

# UC Berkeley

## Research Reports

### Title

Pre-hospital Care of Road Traffic Injuries in Chiang Mai, Thailand

### Permalink

<https://escholarship.org/uc/item/6jv3g4pk>

### Authors

Brown, Ted R  
Geyer, Judy A  
Taghavy, Azita  
et al.

### Publication Date

2004-11-15

## **Pre-hospital Care of Road Traffic Injuries in Chiang Mai, Thailand**

November 15, 2004

Ted R. Brown, MD, MPH  
MS Hub Medical Group  
1100 Olive Way, Suite 150  
Seattle, WA 98101  
Phone: 1-888-634-6778  
Fax: 206-685-3244  
berktocm@yahoo.com

Judy A. Geyer, MSE  
Traffic Safety Center  
University of California  
140 Warren Hall #7360  
Berkeley, CA 94720  
Phone: 510-643-5659  
Fax: 510-643-9922  
jgeyer@berkeley.edu

Azita Taghavy, MD  
Traffic Safety Center  
University of California  
140 Warren Hall #7360  
Berkeley, CA 94720  
Phone: 510-642-4456  
Fax: 510-643-9922  
azita@berkeley.edu

Brian P. Mitchell, MPH, MSc  
University of Utah, School of Medicine  
35 F Street, #423  
Salt Lake City, Utah 84103  
Phone: 801-364-6899  
Fax: 801-581-2931  
mitch4brian@hotmail.com

Corresponding Author:  
David R. Ragland, PhD, MPH  
Traffic Safety Center  
University of California  
140 Warren Hall #7360  
Berkeley, CA 94720

Phone: 510-642-0566  
Fax: 510-643-9922  
davidr@berkeley.edu

**ABSTRACT**

In many developing countries, transportation infrastructure development lags behind the tremendous growth in motorization. Road traffic injuries cause enormous morbidity and mortality worldwide, placing heavy burdens on global and national economies. Underdeveloped transportation infrastructures critical to traffic safety include roadway improvement, occupant protection laws, traffic law enforcement, and emergency medical services (EMS). Highlighting one important aspect of lagging infrastructure, this article focuses on emergency medical services. This research study offers a descriptive evaluation of the existing pre-hospital care system in Chiang Mai, Thailand. The research objectives were (a) to describe how emergency rescue services are organized in Chiang Mai, (b) to examine ongoing public health efforts to improve emergency services, and (c) to document the training, certification, employment, and medical use of pre-hospital personnel. Thailand's national and local pre-hospital services (i.e., services designed to transfer persons with traffic injuries into the country's hospital infrastructure) are both insufficient and inefficient. The Thai National Government has promised funding to create a national EMS network by 2006. Research recommendations for Thailand EMS include more professional training for emergency workers, standardization of equipment, centralization of communications, and further analysis of competitive services.

## INTRODUCTION

Road traffic injuries cause enormous morbidity and mortality worldwide and place heavy burdens on global and national economies. Worldwide in 2000, traffic injuries were the ninth leading cause of disability-adjusted life years lost (or, global burden of disease) (1). By the year 2020, traffic injuries are projected to be the third leading cause of the global burden of disease (1). Ninety percent of disability-adjusted life years due to road traffic accidents are in developing countries (2).

In developing countries, rapidly increasing motorization is outpacing the development of transportation infrastructure. This fact is the primary reason for the increasing numbers and rates of motor vehicle injuries in developing countries. The lagging transportation infrastructure includes roadway improvement, occupant protection laws, traffic law enforcement, and emergency medical services. This article focuses on one aspect of the developing world's transportation infrastructure: emergency medical services. Because the majority of trauma deaths in developing nations occur in the pre-hospital setting, it is imperative that emergency medical systems be established and improved in such countries. (3)(4) The countries of Asia are making progress in organizing emergency medical systems, but much work remains to be done.

This article describes emergency medical services (EMS) as well as a cross-sectional field survey of rescue workers in Chiang Mai, Thailand, the second largest province of Thailand. Chiang Mai Province, which is located in northern Thailand, has a population of 1.47 million, of whom 248,000 live in the municipal district, and about 200,000 live in its immediate suburbs. There are 45 hospitals in the province, and more than half of these are in the vicinity of the city. In Chiang Mai, there are high morbidity and mortality rates due to traffic injuries. In particular, one survey of the EMS providers in Chiang Mai indicates that about 70% of their emergency cases are for motorcycle crash victims.

In Thailand, injuries (including poisonings) are the second leading cause of death overall. Thailand is one of many developing countries that is experiencing rising traffic fatality rates at a time when rates are steadily falling in highly developed countries. The rate of accidental deaths peaks between the ages of 15 to 34. In this age group, the male to female ratio is at least 4:1. (2)(5)(6)(7)(8) Many factors contribute to the rising traffic fatality rates in Thailand. Urbanization and economic growth have been accompanied by rapid motorization. Road infrastructure and traffic safety have not developed as quickly.

In developing countries like Thailand, the percentage of vulnerable road users (pedestrians, motorcyclists, and bicyclists) is relatively high. Although helmet use is legally mandated for motorcyclists, it is not strictly enforced. Motorcycle crashes account for most (72%) of all hospital admissions related to traffic injuries in Thailand compared to only 1.8% in the US.

The goal of this article is to describe the current national and local efforts to improve emergency medical service. The following section summarizes the investigative methods used to research this topic. Next, there is a summary of national efforts, followed by a summary of local efforts. To close, we offer a discussion and conclusion that outline possible improvements to Thailand's developing emergency medical service system.

## METHODS

This article is a descriptive study of the management of road traffic injuries in Chiang Mai and Bangkok, Thailand, between May and June 2003. The data stem from oral interviews and written questionnaires administered to emergency rescue workers. Additional data were collected from publications of The Narenthorn EMS Center of the Ministry of Health and unpublished documents of the Chiang Mai Health Department Office of Emergency Care.

Officials at the Ministry of Health, private rescue foundations, the Chiang Mai Provincial Hospital and two private hospitals were contacted prior to the study to arrange preliminary interviews. Interviewee referrals were used to arrange subsequent interviews with emergency responders at the Chiang Mai Health Department Office of Emergency Medicine, the police and fire departments of Chiang Mai, hospital-based and foundation-based emergency services and one rescue club. Oral interviews were conducted in the Thai language by the investigator based on a prepared list of key questions specific for each interviewee. Interview information was recorded in written notes that were subsequently analyzed.

Structured questionnaires were prepared for emergency rescue workers in consultation with two North American physicians, a paramedic who oversees emergency medical technician (EMT) certification for a California county, and an EMT textbook. (9) The questions were pre-tested with twenty American EMTs (two basic level and eighteen intermediate level), translated into Thai, and then pre-tested again with two Thai nurses and one Thai emergency rescue worker. The questionnaires were administered by a Thai research assistant who was trained by the principal investigator. The questionnaire included four sections: (1) demographic information (sixteen closed-ended questions), (2) quality of training, job satisfaction and seatbelt use (using Likert scale questions), (3) decision

making during triage, work-related problems, suggested improvements and barriers to change (eight open-ended questions), and (4) emergency equipment knowledge and use (battery of questions).

All aspects of the emergency rescue worker survey were done according to the protocol approved by the Human Subjects Committee at U.C. Berkeley. Subjects were recruited by written invitations that were distributed by the subjects' employers. For all participants, written informed consent was obtained before study participation. All participants were full-time emergency rescue workers in the Chiang Mai municipal area.

## RESULTS

### National Efforts by Thai Government

In Thailand, progress on road safety has been slow. Two national departments, the Department of Transportation and Communication and the Ministry of Health, are poised to improve emergency medical response services. The former has been drafting, but has not fully implemented, a plan to create an agency governing road traffic safety. (10) This effort, four years in the making, is only part of the Department of Transportation and Communications' 20-year effort to establish EMS services. These efforts are plagued by a lack of coordination with other departments, limited national funding, and/or lasting results.

More promising progress has come in the past five to ten years under the auspices of the Ministry of Health. (11) Under Thailand's Ninth National Plan for Economic and Social Development, the Narenthorn EMS Center, an EMS Center in Bangkok and a division of the Ministry of Health, aims to make EMS available throughout the country by 2006. Narenthorn defined the project goals to include:

- Hitting a target response-time of ten minutes or less
- Field stabilization by EMT basic and intermediate personnel.
- Providing pre-hospital services through this program for 25% of all emergency cases in the participating provinces.

The plan is predicated upon promoting the existing loose network of provincial emergency rescue providers, rather than replacing them with a uniform workforce. Under this plan, hospital-based services shall be responsible for pre-hospital care for life-threatening, neurological, vascular and severe orthopedic injuries. Payment for EMS services shall be accounted on a case-by-case basis. Triage decisions shall be made at an EMS radio control room located at the provincial health office, police station or provincial hospital, depending upon the requirements of each province. Participating hospitals and rescue foundations shall be required to have annual vehicle inspections and staff-training courses. The inspecting committee would include provincial health nurses and emergency room doctors.

According to the Narenthorn plan, EMS providers will receive government payments based on the number and seriousness of cases that they retrieve, rather than on the size or comprehensiveness of the pre-hospital service that they maintain. This approach is in contrast to the national health insurance scheme, which reimburses hospitals based on the number of persons that they enroll, not based on the actual number of patients seen. All accredited hospitals in Thailand are required to maintain ambulances with features approximating Western standards. Only a few large urban hospitals have full 24-hour staffing for ambulances. Most hospitals send ambulances in response to phone requests or police radio requests, but the primary use of hospital ambulances is non-emergency patient transportation.

There are also emergency transport services provided by philanthropic organizations and hospitals, each maintaining its own workforce and emergency vehicles. The foundations' emergency vehicles are typically operated by teams of two or three men paid small salaries. The vehicles are simplified ambulances: that is, most are a pick-up truck with a covered cabin over the bed in the rear. These volunteer patrols park at street-side locations where they wait for a command from their communication unit. When an emergency message is received, they hasten to traffic crash sites and transport injured persons to public or private hospitals. In Chiang Mai, two private hospitals and one public hospital have EMS programs. The hospitals have between two and nine full-time rescue workers and between one and four 24-hour rescue units. (Statistics for 2002 could not be obtained from the private hospitals.)

Both rescue foundations and hospital-based EMS programs are geared toward the management of traffic injuries and not toward transporting people with illness from home to the hospital. Unlike traffic injury services, which are free, hospitals charge a fee to pick up a patient from home.

In the US, there is generally only one ambulance company responsible for EMS in a given county. In Chiang Mai Province, the central government and provincial government have had only minimal involvement in developing EMS until the last few years. Although much has been done to coordinate communications between the emergency networks, there are still a half-dozen or more emergency hotlines to choose from. Emergency calls are

also made directly to hospitals. Finally, there are three rescue foundations with their own emergency hotlines and radio bands.

As the number of pre-hospital providers and emergency hotlines grew during the 1990's, the EMS system became disjointed and competitive. Until 2002, there was no registry of emergency rescue workers in Chiang Mai. The Health Department had no control over the staffing of rescue vehicles, and the only way that it could enforce standards for emergency worker pre-hospital training was by sponsoring voluntary courses and encouraging emergency rescue service providers to send their regular workers for training.

### **Local Efforts in Chiang Mai**

The Provincial Health Department's Office of Emergency Medicine launched its effort to bring organized EMS to Chiang Mai in 2002. It convened a series of meetings attended by officials of most of the local EMS private organizations and major hospitals to devise an EMS referral plan for metropolitan Chiang Mai. Modeled after the Ministry of Health plan, rescue foundations were granted responsibility for management of emergency cases with only Basic Life Support (BLS) requirements. Hospital-based EMS units were given charge of emergency cases with Advanced Life Support (ALS) requirements. There were originally nine hospitals that offered to provide EMS. Each was to operate EMS units only within their designated EMS zone (within ten kilometers of the hospital). Triage of patients with the most acute critical care needs was organized separately. Overseeing the pre-hospital triage process was a central radio communication center, the Wiang Ping Rescue Center, which had already been established within the provincial hospital.

The 2002 meetings set a blueprint for the orderly conduct of emergency dispatch and triage to hospital. Emergency calls in Chiang Mai reach EMS providers through a range of channels and most calls were acted upon without clearance through the Health Department's communication system, especially by rescue foundation respondents. To date, the attempt to dispatch hospital and foundation EMS units based on the severity of the injury has not been very successful. Rescue foundations often go beyond their designated responsibility for BLS cases and also manage ALS cases. Some hospitals are providing emergency services for ALS cases as planned, but are also competing with the rescue foundations for BLS cases and sending units outside of their own catchments areas, bypassing other hospitals that may be nearer to the crash scene. Most decisions about hospital referral are made by the EMS units without much input from the Health Department's communication center. Meanwhile, most of the hospitals that agreed to provide EMS within their zones have not gotten their programs started and are serving only as receiving hospitals. In short, operations are much the same as before the EMS plan was introduced.

In practice, rural district hospital ambulances rarely give ALS to road traffic accident victims. Most often, they are utilized for inter-hospital patient transportation. Routine ambulance equipment is limited to a stretcher with an intravenous stand, an oxygen tank, bag-mouth breathing apparatus and a basic first aid kit. Hospitals providing EMS services in the city of Chiang Mai have the best-equipped ambulances in the province. Even so, they are generally not equipped with defibrillators, ventilators or equipment for intubations.

Equipment in the rescue foundation vehicles is limited by the small space available in the back of a pick-up truck. Typically, they contain a stretcher, home made spinal board and splints for arms and legs. Cervical collars, first-aid kits, gloves and bag-mouth apparatus are not uniformly provided. Meanwhile, the rescue workers have limited knowledge about emergency equipment. Table 1 contains the results of an equipment survey of 40 emergency rescue workers in Chiang Mai.

The emergency equipment knowledge battery revealed that a large majority of the rescue workers are familiar with spinal boards and cervical collars (Table 1). Workers who had such equipment in their vehicles reported that they put them to use. However, 22% of the workers stated that their vehicles did not have spinal boards or cervical collars, and limited inspection of the vehicles by the investigators confirm their assertion. Low-cost spinal boards and cervical collars are now manufactured in Thailand.

In addition to equipment deficiencies, EMS programs lack well-trained workers. The results of interviews with 40 emergency rescue workers (all males, n=40) are contained in Table 2. Generally, this occupation is reserved for young men with low education (a ninth-grade education is mandatory and the average education in this survey was 9.7 years). A large majority of the participants have been employed as rescue workers for more than one year, suggesting that job turnover is fairly slow. This may be explained by the high ratings for job satisfaction. That almost all participants rated their job satisfaction as good or excellent is somewhat surprising, considering their poor salaries, especially when calculated on an hourly wage basis. On average, the rescue workers receive about 25% less monthly wage than do nurse's aides at hospitals, but work about 30 hours more per week. The average work week was 76 hours, the average hourly wage was \$0.28 (USD). One occupational safety concern is the use of seat belts. Also as part of this survey, the respondents were asked to report the frequency with which they wear seatbelts

while riding in their rescue vehicles. Sixteen (40%) responded “never,” 21 (52.5%) responded “sometimes,” and 3 (7.5%) responded “always.”

The training of emergency medical responders is often minimal. 35 of the 40 emergency workers interviewed had obtained less than 24 hours of pre-employment training. Only four of the 40 emergency workers had obtained Emergency Medical Technician Certification. In Chiang Mai, new recruits at the rescue foundations start out paired with a more experienced rescue worker and gradually learn while on the job. The foundations have periodic in-service trainings, conducted monthly to quarterly by different organizations. It is hoped that the basic Trauma Life Support course that was conducted in 2002 at the Health Department will be followed by annual refresher rescue courses for the emergency workers.

For comparison, in the US EMT training and licensing requirements vary by location but are much more rigorous. EMT programs are taught at two-year colleges and private trade schools. In California, the EMT curriculum averages 130 hours, including 8 hours of clinical experience. To become a paramedic, one must complete an EMT training program and do additional training (1040 hours in California). Both EMT's and paramedics are awarded two-year licenses. A lack of large training programs continues to be an educational issue for Thailand. In Thailand in the year 2002, only 60 health professionals graduated from EMT programs (Table 3).

In Thailand, the lack of trained personnel has been cited by the Narenthorn Center as one of the chief impediments to developing a national EMS network. Police officers are usually the first personnel to arrive at accident scenes. Their emergency medical training is, however, limited to a few lectures on emergency medicine during their year at police academy. The police play only a supporting role in treatment of injury victims. In addition, firefighters receive BLS training, but their focus is on extrication and they usually defer pre-hospital care to others.

Khon Kaen University in Thailand's Northeast, has had a two-year EMT-intermediate vocational program for several years. Two other universities are starting similar programs. The graduates are capable of some ALS procedures (starting intravenous fluids, resuscitation, giving injections), but not intubations or operation of a defibrillator. The Narenthorn EMS Center in Bangkok has a six-month EMS training course that produces EMS intermediates, but it only accepts a few students per term.

Generally, it is understood that the National Health Insurance program is placing great demands on the teaching hospitals in Chiang Mai. Therefore, at the moment, the additional work in starting, funding, and maintaining an EMS program is thought to be an insurmountable task. It will likely be several years before such a program is begun.

## **DISCUSSION AND RECOMMENDATIONS**

In Thailand, the number of registered passenger cars and motorcycles grew by over 1300% in the last two decades of the 20<sup>th</sup> century. Associated with this motorization was a marked increase in the traffic mortality rate. Currently, about 500,000 people out of a population of 61 million experience traffic injuries annually at an economic cost of 2.5 billion dollars (USD). Causes include poor traffic engineering design, limited enforcement of traffic safety laws, unsafe driving habits, and a high percentage of vulnerable road users. Thailand has created a system of hospitals covering every district in the country and has instituted universal health care coverage. There is a high rate of road traffic accidents (the highest rate in Southeast Asia) and a good hospital infrastructure to manage these events. However, insufficient pre-hospital services make it difficult to get patients safely to the hospital. Improvement in EMS is a critical component of transportation infrastructure.

The Chiang Mai Health Department's initiatives have moved the EMS providers toward cooperation and established a means to enforce educational requirements and competency standards for emergency rescue workers. Both local efforts and national efforts still have room for improvement. Following is a list of recommendations resulting from this article's summary of EMS in Chiang Mai.

### **Training**

Basic improvement would result from improved training and employment conditions for emergency medical service responders. Emergency rescue workers receive minimal pre-employment training, and must learn on the job. They work long hours and receive small wages. Their vehicles often lack essential equipment for the safety of their patient's, let alone the driver's or the medical technician's.

Little attention is given to the safety of the drivers and other rescue workers during patient transportation. Training seminars should place greater emphasis on safe driving and seat belt usage in emergency vehicles. The absence of female emergency rescue workers, perhaps a result of sexual discrimination by employers or well-defined social roles, reduces the pool of potential rescue worker applicants. Moreover, it may be a cause of friction



between male rescue workers and female nurses who lead some hospital-based ALS ambulance units. Therefore, the Health Department should encourage EMS providers to actively recruit females to the field.

### **Equipment**

The Ministry of Health and local health departments should act quickly to provide all emergency rescue vehicles with spinal boards and other essential emergency medical equipment. Even the more modern ambulance units have deficiencies in equipment. The rescue foundation units, as opposed to the hospitals, are the least well equipped. Vehicle inspections are conducted at the Provincial Health Office, creating an opportunity for EMS providers to pool emergency equipment from several units to put together a complete array of what is required for the inspection. Spot inspections would allow a much more accurate assessment of compliance with ambulance equipment standards. Basic life support courses are conducted at the Provincial Health Office using Health Office equipment that in some cases is not generally available. For example, scoop stretchers are used in practicing transfers at the office, but most stretchers used in the field are simple boards covered with foam. If the trainees brought and used their own equipment in training seminars, it would benefit their emergency techniques in the field.

### **Improved Hospital, Police, and EMS Coordination and Communication**

Even in Bangkok, where EMS is most prevalent and most advanced, less than half of emergency cases are brought to the hospital by EMS. Once the national plan to support EMS services is instituted, the annual budget will be limited to \$10.7 million (USD), which many believe is not a sufficient sum.

There is an array of EMS providers, including private rescue organizations supported by donations and hospital-based providers supported by hospital budgets. It is fair to say that local governments, hospitals, and citizen groups are leading the effort to establish systems for pre-hospital care, however funding for EMS is not well coordinated by government. In 2002, the Health Department attempted to organize an EMS system by (1) delegating responsibilities to various EMS providers according to their neighborhood zones and according to severity of injury, (2) promoting an emergency dispatch communication center, and (3) providing BTLS training courses for rescue workers and creating a formal emergency rescue worker registry. However, efforts still prove to be uncoordinated. For example, non-hospital-based EMS workers are responding to emergency radio transmissions from the police radio network without waiting for instructions from the emergency medical dispatch center. As long as this continues, pre-hospital care will remain haphazard. To coordinate EMS providers, it may be necessary to protect police radio signals and hire a few more workers at the emergency medical dispatch center to achieve more effective communications

### **Plan for Expansion**

Currently, the EMS programs of hospitals and foundations in Chiang Mai focus on road traffic injury management, both in training and in the scope of operations. There is an unmet need for EMS in illness and injury occurring at homes and workplaces. As the EMS system matures, it should assume more responsibility for more diverse emergency settings, including stroke, asphyxiation, drug overdose, falls, and firearms injuries. Appropriate training and additional equipment, such as defibrillators, should be provided.

### **Analysis of Effects of Competition**

The National Government's proposed fee-for-service payment program ties reimbursement to the quantity of service provided, i.e. the number of patients delivered to the hospital, and the severity of their condition. Competition, instead of cooperation, might decrease the pre-hospital travel time, but with the current state of communication, it also results in a lack of communication between police, EMS teams, and the hospitals. Given the widespread lack of adequate training, this reimbursement system may also prompt EMS providers to respond to very severe injury cases that exceed their knowledge of pre-hospital care. A better payment system might be based on quality standards (e.g., maintenance of 24-hour coverage with ALS capabilities within a specific district). Further economic analysis of possible reimbursement strategies would help reveal the most appropriate payment scheme.

## **CONCLUSION**

Injuries are the leading cause of hospital admissions in Chiang Mai, and traffic injury is the leading subcategory. Motorcyclists comprise about 70% of traffic injuries. There is increasing awareness of the need for improved pre-hospital services to respond to traffic injuries. The Department of Transportation and Communications and the Ministry of Health have launched programs to coordinate EMS services and register emergency rescue workers. By 2006, the Thai National Government plans to fully support local Health Departments and EMS programs and to

integrate them into an effective system. Before then, areas of improvement that could benefit the current system include sufficient supply of emergency equipment, training of emergency responders and centralizing communication between hospitals and emergency responders. Throughout this expansion in medical services, coordinators must carefully weigh the effects of competition and reimbursement programs in providing quality services. Finally, in addition to traffic safety, these efforts could be combined with a goal to provide emergency medical service for a vast array of medical emergencies.

This report summarized emergency medical services in Thailand. EMS is only one component of transportation infrastructure that can reduce the severity of motor vehicle collisions. Understanding the barriers to a comprehensive EMS system in Chiang Mai provides insight into the struggles of many developing nations as they seek to improve transportation safety.

**ACKNOWLEDGEMENTS**

The investigators thank Prawit Wongpeng for field work, Dr. Richard Gosselin for research assistance and Theresa Gray for help in manuscript preparation. Dr. Somchai Kanchanasut and Dr. Verawat Muttarak provided insights about Thai Government policies. The principal investigator received financial support from the David Boren Graduate Research Fellowship Program and the Wellness Educational Fund. Preparation of this report was supported by the Traffic Safety Center at U.C. Berkeley, whose funding is provided by the California Office of Traffic Safety through the Business, Transportation, and Housing Agency.

**REFERENCES**

1. Mohan D, Tiwari G. Road safety in less motorized countries- relevance of international vehicle and highway safety standards. Proceedings of the International Conference on Vehicle Safety 2000. June 7-9 2000, pg.155-165
2. Arreola-Risa C, Mock CN, Lojero-Wheatly L, de la Cruz O, Garcia C, Canavati-Ayub F, Jurkovich GJ. Low-cost improvements in pre-hospital trauma care in a Latin American city. *J Trauma*. 2000 Jan;48(1):119-24.
3. Mock CN, Jurkovich GJ, Amon-Kotei D, Arreola-Risa C, Maier RV. Trauma mortality patterns in three nations at different economic levels: implications for global trauma system development. *J Trauma*. 1998 May;44(5):804-12; discussion 812-4.
4. Pozner CN, Bayleygne TM, Davis MA, Benin-Goren O, Noble VE, Halpern P. Emergency Medical Services Capacities in the Developing World: Preliminary Evaluation and Training in Addis Ababa, Ethiopia. *Pre-hospital Emergency Care* 2003 7:392-396.
5. *Public Health Statistics A.D.1999*. Ministry of Public Health, Bangkok, 2001. pg.71,89,105,126-133,179-180.
6. Thailand Health Profile 1997-98. Chapter Five: Health Service Systems in Thailand. Ministry of Public Health, Nonthaburi. 1998 URL: <http://eng.moph.go.th/profile97-98/chapter51.htm> (Accessed 3/1/03)
7. *Traffic Safety Facts 2000*. U.S. Dept. of Transportation, National Highway Traffic Safety Administration, DOT HS 809329.
8. World Health Organization South-East Asia Regional Office Disability Injury Prevention and Rehabilitation Work Plan for 2002- 2003 #ICP DPR 001-II URL: <http://w3.whosea.org/drd/mainf.htm>. Accessed February 25, 2004
9. McSwain NE, White RD, Paturas JL, Metcalf WR. The Basic EMT: Comprehensive Pre-hospital Patient Care. Mosby Lifeline, St. Louis, 1996, pg.43.
10. Bangkok Post: Road Safety. Nov.9, 2002. URL: [bangkokpost.co.th/bkkpost/2002/nov2002/bp20021109/news/](http://bangkokpost.co.th/bkkpost/2002/nov2002/bp20021109/news/) (and) [bangkokpost.co.th/bkkpost/1998/bp98\\_sep/bp19980919/190998\\_news10.html](http://bangkokpost.co.th/bkkpost/1998/bp98_sep/bp19980919/190998_news10.html) (Accessed 3/1/03)
11. Kanchanasut S, Emergency Medical Services System for Thailand. Linked to Narenthorn Center URL: <http://www.narenthorn.or.th> (Accessed 3/10/03)

**LIST OF TABLES**

TABLE 1 Emergency Equipment Questionnaire Conducted with 40 Emergency Rescue Workers in Chiang Mai.

TABLE 2 Survey of 40 Emergency Workers in Chiang Mai.

TABLE 3 Graduating Health Professionals in Thailand.

**TABLE 1**  
**Emergency Equipment Questionnaire Conducted with 40 Emergency Rescue Workers in Chiang Mai.**

Equipment Item	Number and percentage of the equipment being present in the vehicle	If present, frequency that the equipment is actually used
Medical gloves	40 (100%)	100%
Leg splint	40 (100%)	100%
Compressive dressing	35 (87.5%)	100%
Oxygen tank	35 (87.5%)	94%
Bag valve mask	33 (82.5%)	97%
Spinal board	31 (77.5%)	100%
Cervical collar/immobilizer	31 (77.5%)	100%
Sphygmomanometer	30 (75%)	70%
Oral airway	26 (65%)	96%
Stethoscope	16 (40%)	100%

**TABLE 2**  
**Survey of 40 Emergency Workers in Chiang Mai.**

Variable	Findings	Comments
Site of employment:		
Hospital	n = 9	
Rescue Foundation	N = 27	
Rescue Club	n = 4	
Gender	Male = 40, Female = 0	
Age	Mean = 27	Range = 18 - 46
Years of Education	Mean = 9.7	Range = 6-14
Pre-employment training:		Range = 3 hours- 2 years
≤ 24 hours	N = 25	
25 – 80 hours	n = 6	
81 – 160 hours	n = 6	
161 – 320 hours	n = 1	
≥ 320 hours	n = 2	
Certification for Basic Trauma Life Support	Yes = 35 (88%) No = 5 (12%)	
Certification for Emergency Medical Technician	Yes = 4 (10%) No = 36 (90%)	
Time employed in emergency rescue:		
< 1 year	n = 6	
1 - 2 years	N = 16	
≥ 3 years	N = 18	
Hours worked per week	Mean = 76	Range = 60 - 96
Number of workers per rescue unit (including driver)	Mean = 2.6	Range = 2 - 3
Monthly salary (U.S.\$)	Mean = \$84	Range = \$73 - \$153
Hourly wage (U.S.\$)	Mean = \$0.28	Range = \$0.19 - \$0.81
Self-reported case-load per 12-hour shift	Mean = 3.0	Range = 1- 7
Job satisfaction:		
Poor	n = 0	
Fair	n = 1	
Good	n = 19	
Excellent	n = 20	

\*All results are self-reported and unverified.

**TABLE 3**  
Graduating Health Professionals in Thailand.

<b>Professionals</b>	<b>Graduating Health Professionals in Thailand</b>
Physicians	960/yr (1998)
Nurses	3393/yr (1998)
EMT's	60/yr (2002)
Paramedics	none

*\*(6) (11)*