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A case-control study of non-fatal traffic accidents on hospital patients in Bangkok metropolis

Summary

Morbidity and mortality from road traffic accidents in Bangkok metropolis is high with a trend strictly increasing in time, thus establishing one of the major public health problems and targets of the Kingdom of Thailand. An unmatched case-control study was undertaken to evaluate various risk patterns connected with the occurrence of traffic accidents. 350 cases were sampled from five major hospitals distributed over the Bangkok Metropolitan area and 350 controls were included from outpatients of Rajawithi hospital. The major interest in this case-control analysis is to estimate relative risk (through odds ratio) and measure statistical significance of association between road traffic accident and the following risk factors: the demographic risk factors are age (age between 15 and 19 years has odds ratio of 8.25 [1.01, 67.72]; age above 40 is baseline), marital status (single has odds ratio of 2.74 [1.26, 5.95]; baseline is not-single), sex (males have an odds ratio of 2.05 [0.51, 8.24], occupation (salespersons have an odds ratio of 4.27 [1.47, 12.46]; baseline are office workers); the driving related exposure factors type of vehicle (motorbykers have an odds ratio of 6.22 [2.82, 13.78]; baseline are other vehicle drivers), driving time per day (odds ratio 1.35 [0.88, 2.09]) and the number of accidents in the last three years (odds ratio of 4.36 [2.51, 7.58]); the behavioral factors one hour before driving such as the consumption of alcohol (odds ratio 3.01 [1.53, 5.94]; baseline is no alcohol) and the consumption of a lot of food (odds ratio of 0.07 [0.03, 0.16]; baseline is not eating a lot before driving). The odds ratios for traffic accident when being under allergic medication and the consumption of tranquilizer were not significant. The results are consistent with current results in traffic accident research and point to target groups for potential prevention programmes in traffic accident prevention.

The mortality and morbidity from road traffic accident is a major public health issue in the Kingdom of Thailand. Traffic accidents have become an integral part of

the daily life of all Thai residents as well as all visitors to Bangkok Metropolis and other parts of the country while participating in travelling.

According to data published by the Ministry of Public Health, The Kingdom of Thailand, the trend in mortality is strictly increasing since 1986¹. If all transport accident deaths are considered, it was the fourth leading cause of death in the year 1993¹. Comparing the road traffic accident mortality between industrialized and developed countries such as the United Kingdom and Thailand, the mortality rates are: for the United Kingdom in the year 1990, 0.257 for males, 0.173 for females; for Thailand the same year, 26.9 for males, 6.0 for females (all rates are age-standardized and relate to number of deaths per 100,000 population). This underlines the different situation in developing countries and in particular, in countries being in a state of transition such as the Kingdom of Thailand.

Risk factors for traffic accidents are discussed widely in studies ranging over the whole globus. A study in New Zealand on the risks of child pedestrian injury on the school-home journey concludes that traffic volume and speed are the major risk factors^{2,3}. A study in the United Kingdom finds that traffic accident risk were associated with the driver falling asleep behind the wheel⁴, and a survey of international traffic mortality rates

showed relationships with age, sex, and population density⁵. A study in Australia on injured vehicle occupants and motorcyclists finds a relationship between blood alcohol concentration and injury severity⁶, that injured male motorcycle riders were younger than the injured male drivers, and that alcohol involvement is greater in single-vehicle crashes⁷. A case-control study in Switzerland shows that the males with permanent heavy drinking style, with risky-driving style in combination with a regular or periodically heavy drinking style had a high risk of involvement in an accident⁸. A study in Thailand shows that there is an association of age, sex, marital status, education, and occupation with traffic accident occurrence⁹ as well as there is spatial variation of traffic accident risk¹⁰.

Materials and methods

Population

From the study population of all traffic participants in Bangkok metropolis 350 cases were sampled and 350 controls. The case group consists of all patients who were admitted in five hospitals in Bangkok (Phumipol, Nopparat-Rajathani, Rajavithi, Police and Siriraj) during the period of four months (May to August) in the year 1993 as cause of road traffic accident and were able to answer the questions which have been asked by well-trained nurses who took care of the patients in the wards. The control group were outpatients in Rajavithi hospital who came to the hospital because of a disease having nothing in common with a road traffic accident. Controls were sampled from Rajavithi hospital only; this was due to limitations in resources. There is no reason to believe that this has led to any severe bias, since the socioeconomic background of all five study

hospitals is similar and Rajavithi hospital is easy to assess from Mahidol campus.

Also, Rajavithi hospital can be viewed as a hospital which typically will include patients from all age and sex groups as well as all social classes (which would be not the case for Ramathibodi hospital or Pramongutkiao hospital, both also located in the vicinity of the Mahidol campus). It was therefore judged that Rajavithi hospital is a more representative hospital for sampling control patients. In addition, the age distribution of the study controls have been compared to the age distribution of the 1990 Bangkok census. Both distributions are presented in Figure 1 and look rather similar. We conclude that the control sample is reasonably representative for the Bangkok population.

In fact, the reason for the inclusion of the other hospitals for recruiting cases was to increase the sample size, since in Rajavithi hospital not enough cases could be expected to emerge in the period of study. The control patients were interviewed

during the same period of time by well-trained personnel. The questionnaire had been pretested with inpatients at Rajavithi hospital.

Analytic methods

It is the major interest in this case-control analysis to estimate relative risk (through odds ratios) and measure statistical significance of association between road traffic accident and the following risk factors: demographic risk factors, driving related factors, and health related and behavior related factors. The odds ratios were estimated by three logistic regression models. One model was fitted for the demographic risk factors sex, age, marital status, and occupation. The second one was analyzed by including type of vehicle, driving time per day, and years of driving in the model as well as sex and age to control for potential confounding. The third one was fitted with all behaviour related risk factors such as consumption of alcohol, tranquilizer, a lot of food, feeling of tiredness, allergic medication, feel-

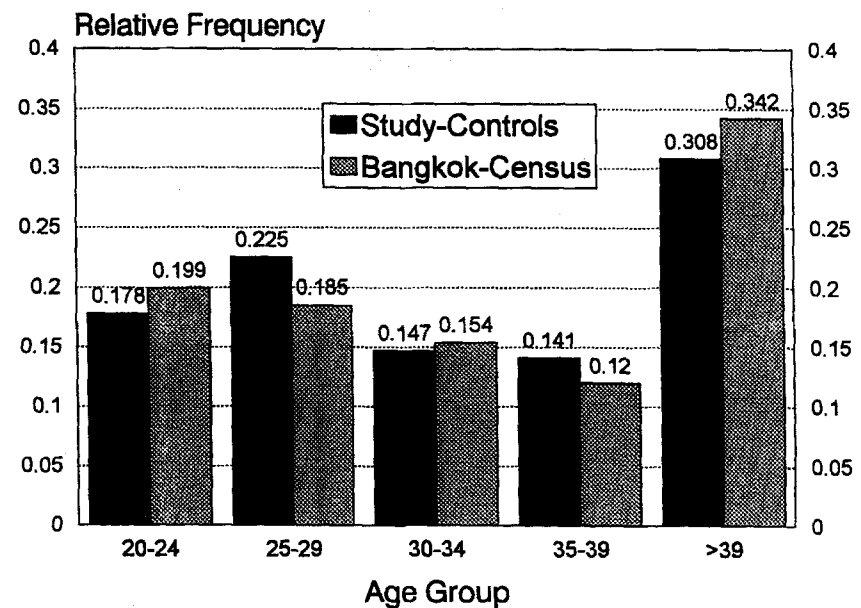


Figure 1. Age distribution of study controls and Bangkok 1990 census.

ing of stress as well as sex and age to control for confounding. The actual calculations were done using Generalized Linear Interactive Modeling (GLIM 3.3).

Results

Demographic exposure risks

Marital status turns out to be a significant risk factor for road traffic accident with odds ratio: marital

status 2.74 (1.26–5.95), whereas the risk for males is not significantly increased: sex 2.05 (0.51, 8.24).

Using age above 40 as the baseline, the age-group 15–19 years shows high relative risk with an odds ratio of 8.25 (1.01, 67.72). Also the younger age-group of below 15 years shows a highly increased relative risk with odds ratio 9.47 (0.53, 169.38).

Occupation: Using office work as the base, the occupation of a sales person shows the only significant

risk with odds ratio 4.27 (1.47–12.46), see Table 1.

Driving related exposure risks

Type of vehicle and accident in last three years were significant risk factors with odds ratios: type of vehicle 6.22 (2.82–13.78), driving hour/day accident in last three years 4.36 (2.51–7.58), whereas driving hour/day had an increased odds ratio of 1.35 (0.88–2.09), see Table 2. It should be pointed out

Factor	Control n = 350 (%)	Case n = 346 (%)	Odds ratio ^a	95% Confidence interval
<i>Sex</i>				
Male	294 (84.0)	285 (82.4)	2.05	0.51–8.24
Female	55 (15.7)	60 (17.3)	1	
Unknown	1 (0.3)	1 (0.3)		
<i>Age</i>				
<15	2 (0.8)	12 (2.0)	9.47	0.53–169.38
15–19	8 (2.3)	82 (23.7)	8.26	1.01–67.72
20–24	47 (13.4)	83 (24.0)	1.12	0.21–5.86
25–29	97 (27.7)	71 (20.5)	1.08	0.24–4.80
30–34	50 (14.3)	43 (12.4)	2.21	0.51–9.49
35–39	48 (13.7)	24 (6.9)	0.99	0.19–5.23
≥40	98 (28.0)	31 (8.7)	1.00	
Unknown	0 (0.0)	1 (0.3)		
<i>Marital status</i>				
Single	101 (28.9)	208 (60.1)	2.74	1.26–5.95
Other	248 (70.9)	134 (38.7)	1	
Unknown	1 (0.3)	4 (1.2)		
<i>Occupation</i>				
Business	36 (10.3)	19 (5.5)	2.26	0.59–8.64
Semi-skilled labour	34 (9.7)	22 (6.4)	1.24	0.36–4.20
Unskilled labour	81 (23.1)	123 (35.6)	1.54	0.58–4.07
Sales person	37 (10.6)	91 (26.3)	4.27	1.47–12.46
Office work	109 (31.1)	36 (10.4)	1.00	
Housework	22 (6.3)	44 (12.7)	0.71	0.17–3.00
Unknown	31 (8.9)	11 (3.2)		

^a Odds ratios computed from logistic regression model with the following variables simultaneously in the model: Sex, age, marital status, occupation.

Table 1. Controls, cases, odds ratios with 95% confidence intervals for demographic exposure factors.

Traffic related Factors	Controls n = 350 (%)	Cases n = 211 (%)	Odds ratio ^a	95% Confidence interval
<i>Type of vehicle</i>				
Motorbike	111 (31.7)	113 (53.5)	6.22	2.82–13.78
Other	204 (58.3)	14 (6.6)	1	
Unknown	35 (10.0)	84 (39.8)		
<i>Driving hours/day</i>				
0–2	141 (40.3)	54 (25.6)	1	
≥ 3	190 (54.3)	117 (55.5)	1.35	0.88–2.09
Unknown	19 (5.4)	40 (18.9)		
<i>Years of driving</i>				
0–4	108 (30.9)	102 (48.3)	1	
≥ 5	235 (67.1)	84 (39.8)	0.71	0.47–1.08
Unknown	7 (2.0)	25 (11.9)		
<i>Number of accidents in the last 3 years</i>				
0–1	311 (88.9)	86 (40.8)	1	
≥ 2	33 (9.4)	53 (25.1)	4.36	2.51–7.58
Unknown	6 (1.7)	72 (34.1)		

^a Odds ratios estimated by means of logistic regression with controlling for sex and age.

Table 2. Controls, cases, odds ratios with 95% confidence intervals for driving related factors.

that these results refer to a reduced sample size of $n = 211$ in the case group. This is due to the fact that not all cases were driving when the accident occurred (and only for those the questions made sense to be asked).

Health behavior before driving

The behavioral factors within 1 h before driving were significant with odds ratios as follows: consumption of alcohol 3.01 (1.53–5.94), consumption of a lot of food 0.07 (0.03–0.16), feeling of tiredness 0.21 (0.09–0.48), feeling of stress 0.09 (0.04–0.20), see Table 3. Note that these factors were measured for the *control group* by asking the

patients about their behaviors within 1 h before driving.

Discussion

The young age group of under 15 has the highest odds ratio, and the ones between 15 and 19 years of age have a high and significant odds ratio. Similar results are given in the study of Robert et al.² and Söderlund and Zwi⁵. Male have higher odds ratios than females in our study, though this is often highly significant^{5,7}, but not in our analysis. Singles have a significantly elevated odds ratio as has the group with the occupation of a salesperson. Similar results are

given in Böhning and Na Ayuthya⁹. Motorbikers have a highly increased odds ratio in our study, as is found in other studies e.g. Holubowycz et al.⁷. On the behavioral side, having had an accident in the last 3 years and the consumption of alcohol establish central risk factors as is confirmed in the studies by Tulloh and Collopsy⁶, Holubowycz et al.⁷, Fahrenkrug and Rehm⁸. Also, driving many hours a day establishes an increased odds ratio, a result quite similar to that of the study of Horne and Reyner⁴. Although many of the results found in this study are known to hold in other countries, this paper is part of first results on applying epidemiologic methodology to the

Factor	Control n = 350 (%)	Case n = 211 (%)	Odds ratio	95% Confidence interval
<i>Alcohol</i>				
Yes	104 (29.7)	69 (32.7)	3.01	1.53–5.94
No	246 (70.3)	142 (67.3)	1	
<i>Tranquilizer</i>				
Yes	26 (7.4)	2 (0.7)	0.11	0.01–1.01
No	324 (92.6)	209 (99.1)	1	
<i>Consumption of a lot of food</i>				
Yes	183 (52.3)	14 (6.6)	0.07	0.03–0.16
No	167 (47.7)	197 (93.4)	1	
<i>Feeling of tiredness</i>				
Yes	151	16	0.21	0.09–0.48
No	199	195		
<i>Under allergic medication</i>				
Yes	103 (29.4)	6 (2.8)	0.35	0.11–1.05
No	248 (70.6)	205 (97.2)	1	
<i>Feeling of stress</i>				
Yes	212 (60.6)	15 (7.1)	0.09	0.04–0.20
No	138 (39.4)	196 (92.9)	1	
^a Odds ratios from logistic regression model with controlling for age, sex.				
^b These factors were measured by asking the patients about their behaviors within 1 h before driving.				

Table 3. Controls, cases and odds ratios with 95% confidence intervals for Health Related Factors^{a, b}.

area of traffic accidents as a public health issue in the *Kingdom of Thailand*. Therefore these results are interesting by themselves. They underline that patterns are ruling the traffic accident occurrence in Thailand, which are very similar to patterns in other parts of the world. However, their severity and strength is more elevated than elsewhere. As outlined above, morbidity and mortality from traffic accidents have become one of the central public health issues in the Kingdom of Thailand. These results are of primary interest for designing prevention programmes

for the prevention of traffic accidents, as they provide insight into the target groups in Thailand (young males, street vendors and people with high mobility, motor-bikers, and persons with a traffic history) and which behavior to focus on (not to say blame) such as the consumption of alcohol and driving many hours a day.

A final aspect concerns the group of tourist visitors coming to the country. Currently, the appropriate institutions (such as university departments or state departments for tropical medicine) which potential travellers to tropical countries

consult for the medical preparation do focus in their advisory guidelines on tropical diseases such as malaria, hepatitis A, or cholera. Very rarely (not to say not at all) they are warning with respect to the large risks involved in the daily exposure to traffic accidents. It seems appropriate to change consulting guidelines according to the known risks involved in motor traffic transport as well as in moving as a pedestrian.

Zusammenfassung

Eine Fallkontrollstudie von Verkehrsunfällen mit nicht-tödlichem Ausgang an Krankenhauspatienten in Bangkok Metropolis

Die Verkehrsunfallmorbidity und -mortality in Bangkok Metropolis (Thailand) ist hoch mit zunehmendem zeitlichen Trend und stellt daher eines der grössten Probleme im öffentlichen Gesundheitswesen von Thailand dar. Es wurde eine ungepaarte Fallkontrollstudie mit 350 Fällen und 350 Kontrollpatienten zur Bewertung der folgenden Risikofaktoren durchgeführt: die demographischen Risikofaktoren Alter, ehelicher Status, Geschlecht, Beruf; die mit dem Führen eines Fahrzeugs verknüpften Expositionen wie Fahrzeugtyp, Zeit hinter dem Lenkrad pro Tag und die Anzahl der Verkehrsunfälle in den letzten drei Jahren; die Risikofaktoren im Verhaltensbereich einer Stunde vor Fahrantritt wie Alkoholkonsum und grosse Nahrungsaufnahme 1 Stunde vor Fahrantritt. Die relativen Risiken für einen Verkehrsunfall stellten sich als nicht signifikant für die Faktoren der Einnahme eines Beruhigungsmittels bzw. einer allergenen Behandlung heraus. Die Ergebnisse der Studie sind konsistent mit dem momentanen Stand der Verkehrsunfallforschung und weisen auf Zielgruppen für potentielle Präventionsprogramme in der Verkehrsunfallprävention.

Résumé

Étude par cas-témoins d'accidents de la circulation sans issue mortelle auprès de patients en traitement stationnaire à Bangkok Metropolis

La morbidité et la mortalité en relation avec des accidents de la circulation sont à Bangkok Metropolis (Thaïlande) très élevés, de tendance ascendante, et représentent en conséquence un gros problème pour la santé publique en ce pays. L'étude par cas-témoins non-accouplés avec 350 cas et 350 patients-témoins a déterminé les facteurs de risque suivants: sous l'aspect démographique d'abord: l'âge, l'état civil, le sexe, la profession; puis les expositions inhérentes à la conduite d'un véhicule ainsi que le type de véhicule, le temps journalier passé derrière le volant; enfin les facteurs de risque dans le domaine du comportement une heure avant l'utilisation du véhicule comme la consommation de boissons alcooliques ou la consommation copieuse de nourriture. Le risque relatif d'accident de circulation n'était pas significativement augmenté pour les tranquillisants ou les médicaments antiallergiques. Les résultats de l'étude sont en accord avec les données actuelles de la recherche sur les accidents et indiquent quels sont les groupes particuliers auxquels devraient s'adresser les programmes de prévention des accidents.

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