

# *Toward the Development of Emergency Medical Service System in Thailand: An Experience at Khon Kaen Regional Hospital*

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## **Abstract**

Injury is the major health problem in Thailand. It is the complex social problem and extremely difficult to deal with. The co-operative efforts from various concerned healthcare institutes and government organizations are essential in solving the problem. Khon Kaen Province has realized the tremendous loss resulting from all types of injury, thus an "Injury Prevention and Control Project" has been set up since 1989. The main activity of both injury prevention and trauma service development consists of trauma registry, pre-hospital care, trauma audit, inter-hospital transfer and mass casualty control network. This project has since enabled Khon Kaen Province to reduce the number of injury and death especially from traffic accident. In addition, the model of injury prevention and control of Khon Kaen Province has become an example for expansion of such development to many other provincial hospitals in the country.

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Accident and poisoning have been the major causes of death in Thailand since 1985. The main reason why accident has become a leading health issue in Thailand is because the number of traffic accident has been increasing steadily. For example, the number of annual traffic accidents increased by 411 per cent from 1984 to 1995. In the same period, the number of death and the injured also increased from 2,908 to 16,727 and from 8,812 to

43,541 respectively. Traffic accidents accounted for 46 per cent of the deaths due to accidents and poisoning in 1995.

Most people who were killed in traffic accidents were between 15 and 55 years of age. Because they are in the active working age, their death has an enormous economic and social impact to their family, their community and to the development of Thailand as well. It was estimated that the economic loss from death due to traffic accidents was 60-90 billion Baht, or 16.5 per cent of the National Budget in 1993. It was also estimated that 3,000-5,200 victims of the traffic accidents became disa-

bled each year.

Thus, it is necessary to develop a system to prevent traffic accidents, to take care of the patients of traffic accidents effectively, and to support the disabled due to traffic accidents in Thailand. This report describes the activities of Accident Control and Prevention Project led by Khon Kaen Regional Hospital to facilitate the actions toward achieving a safer community.

### Health Care System in Thailand

The administration of Thailand is divided into 2 special local administrations (Bangkok and Pataya), and 75 provinces. By and large, structure of local administrative units is province, district, tambon (subdistrict), and village by descending order.

In each province, Ministry of Public Health has taken initiative to establish health care system. At a tambon level, there is a health center where health workers provide preventive, promotive, and basic curative services to the people in its catchment area.

At a district level, there is a community hospital where doctors and nurses provide both outpatient and inpatient services. The number of bed in each community hospital varies from 10 to 60. Community hospitals also provide promotive and preventive services. At a provincial level, there is a general/regional hospital which functions as a referral hospital for the community hospitals and also as a community hospital to the district where it is located. In addition to those health facilities of Ministry of Public Health, other ministries such as Ministry of University Affairs, Ministry of Defense, and Ministry of Agricultural Cooperation also maintain hospitals, but they are usually located in urban areas.

Currently, it is estimated that 70 per cent of the population is covered by a medical welfare of insurance scheme in Thailand. Different schemes cover the medical expense of the different groups of people. Table 1 shows the summary of medical welfare and insurance scheme in Thailand. Those who are not covered by any scheme usually have to

Table 1 Summary of financing schemes, 1993.

Scheme	Nature of scheme	Population covered (no. and %)		Source of funds	Expenditure per capita (baht)
Free medical care	Social welfare	Low income	11.7 million	General tax	214
		Elderly	3.5 million		72
		primary school children	5.1 million		31
			(35.9%)		
Civil Servants and State Enterprises Medical Benefit	Public employee fringe benefits	Employees, pensioners, and dependents	6.4 million (11.3%)	General tax	916
Social Security	Compulsory Health insurance for firms	Employees	4.6 million (8.1%)	Tripartite	805
Workmen's Compensation Fund	with more than 10 employees	Employees	1.8 million	Employer	421
Health cards	Voluntary health insurance		1.3 million (2.3%)	Household and general tax	141
Private Health Insurance			0.9 million (1.6%)	Household	933
Total covered population			59.2%		

Low income: monthly income below 2,800 Baht for households and 2000 for singles. Elderly: population 60 years old and above.  
Source: Dow Mongkolsmai, *Private Health Sector Growth and Social Security Insurance in Thailand*.



pay for the medical expense by themselves even at public health facilities. However, there is a safe net system by which patients may be partially or fully exempted from paying the medical expenses if they are accepted as indigent by the staff at public health facilities.

There are also private hospitals and clinics, but they mostly provide medical services in urban areas. Due to rapid economic growth and urbanization, their role in the provision of medical services is increasing these days.

### ***Accident Prevention and Control Project in Khon Kaen Province***

Khon Kaen Province is located in the center of northeastern part of Thailand. The population is about 1.7 million (1994). The area is about 10,900 km<sup>2</sup>. Khon Kaen Regional Hospital forms a referral network with 19 community hospitals and 209 health centers in the province, and the health facilities in the adjacent provinces. There are also a university hospital, 5 private hospitals, and 188 private medical clinics within the province.

In accordance with the national trend, the number of trauma patients rapidly increased in Khon Kaen in the late 1980s. However, medical staff at community hospitals could not provide appropriate care to those patients because they had less experience in taking care of trauma patients. Community hospitals do not have adequate medical supplies, materials and equipment for diagnosis and treatment of trauma patients. Furthermore, they do not have adequate number of paramedical personnel such as anesthetist nurse, OR nurse, IPD nurse. Consequently, they usually had to refer trauma patients to Khon Kaen Regional Hospital. Although Ministry of Public Health has set up a practical referral system, there are still many problems in referral of patients from community hospitals to Khon Kaen Regional Hospital. This study was conducted retrospectively on referred patients with head injury from community hospitals to Khon Kaen Regional Hospital between October 1987 and May 1988. We found the following problems about referral of the patients:

1. Most community hospitals were lacking of an adequate observation system. For example, the community hospitals not utilizing Glasgow scale,

were unable to monitor the patients and to notice any changes in their symptoms. Even the community hospitals which used Coma scale, 15 per cent of trauma patients who had Coma scale less than 8 were kept at the community hospitals for more than 6 hours. Thus, the patients could not have received appropriate examination and treatment in a timely manner.

2. More than 35 per cent of the trauma patients were not intubated during transportation from community hospitals to Khon Kaen Regional Hospital. Also, more than 15 per cent of the patients came to Khon Kaen Regional Hospital by themselves from community hospitals.

3. More than 50 per cent of the trauma patients were sent to Khon Kaen Regional Hospital without the essential information such as vital signs, neurological signs, level of consciousness, and the interim progress records.

4. Health personnel sometimes provided improper medical care to the patients.

It was assumed that more trauma patients would have been saved if the above problems were solved or minimized. There was, thus, an urgent need to improve the quality of medical care services to the trauma patients as well as the system of trauma care. At the same time, it was recognized that medical care could not save the damage caused by accident such as loss of property, loss of job due to physical disability, etc. Therefore, effective accident control and prevention was also considered to be very important.

With this background, Khon Kaen Regional Hospital, cooperated with Khon Kaen Provincial Health Office, launched an Accident Prevention and Control Project in 1989.

#### ***The objectives of the project were as follows:***

1. To seek an efficient method of medical care for trauma patient in Khon Kaen Province and in the public health network which could be systematic and effective in reducing the rates of death and disability

2. To urge the organizations in Khon Kaen to speed up the implementation of accident prevention with cooperation between public and private sectors.

3. To disseminate knowledge and the method of implementation to other provinces and regions

in order to widen the coverage of accident prevention project.

4. To report the problem and method of implementation to government administration in order to determine the policy and law to prevent and control accident.

This project was first supported by WHO Collaborating Committee in Thailand from 1989 to 1991, and subsequently by JICA Community Health Project from 1991 to 1996.

The following are the major activities in Accident Control and Prevention Project.

### Trauma Registry

Trauma registry was started in 1989 in order to

create the data system of trauma patients who were treated at Khon Kaen Regional Hospital. Questionnaire was developed by the staff of Emergency Department (ED staff). ED staff collected the data of each trauma patient by interviewing the patients and/or their family members. The data were sent to Medical Statistic Unit for coding and analysis. Data were used to classify the accident problems according to the severity of the problems, to study the causes of patients' death, and to monitor the efficiency of medical care system.

According to the data from Trauma registry, the number of patients who visited Emergency Department has been increasing from 1989 to 1996 (Fig. 1). In 1996, there were 60,230 trauma patients

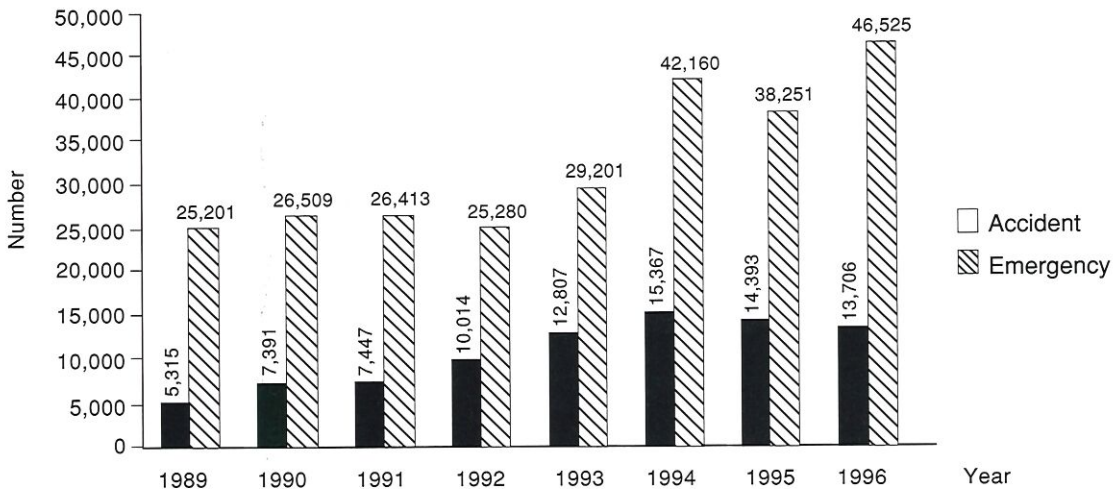


Fig. 1 Number of patients visiting Emergency Department.

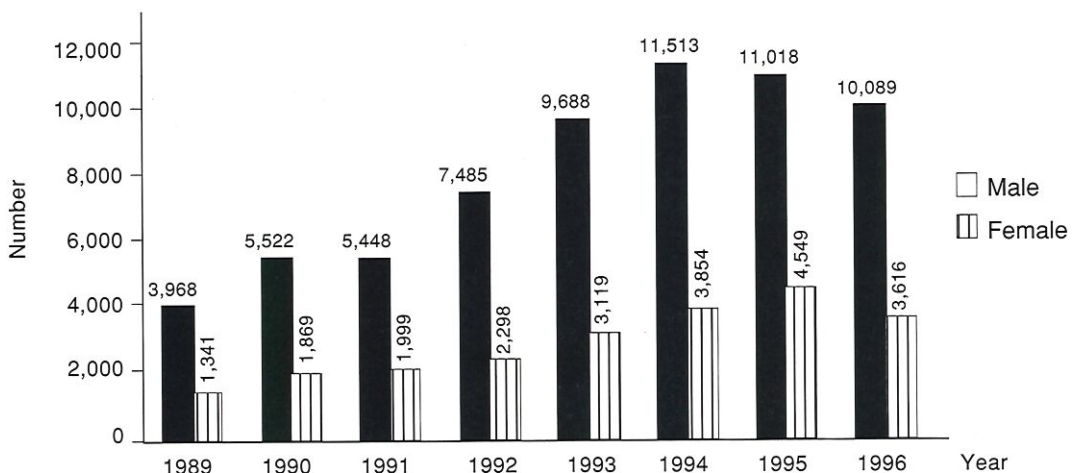


Fig. 2 Number of trauma patients classified by sex 1989-1996.



**Table 2** Number of traumatic patients classified by age group 1989-1996.

Age Year	0-9 Age	10-19 Age	20-29 Age	30-39 Age	40-49 Age	50-59 Age	60-69 Age	70-79 Age	> 79 Age	Unknown
1989	739	1,355	1,634	755	412	219	96	26	10	68
1990	979	1,956	2,181	1,096	546	284	124	47	9	169
1991	940	1,938	2,294	1,111	548	299	139	41	22	115
1992	1,192	2,623	3,028	1,570	7063	372	199	69	16	182
1993	1,318	3,340	4,040	2,026	1,028	503	268	92	38	200
1994	1,542	4,062	4,633	2,454	1,299	617	269	110	52	356
1995	1,479	3,902	4,316	2,291	1,143	596	286	98	27	255
1996	67	1,721	3,750	3,904	2,015	1,138	636	296	143	35

**Table 3** Number of traffic accident patients classified by the vehicle causing accident 1989-1996.

Year Type	1989	1990	1991	1992	1993	1994	1995	1996
Motorcycle	1,641	2,440	2,490	3,607	5,065	6,764	6,609	5,872
Pick up truck	112	100	163	217	295	506	505	149
Bicycle	96	125	135	168	158	167	132	59
Truck	41	39	65	96	131	113	77	517
Micro bus	53	55	48	79	93	75	59	35
Motor car	45	1	46	55	68	96	106	85
Tricycle	60	60	56	85	61	90	72	28
Others	123	166	105	184	205	208	192	333

(165 patients per day) visited the Emergency Department. It also showed the number of accident patients began to decline as of 1994. Most of the trauma patients were male (Fig. 2).

The average ratio of male to female patients from 1989 to 1996 was 2.9:1. A large percentage of the trauma patients were between 10 and 39 years of age (Table 2). Most patients from 1989 to 1996 who were taken to Emergency Department had accident with motorcycle (Table 3). The number of patients who had accident in Municipality and outside Municipality began to decrease as of 1994. On the other hand, the number of trauma patients referred from other province has been increasing (Fig. 3).

Khon Kaen Regional Hospital has published an annual report of trauma patients since 1990. These reports have been used as reference for the other activities in the Project as well as research project and seminar in both regional and national level. Trauma registry has become a routine work

of the Emergency Department, Surgical Department, and Academic Department.

Based on the data from trauma registry, the places where traffic accidents occurred in Khon Kaen Municipality has been recorded in the map since 1993. This map helps to identify the location of risk and draws the attention of various concerned organizations to improve trauma prevention at those places. The map, light signals and overpasses were constructed at the places where traffic accidents frequently occurred as part of preventive measures.

### *Pre-hospital Care*

Pre-hospital care service system is an important component of trauma care system to save the trauma patients and to reduce the incidence of disability. However, in 1993, 95 per cent of the injured persons were brought to Khon Kaen Regional Hospital by their family or by the people who were at the scene of accident. The remaining 5 per cent were

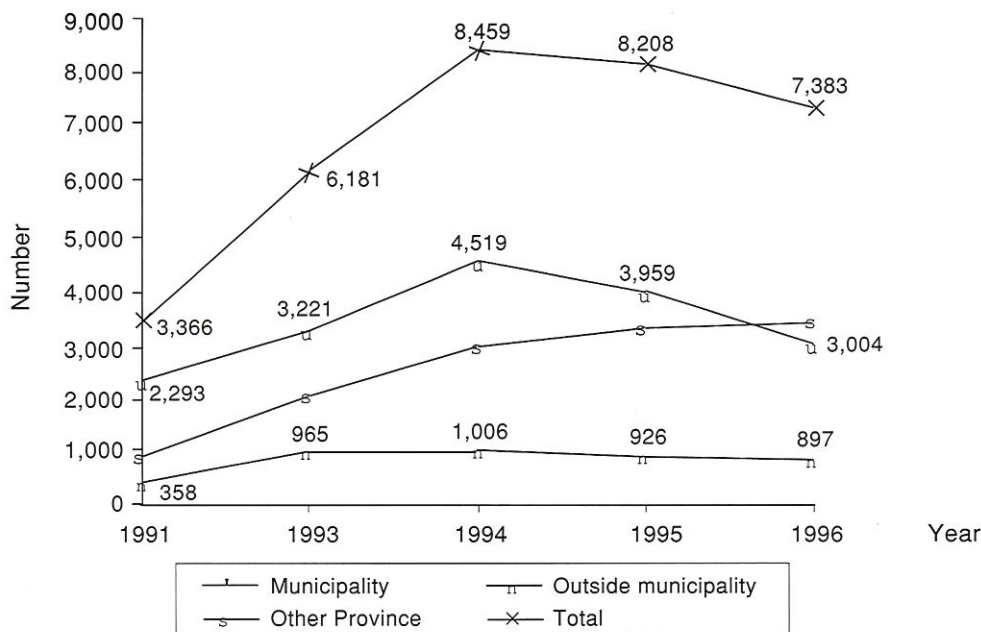


Fig. 3 Number of trauma patients classified by accident scene 1991-1996

brought to the hospital by policeman. It was, therefore, an urgent need to set up the pre-hospital care system.

Khon Kaen Province has set up the Pre-hospital Care Development Committee in 1992. The first ambulance station was opened at Chitkusol Foundation in March 1993. The second station was opened at Emergency Department of Khon Kaen Regional Hospital in February 1994. Khon Kaen Samakkeewis Foundation subsequently opened another station. An information and Communication Center was then set up at the Emergency Department of Khon Kaen Regional Hospital. People have been informed of the pre-hospital service

through various media. They have also been informed that they could contact the Center either by radio communication or by phone 24 hours a day.

Khon Kaen Regional Hospital holds a short-term course to train the Level 1 emergency medical technicians (EMTs). Six EMTs (Level 1) are currently working at Khon Kaen Regional Hospital. Sirinthorn Public Health College, in collaboration with Khon Kaen Regional Hospital, started a 2-year course for Level 2 EMTs. Currently, 8 candidates from Khon Kaen Regional Hospital are enrolled in this course.

Table 4 showed the data about the transfer of patients to Khon Kaen Regional Hospital in 1995 and 1996. Relatives brought nearly one half of the trauma patients to Khon Kaen Regional Hospital in both years. Emergency Medical Service brought only small percentage of them (0.4% in 1995 and 0.7% in 1996). Thus, it would be necessary to improve the development of human resource as well as the system of pre-hospital care of the traumatic patients.

#### Trauma Audit

Khon Kaen Regional Hospital conducted Trauma Audit Committee to improve the efficiency of medical care for the trauma patients from April

Table 4 Category of the people who transferred trauma patients to Khon Kaen Regional Hospital.

	1995	1996
Relatives	4,503 (38.5)	6,123 (45.5)
Police	72 (0.6)	183 (1.4)
Foundation	436 (3.7)	770 (5.7)
Health Personnel	1,960 (16.8)	1,671 (12.4)
Emergency Medical Service	45 (0.4)	88 (0.7)
Self-coming	2,337 (20.0)	2,777 (20.6)
Others	2,337 (20.0)	1,846 (13.7)
<b>Total</b>	<b>11,690 (100.0)</b>	<b>13,458 (100.0)</b>



1994 to December 1995. The Committee evaluated the quality of care and the causes of death of the trauma patients. Based on the evaluation, trauma care standard was created and introduced to the medical care process. After the introduction of trauma care standard, it was found that the preventable death rate decreased from 37.8 to 30.1 per cent, and potentially preventable death decreased from 27.7 to 24.3 per cent. It was also found that the incorrect medical care and the mistakes leading to death decreased from 407 points to 301 points and from 265 points to 217 points, respectively. Trauma audit has been evolved to include Medical audit for management of trauma patient and Nursing audit for nursing care improvement to make the trauma care process more efficient.

#### *Inter-hospital Transfer*

Khon Kaen Regional Hospital and Khon Kaen Provincial Health Office set up the Trauma Service Development Project. The objectives were to improve the trauma care at community hospitals in Khon Kaen Province, general hospitals in the adjacent provinces and their network hospitals and to conduct inter-hospital communication and transfer more efficiently.

There were 5 main activities in the Project. First of all, in-service training was provided to personnel from community hospitals and general hospitals to improve trauma care skills. In addition, trauma care handbook was compiled and distributed to community hospitals. Four community hospitals and 4 general hospitals were selected to manage a supervision system. Secondly, Glasgow Coma Scale was introduced to monitor the patients with head injury for all community hospitals and general hospitals in the Project. Third, all the participating hospitals were provided with equipment such as suction apparatus, O<sub>2</sub> tank, stretcher for the treatment of trauma patients. Multipurpose pick-up truck is modified to be able for use as an ambulance in case an ambulance was not available. Meetings were held to help the doctors from participating hospitals making immediate decision whether or not the patient should be admitted to their hospitals or referred to Khon Kaen Regional Hospital. Fourth, the model of consultation by radio communication and telephone was developed

to help doctors making prompt decisions about the treatment of the patients. Last, to improve the information system, each hospital was instructed to make a trauma referral report on a regular basis.

#### *Mass Casualty Control Network*

Khon Kaen Province has set up the Mass Casualty Control Network Project in order to pool the human resources, vehicle, medical supplies, and equipment from the health facilities in the network to provide appropriate medical care services in case of a mass casualty.

#### *Injury Prevention*

Khon Kaen Hospital Safety Committee realizes that the importance of accident prevention is not only providing efficient medical care services to the trauma patients but also to minimize the damage to society from the accidents. However, prevention of accidents cannot be achieved by health sector alone. Thus, an intersectorial approach is deemed necessary.

In 1991, Khon Kaen Hospital Safety Committee successfully presented the problems about traffic accident to the Governor of Khon Kaen Province and convinced him to set up Provincial Safety Committee. Annex 1 shows the members of Provincial Safety Committee. Provincial Safety Committee has 4 operational committees. The functions of each committee are as follows:

##### *1. The Committee of Education and Environment Improvement for Accident Prevention.*

This committee has developed and introduced the subject of traffic accident prevention into the curriculum of all schools in municipal area. At the same time the committee provides training for the teachers responsible for teaching the subject. The committee is also responsible for improving the traffic signs and signals in Khon Kaen.

##### *2. The Committee of Law Enforcement.*

This committee conducts the following projects: Traffic Gentleman Project, Safety Road Project, Traffic School Project, 5 minutes Teacher Project, Traffic Regulation Education Project, Traffic Sign and Signal Improvement Project.

##### *3. The Committee of Treatment for Disease due to Accident.*

This committee is responsible for the follow-



ing projects: Integrated Regional Trauma Service Project, Alcohol Detection Project, Third Party Injury Insurance, 100 per cent Antiknock Helmet Project, Accident Prevention Project for Plant Workers, Pre-hospital Care Development Project.

4. *The Mass Casualty Control Network Committee.*

This committee was formed in 1994 to provide cooperative system for mass casualty control. The Committee created communication system to exchange data among the related agencies and to command them to perform appropriate actions.

Provincial Safety Committee successfully raised the awareness of people about the importance of wearing helmet. Almost 100 per cent of them now wear helmet when they ride the motorcycle. Consequently, the rate of head injury was decreased by 60 per cent and fatality rate from head injury was also decreased by 24 per cent between September-December, 1995 and January-June, 1996.

Provincial Safety Committee has also constructed traffic signals and overpasses at the places identified as dangerous places by mapping of traffic accidents in Khon Kaen Municipality.

Provincial Safety Committee has organized the meetings among hospitals, insurance companies, and provincial Commerce Office in order to help hospitals collecting the medical fee for the accident victims from provincial insurance companies.

Such activities and experiences in Khon Kaen have become the models for accident control and prevention nationwide. The following are some of the examples:

1. Epidemiology Division, Ministry of Public Health modified the Trauma Registry and expanded it to 5 regional hospitals. In 1997, Rural Hospital Division plans to expand it to all 17 regional hospitals in the country.

2. Epidemiology Division and Rural Hospital Division experimented the use of Trauma Audit in 9 regional hospitals in 1996 and plans to expand it to all regional hospitals.

3. Traumatic Medical Institute for Accident and Disaster and Rural Hospital Division are in the process of developing a model of pre-hospital care based on the experience in Khon Kaen.

4. Rural Hospital Division and Rural Health Division plans to expand the referral audit model of Khon Kaen Regional Hospital to other hospitals.

5. Based on the structure of Accident Control Project in Khon Kaen, Rural Hospital Division has submitted Emergency and Trauma Service System Development at regional and general hospitals to the 8th National Social and Economic Development Plan.

*Prospect for the Future*

Khon Kaen Regional Hospital initiated Trauma Prevention and Control Project in Khon Kaen in 1989. In the past 9 years, it has contributed to the improvement of medical care of trauma patients in community hospitals and the development of referral system of trauma patients among hospitals under Ministry of Public Health in Khon Kaen. Project also successfully involved various other non-medical sectors to prevent traffic accidents. The intersectorial approach consequently contributed to the decrease of the number of trauma patients. For example, the number of injured patients due to traffic accident in Khon Kaen Municipal area admitted to Khon Kaen Regional Hospital in 1996 decreased from 1995 for 955 cases or 31.6 per cent. The number of motorcycle accident patients in municipal area admitted to Khon Kaen Regional Hospital in 1996 also decreased from 1995 for 872 cases or 34.4 per cent. Its success led to enactment of the law that obliges the motorcycle riders to wear anti-knock helmet in 1996. Yet, the number of injured and dead person due to accidents is still high in Khon Kaen Municipality as well as in the areas outside Khon Kaen Municipality. Thus, more efforts are needed to improve the system of trauma prevention and control.

Khon Kaen Regional Hospital has the following short-term objectives in trauma prevention and control:

1. To improve the output of Trauma Registry system and make the format of report conform to the report of Epidemiology Division, Ministry of Public Health.

2. To make the report of trauma situation and major trauma data and present the report to the involved bodies regularly.

3. To improve the quality of trauma care by conducting trauma audit and quality hospital care.

4. To develop 2-year course for Level 2 EMTs.

5. To promote and evaluate the result of pre-



hospital care implementation.

6. To strengthen the quality of trauma care services in community and general hospitals.

7. To create annual plan of trauma Control and Prevention Campaign of Provincial Safety Committee and the plan of other subcommittees.

The long-term objectives are to effectively manage trauma care system which consist of total trauma care (pre-hospital care, hospital care and rehabilitation) of Khon Kaen Regional Hospital and of community hospitals and to effectively manage trauma prevention system. In 1997, Trauma Complex Project was launched in Khon Kaen. Trauma Center will be constructed at Khon Kaen Regional Hospital and is planned to have the following functions:

- a. Integrated trauma service,
- b. Ambulance station,
- c. Command-control center,

d. Emergency training center,

e. Injury research center.

Trauma center will be the multipurpose function center to deal with the trauma problems and lack of skillful personnel. The Center is planned to be in operation from the year 2000. Trauma Center is expected to be the center of activities to achieve the short-term as well as long-term objectives in trauma prevention and control in Khon Kaen Province.

National Safety Committee has recently requested Khon Kaen Regional Hospital to explore the possibility of extending the model of trauma care system in Khon Kaen to nationwide implementation. Thus, Khon Kaen Regional Hospital will try to disseminate the experiences in Khon Kaen in terms of trauma care system development to support other provinces to develop their trauma care system.

#### **Annex 1** The members of Provincial Safety Committee.

1. Provincial Governor	<i>Chairman</i>
2. Director of Khon Kaen University	<i>Vice-chairman</i>
3. Deputy Provincial Governor	<i>Vice-chairman</i>
4. Undersecretary of the Office of the Governor	<i>Member</i>
5. Commander of Khon Kaen Provincial Police Station	<i>Member</i>
6. Chief of Khon Kaen Provincial Administration Office	<i>Member</i>
7. Chief of Officer of Provincial Community Development Office	<i>Member</i>
8. Chief of Officer of Provincial Public Works Office	<i>Member</i>
9. Chief Officer of Provincial Accelerated Rural Development Office	<i>Member</i>
10. Chief Officer of Provincial Education Office	<i>Member</i>
11. Chief Officer of Khon Kaen Highway District	<i>Member</i>
12. Chief Officer of Khon Kaen Provincial Transportation Office	<i>Member</i>
13. Lord Mayor of all Municipalities in Khon Kaen Province	<i>Member</i>
14. Director of Khon Kaen Public Relation Center Region 1	<i>Member</i>
15. Director of Khon Kaen Provincial Electricity Authority	<i>Member</i>
16. Superintendent of Highway Police Department	<i>Member</i>
17. Chief Engineer of Khon Kaen State Railway	<i>Member</i>
18. Director of Srinagarind Hospital	<i>Member</i>
19. Director of Khon Kaen Regional Hospital	<i>Member</i>
20. Chief Officer of Khon Kaen Provincial Labour Protection and Welfare Office	<i>Member</i>
21. Chief Officer of Khon Kaen Provincial Town and County Planning Office	<i>Member</i>
22. Provincial Chief Medical Officer, Khon Kaen Provincial Health Officer	<i>Member &amp; Secretary</i>
23. Chief of Project and Planning Department, Khon Kaen Provincial Administration Office	<i>Member &amp; Assistant Secretary</i>
24. Provincial Deputy Medical officer, Khon Kaen Provincial Health Office	<i>Member &amp; Assistant Secretary</i>
25. Chief of Academic Department, Khon Kaen Regional Hospital	<i>Member &amp; Assistant Secretary</i>

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