

# **Epidemiology & Health Bulletin**

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An Epidemiological Study of  
Traffic Injuries in Taiwan

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## **An Epidemiological Study of Traffic Injuries in Taiwan**

### **I. Introduction**

Injuries have been the third leading cause of death in the Taiwan area, of which traffic injuries account for more injury deaths. In 1989 for instance, of the 14,047 injury deaths in the Taiwan area, 56% died of traffic injuries on land. Injuries are the first cause of death of children between 1 and 14 years of age in the Taiwan area. Of every two injury deaths of the youngsters, one is a result of traffic injury.<sup>(1)</sup>

The main purposes of the study are to observe and analyze through epidemiological methods:

1. the background characteristics of traffic injury patients: their age, sex, types of traffic accidents, and time and places of accidents;
2. the sites most likely to be injured, the kinds of injuries and their severity;
3. the direct and indirect economic losses of traffic injuries;
4. risk factors related to deaths due to traffic injuries;
5. drinking and traffic injuries;
6. estimated number of traffic injuries in a year in the Taiwan area and the incidence rate.

### **II. Materials and Methods**

The study employs the prospective study method. Information of acute patients due to traffic injuries admitted to the Tri-Service General Hospital for the year 1990 such as: the background information of patients, types, time, places and weather conditions of accidents, injury sites, severity (ISS scale),<sup>(2,3)</sup> and diagnosis and medical care costs, was collected. Patients were actually tested of alcohol content by the Alcosensor III. Data are analyzed as to their frequency distribution and again, by the multiple logistic regression method to study the relation between drinking and traffic injury and also to investigate the risk factors associated with deaths due to traffic injuries.<sup>(4)</sup>

### III. Findings

In 1989, of the 4,329 acute traffic injury patients, 2,925 (67.6%) were male and 1,404 (32.4%) female, giving a male-female sex ratio of 2.1:1.

Of various types of traffic injuries, the most difference in sex ratio of 3:1 is seen in automobile accidents; the least difference of 1.4:1 in pedestrians. Most patients are in the 20 to 39 year age groups, with 303 persons walking, 79 riding on bicycles, 1,501 riding on motor-cycles, and 495 driving automobiles when the accidents took place. 52% of persons above the age of 60 years had the traffic injuries while walking or standing still. The data, when tested with Pearson and Chisquare tests, are found to be statistically different; that is, types of accidents and the ages of victims are closely related.

Most of the accident victims were laborers (26.3%), followed by students (22.3%), servicemen (13.8%), housewives, unemployed persons, retired persons and young children (12.2%), businessmen (12.0%), government employees (6.7%) and others (6.7%).

Distance was the reason to select the Tri-Service General Hospital for treatment (41%). Other reasons include: referral by other hospitals for either insufficient facilities, no available beds or refusal for admittance (23.7%), and patients transported or reported by the "119 Emergency Care", the causers of accidents, or passersby (12.4%).

Of the 4,329 traffic injury patients, 1,246 (29.4%) were results of collisions between motorcycles and automobiles, 724 (17.1%) of motorcycle accidents, 464 (11%) of collisions of motorcycles, 461 (10.9%) of hitting by motorcycles, and 408 (9.6%) of hitting by automobiles. 71% of the accidents are related to motorcycles, indicating that motorcycles are the most important cause of traffic injuries.

No variance is seen in the number of traffic injuries by month. Slightly more injuries in June through September (average 13 per month) and fewer in February through May (average 11 per month) are noted.

Of all types of traffic injuries, pedestrians had the most accidents of 2.7 persons per day in November; bicycle riders had the highest accidents of 1.0 person per day in October. Motorcycles had more accidents in July and October (8.7 persons per day). More automobile accidents occurred in October (2.8 persons per day).

In a week, Saturday had the highest number of traffic injuries (13 persons); and Friday had the least number (10 persons).

Of the 365 days in 1990, there were 16 days of national holiday, 52 Sundays, 51 Saturdays and 246 working days. The average numbers of traffic injuries on these days were 13.1, 12.2, 13.4 and 11.3 persons respectively.

In 24 hours, pedestrians, bicyclists and motorcyclists had most accidents between

7 and 8 am and 4 and 6 pm, the rush hours for going and returning from work. Pedestrians and bicyclists had the least accidents between mid-night and 5 am, and motorcyclists had the least accidents at 5 am. Automobiles had the most accidents at 4 pm, then another peaks at 11 pm and 1 to 3 am.

Most patients are from Taipei City (61.6%), and Taipei County and neighboring towns (27.6%). Some (10.3%) are from other cities, counties and islands.

13.6% (590 persons) of patients arrived at the Hospital within ten minutes after the accidents; 47.5% (2,055 persons) arrived within 30 minutes. The rest 1,684 patients (52.2%) did not arrive at the Hospital immediately (that is, within 30 minutes) after the accidents.

More injuries are injuries of skins (81.9%), extremities (60.7%), head and neck (56.9%), chest (11.3%) and abdomen (7.8%).

Bone fracture is a common traffic injury, particularly of pedestrians. 32.5% of pedestrians in traffic accidents had bone fractures. 22.1% of bicyclists, 24.3% of motorcyclists and 23.8% of automobile drivers in traffic accidents had bone fractures. In other words, of every four traffic injuries, one would have bone fracture.

When patients were measured of their severity by the Injury Severity Score (ISS), the average score was 5, ranging from 87.7% (3,795 persons) in the mild severity (score of 1 to 10), 8.5% (370 persons) in the moderate group (score of 11 to 20), and 2.8% (120 persons) in the severe group (score of 21 and above).

#### Direct economic losses:

- 1) emergency care costs ranging from NT\$270 to 84,720, averaging NT\$4,395;
- 2) hospital care costs ranging from NT\$720 to 955,584, averaging NT\$20,305.

#### Indirect economic losses:

1) loss of working days: of the 4,329 patients, 3,301 (76.3%) were either students or employees; of them, 58.2% had to take leave (not including summer or winter vacations) due to the injuries; 20.5% had to take more than four weeks of leave; the median days of leave taken were 14 days;

2) resignation: 96 patients had to resign due to the injuries; the resignation rate for all patients was 3.4%;

3) suspension from school: 38 students had to suspend from school temporarily due to the injuries; the suspension rate for students was 4.0%;

4) disability and death: after four to six months of treatment, 3,140 of the 4,329 patients had recovered (76.5%); yet, 811 patients (19.8%) had some local functional disability, 51 persons (1.3%) were disabled, and 100 patients (2.4%) died; the disability ratio was 5:1, and the death ratio, 43:1.

Drinking and traffic injuries are shown in Table 1.

**Table 1. Multiple Logistic Regression Analysis of Drinking and Traffic Injuries\***

Variable	Regression Coefficient	Standard Deviation	Regression Coefficient/ Standard Deviation
Sex	0.755	0.116	6.49
Age	0.186	0.101	1.85
Being 1	-0.367	0.195	-1.89
Being 2	-0.325	0.143	-2.28
Being 3	-0.049	0.299	-0.165
Driver	0.295	0.110	2.68
Many	0.233	0.081	2.89
Night	-0.814	0.079	-10.3
Constant	2.58	0.171	15.1

\* Goodness of Fit, Chi-square test = 60.598, P value = 0.915

Of all deaths from traffic injuries, the sex ratio (male:female) is 2.3:1. The sex ratio becomes smaller when ages increase, for instance, the sex ratio for persons in ages 0 to 19 years being 8:1; 5.4:1 for persons in ages 19 to 39 years; 4:1 for those in ages 40 to 50 years; and 1.1:1 for those in ages 60 years and older.

The fatality rate due to traffic injuries, regardless of sex, increases with age. For persons above the age of 60 years for instance, the fatality rate for man is 5% and for woman 10%.

Fatality rate is the highest among pedestrians (3.8%), followed by automobile drivers (2.3%), motorcyclists (1.8%), and bicyclists (0.8%).

The logistic regression of lethal traffic injuries is shown as follows:  $\text{Log Odds} = -10.1 + 0.03 (\text{Age}) + 1.89 (\text{Head}) + 1.03 (\text{Abdomen}) + 0.5 (\text{Extremity})^*$ .

\*Age refers to the actual age of patient;

Head, by the abbreviated injury scale, scores for 0-5;

Abdomen, by the abbreviated injury scale, scores for 0-5;

Extremity, by the abbreviated injury scale, scores for 0-5.

The statistics of the Department of Health of the Executive Yuan show a total of 7,851 deaths due to traffic injuries per year for a population of 20 million. At the fatality rate of 2.3% of all traffic injuries estimated by the present study, the total number of traffic injuries in a year for the Taiwan area as a whole is

estimated to be around 330,000, the incidence rate of traffic injuries for the Taiwan area thus is  $1,706/10^5$ .

The number of traffic injuries by age group for the Taiwan area is: 157,500 persons for the 0-19 group, 149,632 persons for the 20-39 group, 70,115 persons for the 40-59 group, and 27,288 persons for the 60 and above group. More injuries occur among persons in the younger age groups.

In a year, the incidence rate of traffic injuries by age group is:  $2,137/10^5$  for the group 0-19,  $2,054/10^5$  for the group 20-39,  $2,012/10^5$  for the group 40-59, and  $1,463/10^5$  for the group 60 and above. The incidence is higher among persons in the younger age groups.

#### IV. Discussion

Due to difficulties in manpower, fundings and administrative coordination, the present study was not able to conduct an overall investigation of traffic injuries focusing on a specific area. It was decided to study the traffic injury patients of the emergency care department of a hospital, the Tri-Service General Hospital (a large-scale teaching hospital). This choice set some limitations while making conclusions out of the findings. One interesting fact is noted from the present study, that is, distance is the most important factor in the selection of hospital for treatment by patients of traffic injuries. Therefore, the geographical site of traffic accident is closely related to the hospital. The findings from an epidemiological study of traffic injuries of a large-scale teaching hospital, therefore, are still of value.

Beginning 0 hour on 1st January 1990 till mid-night of 31st December 1990, there were 4,329 patients of traffic injuries admitted to the emergency care department of this Hospital. Of them, 71.1% were related to motorcycles. Of all deaths, motorcyclists occupied 48.4%, their accompanying persons occupied 7.2%. That is, of every two deaths due to traffic injuries, one is motorcyclist. What is shocking is, at such a high death rate, only 14.3% of motorcyclists wore safety helmets.

Of all injuries, more young people are the victims. This indicates that the traffic safety education in Taiwan deserves further strengthening.

The monthly distribution of traffic injuries throughout the year shows that except in June through August when there are slightly more traffic injuries, the average number of traffic injuries per day and per month is relatively evenly distributed. That is, each and every month of the year is of equally high risk.

The number of traffic injuries is higher on Saturdays (13.4 persons per day), national holidays (13.1/day) and Sundays (12.2/day) than on working days (11.3/day); the differences, however, are not significant. In terms of hours of the day, pedestrians, bicyclists and motorcyclists seem to have more injuries between 6-8 am, 4-6 pm and 9-10 pm. Automobile drivers seem to have more injuries on and around 4 pm and

again, between 11 pm and 2 am.

Automobile accidents at night may be related to drunken driving. Alcohol content in an individual certainly will have adverse effect on his judgement. The present study reveals that of all automobile accidents, 30.4% were due to drunken driving; and that 75% of accidents due to drunken driving occurred between 10 pm and 5 am with a peak at 1 am (17.9%).

More injuries affect the skin (81.9%), the extremities (60.7%), the head and neck (56.9%), the chest (11.3%) and the abdomen (7.8%). By analysis of logistic regression, it was found that the injuries on head, neck and abdomen were the major causes of traffic deaths.

The emergency care network plays an important role in the emergency care of injuries. That 23.7% of patients in the present study were referred by other hospitals, and that a half of patients did not arrive at hospitals within 30 minutes after injuries indicate that the emergency care system needs further review.

**Prepared by:** H. L. Ting (FETP, National Institute of Preventive Medicine, also Cancer Epidemiology Study Group, the Tri-Service General Hospital).

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## Announcement:

Title : Annual Summer Program in Epidemiology & Biostatistics.

Date : May 3 — June 25, 1993.

Place : Department of Epidemiology & Biostatistics Faculty of Medicine, McGill University Montreal, Quebec Canada.

Information : Coordinator Annual Summer Program McGill University 1020 Pine Avenue, W. Room 30 — FB Montreal, Quebec, Canada. H3A 1A2.

Tel : (514) 398—3973

Fax : (514) 398—4503