

## Capability of Emergency Medical Service Response Teams at Khon Kaen, Thailand

<sup>1</sup>Ounjai Kruesathit, <sup>2</sup>Malinee Laopaiboon and <sup>3</sup>Witaya Chadbunchachai

<sup>1</sup>Department of Emergency Medical Technician, Sirindhorn College of Public Health,  
Khon Kaen 90/1 Anamai Road, Muang District, 40000 Khon Kaen, Thailand

<sup>2</sup>Department of Biostatistics and Demography, Faculty of Public Health,  
Khon Kaen University, 40002 Khon Kaen, Thailand

<sup>3</sup>Trauma and Critical Care Centre, Khon Kaen Regional Hospital 54-56 SriChan Road,  
Muang District, 40000 Khon Kaen, Thailand

---

**Abstract:** To describe capability of response team provided vital care to patients and characteristic of EMS case. A descriptive study was done to describe capability of response team providing care among EMS patients from March 1 through August 31, 2009. EMS operation data was extracted from the database in November 2009. A total of 37,042 EMS case were analysed. The most of response team was BLS care as 95.5% (23.9% BLS and 71.6% FR team). The most of case was the urgent as 61.0% (95% CI 60.5-61.5%) and emergent as 8.0% (95% CI 7.7-8.3%). Capability of all teams on the airway and breathing, circulation control, immobilization and lifting and moving for patients were appropriate rate within team's competency of 83.4-100%. Capability in vital care of all EMS response teams in Khon Kaen, Thailand was highly appropriate rate within team competency. The most of response team was BLS care. Thus, the BLS care team should well train in essential skills to care for critical patient.

**Key words:** Capability, response team, EMS, medical, emergency, Thailand

---

### INTRODUCTION

Statistics of the World Health Organization indicate that 70% of all deaths are due to non-communicable diseases and this will increase for 40% for all global death up to 2030. A major problem in this aspect is the increase of deaths from road traffic accidents (WHO, 2007). In this situation an effective Emergency Medical Service (EMS) can improve the consequence of injury, reduce mortality related to accidents and other emergency situations by 30% (Sasser *et al.*, 2006; Trauma and Critical Care Center, 2005). The mission for EMS services is not only to prevent injuries but also mitigating their consequences and be instrumental enhancing the quality of life of people further on by avoiding as much as possible that the patients within an emergency situation will suffer from disabilities later (Sasser *et al.*, 2005). It provides appropriately care to patients with life threatening caused by trauma and other serious conditions and move them to the next suitable medical facilities when needed (Ely *et al.*, 2006).

Thailand has established EMS care in 1994 by adapting the concept of the Anglo-American EMS Model

which uses hospital-based services. EMS teams come along in 4 categories of team and each of them has at least 3 staff including the ambulance driver who is usually trained as First Responder (FR). The Advanced Life Support (ALS) team includes the service of a medical doctor or nurse and an Emergency Medical Technician-Intermediate (EMT-I) and a FR. The Intermediate Life Support (ILS) team includes 2 EMT-I and a FR and the Basic Life Support (BLS) team consist of 1-2 persons with EMT-Basic training and a FR while the FR teams made up of 2-3 FR. The teams' competence depends on their qualification.

The importance of the professional medical is help to patients in need for survival. The basic procedure for EMS operations advises all the teams to specially assess and assure that airways are not obstructed (A), breathing is possible (B) and blood circulation is maintained (C) (Chadbunchachai *et al.*, 2004, 2005). In addition of immobilization and lifting and moving to transporting the patients in a careful way is a necessity as well. All of response teams have to administrate the vital procedure to case during EMS operation process (Emergency Medical Institute of Thailand, 2010) (Table 1).

Table 1: Capability of EMS response teams for care and management

| Capability of EMS response teams to care and management relate to competency of teams |  |   |   |  |
|---|--|---|---|--|
| Patients' need and initial deficit  | ALS  | ILS   | BLS   | FR   |
| Airway (A)  | Suction by machine<br>Open airway by head<br>tilt chin lift and Jaw thrust<br>On oro/naso pharyngeal airway<br>Intubation by ET tube | Suction by machine<br>Open airway by head<br>tilt chin lift and jaw thrust<br>On oropharyngeal airway | Suction by machine<br>Open airway by head<br>tilt chin lift and jaw thrust<br>On oropharyngeal airway | Suction by syringe ball<br>Open airway by head<br>tilt chin lift |
| Breathing (B)   | Give oxygen by cannula/mask/<br>ambu bag/ ET tube  | Give oxygen by cannula/mask/<br>ambu bag  | Give oxygen by cannula/mask/<br>ambu bag  | Use pocket mask  |
| Circulation (C)   | Stop bleeding<br>Give IV fluid<br>Basic and advanced CPR<br>Defibrillation<br>Give medication<br>EKG monitor                         | Stop bleeding<br>Give IV fluid<br>Basic CPR<br>Assist to perform advanced CPR<br>EKG monitor          | Stop bleeding<br>Basic CPR<br>-   | Stop bleeding<br>Basic CPR<br>-                                  |
| Immobilization  | On cervical hard collar<br>Splint and slab<br>Helmet removal   | On cervical hard collar<br>Splint and slab<br>Helmet removal  | On cervical hard collar<br>Splint and slab<br>Helmet removal  | On cervical hard collar<br>Splint and slab<br>Helmet removal     |
| Moving and equipment  | Ambulate Pt./<br>LSB/scoop/KED   | Ambulate Pt./<br>LSB/scoop/KED  | Ambulate Pt./<br>LSB/scoop  | Ambulate Pt./<br>LSB/scoop                                       |

ILS = Intermediate Life Support team; FR = First Responder team; CPR = Cardiopulmonary Resuscitation; LSB = Long Spinal Board; EKG = Electrocardiography; KED = Kendrick Extrication Device

The capability of EMS response teams is related to many aspects. A study of Moore (1999) stated that there are no universally accepted methods for measuring the capability of EMS response teams. Some studies assessed the survival of patients in view of the benefit of ALS vs. BLS care (Isenberg and Bissell, 2005). Other investigations explored the role of the EMS personnel (Cone *et al.*, 2007). In case the competency of the EMS teams is sufficient, their actions will gain optimal results. The EMS in Thailand aims to provide quality emergency care following a global standard and treat all the patients according to their needs equally (Committee of Emergency Medical Institute of Thailand, 2010). In the situation of rare and unclear evidence about capability of EMS teams, a different level of care and mainly in BLS care. Researchers studied the capability of teams providing vital care for patients and the characteristic of EMS cases at Khon Kaen where the first EMS unit was established and leads the field in EMS development in Thailand.

**MATERIALS AND METHODS**

**Study design and population:** A descriptive research was done among EMS patient from March 1 through August 31, 2009. The study population was cases that alarmed medical aid to Khon Kaen dispatch center and responded by EMS team. The exclusion criterions were: insufficient information to evaluate the result of the EMS activities; cases were treatment and transfer was not required, case cancelled by the dispatch center, cases that the team could not locate and dead persons on scene or arrival (DOA) as well as those refusing treatment. Error result of evaluation of vital procedure; no evaluation at all and incomplete evaluation by the ED team.

The response team assessed, cared and managed the patients according to their needs by following the standard basic EMS protocol. The results of teams' care were evaluated whether they were appropriate by the ED team. The content of EMS operation was done data entry into database by the staff of Khon Kaen EMS center. Khon Kaen province covers approximately 10,886 km<sup>2</sup> with a population of approximately 1.75 million. There were 266 EMS response teams; 25 ALS, 22 ILS, 105 BLS and 114 FR teams. The standard basic EMS protocol stated the competency of team depend on capacity of the leader team and all of teams' competency have to care for airway and breathing, circulation control, immobilization and lifting and moving of patient. This study was approved by The Ethics and Research Institutional Review Board of the Khon Kaen University.

**Outcome measure:** The primary outcome was capability of team. It was defined as cares and manages the patient within team's competency upon the airway and breathing circulation; bleeding control and intra venous infusion, immobilization and lifting and moving. The capability of team on vital care classified into 2 types as appropriated and inappropriate care; patient was not cared even need and done with inappropriate.

**Data collection:** EMS operation form data was extracted from the EMS database at the 11th and 12th EMS information technology center in November 2009. Data included of the characteristic of EMS case, level of response team, medical priority of patient at ED,

procedure was done by team and the result of evaluation of team providing care by ED team. Data were checked for completeness and evaluated before analysis.

Researchers studied validity of EMS reports and conducted a pilot study in September 2008 by observing and interviewing. EMS operation form as filled in by the EMS response teams included the ED triage by nurses at the hospital. The EMS response teams were observed while transferring a patient to the hospital ED. Hospital ED nurses, in a regional and four community hospitals were interviewed. The finding was that the staff of the EMS response team could correctly write their reports using a check box list. They could also accurately use a numeric form to evaluate living patients on a scene. The staff of Khon Kaen EMS center were experienced and specially trained to enter the data into the online report for >4 years. In addition, nurses from five hospitals were observed during deciding about the ED triage. The forms were corrected if necessary according to the report of the ED triage. However, researchers were not able to study the validity of the report of the EMS teams about the true condition of a patient.

**Statistical analysis:** Frequency and 95% Confidence Interval (CI) were used to describe the capability of EMS response teams, characteristics of the emergency cases. Frequencies and percentage were used to describe characteristics of the EMS operation, procedures and its appropriateness. The STATA Version 10 was used for statistical analysis.

## RESULTS AND DISCUSSION

There were 41,802 EMS cases recorded at Khon Kaen during March 1 through August 31, 2009. Excluded were 1,983 cases because suitable information was not available in order to evaluate the EMS operation and records about 2,777 cases were error. A total of 37,042 cases with complete information were available and analyzed (Fig. 1).

**Characteristic and demand for care of EMS case:** BLS was the service provided most for 95.5% of cases, of which FR and BLS accounted for 71.6% (95% CI 71.2-72.1%) and 23.9% (95% CI 23.5-24.3%), respectively. About 80% of cases (95% CI 79.6-80.4%) had illnesses with non trauma, 8.0% of cases (95% CI 7.7-8.3%) needed ALS care which the ALS team responded only 3.8% (95% CI 3.6-4.0%). The most of EMS case was the urgent to care, of which 61.0% of cases (95% CI 60.5-61.5%) needed

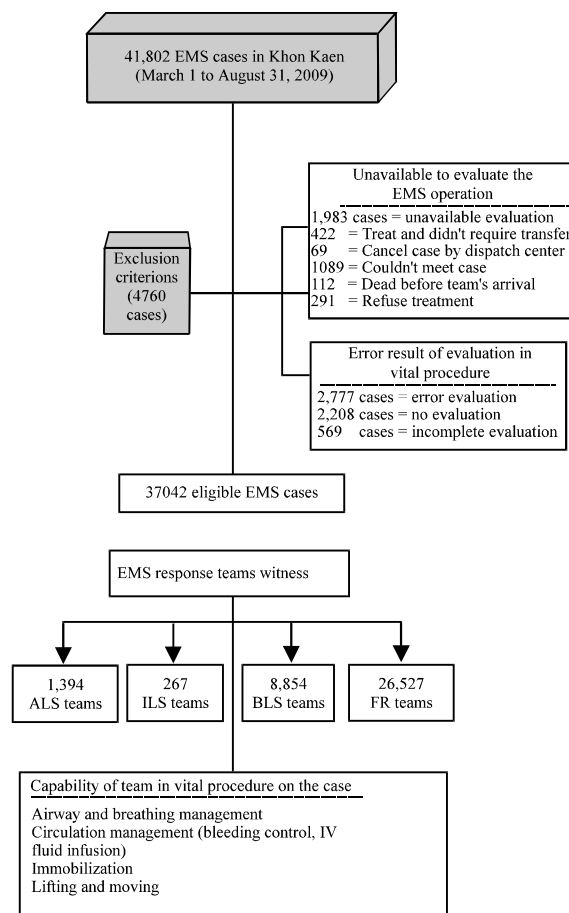


Fig. 1: Data flow of study

ILS care while the ILS team responded only 0.7% of cases (95% CI 0.65-0.8%) and 12.2% of EMS cases was not done triage at ED (Table 2).

### Procedure was done on scene by the EMS response team:

The most often applied vital procedure was related to administering oxygen for 4.7% of patients, 7.5% had been treated for bleeding by wound dressing, immobilization by using a long spinal board was necessary in 2.9% of cases, lifting and moving had been done for 42.5% of cases and another procedure such as keeping the patient warm was necessary for 25.4% of cases (Table 3).

### Capability to provide vital care by the EMS response teams:

There are 4 different levels of response teams allocated to 25 ED in hospitals throughout Khon Kaen. The result of their care and management on patient was evaluated by the ED team. The evaluators were for 1.9% physicians, for 74.1% nurses, for 12.3% EMT-I and for 11.7% personnel not specified. The care provided within

Table 2: Characteristics and EMS care demand

| Characteristics and demand care of EMS cases | Number | Percentage (95% CI) |
|--|--------|---------------------|
| <b>EMS response teams</b>                    |        |                     |
| FR   | 26,527 | 71.6 (71.2-72.1)    |
| BLS  | 8,854  | 23.9 (23.5-24.3)    |
| ILS  | 267    | 0.7 (0.6-0.8)       |
| ALS  | 1,394  | 3.8 (3.6-4.0)       |
| <b>Type of illness</b>                       |        |                     |
| Non trauma                                   | 29,640 | 80.0 (79.6-80.4)    |
| <b>Trauma</b>                                |        |                     |
| Traffic accident                             | 4,010  | 10.8 (10.5-11.1)    |
| Non traffic accident                         | 3,392  | 9.2 (8.9-9.5)       |
| <b>Demand care of EMS case at ER</b>         |        |                     |
| BLS care demand (Urgent)                     | 22,588 | 61.0 (60.5-61.5)    |
| BLS care demand (Non urgent)                 | 6,950  | 18.8 (18.4-19.2)    |
| ALS care demand (Emergent)                   | 2,959  | 8.0 (7.7-8.3)       |
| Did not perform triaging at ED               | 4,517  | 12.2 (11.9-12.5)    |
| Unavailable to do ED triage                  | 28     | 0.07 (0.05-0.10)    |

N = 37,042 cases; ED = Emergency Department

Table 3: Procedure at scene to cases

| Procedure at scene                                 | n      | Percentage |
|--|--------|------------|
| <b>Procedure of airway management</b>              |        |            |
| Oxygen administration                              | 1,736  | 4.7        |
| Breathing assist by pocket mask or mouth to mouth  | 247    | 0.7        |
| Breathing assist by AMBU bag with mask             | 195    | 0.5        |
| Suction  | 180    | 0.5        |
| Mouth gag insertion                                | 89     | 0.2        |
| ET tube insertion                                  | 25     | 0.1        |
| <b>Procedure of circulation management</b>         |        |            |
| Dressing wound                                     | 2,781  | 7.5        |
| Manual pressure or pressure dressing               | 1264   | 3.4        |
| IV fluid administration (NSS, 5%DN/2, RLS, Acetar) | 733    | 2.0        |
| Others for bleeding control                        | 46     | 0.1        |
| <b>Procedure of immobilization management</b>      |        |            |
| LSB as splinting                                   | 1,074  | 2.9        |
| Splint/Slab  | 736    | 2.0        |
| Cervical hard collar                               | 490    | 1.3        |
| Vacuum splint                                      | 214    | 0.6        |
| <b>Procedure of lifting and moving</b>             |        |            |
| Ambulate patient                                   | 15,759 | 42.5       |
| Stair chair/Chair                                  | 4,618  | 12.5       |
| Long spinal board                                  | 3,141  | 8.5        |
| Scoop  | 1,997  | 5.4        |
| Another device                                     | 1,731  | 4.7        |
| <b>Another procedure for caring</b>                |        |            |
| Keeping warm                                       | 9,417  | 25.4       |
| Clean body/Decontamination                         | 86     | 0.2        |

N = 37,042 cases

team competency on the airway and breathing, bleeding control, intra venous fluid infusion, immobilization and lifting and moving from all teams regardless of their levels was highly appropriate for 83.4-100.0% (Table 4).

The finding from 37,042 completed cases showed that the capability of all levels of the EMS response teams related to vital care was highly appropriate (83.4-100.0%). All teams responded to their duties according to their competency. Measures for vital care does not require complex skills when it comes to oxygen administration, using pocket mask or AMBU bags, dressing wounds, using a long spinal board for splinting and caring for ambulant patients. All EMS personnel at all levels of care

Table 4: Capability of EMS response teams in vital care to patient

| Procedures                                  | Level of team | Appropriate care on vital care |       |             |
|---|---------------|--------------------------------|-------|-------------|
|   |               | n                              | %     | 95% CI      |
| Airway and breathing management             | ALS           | 1,139                          | 98.7  | (97.9-99.3) |
|   | ILS           | 198                            | 99.5  | (97.2-100)  |
|   | BLS           | 4,262                          | 98.9  | (98.6-99.2) |
| Circulation management of bleeding control  | FR            | 6,022                          | 91.3  | (90.6-92.0) |
|   | ALS           | 333                            | 96.2  | (93.7-98.0) |
|   | ILS           | 44                             | 91.7  | (80.0-97.7) |
| Circulation management of IV fluid infusion | BLS           | 1,224                          | 94.7  | (93.3-95.8) |
|   | FR            | 1,957                          | 86.2  | (84.7-87.6) |
|   | ALS           | 712                            | 96.1  | (94.4-97.4) |
| Immobilization management                   | ILS           | 68                             | 85.0  | (75.3-92.0) |
|   | ALS           | 358                            | 97.5  | (95.4-98.9) |
|   | ILS           | 51                             | 92.7  | (84.4-98.0) |
| Lifting and moving                          | BLS           | 912                            | 91.2  | (89.3-92.9) |
|   | FR            | 1,220                          | 83.4  | (81.4-85.3) |
|   | ALS           | 1,039                          | 99.1  | (98.4-99.6) |
|   | ILS           | 187                            | 100.0 | (98.0-100)  |
|   | BLS           | 4,284                          | 98.6  | (98.3-99.0) |
|   | FR            | 7,610                          | 96.5  | (96.0-96.9) |

were trained before becoming a staff of a response team. Thus, it can be expected that they have sufficient competence. Moreover, lifting and moving was the most appropriate care for 96.5-100%. More complex skills such as giving intra venous infusion, only ALS and ILS teams are required to have that ability. All EMS staff was well educated and underwent field practice during their training and their studies so that competency should be assured. It should be noted however that FR had deficits in properly immobilize patients.

The demand for ALS care was 8% while the previous studies estimated 3-10% (Schmidt *et al.*, 2000; Hjalte *et al.*, 2007; Lu *et al.*, 2006). However, this study the demand for ALS care was only met in 3.8% of all such cases which is 50% of what was asked for. This corresponds to the findings of a study of Schmidt *et al.* (2000) who found that 3-11% of patients experienced serious and critical health problem but were not cared for by the appropriate teams. This study found the appropriate assignment of teams according to medical priority at the scene was poor which a finding similar is as the others study (Schmidt *et al.*, 2000; Hjalte *et al.*, 2007; Lu *et al.*, 2006; Calle *et al.*, 1995). Researchers concluded that mainly BLS teams were operating in the field and the capability to provide vital care for patients by all EMS response teams was highly appropriate within team competency. EMS in Thailand was inaugurated 2 decades ago. The system still is developed by limited resources and has difficulties to meet the costs for EMS education or training institutes causing especially a lack of professional staff for ALS and ILS teams. The majority of ALS teams are headed by a nurse who was specially trained as pre-hospital nurse while emergency physician are seldom found. In addition, a study undertaken in the UK and USA in comparing the different EMS Systems in

the way how pre-clinical emergency medical care is provided and the impact of care on the patient's status found that higher medical qualification and greater training and experience of ALS unit personnel increase survival for cases of out of hospital cardiac arrest and improve patient's status (Fischer *et al.*, 2011). At Khon Kaen the most frequent dispatched EMS teams being FR and BLS teams are not equipped with a device which can be easily handled to monitor and defibrillate patients. So, it is very necessary to equip the teams with AED for resuscitation for patients with cardiac arrest. In addition the FR and EMT-B who are the most of EMS provider need to be trained more for being able to dealing with critical illness. It should be assured that the EMS provides the optimal care to all EMS patient in all situations.

In this study, researchers found the EMS cases did not perform triaging at ED for 12.2% (4,517 cases). This may be due to the fact that that was not mentioned especially at the forms due to crowding conditions at the hospital and the necessity to immediately care for a critical patient. However, care should be taken to improve this shortcoming.

Thailand still is in the phase of developing the EMS system especially as far as manpower is concerned. The rare of professional career effected to proportion of advanced team. Overall it seems that BLS and FR personnel are sufficient, their competence is limited but they were the main of EMS response. According to the results of this study, researchers suggest the following to the national EMS administrators:

- Training of FR and EMT-B should be improved and they should be enhanced their competence to deal with the critical patient at the scene
- The appropriate proportion of ALS and ILS units must be reconsidered to ensure that there is optimal quality of care given to EMS patients at the scene

Furthermore, human resource development for the EMS services should be rapidly accelerated and progress to professional.

### CONCLUSION

Capability in vital care of all EMS teams in Khon Kaen, Thailand was highly appropriate rate within team competency. The most of response team was BLS care. Thus, the BLS care team should well train in essential skills to care for critical patient. Further study should be conducted to evaluate the necessary competency and

quality of care by BLS care teams and the optimal proportion of ALS care should be established in order to enhance the quality of EMS services in Thailand.

### LIMITATIONS

The data used for this study were collected from the EMS database at the 11th and 12th EMS information technology center. Data entries were assumed to reflect the real situations. Researchers studied the validity of the EMS data reports and entering was correctly done.

### ACKNOWLEDGEMENTS

Researchers would like to thank the Khon Kaen EMS office, Khon Kaen dispatch center and the 11th and 12th EMS information technology center for their data support. Thanks to Prof. Dr. Frank Perter Schelp who is kind and thoroughly edit the English. Most of all, we would like to thank the EMS patients who participated in this study.

### REFERENCES

- Calle, P., H. Houbrechts, L. Lagaert and W. Buylaert, 1995. How to evaluate an emergency medical dispatch system: A Belgian perspective. *Eur. J. Emerg. Med.*, 2: 128-135.
- Chadbunchachai, W., P. Chotklom, S. Sriwiwat and S. Kulleab, 2004. Manual for Setting up the Emergency Medical Service Khon Kaen. Khon Kaen Printing, Thailand.
- Chadbunchachai, W., P. Ruangchui and S. Sriwiwat, 2005. Emergency room trauma guideline 2005. The Project for Development of Trauma Center Complex, Khon Kaen Hospital, (JICA), WHO Collaborating Center for Injury Prevention and Safety Promotion.
- Committee of Emergency Medical Institute of Thailand, 2010. A Master Plan of Emergency Medical Institute of Thailand (2010-2012). Ruk Prim, Bangkok, Thailand.
- Cone, D.C., N. Galante, D.S. MacMillan, M.M. Perez and V. Parwani, 2007. Is there a role for first responders in EMS response to medical facilities?. *Prehosp. Emerg. Care*, 11: 14-18.
- Ely, M., L.K. Hyde, A. Donaldson, R. Furnival and N.C. Mann, 2006. Evaluating state capacity to collect and analyze emergency medical services data. *Prehosp. Emerg. Care*, 10: 14-20.
- Emergency Medical Institute of Thailand, 2010. Standard and Regulation of Emergency Medical Service System. Emergency Medical Institute of Thailand, Nonthaburi, Thailand.

- Fischer, M., J. Kamp, L.G.C. Riesgo, I. Robertson-Steel, J. Overton and A. Ziemann, 2011. Comparing emergency medical service system-A project of the European Emergency Data (EED) project. *Resuscitation*, 82: 285-293.
- Hjalte, L., B.O. Suserud, J. Herlitz and I. Karlberg, 2007. Initial emergency medical dispatching and prehospital needs assessment: A prospective study of Swedish ambulance service. *Eur. J. Emerg. Med.*, 14: 134-141.
- Isenberg, D.L. and R. Bissell, 2005. Does advanced life support provide benefits to patients? A literature review. *Prehosp. Dias. Med.*, 20: 265-270.
- Lu, T.C., Y.T. Chen, P. Chow-In Ko, C.H. Lin and F.Y. Shin *et al.*, 2006. The demand for prehospital advanced life support and the appropriateness of dispatch in Taipei. *Resuscitation*, 71: 171-179.
- Moore, L., 1999. Measuring quality and effectiveness of prehospital EMS. *Prehosp. Emerg. Care*, 3: 325-331.
- Sasser, S.M., M. Varghese, A. Kellermann and J.D. Lormand, 2005. *Prehospital Trauma Care Systems*. World Health Organization, Geneva, Switzerland.
- Sasser, S.M., M. Varghese, M. Joshipura and A. Kellermann, 2006. Preventing death and disability through the timely provision of prehospital trauma care. *Bull. World Health Organ.*, 84: 507-507.
- Schmidt, T., R. Atcheson, C. Federiuk, N.C. Mann, T. Pinney, D. Fuller and K. Colbry, 2000. Evaluation of protocols allowing emergency medical technician to determine need for treatment and transport. *Acad. Emerg. Med.*, 7: 663-669.
- Trauma and Critical Care Center, 2005. Strategies for develop service system for pre-hospital emergency care. Proceeding of the Summary from Seminar at Khon Kaen Hospital, September 3-5, 2005, Khon Kaen, Thailand.
- WHO, 2007. *World Health Statistics 2007: Part I Ten statistical highlights in global public health*. [http://www.who.int/whosis/whostat2007\\_10highlights.pdf](http://www.who.int/whosis/whostat2007_10highlights.pdf).