Traumatic brain injury registry in Taiwan

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This project was designed to examine the epidemiology of traumatic brain injury (TBI) in Taiwan. A total of 58,563 cases of TBI was collected from 114 hospitals in Taiwan during the period July 1, 1988–June 30, 1994. Traffic accident was the major cause of TBI (69.4%), followed by falls and assaults. Motorcyclists accounted for the vast majority of TBI cases among traffic accident victims (64.5%). The Glasgow Coma Scale was used in assessing the severity. 41,646 cases (79.5%) were considered mild, 4,637 cases (8.9%) moderate, and 6,078 cases (11.6%) severe. Skull x-ray showed fracture in 7,663 cases (14.6%). Intracranial hemorrhage was identified in 28.6% of patients receiving CT scanning. Craniotomy was performed in 5,226 cases (9%). The outcome of TBI was determined by the Glasgow Outcome Scale. Death occurred in 2,621 cases (5.4%), vegetative state in 429 cases (0.9%), severe disability in 1,293 cases (2.6%), moderate disability in 1,890 cases (3.9%), and good recovery in 42,596 cases (87.2%). The severity and outcome were worse than those of Western reports. In order to alleviate this problem, a helmet use persuasion program was conducted by the Police Department in Taipei City from January to June, 1994. Results of this program showed a significant reduction of TBI-related hospitalization, severity and fatality during this period of intervention. This study points out the seriousness of TBI in Taiwan and suggests some approaches and priorities for prevention. [Neurol Res 1997; 19: 261–264]

Keywords: Traumatic brain injury; helmet use; Registry

INTRODUCTION

The epidemiologic study of traumatic brain injury (TBI) has gradually received attention since the 1980s[1–21]. This study was designed to evaluate the distributions and determinants of TBI across the whole nation using consistent definitions and case ascertainment procedures.

Starting from July 1, 1988, this study established a registry of TBI with the objectives to observe the cause, severity, and outcome of TBI, to evaluate the secular trends of TBI in Taiwan, and to help in assessing and establishing prevention strategies.

MATERIALS AND METHODS

TBI was defined to be a situation in which the patient was found to suffer from at least one of the following:

1. Loss of consciousness or amnesia;
2. neurological deficit;
3. skull fracture; or
4. intracranial hemorrhage, proved by CT scan or surgery.

The hospitals selected for this study were teaching hospitals with more than 100 beds and hospitals with less than 100 beds but still capable of treating TBI cases.

The cases selected included hospitalized head-injured patients from 22 hospitals in Taipei City, 8 hospitals in Eastern Taiwan, 31 hospitals in Central Taiwan, 23 hospitals in Northern Taiwan (excluding Taipei City) and 26 hospitals in Southern Taiwan. Death on arrival (DOA) cases were not included in this study.

The Glasgow Coma Scale (GCS) was used to determine the degree of severity of TBI[22]. The severity of head injuries were classified into 3 categories:

1. Mild: GCS between 13 and 15;
2. moderate: GCS between 9 and 12, or if CT scan revealed intracranial hemorrhage, or if craniotomy was necessary;
3. severe: GCS 8 or below[19].

In the classification of the outcome of TBI, the Glasgow Outcome Scale was used. The categories were:

1. Death;
2. persistent vegetative state;
3. severe disability;
4. moderate disability;
5. good recovery[23].

The definitions and case ascertainment procedures used in this series were standardized for all areas of Taiwan.

Skull x-ray and CT-scan of the brain were performed in each case to identify skull fracture and intracranial hemorrhage.

In order to reduce the motorcycle-related TBI, a motorcyclist helmet use persuasion program was conducted by the Taipei City's Police Department from January to June 1994. During this period, a detailed record of motorcycle-induced head injuries was made specifically in 22 hospitals in Taipei City by the authors for the assessment of the results of the program.

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RESULTS

From July 1, 1988 to June 30, 1994, this study collected a total of 58,563 cases of TBI. The male to female ratio was 2:24. The 20–29 age group accounted for the largest number of cases, followed by the 30–39 and 10–19 age groups (*Table 1*).

The main cause of TBI was traffic accident, which accounted for 36,612 of the cases (69.4%), followed by falls 10,264 cases (19.5%), assaults 3,456 cases (6.5%), sports injuries 603 cases (1.1%), falling objects 229 cases (0.4%), and others 1,607 cases (3.0%). Motorcyclists accounted for the largest number of cases among traffic accident victims, totalling 23,625 (64.5%), followed by pedestrians 5,039 cases (13.8%), car occupants 3,586 cases (9.8%), bicyclists 1,372 cases (3.7%), and others 2,985 cases (8.2%).

Upon the patient's arrival at hospital, the degree of severity of TBI was determined by this study to be severe in 6,078 cases (11.6%), moderate in 4,637 cases (8.9%), and mild in 41,646 cases (79.5%). Of these cases of TBI, 37.5% had associated injuries, of which facial bone fracture was the most common, followed by lower limb fracture, upper limb fracture, chest injury, spine injury, and abdominal injury, etc. X-ray revealed skull fracture in 7,663 (14.6%) of the cases. CT scan revealed intracranial hemorrhage in 14,836 (28.6%) of the cases examined. Among them, 5,226 cases received craniotomy treatment. The outcome of TBI was determined by the Glasgow Outcome Scale (GOS), in which death occurred in 2,621 cases (5.4%), vegetative state in 429 cases (0.9%), severe disability in 1,293 cases (2.6%), moderate disability in 1,890 cases (3.9%), and good recovery in 42,596 cases (87.2%).

The motorcyclist helmet use persuasion program conducted from January to June of 1994 in Taipei City was very successful. After 6 months of persuasion, the helmet use rate recorded by the Police Department increased from 21% in January to 79% in May 1994. This resulted in a very significant decrease in the number and severity of motorcycle-induced TBI cases requiring hospitalization or craniotomy in 22 hospitals in Taipei City (*Figure 1*). The outcome of TBI also showed significant improvement, proven by the decrease in the number of deaths, vegetative states, and disabilities (*Figure 2*).

DISCUSSION

The purpose of this epidemiologic study was to find out the distribution and determinants of TBI. This study collected more than 50,000 cases of TBI during the past 6 years with the purpose of establishing an epidemiologic data bank and designing preventive strategies for TBI in Taiwan.

The incidence rate and mortality rate of TBI were not emphasized because nonhospital deaths were not included in this study. However, nonhospital deaths in urban (Taipei City) and rural (Hualien County) areas were included in a previous study. The incidence rates were calculated to be 220 per 100,000 per year in Taipei City and 30 per 100,000 per year in Hualien County, and the mortality rates were determined to be 20 per 100,000 per year in Taipei City and 82 per 100,000 per year in Hualien County.

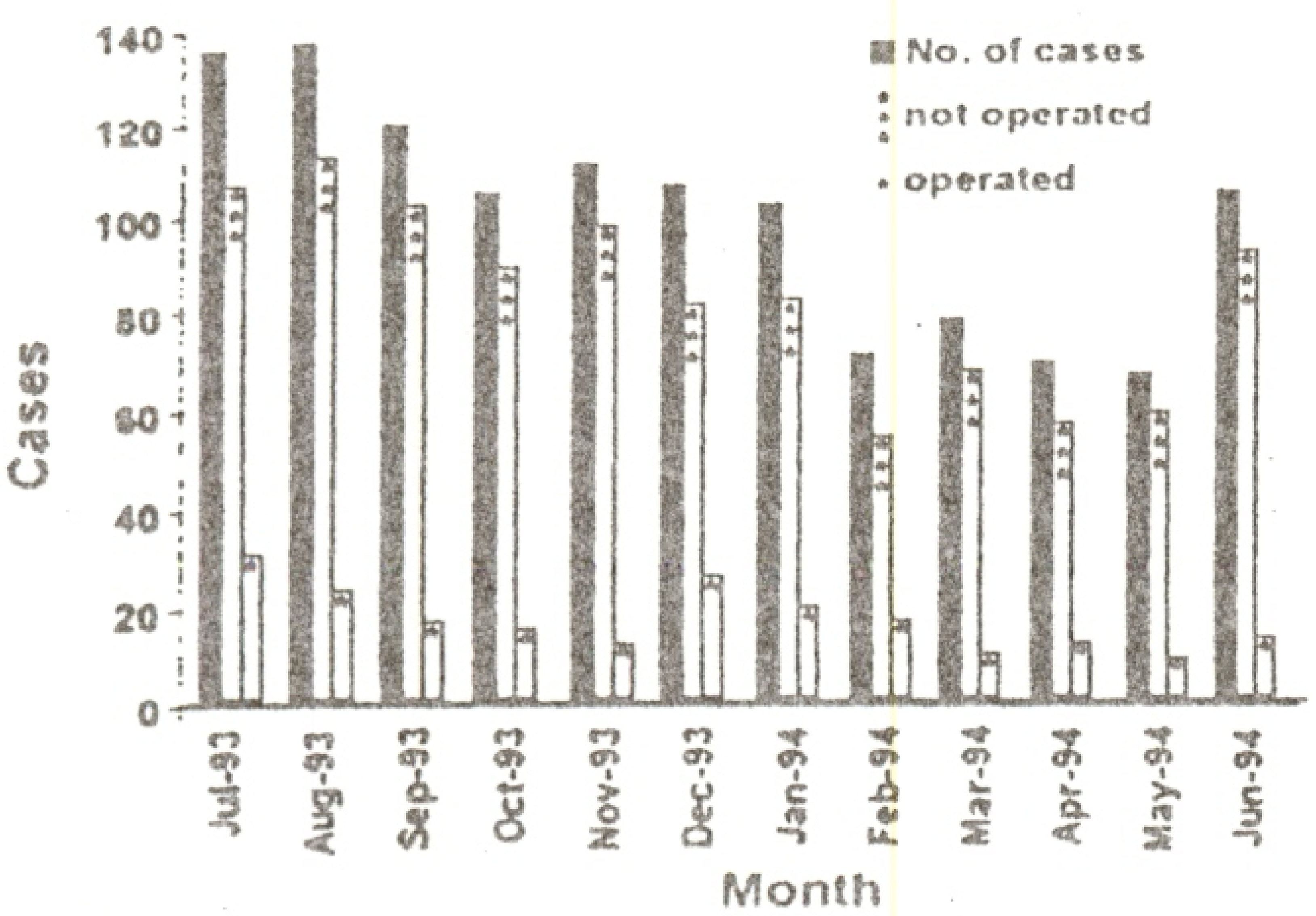

Figure 1: Analysis of the number of operations in hospitalized motorcycle-induced traumatic brain injury patients in 22 hospitals in Taipei City (July 1993 to June 1994)

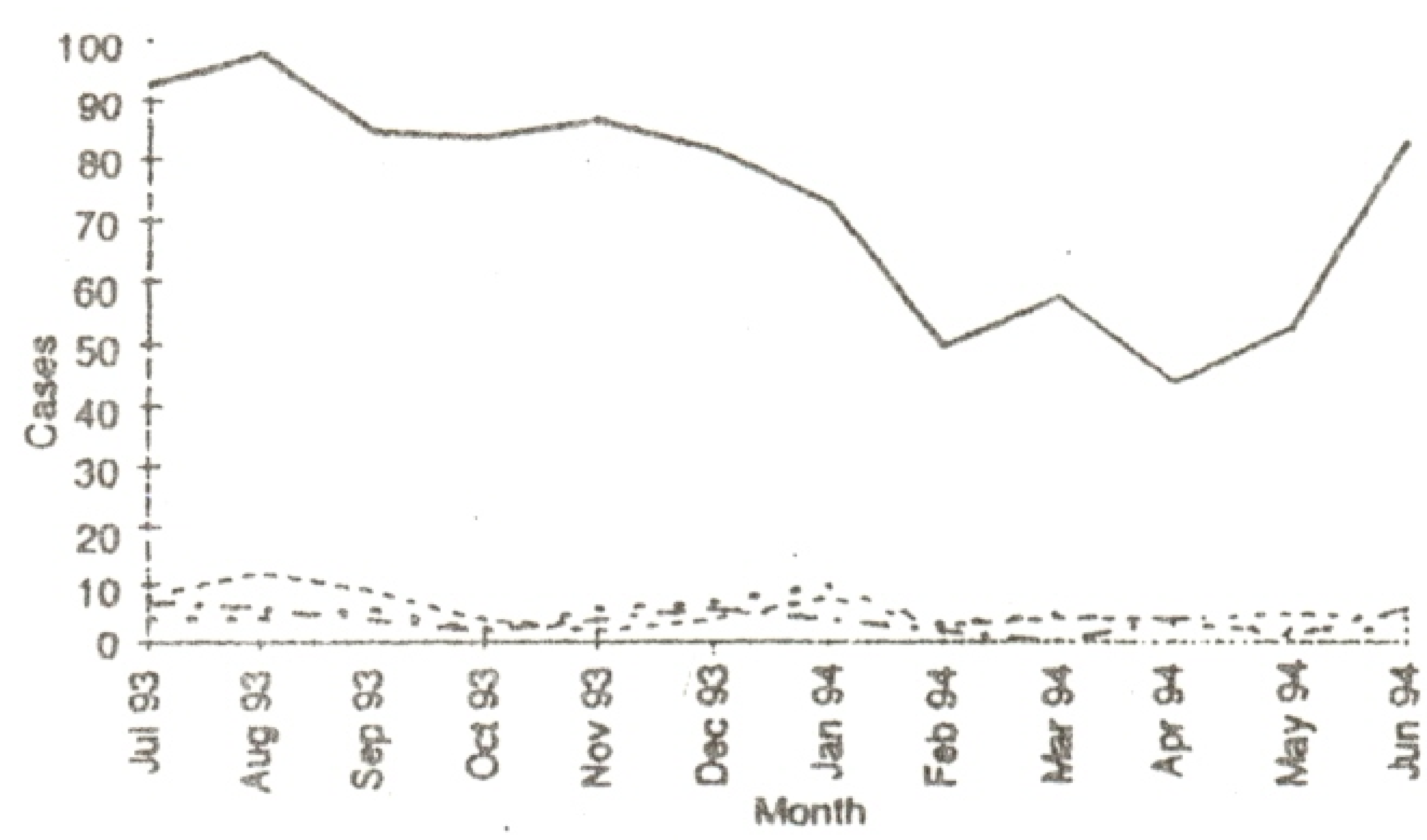

Figure 2: Analysis of outcomes of hospitalized motor vehicle-induced traumatic brain injury patients in 22 hospitals in Taipei City (July 1993 to June 1994). — - —, death; – – –, vegetative state; - - - -, mild disability; ———, good recovery.

Table 1: Number of cases and ratio in each age group

Age	0–9	10–19	20–29	30–39	40–49	50–59	60–69	>70	Total
Number of cases	2,989 (5.8%)	7,483 (14.5%)	12,335 (23.9%)	8,931 (17.3%)	6,159 (12.0%)	5,223 (10.0%)	4,731 (9.2%)	3,686 (7.2%)	51,537

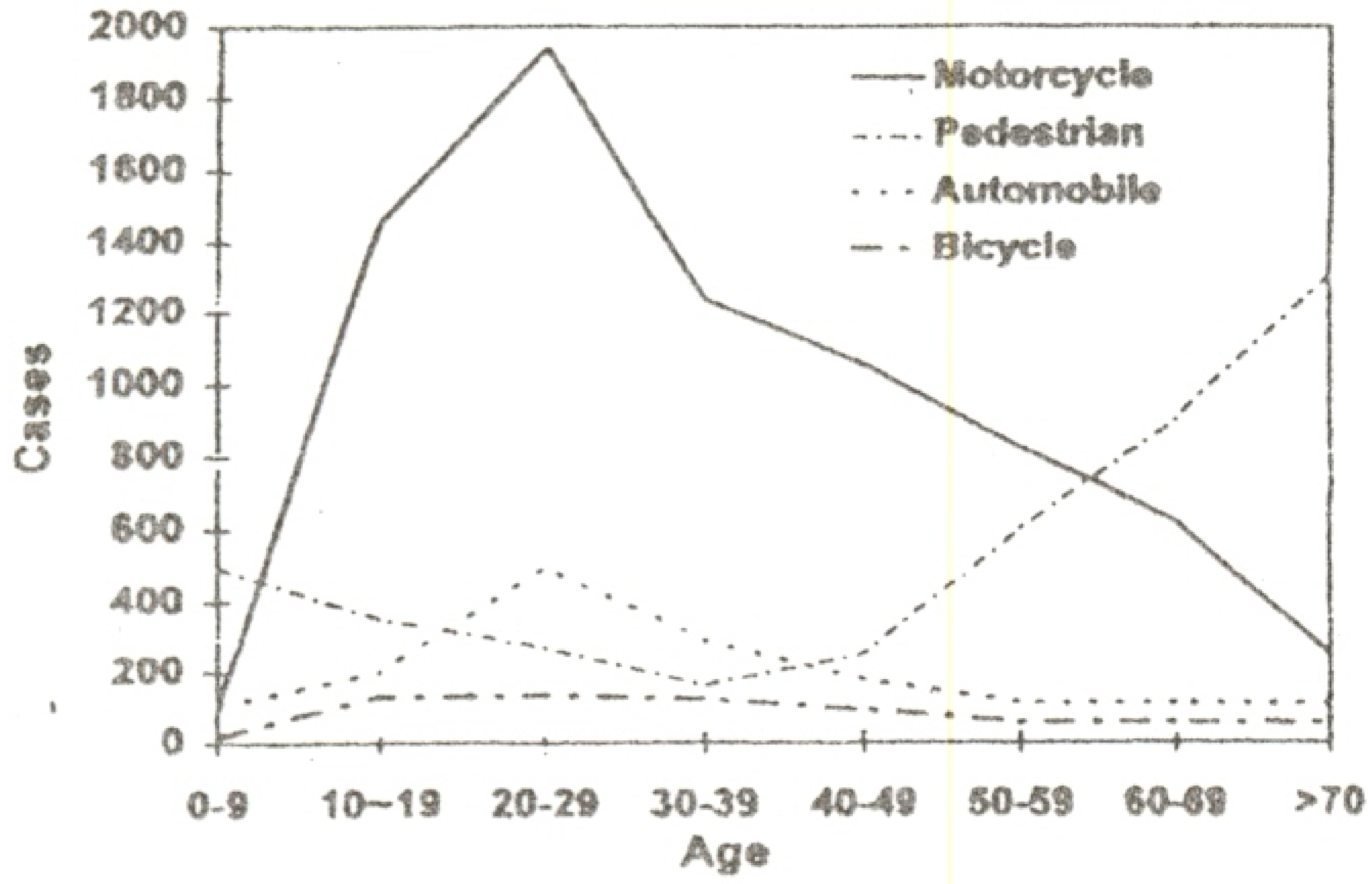

Figure 3: Type of traffic accident-related traumatic brain injury and age distribution (July 1993 to June 1997)

Concerning the cause of TBI, the rate of traffic accident-related TBI is much higher in Taiwan than in Western and other developing countries[1–23]. Motorcycles, in particular, account for 65% of traffic injuries, which is a figure much higher than the range reported in other studies in the rest of the world (6–42%). The motorcycle is the most important factor causing serious TBI in Taiwan, and therefore, motorcycle-related problems should be given first priority when conducting research, carrying out treatment, or establishing preventive strategies.

Motorcycle accidents are not only the most important cause of TBI in Taiwan, but also has the highest incidence in young adults (*Figure 3*). Further study revealed that pedestrian injury tends to occur more frequently in children and elderly groups, and motorcycle accidents mostly tend to involve people aged 10–39 years. The impact of motorcycle accidents on social resources and potential life loss in the younger generation is enormous. Therefore, it is imperative that we confront this problem in the most aggressive way.

The motorcycle has been recognized as one of the most dangerous vehicles. A safety helmet is the only gear that can protect the motorcyclist. An example of this is the following. In 1966 the United States government passed a helmet use law for motorcycle riders. After the law was implemented, the motorcycle fatality rate decreased by 50%. But in 1976, for one reason or another, 27 states weakened or repealed this helmet use law, and as a consequence, the motorcycle fatality rate climbed 40%[26–32]. In 1992, a helmet use law was reimplemented in California, which resulted in a 37.5% reduction in the death rate[33].

Taiwan is one of a few Asian countries without a helmet use law. The total number of motorcycles at the present exceeds 11 million, in a population of 22 million. This figure ranks Taiwan as one of the countries with the highest motorcycle use rates. Therefore, the enforcement of helmet use on motorcyclists is even more critical. Unfortunately, Taiwan has not been able to pass a helmet use law because some legislators and councilmen emphasize the protection of an individual's rights and oppose the implementation of a law that would infringe on personal freedom. This is the reason why the mortality and morbidity rates of TBI have remained high during the past few years.

In January 1994 the Police Department of Taipei City began to conduct a helmet use persuasion program. However, because this activity was not based on the law, the program was criticised and eventually terminated by June, 1994. After the termination of the program, the severity, number of head injuries, and outcome returned to their previous levels. From this study we can see that helmet use not only reduced the incidence of TBI, but also decreased the severity of TBI and improved the outcome.

Based on previous experience, approximately 3,500 people die each year due to motorcycle accidents in Taiwan, of which more than 3,000 do not wear a helmet. According to the experience in Taipei City from January to May 1994, when helmet use persuasion activities were conducted, a 30% reduction of the hospitalization rate and 40% reduction of the death rate due to head injury were observed. Based on these results, if we extend the enforcement to the whole nation and expect 80% of motorcyclists to wear helmets, more than 1,200 people can be saved from dying unnecessarily each year. The number of people with disabilities and sequelae can be drastically reduced. Therefore, we have to obtain the people's support, carry out more research, collect more data, and push hard to pass this much needed helmet use law in Taiwan.

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