The THAI Journal of SURGERY 2004; 25:115-120.
Official Publication of the Royal College of Surgeons of Thailand

Pre Hospital Care System, Khon Kaen Model (1994 - 2004)

Witaya Chadbunchachai, MD
WHO Collaborating Center on Injury Prevention and Safety Promotion
Trauma and Critical Care Center, Khon Kaen Regional Hospital, Khon Kaen

Abstract

Background: **The aims of care for victims of accident and emergency are to avoid preventable death and disabilities. Studies worldwide have shown that death could be prevented in many cases that die before reaching the hospital. Many complications resulting in disabilities could also be prevented with good pre hospital care. Pre hospital care system are much well developed in all developed countries but much less developed in Thailand.**

Objective: **To develop an effective pilot model of pre hospital care system in Khon Kaen Province and to advocate the necessity of pre hospital care system in Thailand.**

Meterials and Methods: **Model development by setting up organization structure, provincial wide command control center in Khon Kaen hospital together with extensive campaign through public media, recruting and developing qualified personnel. Setting up ambulance standard, pre hospital care network and zoning, setting up rules and regulations and software program to monitor the system. Multiple seminars, lectures were held.**

Results: **A well developed pre hospital care model has been established in Khon Kaen province. In the year 2003, 28 ambulance stations had been set up provincial wide. 140 pre hospital care nurses had been trained, 98 EMT had been produced, and thousands of volunteers had been trained. Ambulance missions had been progressively increased every year. In 2003, there were more than 7,000 missions. 89% of the ambulance missions left the hospital within 1 minute after the call and 80% of the ambulance missions reached the scene within 10 minutes. The quality of critical care run by personnel had progressively improved. Four National Seminars were held in 1999, 2000, 2001, and 2002.**

Conclusions: **Pre hospital care system is one of the major components in inclusinve trauma care system. This system is still much less developed in Thailand. Khon Kaen province has developed the pilot project of pre hospital care model since 1994 and has resulted in well developed system provincial wide and it is promising that all accident and emergency in the province would be well covered and people in Khon Kaen are well accessible to this system. The next step of countrywide generalization required more complicated, multisector collaboration, master plan establishment, financial consideration and strong political commitment.**

BACKGROUND

WHO had studied the global situation of pre hospital care system and reported that 60-80 per cent of mortality from injury occurred before the patient reached the hospital. There were obvious differences in mortality from injury between developed and developing countries (Table 1).

The transportation of patients from scene to hospital in the developing countries was still much less effective which resulted in high mortality rate (Table 2) and 15-20 per cent of mortality from injury in developing countries were preventable. Effective pre hospital care system is an important component in the reduction of mortality and this system will be an important turning point for improving the result of treatment of the critically ill patient.

WHO had recommended the following principles for developing the pre hospital care. It should be incorporated into one of the component of inclusive

Table 1 Comparison of mortality rate from injury between developed and developing countries

	No of Death	Pre Hospital	ER	Hospital
Kumasi - Ghana	348	81%	5%	14%
Mongowee - Mexico	300	72%	21%	7%
Seattle - USA	187	59%	18%	23%

1998 - Charles Mock

Table 2 Time spent for transferring the patient to the hospital

	Time spent before reaching the hospital (min)	% of patient reached the hospital within 1 hour	% of patient transferred with ambulance
Kumasi - Ghana	102	50	0
Mongowee - Mexico	73	55	94
Seattle - USA	31	99.5	94

1998 - Charles Mock

trauma system which should have close relation with hospital care and prevention. The work plan in this system should also be done by multisector and multidisciplinary parties. The major principles in developing this system may be similar worldwide, but the details may be different depending on each geographic area. It is not necessary to invest high cost technology. Simple, cheap method may be effective. It should be accepted by community and community participation is required.

WHO had also raised the following achievement for the setting of this system. Mortality rate from injury and critical illness should be reduced. Morbidity should also be reduced. The physical and mental suffering of the patients and families would be reduced and the burden of health personnel and health facilities would be finally reduced.

The Situation of Pre Hospital Care System in Thailand

Data from injury surveillance system of the Department of Epidemiology, MoPH, collected from 14 regional hospitals in 1999 had shown that 0.1-18.4 per cent of the injured patients had been transferred to the hospitals by volunteer, 0.1-7.4 per cent of these patients were transferred by hospital EMS and 81.3-99.7 per cent of the patients came to hospitals by themselves or bystanders.

At present, when facing with traffic injury especially at night on the quiet street, not so many people have the courage to help the victim due to so many reasons especially the safety of the rescuer. At times, people or villager nearby at the site of the accident would collect the properties of the victim first before helping the victim. The volunteers, whose organizations are foundations and are normally found in every province are main personnel in most provinces who act as the rescuer and first responder for victim from traffic injuries. Unfortunately, most of these volunteers are not very skillful, some have poor attitudes and no formal organization in the country control the performance of these volunteers. It is not more than 10 years that the government has realized the necessities of developing a pre hospital care system in Thailand. These evidences confirmed the ineffectiveness of the system in Thailand.

Objectives

To develop an effective pilot model of pre hospital care system in Khon Kaen Province and to advocate the necessity of pre hospital care system in Thailand to the government officials.

Material and Methods

Model Development

The Emergency Medical Service Committee, Khon Kaen Province, has been established since November 1992 and first Emergency Medical Unit was open for service on 11th February 1994 in Khon Kaen Hospital. The system has been developed from a very basic structure to more and more complicated system until now. The structure of the framework in the development system composed of system administration, personnel, ambulance and communication.

System administration Khon Kaen Province has set up Provincial Board for Emergency Medical Service which composed of Administrative Board for Emergency Medical Service with the Governor as the chairman, Board for Emergency Medical Service Office with the Provincial Chief Medical Officer as the chairman and Board for Command Control Center with Khon Kaen Hospital Director as the chairman.

These boards are responsible to set up provincial rules and regulation for emergency medical service. These rules and regulation were announced by the Governor since 1998 and covered 3 areas; the personnel, the ambulance and the regulation to control the activities of personnel.

The financial administration The pre hospital care system in Khon Kaen had been financed by Bureau for Emergency Medical Service, MoPH, which was supported by National Health Security Office. The budget was divided into 2 parts; budget for service fee and budget for administration (Communication, HRD and administration and public relations).

Zoning In 1998 there was an agreement to set up zoning in the municipality and in 2001 there was an agreement to set up zoning for the entire province.

Public relations There were extensive campaigns through every media in the province to help the people to understand the system and know how to get access to the system.

The human resource development There are 3 levels of personnel; nurse paramedics, emergency technician and first responders. Khon Kaen had set up the following training program to produce all 3 level of personnel. The training curricurum for nurse paramedic adopted from Bureau for Emergency Medical Service. Training curriculum for Emergency Medical Technician developed by Khon Kaen Hospital, Khon Kaen Provincial Health Office and Pra Borom Raj Chanok Institute. This 2-year program started since 1996. It is now extended to other 4 colleges in the country and produces more than 100 EMT a year. Training curriculum for first responders focused on volunteers and drivers.

Trauma Center, Khon Kaen Hospital had set up a Training Center to provide training for these programs.

Apart from these 3 major training programs, Khon kaen had also produced several activities which included training in BLS, training in ACLS, annual academic meeting, weekly and monthly conference of EMT, production of several items of books, guidelines, reports, supervision program, study tour, etc.

Khon Kaen Model also set up standard for practice and system for evaluation.

Personnel In order to standardize the practice of personnel, several guidelines and consensus had been set up which included job description for every level of personnel, guidelines for recording the activities during mission, working guidelines when the ambulance get accident, guidelines for practice of personnel during mission, the uniform of the personnel, guidelines for communication during transfer of the patients, guidelines for monthly report, etc.

Ambulance In order to standardize the ambulance service, guidelines for ambulance had been set up which included guidelines for grading the ambulance, guidelines for daily check up of the equipment in ambulance, guidelines for maintenance of the ambulance, and guidelines for insurance of the ambulance.

Communication Command Control Center has been established since 1994 in Khon Kaen Hospital. All modes of communication facilities have been provided which include 6 direct telephone lines which show the calling number and are sound recorded, telefax and radio communication.

The center offers 24-hours service with 2 personnel on duty in each 8-hour shift with one doctor on duty as consultant.

RESULTS

There were 34 ambulance stations in 20 districts distributed throughout the province. There were 402 nurse paramedic, 37 EMT, 48 technical nurses, 564 volunteers and 80 ambulances.

There were several training courses as shown in Table 3.

Ambulance services were shown in Table 4. In 1994 there were only 114 missions and in 2003 the mission had progressively increased to 7,835.

Traffic injured patients were transported from scene in Khon Kaen municipality. In 2003, 54.03 per cent of the traffic injured patients were transported to the hospital by the set up system which mean that the coverage of traffic injured patient were more than 50 per cent (Table 5).

Table 3 Training courses held by Trauma Center during 2000 - 2003

	Basic Course		Advanced Course	
	No. of courses	No. of participants	No. of courses	No. of participants
2000	39	1,043	5	114
2001	40	943	6	354
2002	45	1,160	5	152
2003	15	295	4	308

Table 4 Ambulance mission in Khon Kaen province

	KKH	VR	KKU	Distr	Private	Total
1994	114	-	-	-	-	114
1995	184	-	-	-	-	184
1996	319	-	-	-	-	319
1997	912	966	-	-	-	1878
1998	941	899	35	57	-	1932
1999	1221	639	85	84	-	2029
2000	1808	532	134	105	-	2579
2001	2266	778	287	129	-	3460
2002	3084	656	471	532	-	4743
2003	3255	1790	1154	1573	63	7835

Table 5 The transportation of the patient from scene

	2002 (%)	2003 (%)
EMT	29.68	28.55
Volunteer	12.55	25.48
Police	1.1	0.99
By stander	56.67	44.99

Table 6 Sources of call, 2003

Source	%
Police	7.25
1669	70.89
Radio	2.22
District Hospital	19.63

Sources of call to command control center in Khon Kaen province In 2003, 70.89 per cent of calls to command control center were from 1669 (Table 6).

Time spent between call and dispatch of ambulance In 2003, in 83.9 per cent of the mission, the ambulances dispatched from the hospital within 1 minute after the call (Table 7).

Time to scene after call In 2003, 91.1 per cent of the missions from Khon Kaen Hospital took 10 minutes after call to reach the scene (Table 8).

Types of patients About 50 per cent of the patients taken care by the ambulances were from

Table 7 Time spent between dispatch and receiving call

Minute (s) after call	Number of mission	%
1	2264	83.9
2	330	12.2
3	62	2.3
4	12	0.4
5	7	0.3
6-10	19	0.7
>10	6	0.2
Total	**2700**	**100**

Table 8 Time to scene after call

Time spent	Number of mission	%
0-10	2,129	91.1
11-20	178	7.6
>20	30	1.3
Total	**2,337**	**100**

Table 9 Types of patients

	2001		2002		2003	
	No	%	No	%	No	%
Traffic injuries	1,016	48.2	1,398	53.6	1,225	45.9
Other injuries	181	8.6	259	9.9	338	12.7
Emergency	906	41.2	955	36.5	1,103	41.4
Total	**2,103**	**100**	**2,612**	**100**	**2,666**	**100**

Table 10 Severity of the patients

	2000		2001		2002		2003	
	No	%	No	%	No	%	No	%
Non Urgent	880	54.6	1,101	52.3	1,414	54.1	1,418	53.2
Urgent	596	36.9	870	414	1,022	39.1	1,063	39.9
Emergent	137	8.4	132	6.3	176	6.8	185	6.9
Total	**1,613**	**100**	**2,103**	**100**	**2,612**	**100**	**2,666**	**100**

Table 11 Quality of Care provided by EMT

		Airway	Control of bleeding	Splinting	IV Fluid
Appropriate	1997	30.2	28.3	30.8	37.7
	1998	33.3	37.2	50.0	37.0
	1999	70.0	45.5	67.1	23.7
	2000	68.3	64.0	80.1	22.7
	2001	60.6	61.3	76.5	32.3
	2002	92.3	86.0	93.2	76.7
	2003	95.3	90.6	93.4	74.1
Inappropriate	1997	7.0	22.5	7.7	1.4
	1998	11.1	15.4	6.7	1.9
	1999	0.0	14.7	9.1	0.0
	2000	4.9	12.0	3.4	4.6
	2001	5.3	5.5	2.8	0.8
	2002	0.0	2.6	0.4	0.0
	2003	1.6	1.2	2.0	3.7
Not done but needed	1997	62.8	54.3	61.5	60.9
	1998	55.6	47.4	43.3	61.1
	1999	30.0	39.8	23.7	77.3
	2000	26.8	24.0	16.1	72.7
	2001	34.0	33.3	20.7	66.9
	2002	7.8	11.9	6.5	22.5
	2003	3.1	8.3	4.6	22.2

traffic injury. The second most common type of patient was emergency patient (Table 9).

Severity of the patients About 7 per cent of the patients were emergency patient (Table 10).

The performance of personnel

Care provided by EMT It was shown that the performance of EMT had progressively improved (Table 11).

Care provided by volunteer Like EMT, the performance of volunteers had also much improved (Table 12).

The Unit Cost of EMS Khon Kaen Hospital 2002 (in Baht) is shown in Table 13.

The advocacy Trauma and critical care center had played major role in advocating the necessity of pre hospital care system in Thailand to the public and the government through varieties of activity. During 2000-2003 these included publishing and distributing 60 reports, giving 83 lectures in the field, hosting 56 groups of visitors and holding 4 national seminars on EMS in 1999, 2000, 2001 and 2003.

Innovation produced by Khon Kaen Model included provincial rules and regulation announced by local government, zoning and networking system, provincial Command Control Center, EMS training center, 2-year EMT training curriculum, EMS unit cost analysis, EMT textbook, EMS guidelines in many areas, and EMS monitoring system.

Conclusions

Pre hospital care system is one of the major component in inclusive trauma care system. This system is still much less developed in Thailand. In

Table 12 Quality of care provided by volunteer

		Airway	Stop bleeding	Splint	IV Fluid
Appropriate	1997	0.0	2.5	9.5	0.0
	1998	0.0	5.5	9.4	0.0
	1999	9.0	13.2	27.4	0.0
	2000	0.0	12.4	24.6	0.0
	2001	0.0	16.3	27.5	0.0
	2002	12.2	31.7	53.9	0.0
	2003	25.0	51.7	66.3	0.0
Inappropriate	1997	7.2	6.0	9.0	0.0
	1998	5.3	7.5	14.4	0.0
	1999	0.0	9.2	7.2	0.0
	2000	0.0	8.6	16.0	0.0
	2001	5.4	7.9	12.0	0.0
	2002	0.0	5.5	3.9	0.0
	2003	0.0	6.2	9.5	0.0
No but need	1997	92.8	91.5	81.5	100.0
	1998	91.0	77.3	65.4	100.0
	1999	91.0	77.2	65.4	100.0
	2000	100.0	79.0	59.4	100.0
	2001	94.6	75.9	60.1	100.0
	2002	82.4	62.8	42.1	100.0
	2003	75.0	42.2	24.1	100.0

Table 13 Unit cost analysis of EMS mission (in Baht)

	Average cost	Emergent	Urgent	Non-urgent
October (No)	(194)	(13)	(73)	(108)
Cost/mission	442.6	407.1	378.0	401.1
Cost/Km.	97.3	79.0	87.6	114.6
Cost/min	-	21.0	21.1	21.1
November (No)	(195)	(14)	(81)	(100)
Cost/mission	376.1	507.9	430.3	224.5
Cost/Km.	89.5	79.0	106.9	73.6
Cost/min	-	23.2	23.2	23.5
December (No)	(255)	(18)	(79)	(158)
Cost/mission	307.4	290.1	292.7	250.5
Cost/Km.	70.1	53.8	64.0	83.0
Cost/min	-	15.4	15.3	15.3

Khon Kaen Province, the pilot project of pre hospital care model has been developed since 1994 and resulted in well developed system provincewide. The next step of countrywide generalization requires more complicated multi-sectorial collaboration, master plan establishment, financial consideration and strong political commitment.

Acknowledgment

The author wishes to thank the Director of Khon Kaen Hospital for his kind support and promotion of report presentation at national and international level.

REFERENCES

1. Lormand J D. Early trauma care. Hand-out of presentation at WHO-SEARO meeting on Pre Hospital Care, Ahmedabad, India 2-4 July 2003.
2. Tipsuntornsak N, Chadbunchachai W, Tangkunboriboon S. Process in developing pre hospital care system. Khon Kaen: Khon Kaen Press; 2000.
3. Karnchanasut S. Hand-out in Academic Conference for Emergency Medical Service System Organized by Sirinthorn Health College and Khon Kaen Trauma and Critical Care Center, Charoenthani Hotel, 27-29 August 2003.
4. Annual Report of Directorate Board Meeting. The Project for Development of Trauma Center Complex. 2003.
5. Annual Report of The evaluation for the performance of pre hospital care activities of Khon Kaen Hospital. 2001-2003.