belt use. Magnitude of the risk due to speed was slightly reduced after controlling for alcohol use and seat belt use, but the striking effect remained highly significant. Speed was the strongest risk factor of fatality for both motorcycles and motorcars and for both sexes and seemed to be more critical for motorcyclists than motorcar drivers. The protective effect of seat belt use was unchanged after adjustment for alcohol and speed, and the effectiveness of seat belt use was demonstrated for motorcar drivers. The effectiveness of helmet use for male motorcyclists was dependent upon speed at the time of the accidents, suggesting an interaction between helmet use and speed. Helmet use was definitely protective at a low speed of ≦ 50 km/h, but ineffective at high speeds of over 50 km/h.

Keywords—Alcohol, Speed, Seat belt, Helmet, Fatality

INTRODUCTION

Motor vehicle traffic accidents are a leading cause of death among children, adolescents, and young adults between 5 and 24 years of age, and more than 14 thousand people were killed in such accidents according to the 1989 vital statistics in Japan. Unlike major causes of deaths such as malignant neoplasms and heart disease and despite the critical problem in public health, there are few epidemiological studies on risk factors of fatality in motor vehicle traffic accidents in Japan. There have been many epidemiological studies on this subject in other countries concerning such factors as the protective effect of driving experience (Wong et al. 1990), seat belt use (Evans 1987; Blatchford, Hill, and Edney 1990; States et al. 1990), helmet use (Evans and Frick 1988; McSwain and Belles 1990; Rollberg 1990) and the deleterious effect of alcohol (Connolly, Kimball, and Moulton 1989; Evans 1990; Zador 1991). Although vehicle speed at the time of the accident has not been taken into account in most of these studies, it is an important risk factor and thus an important confounder to estimate the effectiveness of seat belt and helmet use. Taking advantage of traffic accident data recorded by the Fukuoka Prefectural Police, the authors of the present paper evaluated the effect of driving without a license, alcohol use, motor vehicle speed, seat belt use in the case of motorcars, and helmet use in the case of motorcycles on fatality in motor vehicle traffic accidents.

MATERIALS AND METHODS

Subjects

In the present study, the analyses were based on the traffic accidents that occurred in Fukuoka Prefecture. Fukuoka Prefecture is in northern Kyushu, which is located in the southern part of Japan. Fukuoka Prefecture includes two big cities (both of which have over one million population) and has a total population of 4.8 million. The traffic conditions in these two cities, Fukuoka City and Kitakyushu City, seem to be similar to those in most large cities in Japan. Information on all traffic accidents that occur in Fukuoka Prefecture is assembled by the Fukuoka Prefectural Police. Data on features of traffic accidents that took place during 1990 were obtained from the Fukuoka Prefectural Police. A total of 33,821 accidents were reported to the Fukuoka Prefectural Police during this period. Severity of

injury was divided into four categories, death, severe injury, slight injury, uninjured. Traffic accident deaths were limited to those fatalities occurring within 24 hours after the time of the accident reported in police records. This differs from the system used in determining vital statistics, which includes fatalities within one year after the accidents.

Table 1 shows the age distribution of parties responsible for accidents by severity of injury, sex, and type of motor vehicle (motorcar or motorcycle). This table excludes subjects whose sex had not been recorded (175), those involved in railway accidents (3), and bicyclists (177) and pedestrians (90) who were directly responsible for the accidents. We limited the present study to subjects who died from accidents (77 male motorcar drivers, 37 male motorcyclists, 10 female motorcar drivers, 4 female motorcyclists) and uninjured persons (21,068 male motorcar drivers, 1,052 male motorcyclists, 6,306 female motorcar drivers, 198 female motorcyclists), and we compared features of each group.

Statistical methods

Study factors were originally classified into several categories. The categories were recomposed as follows: "Licensed" and "Unlicensed" for driver's license; "≦ 30 km/h", "≦ 50 km/h" (greater than 30 km/h and less than or equal to 50 km/h), "≦ 80 km/h" (greater than 50 km/h and less than or equal to 80 km/h), and "80 km/h+" (greater than 80 km/h) for speed at the time of the accidents; "Nondrinker" (subjects who had not taken any alcoholic beverage before the accidents) and "Drinker" (all subjects had drunk alcohol before the accidents) for alcohol use; "Didn't use" and "Used" for seat belt and helmet use.

In an epidemiological study, the association measure between two attributes (e.g., fatality and seat belt use in the present study) is usually the odds ratio (OR), which is approximately equal to the risk ratio (or relative risk) and represents the magnitude of the association. The null hypothesis H_0: OR = 1, which means no association between fatality and a potential risk factor (e.g. seat belt use in the context of our study), is tested by evaluating ($H_0: \beta = 0$) the estimated coefficient (b) of the risk factor in the unconditional multiple logistic regression model (Breslow and Day 1980). The odds ratio for the factor is estimated by the exponential of its coefficient. If the odds ratio is significantly less than one, the factor is regarded as protective against fatality. If the odds ratio is significantly greater than one, the risk of fatality is greater among those with the factor than those without it. In the present study, the protective or detrimental effect of driving without a license, alcohol use, speed, seat belt and helmet use on fatality were evaluated by odds ratio with 95% confidence interval (CI). The significance of the odds ratios is assessed by the 95% confidence interval represented in the tables of this paper. For example, if 95% CI of the odds ratio of a factor does not include the null value (1.0, which means no association), it means that the factor is significantly related to fatality.

First, the strength of the association for each factor was individually evaluated controlling only for age. Second, it was assessed controlling for age and other factors under study simultaneously. Moreover, the trend of odds ratios for speed and interaction between speed and seat belt or helmet use were assessed by the same model. The significance of the trend of odds ratios was assessed by chi-square test.

RESULTS

Unlicensed drivers seemed to have a higher risk of motor vehicle traffic accident fatality. Specifically, the risk of fatality was considerably increased for male unlicensed motorcyclists (OR = 8.80) compared with licensed motorcyclists (Table 2). The odds ratio of 8.80 means that unlicensed motorcyclists have about 9 times as high a fatality rate as licensed motorcyclists. While a similar risk increase (OR = 3.61) can be seen for motorcar drivers, it is not statistically significant. Since unlicensed female motorcar drivers and motorcyclists were very few, .25% and 1.5%, respectively, and had experienced no fatalities, they were omitted from the analysis.

Evaluation of alcohol use was limited to male motorcar drivers and motorcyclists because of the small number of drinkers among females (.5% for both motorcar drivers and motorcyclists). Alcohol use was suggested to be a risk factor of fatality for both types of motor vehicle traffic accidents (Table 3). The odds ratio was 10.43 and 12.90 for male motorcar drivers and for motorcyclists, respectively.

Table 4 shows the risk of fatality due to speed at the time of the accidents. The odds ratio of fatality was 3.52 for ≦ 50 km/h, 49.38 for ≦ 80 km/h, and 467.78 for 80 km/h+ for male motorcar drivers and 6.92 for ≦ 50 km/h, 326.78 for ≦ 80 km/h, and 2208.79 for 80 km/h+ for male motorcyclists compared with the speed of ≦ 30 km/h. The risk increase with increasing speed was significant, $\chi^2 = 194.1$ for motorcar drivers and $\chi^2 = 57.22$ for motorcyclists, respectively. A significant risk increase was also observed for female motorcar drivers (OR = 29.04 for 50 km/h+) and motorcyclists (OR = 33.56 for ≦50 km/h). The fatal effect of speed was remarkable

Table 1. Age distribution of parties responsible for accidents by severity of injury, sex, and type of motor vehicle

Sex	Severity of injury	Motorcar							Motorcycle						
		Age group							Age group						
		-19	20-29	30-39	40-49	50-59	60+	Total	-19	20-29	30-39	40-49	50-59	60+	Total
Male	Death	8	25	10	12	11	11	77	14	10	2	2	3	6	37
	Severe injury	52	95	33	27	27	26	260	127	55	18	13	27	46	286
	Slight injury	271	665	280	267	184	145	1812	395	142	46	53	53	130	819
	Uninjured	1828	6679	3993	4001	2983	1584	21068	467	322	79	59	52	73	1052
	Total	2159	7464	4316	4307	3205	1766	23217	1003	529	145	127	135	255	2194
Female	Death	1	3	0	4	1	1	10	1	1	0	1	0	1	4
	Severe injury	17	28	10	14	10	3	82	19	2	5	12	7	7	52
	Slight injury	136	361	169	212	80	23	981	86	31	41	95	48	31	332
	Uninjured	581	2222	1503	1357	510	133	6306	55	40	26	42	25	10	198
	Total	735	2614	1682	1587	601	160	7379	161	74	72	150	80	49	586

Subjects without information on sex(175), those concerned with railway accidents(3), bicyclists(177) and pedestrians(90) who were directly responsible for the accidents were excluded from the analysis.

Table 2. Age-adjusted odds ratios and 95% confidence intervals for fatality associated with driving without a license among male motorcar drivers and motorcyclists

Driver's license	Motorcar				Motorcycle			
	Death	Uninjured	Odds ratio	95% confidence interval	Death	Uninjured	Odds ratio	95% confidence interval
Licensed	75	20905	1.00	-	31	1022	1.00	-
Unlicensed [a]	2	163	3.61	0.88 - 14.85	6	30	8.80	3.28 - 23.59
Total	77	21068			37	1052		

a) Unlicensed group includes people who have had a license but lost it.

and the effect seemed to be more critical for motorcyclists than for motorcar drivers of both sexes.

Seat belt and helmet use were obviously found to prevent motor vehicle traffic accident fatalities among motorcar drivers and motorcyclists. Table 5 shows the significant reduction of the risk of fatality due to seat belt and helmet use compared to fatality risk without them. The risk reduction was 0.03 and 0.02 for male and female motorcar drivers, respectively, and 0.06 for male motorcyclists. The odds ratio was not estimated for female motorcyclists.

Table 6 shows the results of unconditional multiple logistic regression analysis to evaluate the protective or deleterious effect of alcohol use, speed, and seat belt and helmet use on fatality. The effect of driving without a license is not shown in this table, since its deleterious effect disappeared after adjustment for age and other factors. Drinking alcohol before driving still showed a significant risk increase after controlling for speed and seat belt use among motorcar drivers. The deleterious effect of high speed on fatality was extreme. The odds ratio remained significant, especially for the speed of 50 km/h+, after simultaneous control for alcohol and/or seat belt use, and the trend was significant for both sexes. The protective effect of seat belt use was independent of speed, suggesting no interaction between them (χ^2 values of all coefficients of interaction terms were less than 1.0, indicating insignificant coefficients), and remained unchanged after adjustment. The effectiveness of seat belt use was confirmed in the present study for both sexes. In contrast to seat belt use, there was considerable interaction between helmet use and speed. The odds ratio was 0.03 (= 0.002 × 15.14, 95% CI : 0.002–0.42) and 0.47 (= 0.002 × 233.20, 95% CI : 0.086–2.32) for ≦ 50 km/h and 50 km/h+, respectively, compared with the speed of ≦ 30 km/h. Helmet use was obviously protective against fatality, but the effectiveness of helmet use was limited to accidents at a low speed of ≦ 50 km/h.

DISCUSSION

The present study confirmed the results of previous studies regarding the association between various factors such as driving without a license, alcohol use, and seat belt and helmet use and the risk of fatality in motor vehicle traffic accidents. However, most of the studies have not taken into account the speed at the time of the accidents. Speed was demonstrated to be the most significant risk factor of fatality for both motorcar drivers and motorcyclists. The strong effect on fatality was unchanged for motorcar drivers after adjustment for the other factors under study. In addition, there was a dose-response relationship between speed and the risk of fatality. Similar findings were also obtained for motorcyclists. Speed must be included in the analysis as a confounder to evaluate the effects of factors other than speed on fatality.

In the present study, the significant risk increase for the unlicensed group in motorcyclists disappeared after adjustment for the other factors under study. Among uninjured subjects, only 56.7% of unlicensed motorcyclists wore helmets compared to 98.7% for licensed motorcyclists. About 17% of unlicensed motorcyclists were driving at speeds above

Table 3. Age-adjusted odds ratio and 95% confidence intervals for fatality due to alcohol use among male motorcar drivers and motorcyclists

Alcohol use	Motorcar				Motorcycle			
	Death	Uninjured	Odds ratio	95% confidence interval	Death	Uninjured	Odds ratio	95% confidence interval
Non-drinker [a]	43	20271	1.00	-	30	1035	1.00	-
Drinker [b]	16	723	10.43	5.85 - 18.61	6	14	12.90	4.58 - 36.38
Unknown	18	74	-	-	1	3	-	-
Total	77	21068	-		37	1052	-	

a) Subjects who did not drink alcoholic beverages before the accidents.
b) All subjects who turned out to drink alcoholic beverages before the accidents were included.

Table 4. Age-adjusted odds ratios and 95% confidence intervals for fatality due to excessive speed among motorcar drivers and motorcyclists by sex

Sex	Speed	Motorcar				Motorcycle			
		Death	Uninjured	Odds ratio	95% confidence interval	Death	Uninjured	Odds ratio	95% confidence interval
Male	≤ 30 km/h	7	13755	1.00	–	4	738	1.00	–
	≤ 50 km/h	10	6095	3.52	1.34 - 9.27	4	276	6.92	1.47 - 32.67
	≤ 80 km/h	20	1069	49.38	20.41 - 119.51	13	36	326.78	58.57 - 1823.3
	80 km/h +	20	131	467.78	183.77 - 1190.74	4	2	2208.79	202.94- 24040.
	Unknown	20	18	–	–	12	0	–	–
	Total	77	21068	p<0.0001 a)		37	1052	p<0.0001 a)	
Female	≤ 30 km/h	3	4839	1.00	–	1	174	1.00	–
	≤ 50 km/h	2	1389	2.62	0.44 - 15.76	3	24	33.56	2.87 - 392.99
	50 km/h +	1	76	29.04	2.90 - 291.01	0	0	–	–
	Unknown	4	2	–	–	0	0	–	–
	Total	10	6306	p<0.05 a)		4	198	–	

a) Test for trend of odds ratios.

Table 5. Age-adjusted odds ratios and 95% confidence intervals for fatality due to seat belt or helmet use among motorcar drivers and motorcyclists by sex

Sex	Seat belt or helmet use	Motorcar				Motorcycle			
		Death	Uninjured	Odds ratio	95% confidence interval	Death	Uninjured	Odds ratio	95% confidence interval
Male	Didn't use	57	1864	1.00	–	9	26	1.00	–
	Used	16	19185	0.03	0.02 - 0.05	28	1026	0.06	0.03 - 0.16
	Unknown	4	19	–	–	0	0	–	–
	Total	77	21068	–		37	1052	–	
Female	Didn't use	6	315	1.00	–	0	4	–	–
	Used	3	5989	0.02	0.01 - 0.10	4	194	–	–
	Unknown	1	2	–	–	0	0	–	–
	Total	10	6306	–		4	198	–	

Table 6. Odds ratios adjusted for age and other factors under consideration and 95% confidence intervals for fatality due to each factor among motorcar drivers and motorcyclists by sex

Sex	Factors		Motorcar		Motorcycle	
			Odds ratio a)	95% confidence interval	Odds ratio a)	95% confidence interval
Male	Alcohol use	Non-drinker b)	1.00	–	–	–
		Drinker c)	2.53	1.13 - 5.63	–	–
	Speed	≤ 30 km/h	1.00	–	1.00	–
		≤ 50 km/h	2.72	0.96 - 7.65	1.75	0.11 - 28.56
		≤ 80 km/h	22.84	8.37 - 62.33	11.48 e)	1.14 - 115.83
		80 km/h +	322.89	110.76 - 941.30	–	–
	Seat belt or helmet use	Didn't use	1.00	–	1.00	–
		Used	0.06	0.03 - 0.11	0.002	0.00 - 0.03
	Interaction	SP30 * helmet d)	–	–	15.14	0.40 - 573.09
		SP50 * helmet	–	–	233.20	8.96 -6071.62
		Total	21007(138)		1077(12)	
Female	Speed	≤ 30 km/h	1.00	–	1.00	–
		≤ 50 km/h	2.58	0.42 - 16.04	33.56 e)	2.87 - 392.99
		50 km/h +	12.68	1.11 - 144.39	–	–
	Seat belt or helmet use	Didn't use	1.00	–	–	–
		Used	0.01	0.00 - 0.09	–	–
		Total	6308(8)		202(0)	

a) Subjects who lacked information on at least one factor were excluded from the analysis and the number is shown in parenthesis.
b) Subjects who did not drink alcoholic beverages before the accidents.
c) All subjects who turned out to have had drunk alcoholic beverages before the accidents were included.
d) Abbreviation: SP30 and SP50 mean 30km/h< speed ≤ 50km/h and 50km/h< speed, respectively.
e) The following category was combined because of an insufficient number of subjects.

50 km/h at the time of the accidents compared to 3.2% for licensed motorcyclists. Unlicensed motorcyclists were found to have a tendency to ride a motorcycle without helmet and at a high speed, which was suggested to be the strongest risk factor of motor vehicle traffic accident fatality. Disappearance of the increased risk regarding driving without a license is probably explained to a considerable extent by lack of helmet use and increased speed.

Connolly et al. (1989) estimated the odds ratio of fatality for blood alcohol concentration from a case-control study. The odds ratio was 4.57 for each increase of 0.05 g/dl after controlling for age, seat belt use and other covariates. The risk of fatality was found to increase with increasing blood alcohol concentration (Connolly et al. 1989; Zador 1991) and was higher among females than males (Zador 1991). Risk elevation for alcohol remained significant after adjustment for speed and seat belt use only for motorcar drivers in the present study. However, a dose-response relationship for male motorcar drivers could not be evaluated, and odds ratios for male motorcyclists and female motorcar drivers and motorcyclists could not be estimated due to the small number of drinkers in the data.

Seat belt legislation was reported to increase seat belt use and therefore to reduce injuries and fatalities in motor vehicle traffic accidents (Williams and Lund 1986; Evans 1987; Blatchford et al. 1990; States et al. 1990). In the United States, 26 states and the District of Columbia had enacted seat belt laws as of 1986, and seat belt use rates increased from 20% or less before enactment of the law to between 50% and 70% after enforcement (Williams and Lund 1986). New York seat belt use rates increased sharply and an estimated reduction of fatality of 9% was observed during the first nine months of the law. In Nebraska, seat belt use of 40% in 1986 dropped to 29% in 1987 after repeal of the law, with an associated increase in injuries (Blatchford et al. 1990). Evans (1987) estimated a 43% ± 3% reduction of fatality among drivers and right front seat passengers without seat belt if they were to use seat belts, and this effectiveness was independent of speed. Such an effectiveness of seat belt use on fatality was consistent with the results of the present study.

Motorcycle helmet use was also protective against fatality in motorcycle traffic accidents. In Louisiana, the helmet use rate decreased from 97% to 50% with the repeal of the motorcycle helmet legislation, but returned to 95% with reinstatement (McSwain 1990). Fatality and helmet use rate among motorcyclists was correlated with enforcement of the law. Similar results were reported from several states in the United States (McSwain and Lummis 1980; McSwain and Petrucelli 1984; Rollberg 1990) and other countries (Supramaniam, Belle, and Sung 1984; Nurchi et al. 1987). These phenomena were not experienced in Japan, since the law requiring a motorcyclist to wear a helmet has never been repealed. In the present study, the main cause of death among male motorcyclists was head injury (42.9% with helmet and 77.8% without helmet) against which a helmet is primarily expected to protect. However, death from chest injury is the following cause of death (25%) among motorcyclists with helmet, and this seems to be due to speed. Therefore, even motorcyclists wearing a helmet have an increased risk of fatal damages due to other than head injury as speed increases. Thus, in contrast to seat belt use, the effectiveness of helmet use was modified by the speed of the motorcycle, which is regarded as an important confounder. A protective effect of helmet use was evident at a low speed (≦50 km/h), while the effect became reduced at high speed (50 km/h+).

The issue of the quality of the information on exposure is a very critical problem in an epidemiological study. The veracity of statements from uninjured persons about seat belt use may be less reliable and thus there may be a differential misclassification of seat belt use between these two types of crashes (noninjury and fatal crashes). Therefore, although there are many evidences of the effectiveness of seat belt use from descriptive and analytical studies, we might overestimate the protective effect of seat belt use on fatality. On the other hand, speed and helmet use were judged by the police not only from statements but also from physical evidence such as tire marks and damage to the car for the two types of crashes. Therefore, information on speed and helmet use seemed to be more reliable.

Although a new regulation enforced in 1992 allows trained rescuers to treat injured persons to some extent before they arrive at emergency medical facilities, previously only physicians were permitted to treat injured persons in Japan, and thus accident victims could not receive sufficient treatment until they were transferred by ambulance to emergency medical facilities. This new regulation will be expected to yield more survivors among severely injured persons, especially in the period immediately after an accident. Since most of these additional survivors can be expected to consist of persons using seat belt or helmet, estimates of odds ratio based on the present 1990 data might be biased toward the null, i.e. we might be underestimating the association between fatality and seat belt and helmet use, due to the fact that in Japan traffic accident victims were not given any emergency treatment before be-

ing transmitted to hospital prior to 1992. Establishment of emergency medical systems and facilities, regulation of treatment by trained rescuers, and development of better methods of treatment and rehabilitation for injured persons must also contribute to saving the lives of these victims. Since the present study confirmed the deleterious effect of speed and alcohol use and the protective effect of seat belt and helmet use, not only education of the public but also intensive supervision of speed, alcohol use, and seat belt and helmet use legislation will reduce the occurrence of motor vehicle traffic accidents, which will then result in the reduction of fatalities.

Acknowledgments—This study was supported by the Research Foundation for Traffic Preventive Medicine. We would like to thank the staff of the Fukuoka Prefectural Police for their cooperation.

REFERENCES

Blatchford, G. J.; Hill, A. A.; Edney, J. A. Seat belts: Personal choice or necessity? Nebr. Med. J. 75(5):117–120; 1990.

Breslow, N. E.; Day, N. E. Statistical methods in cancer research. The analysis of case-control studies. I.A.R.C. Sci. Publ. 32:122–135, 192–246; 1980.

Connolly, M. A.; Kimball, A. W.; Moulton, L. H. Alcohol and traffic safety: A sensitivity analysis of data from composite sources. Accid. Anal. Prev. 21:1–31; 1989.

Evans, L. Fatality risk reduction from safety belt use. J. Trauma 27(7):746–749; 1987.

Evans, L.; Frick, M. C. Helmet effectiveness in preventing motorcycle driver and passenger fatalities. Accid. Anal. Prev. 20:447–458; 1988.

Evans, L. The fraction of traffic fatalities attributable to alcohol. Accid. Anal. Prev. 22:587–602; 1990.

McSwain, N. E., Jr.; Lummis, M. Impact of repeal of motorcycle helmet law. Surg. Gynecol. Obstet., 151:215–224; 1980.

McSwain, N. E., Jr.; Petrucelli, E. Medical consequences of motorcycle helmet nonusage. J. Trauma 24(3):233–236, 1984.

McSwain, N. E., Jr.; Belles, A. Motorcycle helmets—medical costs and the law. J. Trauma 30(10):1189–1197; discussion 1197–1199; 1990.

Nurchi, G. C.; Golino, P.; Floris, F.; Meleddu, V.; Coraddu, M. Effect of the law on compulsory helmets in the incidence of head injuries among motorcyclists. J. Neurosurg. Sci. 31:141–143; 1987.

Rollberg, C. A. The mandatory motorcycle helmet law issue in Arkansas: The cost of repeal. J. Arkansas Med. Soc. 86(8):312–316; 1990.

States, J. D.; Annechiarico, R. P.; Good, R. G.; Lieou, J.; Andrews, M.; Cushman, L.; Ingersoll, G. A time comparison study of the New York State safety belt use law utilizing hospital admission and police accident report information. Accid. Anal. Prev. 22:509–521; 1990.

Supramaniam, V.; Belle, G. V.; Sung, J. F. C. Fatal motorcycle accidents and helmet laws in peninsular Malaysia. Accid. Anal. Prev. 16:156–162; 1984.

Williams, A. F.; Lund, A. K. Seat belt use laws and occupant crash protection in the United States. Am. J. Public Health 76(12):1438–1442; 1986.

Wong, T. W.; Lee, J.; Phoon, W. O.; Yiu, P. C.; Fung, K. P.; McLean, J. A. Driving experience and the risk of traffic accident among motorcyclists. Soc. Sci. Med. 30(5):639–640; 1990.

Zador, P. L. Alcohol-related relative risk of fatal driver injuries in relation to driver age and sex. J. Stud. Alcohol 52(4):302–310; 1991.