

Chapter 1 Introduction

1.1 Introduction

This thesis aims to gain an insight into the management of the current Emergency Medical Services (EMS) in Khon Kaen (KK) Province, Thailand, and investigates how the service can be improved in relation to patient outcome following road trauma. Assessment of pre-hospital EMS has been undertaken in many countries with the majority of these studies conducted in the developed world. While a number of studies in relation to out-of-hospital care and road traffic injury have been conducted around the world, there has been much less research conducted on EMS and its management in developing countries.

Although pre-hospital care is well established in many countries, pre-hospital EMS is still in its infancy in Thailand. There has been some research regarding pre-hospital trauma care and road traffic injury, particularly in Khon Kaen, but these studies have concentrated on injury risks, conducted in isolation from each other and generally do not investigate the social and political context. Moreover, the views from EMS staff who are exposed to the road injury and its management systems, have not been studied in much detail.

Khon Kaen Regional Hospital (KKRH) has long been associated with injury surveillance and injury prevention programs, and there have been a number of projects and studies undertaken by the KKRH Trauma and Critical Care centre. KKRH is also one of the WHO injury surveillance sentinels for Thailand, and road traffic trauma study is one of the targeted surveillance programs which KKRH has developed and progressed since 1989. While injury prevention programs were being developed, KKRH also initiated pre-hospital care for KK Province in 1994 which has been

developing since then. However, any research conducted to date has been primarily more focused on the development of the EM services than on service operation and assessment. Therefore, this study aimed to investigate the use of databases utilized in KK EMS operation, with particular focus on road traffic injuries, and information which could be gained from the subjective views of EMS staff on EMS management issues. The study covers new ground by combining service providers' perspectives with the use of existing administrative data to evaluate the existing EMS system. The focus is to provide insights into major injury risk areas and areas where management could be changed to improve service provision and EMS organisation all over Thailand.

1.2 The importance of pre-hospital Emergency Medical Services

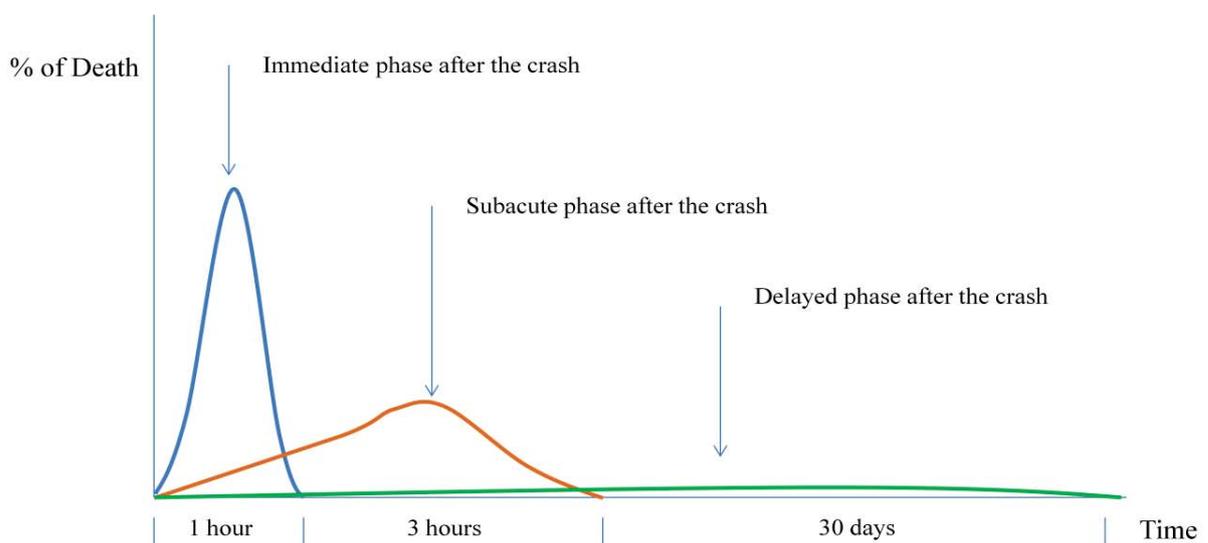
Emergency medical services: systems to deliver rapid emergency care and transport to fixed sites of definitive care. EMS usually has the implication of mobile services, as opposed to emergency services provided in fixed facilities.

(TEACH-VIP 2005)

The importance of out-of-hospital care was first recognized in 1797 following reporting on the needs of medical aids to reduce loss of injured soldiers in battle fields (Post & Treiber 2002). A combat zone treatment and use of horse-drawn wagons were among the first innovations called 'ambulance volantes', which emerged during the Napoleonic wars. This initiation later developed as a new concept in a military operation for the American Civil War and for USA defense forces during the Korean and Vietnamese wars. It was found that the best survival rate for critical trauma patients could be achieved if they received appropriate care within the first crucial hour period of time of injury (De Lorenzo & Mothershead 2002), which later became known as the concept of the 'Golden Hour' (Sanders-Fisher 2008).

The EMS's roles and tasks in improving patient outcome in the Golden Hour can be explained by a natural analysis of death in a severe trauma case. Figure 2.1 shows that death from a severe injury can occur at three different stages (Road Safety Council, Malaysia cited in Tipayarangsarit 2005; World Health Organization 2005a). A number of deaths occur immediately at the scene after the crash from overwhelming injury and trauma. A proper pre-hospital EMS care has the greatest chance to improve outcome of a number of patients at this stage to prevent subacute phase fatalities. Fewer deaths occur at the sub-acute phase, several hours after the incident, and these patients, generally, suffer from treatable conditions emphasizing the importance of timely EMS. Only 3.2% of the deaths occurred after admission to hospital. It can be said that most victims' clinical outcome could be improved if they can be given rapid intervention and transportation to definitive care in the early hours following the trauma (Browner, Jacobs et al. 1999; Giordano and Cagliuso 2002; Sanders-Fisher 2008).

Figure 1.1: A trimodal distribution of death from road traffic injury



Source: Adapted from *Road Safety Council, Malaysia* cited in Tipayarangsarit (2005) and Dobson 1996 cited in WHO (2005a)

*This curve does not represent actual quantitative data

An urgent need to establish a formal nationwide EMS system was raised and taken into consideration in the period after the Second World War, when an increase in the number of road injuries in many countries caused considerable concern (Post & Treiber 2002; Sikka & Margolis 2005). The military based out-of-hospital care initiative was then modified and introduced to the communities. An initiation of Haddon's matrix, which will be described more fully in chapter 2, to reduce morbidity and mortality from road crashes in particular, had highlighted the need for preventive strategies including education, enforcement, empowerment, program evaluation and establishment of effective EM Services (Rivara 2001; Runyan 1998, 2003).

Pre-hospital EMS comprises a range of medical services, depending on the need of emergency cases, and covers all aspects of pre-hospital care from the time of the request for medical response until arrival of the patient at the hospital (Coats & Davies 2002). The factors that may affect EMS patient outcome include the pre-condition of the patient, reporting and detailing information given by the caller, appropriate triaging and dispatching of the ambulance crew, level of care available, provision of treatment at the scene, provision of care in transit, and transfer of patient to definitive care (Karnganasoot et al. 2003).

The function of EMS in improving RTI patient outcomes after the trauma has also been recognized in many countries (European Road Safety Observatory 2009; Post & Treiber 2002; Suphanchaimat et al. 1998). However, many errors, such as error or delay in diagnosis, mistreatment and error in management strategy have been identified as contributing factors to injury and death (Karnganasoot et al. 2003; McDermott et al. 2005). External influences, such as preventive campaigning, local type of facilities, political interests and organisations, can affect EMS processes (Post & Treiber 2002; Satitniramai 2007). Feedback from medical services staff that provides responses to injury can be used to evaluate the preventive strategy and control programs

concerning injury. The individuals who are directly employed and who experience the situation out on the road, at the injury site, can illustrate the contributory factors involved in patient outcomes following the road traffic injury (March & Yancey II 2002). Staff employed at various stages of the EMS can also give information about the administrative processes.

1.3 Background of the study

In Thailand the road traffic injury problem is regarded as a public health and social problem. In 2000, road traffic injuries were estimated to cause 593,263 of the total Years of Life Lost (YLL) in Thailand and were ranked as the second leading cause of death. In 2005, the mortality rate increased to over 22.70 deaths per 100,000 population (n=14,118) and the injury rate was 1,569.81 injuries per 100,000 population (n=976,357) (Bureau of Non Communicable Disease 2006). Moreover, calculations from the Asian Development Bank in 2002 estimated that RTI was associated with a total economic loss of USD\$4,459 million (115,932 million Baht) or accounted for 2.13% of Gross Domestic Product (GDP) (Tanaboriboon et al. 2004:13).

Evidence demonstrated that the significant losses resulting from RTI in Thailand required RTI prevention and control strategies ranging from education, enforcement, engineering prevention solutions and emergency medical services which could prevent the problems (Tipayarangarit 2005:11). Prevention and control of injury could be implemented at different stages of the injury spectrum to reduce morbidity, mortality and economic loss (World Health Organization 2001). If severity of RTI victims' injury can be downgraded from fatal to serious to minor injury the average cost of RTI would be decreased from USD\$109,728 (2,852,924 Baht) to an estimated USD\$5,472 (142,273 Baht) per case (USD\$1=26 Baht) (Tanaboriboon et al. 2004:12). This would not only

protect more lives from preventable traffic related injuries, but also benefit the socioeconomic balance of the country.

The role of EMS is primarily involved in secondary injury prevention (World Health Organization 2005a, 2006). Emergency Medical Services is one of the strategies used for secondary injury prevention of RTI appropriate in many Western and developed countries. Pre-hospital EMS medical treatment can minimise the consequences of life-threatening RTI, especially at the post-impact stage. The benefits of EMS are most obvious at the acute and subacute phase of the trimodal distribution of deaths from RTI where the patients are in treatable condition (Tipayarangsarit 2005:20; World Health Organization 2005a).

Thailand initiated its first official road safety programs in the late 1990s. The National Road Safety Centre based in Bangkok was established late in 2003. Strategies which have been implemented include the five 'Es' (Enforcement, Engineering, Education, Emergency Medical Services (EMS) and Evaluation) (Tipayarangsarit 2005). Enforcement, engineering and education play an important role in primary prevention, while evaluation can play a role in both primary and secondary prevention.

The EMS is placed in a unique position within the health care system because of the interaction of the EMS staff with patients and their environment, where the injury takes place (March & Yancey II 2002:941). The unique characteristics of EM Services can be useful in that the subjective views of EMS providers are eligible for use in assessing not only the EMS system, but also the features of road trauma (Kupas, Neely & Koenig 2002:946). The exposure of EMS staff to the injured patients and the functioning of the EMS system at the injury scene allow them to see both system and the environmental factors which have influenced the behaviour that placed the victim at risk. Their role

in recording first-hand trauma at the scene also places them in a position to observe the etiology of the injury events and treatment which may influence patient outcomes. Systematic use of the data collected at the scene of injury could increase their capacity to accurately identify factors associated with patient outcomes.

Health services which aim to improve their performance to meet changing public needs are influenced by internal and external environments over time (Black & Gruen 2005b; Isouard et al. 2006a). Health service managers are also influenced by internal problems, which originate from complexity within the health services such as retaining autonomy and being influenced by internal politics. The external difficulties in managing health services may include pressures from the national government, local stakeholders, organisations representing health professions and various medical-industrial complexes. These difficulties significantly affect present-day health services administration (Black & Gruen 2005b:16; Leggat, Harris & Legge 2006:42-46).

However, it can be seen that health service managers may often be more concerned about treating disease as clinicians than about complexities of health service provision (Black & Gruen 2005b:17). An awareness of these factors can provide an improved relationship among managers, policy makers, and researchers to create cooperation and mutual success in managing health services (North & Perkins 2006:435). Hence, this research utilised data collected within the Thai injury surveillance and EMS system, as well as information about the subjective views of the EMS staff to gain a better understanding of the complexity of EMS management of road trauma.

1.4 Aims of the thesis

This study seeks to investigate pre-hospital care of road injury injury in Khon Kaen Province. The focus of the study is to use data evidence and EMS workers' perceptions on EMS management of road traffic injuries within the KK Province context to answer the following question.

How can Emergency Medical Services for road traffic injuries be improved?

This study utilised two sets of available databases to describe the profile of traffic related injury and EMS operation in KK Province. As discussed previously, EMS staff can be valuable observers at the road traffic injury scene and of EMS provision and patient care. The perceptions of EMS staff are used to gain an insight into what contributing factors could affect EMS management and what improvements could be made regarding EMS management of road traffic trauma. The following three main aims were developed to investigate EMS management of road traffic trauma.

- (1) To assess the available road traffic injury and emergency medical services data to describe characteristics of road trauma and provision of emergency medical services currently existing in KK province*
- (2) To explore the perceptions of EMS personnel in order to identify contributory factors associated with road traffic injury and management of EMS response*
- (3) To identify how EMS management and patient outcomes could be improved following road traffic trauma.*

1.5 Significance of the thesis

The greatest chance of death occurs immediately following a traumatic injury event which is also where the chain of EMS response begins. An early appropriate treatment can greatly reduce the impact of injury consequences (European Road Safety Observatory 2009). While a considerable

number of studies evaluating EMS management have been undertaken in the developed world, much less research has been conducted in the developing world. Therefore, this study aims to fill that gap by providing ‘quality’ information about the status of EMS in one area of Thailand. An insight into existing pre-hospital management of road injuries would assess the operation of existing services, highlight areas of underperformance in management of the services and provide guidance to managers on how to improve the current EMS functioning.

Generally, medical professions pay more attention to final clinical outcomes of injury patients rather than to performance outcome in early processes of trauma care (March & Yancey II 2002; Ryan 2002). However, EMS personnel are slightly different as they are dealing with the face-to-face injury problems, while involved in the field of pre-hospital emergency care. In road trauma, they observe in graphic detail the contributory factors involved in RTI. They are engaged in various roles from receiving information from the callers, establishing a triage of care, dispatch of an appropriate medical unit, care of the patient at the site and while being transferred, collecting essential information from the scene, and sending the patient to appropriate health care facilities (Castro & Thomas 1999; Gunderson 2002; Karnganasoot et al. 2003).

KK EMS was selected because it has been in operation since 1994 and is one of the first EMS established in Thailand. The experience of being the pioneer and model for other services, with a proven ability to maintain and progress the service in its Province, provides a valuable case study to learn from. The provincial setting gave an opportunity to become conversant with a pre-hospital EMS model in a Thai rural setting.

According to its rural-oriented and developing country setting, the KK pre-hospital EMS stands in contrast with the other pre-hospital EMS or ambulance services in the urban-oriented developed

world. This study therefore was concerned with the management of RTI by EMS as a system within the particular Khon Kaen context where physical and socioeconomic factors are different from the developed world. It also covers new ground in its exploration of EMS staff perceptions about the operation of, and response to RTI, in the EMS where they were employed.

This thesis is also important because the information may be useful in improving services in Thailand and reducing injury from RTI. It is the first time that a researcher in Thailand has linked quantitative and qualitative data sets to explore the operation of KK EMS in regard to RTI. Qualitative data were obtained from EMS staff by probing into their perceptions and asking the 'why' questions, which are often difficult to access due to the fact that workers may be reluctant to criticise management or their employer. This thesis provides a framework by which to evaluate the system and provide feedback while preserving management and employee integrity.

The study will show gaps in management of EMS in regard to RTI injury in KK. The findings will be used to improve the utilisation of existing databases to identify better details about injury and what is required to be added or extracted from the existing database. Reviewing aspects of EMS management of road trauma with respect to Haddon's matrix and Outcome Management approach may provide information not able to be recorded via the current databases. Moreover, the experiences of EMS staff in relation to the social dimensions of EMS management in response to road trauma will highlight how the system currently works and how it can be improved. Finally, the study will contribute to the available literature on the evidence-based outcome management of emergency medical services.

1.6 Organisation of the thesis

The thesis consists of seven chapters. Chapter 1 has provided a context for understanding the significance of the research problem posed by the study.

Chapter 2 reviews relevant literature about road traffic injuries. The chapter also reviews literature that has evaluated the provision of EM Services and the delivery of the EMS, with particular reference to response to road traffic trauma. The contexts associated with Thai EMS management, and how they influence the ways in which individuals employed in the EMS perceive EMS management of RTI in KK Province, are also discussed.

Chapter 3 outlines the research processes used to carry out the study. It discusses the rationale for using a mixed methods approach and the methods used in data gathering. It presents justification for the paradigms chosen for the study. The quantitative and qualitative components utilized in this study are described separately, followed by personal reflections on the research process.

Chapters 4 and 5 present and discuss the quantitative findings of the research. They respond to the research objectives including:

1. Assessing road traffic injury characteristics and risks in the KKRH health service, and,
2. Assessing emergency medical services infrastructure and processes.

Based on data from the KKRH Trauma Registry, a profile of road traffic injury characteristics is shown in Chapter 4. Chapter 5 explores the available data in the existing KK EMS database and provides a description of EMS processes. An examination of the EMS infrastructure and description of the EMS process characteristics is provided.

Chapter 6 describes the experiences of EMS staff regarding EMS management of road trauma. This chapter highlights some important contexts and perceptions that individuals ascribe to their experiences and reflections on the existing EMS management.

Chapter 7 integrates the available findings of this study. It draws attention to evidence that suggests there are a number of limitations and possibilities to patient outcome improvements based on perceptions of KK EMS staff. These contexts influence the EMS management of road traffic injury problems, which in turn hinder the development process of EM Services.

Chapter 2 Theoretical frameworks and literature review

2.1 Introduction

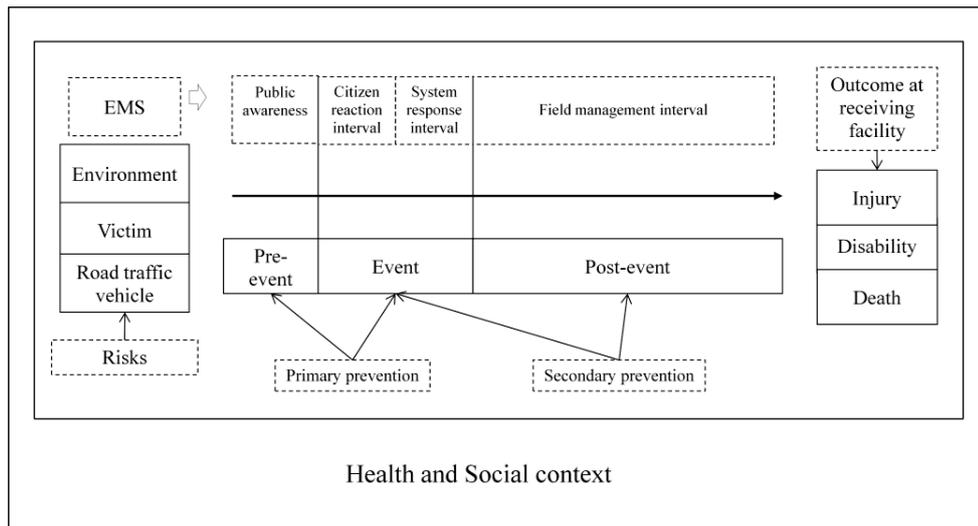
The role of Emergency Medical Services (EMS) in road trauma becomes apparent when road safety primary preventive strategies such as engineering, enforcement and education, are fruitless. This chapter provides a review of research conducted on pre-hospital emergency medical services, with particular focus on response to road traffic injuries, and theoretical frameworks used to assess health care provider management. Models of road traffic injury prevention and emergency medical responses within the international, national and local contexts are discussed.

2.2 The theoretical frameworks underpinning this study

There is a need for quality management and the efficient use of resources in emergency management. The framework underpinning the current study involved a number of theories that were used to enhance understanding and analysis of the complexity of management of RTI by EMS. The eclectic framework consists of four main theoretical contexts. These are the Outcome Management Approach developed from Donebedian's outcome assessment model (Spaite et al. 2001; Walburg 2006), the Contingency theory of Burns and Stalker (cited in Robbins & Barnwell 2002), the application of Institutional Theory, particularly Neo-Institutional theory (DiMaggio & Powell 1983) and Haddon's matrix (Haddon Jr. 1968) to the study. This framework allows us to see, in a systematic way, that EMS outcome is a result of relationships of the system components: inputs, processes, and outcomes. Contingency theory is used to allow us to understand why the existing EMS has to be investigated for its unique features due to KK EMS related contingencies. Institutional theory is used to explain how social institutionalization has an effect on the administration of a system and the difficulty of implementing change of EMS in the KK and Thai

context. Haddon's matrix will also be used to divide EMS management complexities into a small manageable area. The conceptual nature of the area under study is described in Figure 2.2 and discussed under four headings.

Figure 2.1: A conceptual framework of patient care following a road traffic injury



Source: Adpated from Haddon Jr. (1968), Kuehl (2002), Spaite et al. (2001) and Walburg (2006)

2.2.1 An outcome management approach and the concept of episode of care

Health services can be described in terms of a set of interrelated elements including inputs of care, continuum care processes and outcomes of care (Block 2006b; Spaite et al. 2001; Walburg 2006). These three components can be used in concert to manage the performance of health services with a focus on improvement of patient outcome, which is the goal of every health service (Black & Gruen 2005c; Flood et al. 2000; Walburg 2006). With regard to EM Services, there are a number of inputs during the pre-hospital stage that could be associated with patient outcome (see Figure 2.2). As an important point of entry into the healthcare system, pre-hospital EMS is in a unique position to have an immediate impact on post-crash patient outcome (WHO 2006).

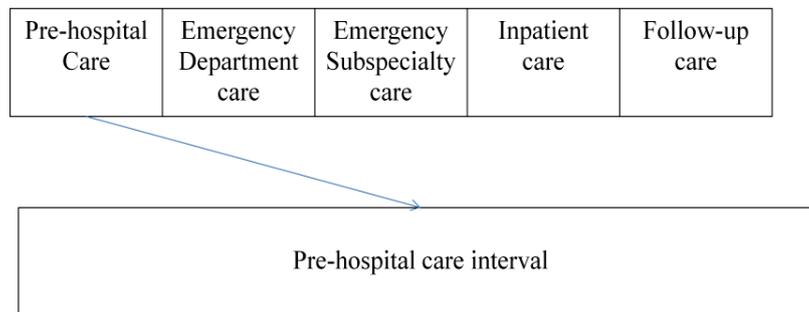
Other inputs into the health system include the patient variables and structure of the health services (Block 2006b; Kane 2006). Gaining information about the patient before entry into the health service arena is important since a number of factors associated with patients and their clinical characteristics can positively affect treatment and care process (Gunderson 2002). Organisational structure including material and human resource availability, which are vital to achieving organizational goals, can impact on employees' productivity (Stone 2002b). Equipment has to be allocated appropriately to meet the characteristics and needs of patients (Block 2006a; World Health Organization 2005b) and the workforce should be constructed with suitable human resource management activities including recruitment, selection, performance appraisal, career planning and development, motivation and health and safety issues.

However, health care services often consist of a number of interdependent health professions working together with the common goal of improving patient conditions. Health personnel can respond differently to these goals, based on the nature and dynamics of their profession and their own interpretation of requirement (Iles 2005). The varying status of professions, the spectrum of interpretation of disease, and degree of structure of clinical problems are among some of the factors which can influence interactions among personnel. Although integrated care with an emphasis on collaborative practice can improve service for patients, members of the health team, sourced from a variety of areas of expertise, may demonstrate difficulties working effectively. A lack of shared understanding may exist as a result of differences in their sets of beliefs, expectations and behaviours. To appreciate the interactions and understanding among professions, an insight into individual differences can help develop a social synergistic approval, which can promote productive relationships and greater benefit to patient outcome (Iles 2005).

The other challenge to EMS outcome management is the complexity of the continuum of care processes extended out of an emergency department (Shapiro 2000; Spaite et al. 2001). A lack of evidence of EMS measurements makes it more difficult to identify factors involved in the performance of care rendered in this pre-hospital setting. The EMS response time interval is particularly related to proof of effectiveness of the quality of EM Services. The functioning of pre-hospital care has become increasingly questioned by researchers such as Shapiro (2000), MacFarlane (2003) and McDermott and Cooper et al. (2005) and a number of studies have reported on the benefits of dividing the episode of care into smaller more manageable units (Block 2006b; Johnson, Tsiros & Lancioni 1995; Øveretveit 1998; Walburg 2006).

The Episode of Care Model becomes important for pre-hospital care evaluation when investigating EMS patient outcome. There are a number of factors involved in the processes of care which can be identified in each episode as shown in Figure 2.2 (Van Matre & Koch 2009). The Episode of Care Model explains that each episode of care can be divided into intervals along a continuum of EMS response. For example, an episode of care involving road trauma is initiated by the injury, which leads to a response and treatment by the EMS crew, followed by emergency department care, emergency subspecialty care, inpatient care, and follow-up care (pre-hospital care interval, Figure 2.2). Every interval of service occurring during one episode of care and each can affect patient outcome.

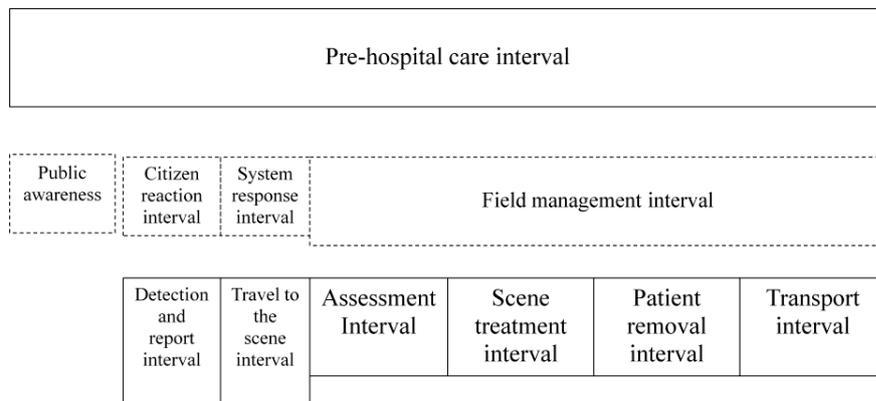
Figure 2.2: An episode of EMS care



Source: *Emergency Medical Services Outcomes Project (EMSOP II)* (Adapted from Spaite et al. 2001)

Figure 2.3 demonstrates the pre-hospital EMS interval which focuses on the earliest isolated subunit in the emergency Episode of Care Model constructed by Spaite, Maio et al. (2001). In this model, the pre-hospital EMS interval of care is simply started by an event which causes a response by the public which is then followed by a response by the EMS system. It is obvious that risk adjustment measurements, which are one of the intervals, need to be made by the bystanders in order to give the right information to the EMS communication centre for the report interval. The next process, which relies heavily on accurate information in the previous interval, is dispatch and travel of an appropriate EMS unit. Appropriate risk-adjustment measurements may be made by EMS personnel after the arrival of the EMS crew at the injury scene. This phase is then followed by the on-scene medical intervention, patient removal, and transport intervals. Outcome measures would typically be collected after the transport interval to the care facility (see Figure 2.3).

Figure 2.3: A pre-hospital interval of an episode of EMS care



Source: *Emergency Medical Services Outcomes Project (EMSOP II)* and *Prehospital Systems and Medical Oversight* (Adapted from Kuehl 2002; Spaite et al. 2001)

The use of these measurements is to evaluate the processes and productivity and EMS performance. The measurements include variables such as linked communication systems, involvement of health care personnel, and medical procedures used (Flood et al. 2000; Kuehl 2002; World Health Organization 2005a). They can also indicate the changes in performance and efficiency of the system used (McDermott et al. 2005; McDermott, Corder & Tremayne 2001; O'Meara 2005; Spaite et al. 2001). Particular attention should be given to the feasibility of obtaining accurate information for risk-adjustment and outcome measures in this unique pre-hospital setting (Mallett, Vaught & Brnich 1999).

As mentioned previously, patient outcome depends on many factors ranging from the risk of exposure to road traffic injury to the factors associated with post-crash care. Although many subunits or intervals under pre-hospital episode of care are identified, there are only a few validated indicators acknowledged as universally accepted indicators. O'Meara (2005) concluded that one of the most published items of evidence of EMS performance involved time intervals such as the activation time, dispatch time, time taken to travel to the scene, and time spent at each interval of care until arrival at the hospital (Feero et al. 1995; Jennings et al. 2006; McLay & Mayorga 2009).

The clinical outcomes measured are limited to cardiac arrest and trauma care (Lerner et al. 2003; McDermott, Cordner & Tremayne 1997; Soo et al. 1999).

2.2.2 Contingency theory

Burns and Stalker (cited in Robbins & Barnwell 2002) argued that the type of structure of an organisation is different when it is in different environments. They characterized two forms of organisations in relation to different environmental conditions. The mechanistic organisation is the formalised organisation performing routine tasks based on rigid rules and directions, whereas the organic type of organisation can perform a more flexible task depending on expertise and knowledge. However, there is no such organization that takes on one side without concerning the other.

It can be observed that out-of-hospital settings may differ significantly to those in fixed health care facilities and require a specific approach towards management of contingencies (Mickan & Boyce 2006; O'Meara 2005; Shortell & Kaluzny 2006:47). EMS staff spend days dealing with time-critical and life-threatening situations (Tippins & Evans 2007) and caring for those patients who experience physical and social disadvantages (Whitnell 2008), who may have more health problems (Bounds 2006; Sterud, Ekeberg & Hem 2006). Although EMS operation seems to require a more hierarchical-based management, it cannot operate under purely machine-like properties. Previously rigidly regulated and bureaucratic style managements need to be combined with a more humanistic approach (Hanlon 2001; Mickan & Boyce 2006; Narayanan & Nath 1993; Robbins & Barnwell 2006) in order to help personnel cope with difficult situations they work in. Contingency-driven managers, who demonstrate a full and diverse range of flexible styles of coping based on critical contingencies in different situations are needed (Kreps 1991; Leggat, Harris & Legge 2006).

EMS management can be more focused on a division-based internal structure supported by rules, where the decision-making role resides with the medical practitioners or the medical administrators, with the use of rewards (Kuehl & Baker 2002; Pointer & McGuire 2002). This perhaps is a result of the origins of the EMS in military-based activities where staff have their own roles within a clear occupational and functional group (Post & Treiber 2002). However, EMS staff need to be more flexible and adaptable than workers employed in specialised disease areas and their job requires more involvement in skill training and effort to continuously improve service quality.

EMS management also has a need to be more flexible since the pre-hospital environment is unstable, where fast actions are needed (Leggat, Harris & Legge 2006; Burns & Stalker 1961 cited in Robbins & Barnwell 2002; Shortell & Kaluzny 2006). EMS workers are required to rely on coordination mechanisms and to link with networks and other professionals. Their work is often carried out in unstable and dangerous environments, where tasks and technologies could be non-routine and could influence their performance (Browner, Jacobs & Pollak 1999; Greenberg 1999; Shortell & Kaluzny 2006). Therefore, to suit the modern EMS where employees' efforts are seen as important, a more humanised management approach should be included in human resource policy in order to empower individuals within the organization (Mathauer & Imhoff 2006; Ranse & Carter 2010).

EMS quality improvement functions should also be organized differently to the intra-hospital setting. The internal EMS contingencies involved, such as characteristics of patients, organisational structure and culture, treatment processes, and types of employee skills, need to be taken into account (Moore 1993). External contingencies including interagency cooperation are also required to be considered, for example, directions from lead national agency and local supports (Moore

1993; WHO 2005). While contingency theory has not been without its critics as a theory it is generally accepted in the literature that ‘the relationship between technology, structure, and organizational effectiveness supports an approach to organizational design that begins with the statement that “it all depends”’ (Schoonhoven 1981:371).

Organisation environments also influence organisational adaptations. Receptive local supports generate success in change (Wilderspin & Bevan 2006). In general, a clear picture of proposed targets must be identified for all the organisation’s stakeholders, including staff will for change (Wilderspin & Bevan 2006). If there is no will to change existing within the staff, there will be many difficulties in implementing strategies to improve performance. However, transformation requires more than a will for change. The steps in Table 2.1 were designed by Reinertsen (2004) and used by Wilderspin and Bevan (2006) to create an environment and infrastructure where change is more likely to be positively received and accepted in an organisation. These strategies consist of the following steps.

Table 2.1: Steps and strategies to improve organisation management

Steps	Steps and strategies to improve management
1	Build the will for change
2	Generate evidence and ideas
3	Build on the voice of customers
4	Execute change
5	Engage the whole system
6	Sustain the changes

Source: Adapted from Reinertsen cited in Wilderspin & Bevan (2006)

2.2.3 Institutional theory

The above theories demonstrate that an organisational design is different from others as a result of varying physical structures and social contexts. In institutional theory organisation management

needs to conform to wider environmental factors to gain legitimacy and support, and uses rationalised formal structures and corresponding policies to achieve this by responding to coercive, mimetic and normative pressures (Heugens & Lander 2007). Strategic adaptation can be targeted towards the rules, regulations, model structure and social norms of an organisation which determine how it is managed (Gerowitz et al. 1996; Gómez, Kirkman & Shapiro 2000; Hofstede 1997; Pasa 2000; Robbins & Barnwell 2006:46). For example, self-actualisation in the hierarchy of needs (applicable to individualistic countries such as Australia and USA) may not be of great use in many Asian countries where an individual's concerns are more likely to be associated with gaining social approval, maintaining social harmony and avoiding conflict (Cianci 2003; Hofstede & Hofstede 2005).

As reported by Hanlon (2001) organisations show a tendency to thrive and succeed by conforming their traits to social environments. It was also suggested by DiMaggio and Powell (1983) that the behavioural patterns of individuals and organizations are influenced by three main institutional forces: 1) political power from outside including government rules and regulations, 2) competitive forces from successful competitors which include modelled organisations and 3) norms embedded in the organisation's shape and management which include the process of professionalisation and culture traits. These factors influence how the Thai health organizational structure is established and how behaviour and routines are interpreted and translated into action. The influences of Thai institutional forces will be discussed later in Section 2.5. Contingency theory emphasises that environmental factors are major determinants of organisation structure whereas neo-institutional theory emphasises legitimacy in the organisational field as being most important and the interplay between these theories is seen by this researcher as influential to the proper functioning of EMS.

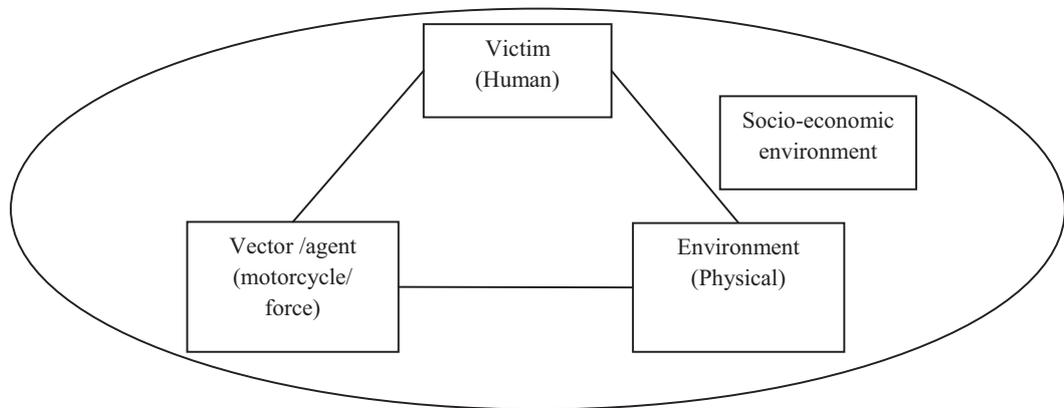
In this study, the researcher used the above theories as a theoretical framework to evaluate the importance of the Thai worldview that institutionalises and influences Thai health service management. Cultural norms, rules and values that reflect Thainess and Thai beliefs which have long been embedded in Thai society, and affect Thai organisational performance, are taken into account. Factors associated with social institutionalisation may be used to understand differences between the management style and characteristics of Thai organisations (Mohan 2000 cited in King 2005; Sheehan & Egan 2007). Another aspect of theoretical framework in the form of Haddon's matrix is discussed below.

2.2.4 Haddon's matrix

The concept of injury control as a public health issue was formulated in the mid-twentieth century in western countries, succeeding the belief that an accident was an act of God or a result of carelessness or bad karma (Mulder 1994:83; Rivara 2001:3-5). Understanding about a 'road traffic accident' had changed since the 1960s when the term 'road traffic accident' was replaced by the term 'road crash' or 'road injury' (World Health Organization 2004). There was a growing awareness in this terminological change that injuries were predictable, preventable and could be controlled especially after application of a public health approach, where host, agent, and environment could be identified as interrelated factors or inputs which could be managed.

The importance of equilibrium in any interaction among host, agent and environment in an epidemiological model plays an important role in study of both disease and injury aetiology (Gordis 2004; Rivara 2001; World Health Organization 2001). Therefore from an epidemiological point of view, causes of injuries can be elucidated and predicted. The tri-polar model seen in Figure 2.4 below can be used to explain the association between those casual factors which can be managed to prevent the injury or reduce the severity of injury (World Health Organization 2001).

Figure 2.4: Epidemiological triad of injury



Source: *Injury Surveillance Guidelines, WHO (2001)*

William Haddon Jr., who has been named as the father of modern injury epidemiology, developed a concept in 1968, later named ‘Haddon’s Matrix’, which could be used to analyse injury patterns thereby controlling injury and reducing injury severity (see Table 2.1). Haddon (1968, 1980), conceptualized his model for motor vehicle injury prevention by combining public health concepts, which consider the host (passenger or driver), vector or vehicle and the surrounding environment. Each of the factors or outputs involved can also be analysed in a continuum of injury process over three stages, before-event, during-event and after-the-event phase. In accordance with Haddon (1968) and the World Health Organization (2001), which developed reference guidelines used for Haddon’s model, consideration of the mitigation prior to, during and after an injury allows us to identify factors which prevent injury before an injury and responses to the injury once it occurs (Runyan 2003).

Table 2.2: A modified version of Haddon’s matrix describing how to analyse and prevent injury events

	Host	Vector/agent	Physical Environment	Socio-economic Environment
Pre-event	Is host pre-disposed or overexposed to risk?	Is vector/agent hazardous?	Is environment hazardous? Does environment contribute to injury?	Does environment encourage or discourage risk-taking and hazard?

Event	Is host able to tolerate force or energy transfer?	Does vector/agent provide protection?	Does environment contribute to injury during event?	Does environment contribute to injury during event?
Post-event	How severe is the trauma or harm?	Does vector/agent contribute to the trauma?	Does environment add to trauma after event?	Does environment contribute to recovery?

Source: *Injury Surveillance Guidelines, WHO (2001)*

The use of Haddon’s matrix in this study assists the researcher to better understand road traffic injury risks and identify EMS management factors which influence road trauma outcomes in the KK context. It also can be used to demonstrate additional possible issues of EMS and RTI contingencies from both institutional and environmental factors. The factors and risks identifiable are those influencing exposure to risk, crash involvement risk, and risk influencing post-crash conditions, all of which influence patient outcome (World Health Organization 2006). Not only can the victim or host be assessed for risk, but also any other individuals or health service personnel entering into the injury scenario can be analysed for their role in patient outcome. At a clinical level, the matrix can be used as a framework for medical professionals to counter causal injury factors by identifying possible EMS errors at each stage of the injury spectrum and then arrange interventions to mitigate injury (Litt & Egger 2008; World Health Organization 2001). It can be seen from the matrix that responsibility for injury prevention and control belongs to not only the health sector, but also to departments associated with traffic engineering, law enforcement and road safety education (Litt & Egger 2008; Tipayarangsarit 2005).

The following sections of this chapter outline a review of the road traffic injury and EM Services at international level as well as in Thailand. Problems associated with road traffic injury, injury prevention programs and road safety strategies are identified. Factors influencing the performance of EMS worldwide are also identified.

2.3 Road traffic injury

Although transportation technology makes life and travelling easier, its advancement has created more opportunity for extended exposure to road traffic injury risk. Road traffic injury had been somewhat overlooked until it was seen as a predictable event with associated causal factors. When host, agent and environment relationships were recognized as shown in Figure 2.5, road traffic injury was acknowledged as a public preventable health problem (World Health Organization 2002, 2004).

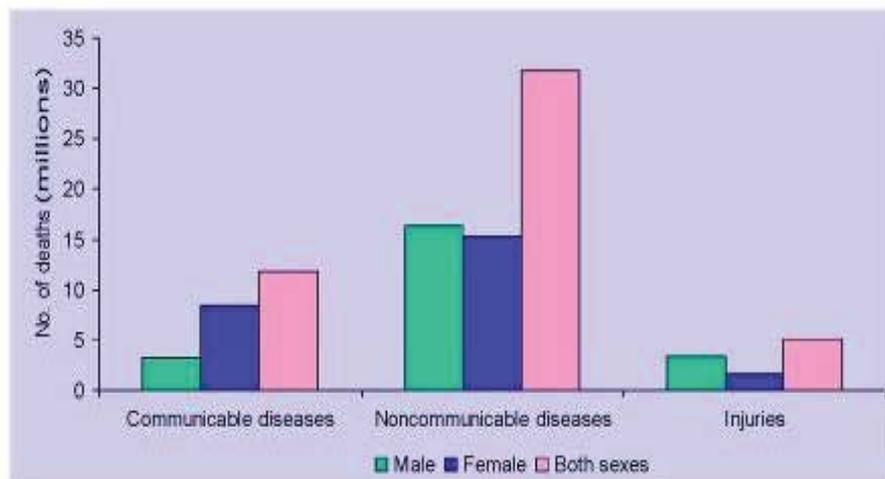
2.3.1 Road traffic injury and its management

In the early 21st century, road traffic injury has become recognised as one of the major public health issues worldwide, particularly among low and middle income countries. While death rates from injury have been reported to account for more than 25% of total injury deaths around the world (Ameratunga, Hajar & Norton 2006; World Health Organization 2002), road traffic injury makes up 85% of these deaths and 90% of Disability-Adjusted Life Years of the population of Low-and Middle-Income Countries (LMICs) (Hofman et al. 2005:13; World Health Organization 2004). Nearly half of the fatalities were vulnerable road users such as pedestrians, and riders of motorized two- and three-wheeler vehicles (World Health Organization 2009a). Moreover, more than half of the injuries and deaths occur to those aged between 15 and 44 years of age. Globally, the death rate of RTI for this age group accounted for approximately 22 fatalities per 100,000 population on average.

According to data published by WHO (2002), global injury deaths were estimated to number approximately 5 million fatalities in 2000 (see Figure 2.5). Of these approximately 1 million were associated with road traffic injuries. In addition, around 10 million people are seriously injured and roughly 40 million encounter adverse effects after being injured on the roads. WHO (2004) also

forecasted that without effective strategies to reduce this burden, road traffic injury will be the sixth leading cause of fatality and the third leading contributor to global life lost by 2020 (see Table 2.2). In 2008, road traffic injury remained the ninth leading cause of death and was forecasted to be the fifth leading cause of total global fatality in 2030 (World Health Organization 2009a).

Figure 2.5: Estimated global mortality by cause and sex, 2000



Source: *The Injury Chart book*, World Health Organization (2002)

Table 2.3: World ranking of injury-related mortality and burden of disease (DALYs lost), 1990 and 2020

	No. of Deaths		DALYs Lost	
	1990	2020	1990	2020
Road traffic injuries	9	6	9	3
Self-inflicted injuries	12	10	17	14
Interpersonal violence	16	14	19	12
War	20	15	16	8

Note: DALY=Disability-Adjusted Life Years

Source: *The Injury Chart book*, World Health Organization (2002)

Road traffic injuries, moreover, have a considerable economic impact on the countries in which they occur. They are estimated to cost at least 1% of GNP in low-income countries (LICs), 1.5%

in middle-income countries (MICs) and 2% in high-income countries (HICs). Projections also show that deaths due to road traffic injuries in LMICs will increase considerably between 2000 and 2020 unless new preventive actions are developed and implemented. It is estimated that losses from RTI globally will cost approximately USD\$518 billion per year (World Health Organization 2004, 2009a).

A recent increase in global awareness and political commitment on the above injury issues, especially road traffic injuries, has gained greater global recognition for them as subject matter for public concern and development (World Health Organization 2008). Many road traffic injury prevention strategies have been identified and implemented. However, while faced with these injury related problems, and road traffic injury in particular, the community and the health workforce have not kept pace (World Health Organization 2005b). In keeping with 'Health for All', a range of community groups and health departments are required to work collaboratively to improve preventive strategies and road trauma outcomes (World Health Organization 2005b). Capacity to manage this problem also needs to be more effective. To a large extent, injury prevention and control requires systemic and multi-sectoral collaboration approaches to implement timely, measured injury control and effective trauma care services.

In general, many mainstream health care settings address treatment of trauma with little or no consideration of other injury-related preventive strategies and pre-hospital care (Overton & Stout 2002). Additional competencies of health professionals, such as patient-centred care, quality improvement, information and communication technology and public health perspective, must be adopted and expanded to meet injury and violence problem requirements (World Health Organization 2005b). Capacity building for reducing injury and violence among health care personnel regarding the above competencies is necessary. WHO (2008) launched a medium term

strategic plan for health professionals who work in the area of injury and violence prevention, which consists of human resources, institutional and infrastructural capacity and networks as well as partnerships development. The commitment to reduce the number of fatal and non-fatal RT injuries by authorities in many countries has been acknowledged, encouraged and supported by many organizations, such as the United Nations (UN), WHO, the World Bank and a number of regional development banks and their own road safety organizations (European Transport Safety Council 1999; Tanaboriboon et al. 2004; World Health Organization 2006).

Many countries have responded to the RTI problem in varying ways (Dumbaugh 2005; Ijjasz 2008; World Health Organization 2009a; Zambon et al. 2007). There have been wide-ranging approaches, depending on local contexts, to management of road safety in countries where road safety models are more focused on integration of public education and behaviour control countermeasures, including establishment of trauma care services to lower impact and severity of road traffic injuries (Runyan 2003; World Health Organization 2004; Zaal 1994). The main strategies which include engineering, education and enforcement have been implemented with good results in reduction of road fatalities, particularly in some developed countries such as Australia, Sweden and USA over the years (Bourne & Cooke 1992; Delaney, Dimantopoulo & Cameron 2006; Henderson 1991; Rechnitzer, Haworth & Kowadlo 2000; Zaal 1994).

Engineering approaches, especially those addressing the issues of vehicle road worthiness and road environment safety, have been reported by Navina, Zeinb et al. (2000), Rechnitzer, Haworth et al. (2000), Road Traffic Authority (2006) and Beyer and Ker (2009) as an effective tool to reduce road traffic injury. Properly inspected vehicles are found to have a lower crash rating than non-inspected vehicles, particularly those with brake and tyre defects (Rechnitzer, Haworth & Kowadlo 2000). Road environment safety principles, including road design, traffic management and control

devices, signposting devices and work zones, have been found to reduce the number of road traffic injuries (Bunn et al. 2003; Elvik 2001; Roads and Traffic Authority 2006). However, engineering models also have their limitations, such as the prohibitive expense of large-scale change and a requirement of medium to long-term time-frames for implementation (Bourne & Cooke 1992; World Health Organization 2009c).

An educative approach is often seen as a more appropriate and sustainable approach to road safety programs by raising road user knowledge (Ramos et al. 2008). An effective way to prevent unlawful driver behaviour is to change subjective intention and create a perceived threat to their health or benefit gain from their action (Rutter & Quine 2004a). However, promoting better road safety behaviour also needs to be associated with many other road safety related activities (Bourne & Cooke 1992; Ewles & Simnett 1992; Henderson 1991). A combination of increased road safety education and tightly enforced legislation has been respected by Henderson (1991) as one of the most effective ways to change human behaviour.

Enforcement alternatives are also valuable for other areas of road safety and bring immediate effects to road users (Zaal 1994). They focus on creation of a deterrent threat for at-risk road users and reinforce good driver behaviour by highlighting unlawful behaviours (Gibbs 1975). To be successful in enforcing traffic law, the level of enforcement must be stringent if it is going to have any serious long-term effect. For example, enforcement of speed limits significantly lowers crash deaths if enforced through use of speed detection devices and increased police presence (Ramos et al. 2008; Richter et al. 2005; World Health Organization 2009b). Sobriety checkpoints and random breath-testing have also been found to lower alcohol-related crashes (Ramos et al. 2008; Shults et al. 2001). However, law enforcement may be useful to constrain those who comply with legislation

but may not change the behaviour of less law-abiding individuals (de Waard and Rooijers 1994 cited in Parker 2004).

In a study conducted by WHO in 2009, many participating countries reported implementation of comprehensive road safety strategies and legislation in relation to five main risk factors: speed, drink-driving, helmet use, seatbelt use and use of child restraints (World Health Organization 2009a). A scale of 0-10, where 0 was “not effective” and 10 “highly effective”, was used to subjectively evaluate effectiveness of each law enforcement activity in each country by a participating National Data Coordinator. Enforcement relating to the five important issues was found to be ineffective in many countries. Of the 178 participating countries only 9%, 13%, 19% and 6% ranked their strategies as being effective (rating of >7 out of 10) in relation to speed limits, blood-alcohol concentration limits, seatbelt use and child restraint respectively. Even though 90% of the participating countries had existing helmet laws, only 40% had comprehensive legislation involving standardised helmet use.

Table 2.4: Enforcement relating important issue (% of countries rating of > 7 out of 10)

Issues	% of participating countries
Speed limits	9
Blood alcohol concentration limits	13
Seatbelt use	19
Helmet use	25
Child restraint	6

Source: World Health Organization (2009)

It can be seen that at this point in time considerable effort to decrease road crashes has been taken globally, but much remains to be done. While we cannot prevent all road crashes, adverse

consequences of unavoidable road crashes can be reduced in their severity by providing a rapid and appropriate emergency response to the victim, especially at pre-hospital stage (Sikka & Margolis 2005; World Health Organization 2005a). Many countries have undertaken to strengthen provision of emergency medical services to minimise the burden of morbidity and mortality. Most of these are those in high and middle income countries. Moreover, only 76% of the participating countries in the WHO study were found to have formal pre-hospital care systems and quality of these was not evaluated (World Health Organization 2009a).

2.3.2 Road traffic injury and its management in Thailand

RTI loss comes from approximately 22.6 million motor vehicles registered in Thailand in 2005 which rose up to 25.6 vehicles in 2007 (Tangpaisalkit 2007). Of these vehicles, 64.5% and 63.0% were grouped as motorized 2-wheelers, which are the main form of transportation, in 2005 and 2007 respectively (Waranpitikul 2008a, 2008b). The Ministry of Transport also estimated that there could be approximately 6 million more unregistered motorcycles currently used on the roads in Thailand (cited in Erickson 2004). These vehicles travel on a total road network of 212,800 kilometres, which is overseen by the Department of Highways and the Department of Rural Roads.

Consistent with many other countries, comprehensive injury data is an issue for Thailand (Ponboon & Tanaboriboon 2005; Suriyawongpaisal & Kanchanasut 2003). At present there is fragmentation of and limited road safety knowledge and research. There have been a number of projects conducted by organisations such as Asian Institute of Technology (AIT) and WHO using information from various sources. The datasets related to road traffic injury appear to be collected in isolation by various organizations as shown in Table 2.4. The available datasets were collected, standardized and used by various organisations at both national and international levels

(Chadbunchachai et al. 2006a; King 2005; Ponboon & Tanaboriboon 2005; Tanaboriboon 2004; Tanaboriboon et al. 2004; Tanaboriboon & Satiennam 2005; Wibulpolprasert 2008, 2004; World Health Organization 2009b).

Table 2.5: Road traffic injury data sources, Thailand

Database	Source of information	Comments
National Police Office (NPO)	Police stations	Police classification
Department of Land Transport, Ministry of Transport (MoT)	Information System Centre Traffic Report and Accident Management System	Police classification
Ministry of Public Health (MoPH)	Hospitals Bureau of Non-communicable Disease Injury Surveillance Sentinel sites	MoPH classification ICD* 10
Emergency Medical Institute of Thailand (EMIT)	Emergency Medical Service Units	EMIT classification

*ICD = International Classification of Disease

Source: Suriyawongpaisal and Kanchanasut (2003), the Office of Transport and Traffic Policy and Planning (2004), Tipayarangsarit (2005), Chadbunchachai (2008a) and World Health Organization (2009b)

According to the dataset used for the Thailand Road Safety Action Plan 2004-2008, Office of Transport and Traffic Policy and Planning (2004), there were approximately 13,000 fatalities and 50,000 non-fatalities resulting from road traffic related injury in Thailand in 2003. Of those approximately 80% were males. The largest percentage of total fatalities is the young aged 20-24 years old. Motorcyclists were the most common road users associated with RTI in each year and accounted for 37.65% of total nationwide police data compilation. Road injuries were also reported to be more common during festivals such as the New Year (January) and Songkran¹ (April) holidays. Data from the Road Safety Centre, Ministry of Interior, for example, shows that during the New Year Holidays 2004 (29 December 2003 – 4 January 2004) there were 628 fatalities,

¹Songkran is a Thai New Year and is a time that most people who work away from their families will travel back to their home towns to visit and pay respect to older family members. This creates a heavy road traffic which leads to road injuries. It is also a time that people can relax more and hence tend to consume alcohol, and this of course tends to lead to more road injuries.

26,100 non-fatalities and a total of 19,562 cases. In the same year, during the Songkran holidays (9-18 April 2004), there were 654 fatalities and 36,642 non-fatalities occurring in the ten-day period. The most common causes of police-registered RTI cases in 2004 were from exceeding speeding limits, failing to judge the other person's path or speed, and drink driving, in that order (Tipayarangsarit 2005).

The Bureau of Non Communicable Disease, Ministry of Public Health report (2006) also states that injury is among the leading causes of death of the Thai population and one of the top ten causes of DALYs lost in both males and females. Road traffic injuries have become one of the leading causes of death in Thailand since 2000 and have caused a large scale economic loss. The hospital-based data compiled in the MoPH reports (Wibulpolprasert 2008, 2004) shows that a number of RTI related fatalities rose from 11,307 cases in 2002 to 14,118 cases in 2005, while a number of non-fatal cases increased from 888,151 to 976,357 cases in the same period. The mortality rate increased to over 22.70 deaths per 100,000 population and estimated injury rate was 1,569.81 injuries per 100,000 population in 2005. The national road injury cost (including cost of medical loss, loss of output, property damage, insurance, EMS and social cost) for the 2002 RTI impacted on the economy of the country at an estimated cost of 115,932 million baht or 2.13% of GDP (Tanaboriboon et al. 2004:13; Wibulpolprasert 2004:180). These figures, particularly the non-fatalities, are much higher than those used by the Road Safety Centre and documented by the Royal Thai Police database since they cover all RTI related victims who required proper medical care.

The National Injury Surveillance (IS) system has also reported road traffic injuries as the most common cause of fatal and non-fatal injury recorded in Thai history over time (Santikarn et al. 1999; Tipayarangsarit 2005). The National Injury Surveillance database using international classification of disease operates in 29 sentinel sites around the country. This provides data on

severely injured cases, death before arrival, death at emergency department, and observed or admitted cases presenting within seven days after the incident occurred. However, data from the Bureau of Non Communicable Disease (2006) indicate that data from the IS database may only have accounted for approximately 27.7 % (n=3,905) of the total national RTI fatalities and 5.5% (n=53,601) of non-fatalities in 2005. It suggests that there may have been a large number of cases that were not recorded and, as a result, the statistics for road traffic injuries may not reflect the full picture to inform policy about managing road traffic injuries in Thailand.

On the Injury Surveillance dataset in 2005, of the 6,193 fatal injury cases, 63.1% were road traffic related in 2005. Of the 109,151 non-fatal injury cases, 49.1% were road traffic injuries. The majority of road injury victims were males aged 15-24 years. Labourers and students accounted for 60.3% of fatal and non-fatal RTI injuries. Motorcycle related injury (81.8% of the cases) was the most common cause of road transport injury. Nearly half (49.7%) of the RTI cases were associated with alcohol use and more than 80% were not using personal protective equipment such as helmets or safety belts while driving. The incidence of road traffic injury was slightly higher on weekends, particularly Fridays and Saturdays, and also during April, November and December, the time of the Song Kran (Thai New Year) and the New Year festivals.

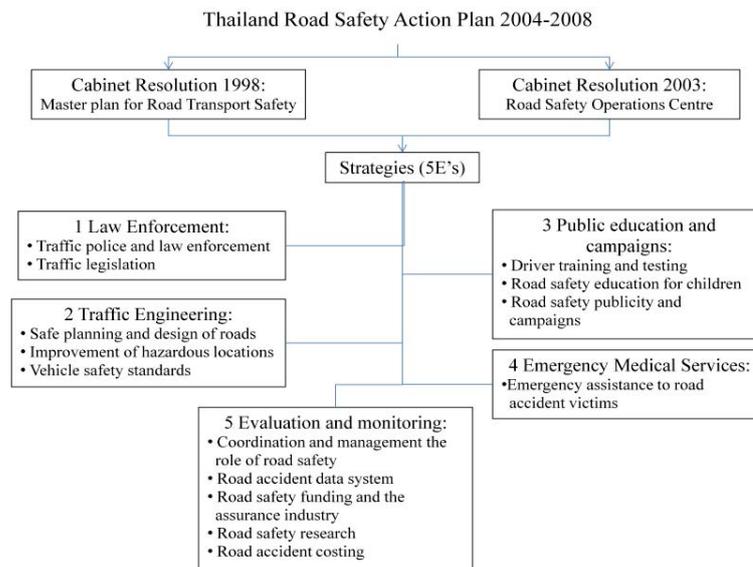
Road safety management

Following fragmented approaches to reduce road traffic injuries the first national master plan on road transport in Thailand was developed during the late 1990's. This was followed by establishment of the Road Safety Operations Centre under the Ministry of Transport in 2003, which was later handed over to the Ministry of Interior and renamed as the Road Safety Centre (RSC) with a change of the ministerial committee (Office of Transport and Traffic Policy and Planning 2004; Tipayarangsarit 2005).

The ‘*Thailand Road Safety Action Plan 2004-2008*’ under the Ministry of Transport was launched with the aim of reducing the road traffic injury rate (see Figure 2.7). The committee consisted of multi-sectoral stakeholders with targets to increase road safety standards and reduce the expected annual increase of 5-10% in fatalities for the 2004 and 2008 period. The five ‘E’s’ strategies was developed as a national road safety capacity building initiative (utilising law-Enforcement, traffic Engineering, Emergency Medical Service, Education and Evaluation) to more effectively control road traffic injury. A review of the program found that the budget had been unequally distributed, showed overlap, and was poorly evaluated, and that the effectiveness of the road safety campaigns implemented was not demonstrated (Tipayarangsarit 2005:46-53). Tipayarangsarit also concluded that the strategies seemed to be partially adopted from developed countries and implemented without any adaptation to the local context.

Tipayarangsarit (2005) also reported that there was some evidence that activities were effective only during festivals. One of the most successful campaigns to tighten law enforcement was ‘*Sam Mor, Song Khor, Nueng Ror*’ (3M, 2K, 1R): 1) *Mao* (Drinking); 2) *Muak* (Helmet); 3) *Motorcycle* (Safety motorcycle); 4) *Kubki* (Driver license); 5) *Kemkud* (Safety belt); and, 6) *Rew* (Speeding). This campaign was commonly carried out during the long holiday period.

Figure 2.6: Thailand road safety action plan 2004-2008



Source: Adapted from *Thailand Road Safety Action Plan 2004-2008*

Although an engineering approach can be an effective tool to reduce road traffic injury, the Thai studies conducted in this area were primarily associated with road injury causal identification and information systems development (Islam, Ponboon & Boontob 2006; Ponboon & Tanaboriboon 2005; Ponboon et al. 2004; Reungson et al. 2003). Studies on use of information systems to identify and improve road environment factors were conducted by Reungson, Thanaboriboon et al. (2003) and Suttayamully (2005). It would appear that proper implementation of traffic engineering measures has not been effectively carried out in Thailand.

Studies regarding road safety education in Thailand were found to be associated with contextual factors. Klein (2001) cited in King (2005) reported that subjective intentions to appropriately use the road among Thai road users were influenced by their social environment. Hence, road safety education campaigns in Thailand were seen to be more effective when combined with other road safety strategies and social influences. A similar pattern is seen in other countries (Delaney, Dimantopoulo & Cameron 2006; Henderson 1991), particularly strict law enforcement and public

promotion (King 2005). Lack of coordination between engineering and law enforcement bodies regarding building road safety zones was noted as one of the factors associated with the ineffectiveness of education strategies (Suttayamully 2005).

Legislation may be successful when used with road users who comply with the law and when enforcement officers can use their power independently. Legislation has focused on four factors associated with road traffic injuries including speed, drink driving, helmet use and seat-belt use. Traffic legislation has been implemented but the sanction of penalties was leniently maintained by the police (King 2005). There have been a number of factors commented on in Thai research which may be associated with police enforcement performance, such as the size of the fine, attitudes toward persons of authorities, police priorities, police knowledge, and scarcity of police resources (Cheurprakobkit, Kunttee & Denq 1997; King 2005; Rachatorn et al. 2009). This may explain why the enforcement of legislation initiatives (speed, drink-driving, helmet use and seat-belt use) in Thailand was rated at 2, 5, 4, and 5 respectively for effectiveness of enforcement in a scale of 10 (World Health Organization 2009b).

2.4 Pre-hospital emergency medical services system

The need to have emergency medical services in both developed and developing countries originates from an objective to reduce individual patients' the severity and impact of injury and other acute illnesses. This principle applies particularly to road traffic injury (Lieberman et al. 2003; Post & Treiber 2002; Satitniramai 2007). The role of pre-hospital trauma care becomes obvious when viewed in the chronological spectrum of injury, particularly the natural narrative of death from severe injury (Road Safety Council in Malaysia cited in Tipayarangsarit 2005; World Health Organization 2005a) and the Golden Hour concept (Sanders-Fisher 2008) which has been described in section 2.1. At present, EMS roles are not only to provide medical care and

transportation for emergency medical conditions at prehospital setting, but also to provide health education and health promotion as a result of broadening community needs and expectations (Brown & Devine 2008). In this section, attention is paid to the role of EMS in improving RTI patient outcomes at out-of-hospital settings following unsuccessful injury prevention in the pre-injury phase. The development of international and Thai EMS is investigated and described below.

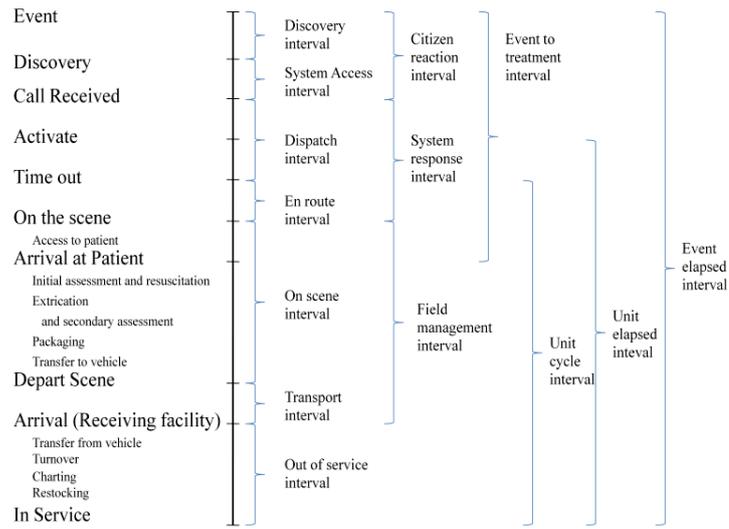
2.4.1 Pre-hospital emergency medical services

Internationally, EMS development has traditionally been planned to work collaboratively with local public health services, communities, community-based primary care units, emergency departments, hospitals, and rehabilitation units (Spaite et al. 2001; World Health Organization 2005a). Local issues such as legislation, infrastructure, health system capacity, economic considerations, administrative resources and local culture also have to be taken into consideration (Dykstra & Arnold 2002; Post & Treiber 2002; World Health Organization 2005a). This is because there are many intervals of care involved in a response to an injury and an episode of EMS patient care. These intervals include a citizen reaction interval which is comprised of a detection and system access interval, a system response interval which commences after a call is received, and a field management interval which ends with the arrival of the patient at hospital (see Figure 2.7). Each interval can pass on unintended consequences which will affect patient outcome if there is no predetermined plan or policy (Bevan & Lendon 2006).

The following 15 essential components also play an important part: manpower, training, communication, public transportation, centre or unit facilities, critical care units, public safety agencies, consumer participation, access to care, transfer of patients, record keeping, public information and education, evaluation, disaster planning and mutual aids (Dykstra & Arnold 2002; Overton & Stout 2002). The core components include EMS mission, involvement of stakeholders,

operations, logistics, planning, administration and finance. These should be carefully developed. Administration of pre-hospital EMS systems requires involvement of: a lead agency, system models, local supports, medical direction and political supports.

Figure 2.7: EMS time and terminology



Source: Adapted from *Prehospital Systems and Medical Oversight* (Kuehl 2002)

The disparities in local health care contexts can cause a diversity of EMS management and administration (Dykstra & Arnold 2002; Overton & Stout 2002; Satitniramai 2007). There are a variety of models for EMS systems operating around the world such as the Anglo-American model, the Franco-German model and the Japanese model. The Anglo-American model, where non-physicians can provide medical care under supervision of a physician and take the patient to the hospital, has been implemented in many countries, including the USA, United Kingdom, Australia and Thailand. The Franco-German EMS model, which exists in Germany, France and many Latin American countries, uses emergency physicians to provide medical support at the scene, while the Japanese model transfers patients directly to care centres.

For all models described above, a lead national organisation needs to be designated to direct the pre-hospital care system at both central and local levels (Overton & Stout 2002). It has to ensure that all appropriate stakeholders, such as medical teams, community leaders, politicians and legislative bodies are involved in planning, implementing and ongoing processes of the service. Moreover, designated lead organisations must provide certain administrative tasks to ensure that every unit in the episodes of care will proceed and be monitored appropriately. The lead agency generally operates under the so-called 'Public Utility Model' where a government authority is established to cost-effectively manage contracted EMS providers (Swor 2002).

Direct and indirect medical supervision must be set in place to ensure that EMS staff provide adequate medical care in all aspects that impact upon patient outcome (Gunderson 2002; Kuehl & Baker 2002; World Health Organization 2005a). When EMS personnel are acting in place of a physician, there is a need to have strict medical protocols or procedures to be followed, especially where direct medical supervision is not available. The indirect medical supervision templates are normally provided for communications, clinical practice, education and evaluation.

The placement of EMS in an urban area is normally calculated from population numbers and the type of emergency care required. In normal circumstance, it is expected to have a single EMS provider to cover approximately 40,000 to 100,000 people, which may have more than one unit depending on the context (Giordano & Cagliuso 2002; Overton & Stout 2002). In rural settings, where the environment isolates victims from definitive care, service regions may be defined differently and depend on their local context. These contextual differences will also be associated with levels and types of EMS provision (see Table 2.5).

Table 2.6: EMS systems in various countries

	USA	Japan	Australia	France	Sweden	China	South Africa	Pakistan	Thailand
Human resource	Paramedic EMT-I, B., FR, Bystander, PSC, EMD	EP, P, ELST, SFAC, FAC-1, Bystander	EP, P, AO, PTO I-III, FR, Bystander	EP, P, EN, FR	EP, P, EN, FR, Bystander	EP, P, EN, Barefoot doctor,	EP, P CCA, AEA, BAA,	P, Paramedic	EP, P, EN, EMT-I, EMT-B, FR,
Type of responses	BLS, ALS	BLS, ALS	FR, BLS, ALS	BLS, ALS	ALS	FR, BLS, ALS	BLS, ALS	ALS	FR, BLS, ALS
Medical oversight	Direct/ indirect	Direct/ indirect	Direct/ indirect	Direct/ indirect	Direct/ indirect	Direct	Direct/ indirect	Direct	Direct
Emergency number	911, VHF	119	000	15, 112	112	120, VHF	10177, 112, VHF	15, VHF	1669
Transportation	Ambulance aircraft and ship	Ambulance aircraft and ship	Ambulance aircraft, ship and motorcycle	Ambulance aircraft and ship	Ambulance aircraft and ship	Ambulance aircraft and ship	Ambulance aircraft and ship	Ambulance aircraft and motorcycle	Ambulance aircraft and motorcycle
No. Caller	NA	5,300,000	111,099	4,100,000	900,000	NA	NA	466,738	252,676
Cases per hour	-	353	12	468	-	-	-	53	29
Treat at the scene	-	-	-	-	-	-	-	350,053 (75.00%)	228,951 (91.61%)
Transport to the hospital	-	4,700,000 (93.43%)	79,724	634,892 (15.40%)	-	-	-	77,012 (16.50%)	221,733 (96.84%)
Response time (min)	Urban=7 Rural =13	6.4	6	Urban is better.	6.8	5-10	Urban=15 Rural =40	10.4	<= 10 (69.52%)
On- scene time (min)	Urban= 8.7 Rural = 21.7	-	Rural 28-32	-	-	-	-	-	<= 10 (88.30%)
Patient satisfaction (User) Call taker Crews Assistance Over all	-	-	-	-	-	-	-	Score (-2 to 2) 1.72 1.31 1.12 1.05	-
Patient satisfaction (provider)	-	-	-	Good (41%)	-	-	-	-	-

EP Emergency Physician
P Physician
EN Emergency Nurse
CCA Critical Care Ambulance
ELST Emergency Life Saving Technician
AO Ambulance Officer
EMT-I Emergency Medical Technician – Intermediate
FAC-1 First Aid Class 1
PTO I-III Patient Transport Officer
AEA Ambulance Emergency Assistant
EMT-B Emergency Medical Technician – Basic
SFAC Standard First Aid Class
FR First Responder
BAA Basic Ambulance Assistant
EMD Emergency Medical Dispatcher
PSC Public Safety Community
ALS Advanced Life Support
BLS Basic Life Support
Bystander Trained Lay-person

Source: Adapted from Satiniramai (2007)

Structure of EMS system

Depending on disparities among local environments and EMS models used, there are usually three main tiers, or levels of care, existing within EMS systems (see Table 2.5). Assorted medical interventions range from a basic non-invasive intervention to the more invasive medical procedures depending on the degree of trauma suffered by RTI victims and the level of care needed. The level provided depends on many local factors. The effectiveness of this multi-tiered system has been questioned by researchers such as Liberman, Mulder et al. (2003). Although the cost-effectiveness of sending a physician or advanced level staff to assess non-urgent cases, as in a non-tiered system, does appear to be flawed.

In some countries, the first responder EMS level is established as the first and most basic tier, to be the first person to recognize and respond to the emergency medical condition and activate the EMS system (World Health Organization 2005a). They can be taught to provide an acceptable level of basic emergency care with a kit of simple equipment and a suitable vehicle while transporting the patient to an appropriate definitive care. The first responders can be a layperson trained bystander or EMT-B trained EMS personnel. As shown in Table 2.4, the countries that operate with this level of care include the USA, Sweden, Japan, France, China and Thailand.

The basic level of care is the next tier up in the EMS system. The EMS personnel in this classification are required to have formal basic life support (BLS) training. The procedures provided at this level are non-invasive types of medical intervention including scene management, rescue, stabilization and transportation. Basic level personnel may be identified differently depending on where they have been trained and the course provided. They could be identified as Emergency Medical Technician – Basic/Intermediate (EMT-B/I), Standard First Aid Class officer

(SFAC), First Aid Class 1 officer (FAC-1), Patient Transport Officer (PTO I-III), Ambulance Emergency Assistant (AEA) and Basic Ambulance Assistant (BAA) (Satitniramai 2007).

An advanced level of care can provide more sophisticated invasive procedures including intravenous fluid replacement, intubation and administration of medication. Professional pre-hospital care staff such as physicians and paramedics, who have undertaken an advanced life support (ALS) training course, fill this role. This level of care also requires high cost interventions such as establishment of a communication centre and highly sophisticated pre-hospital fleets of ambulance units (World Health Organization 2005a). EMS staff classified in this level of care can be identified as Ambulance Officer (AO), Emergency Life Saving Technician (ELST), Critical Care Ambulance Officer (CCA), Emergency Nurse (EN), Physician (P) and Emergency Physician (EP).

The resources and equipment used for transferring those patients severely injured also needs to be taken into account as well as staff level and expertise. Where it is feasible, severely injured victims should be treated in the field and transported as quickly and safely as possible in an appropriately designed, equipped and well-staffed ambulance. However, where ambulances are unavailable or overpriced, the use of local alternatives may need to be utilised (Choteklom et al. 2004; Satitniramai 2007). Ground or air medical transportation may also be selected depending on local catchment area, identified populations, expected call out volumes, and costs associated with developing and maintaining transportation capability (World Health Organization 2005a).

Ensuring proper use of EMS

Gunderson (2002) suggests that public education must be conducted to assist people to appropriately access their local EM Service. This involves varying methods and points of access,

information about the service, triaging criteria and the configuration of the response after call-taker/dispatcher's assessment. Education is required to be made public in order to reduce inappropriate use of the EMS (Henry 2002). The misuse of EMS can possibly influence patient outcomes since resources may become unavailable for real need.

Areas where better public education and promotion of improved knowledge would be helpful would involve situations of life threatening conditions: strokes, heart attacks, and road traffic injury (Kumar et al. 2008; Mazighi, Derex & Amarenco 2010; Meyer et al. 2000). Education strategies have also to cover procedures on how to seek efficiency, assess the victim and provide first-aid support until the arrival of EMS crews. Accuracy of information given to the EMS call centre by the public can affect the performance of the EMS units and effectiveness of use of EMS significantly (Berdowski et al. 2009; Gunderson 2002; Purtill et al. 2009).

EMS communication networks

Mears and Cummings (2002) reported on the need for an effective EMS communication networks. Documentation has also been presented by Augustine (2002) and WHO (2005a) to indicate that benefits would be achieved by linking and centralising all levels of patient care including hospitals, EMS stations, ambulances and communities. A centralised and easy-to-remember number allocated to each case would need to be easily remembered and accessed by bystanders or those needing emergency medical assistance in an out-of-hospital setting (see Table 2.4). Local needs, available resources, and existing communication technologies must be considered in order to support the communication networks in the catchment area.

The communication of pre-hospital EMS systems is established to transfer information about the emergency event among those involved in an EMS episode of care. This includes caller

communication about a patient's condition to the EMS crew and consultation between EMS staff and the medical director while en route (World Health Organization 2005a). Interaction between a public caller and dispatcher is important since information gained from the caller will be used to make a decision for appropriate response to the event (Bång, Herlitz & Martinell 2003; Ornato 2009). Medical supervision over the dispatcher and protocols used in dispatch should be approved by a medical director. The dispatcher therefore must be trained to work as an EMS operator controlling any EMS operation. These vital information channels must work efficiently and be available at all times (Augustine 2002).

Although the dispatcher may not appear to have an impact on unmet need cases, this role does in reality have a significant impact on inappropriate use and system efficiency (Dunt et al. 2007). All calls from the callers should be considered and triaged by the dispatcher before deciding to send an EMS unit. The dispatcher also needs to be skilled in detecting both unmet and inappropriate use of the service which can arise due to poverty, lack of transportation and alcohol intoxication (Henry 2002).

Financial management of EMS

The funding available for EMS development determines the availability of existing EMS staff and functioning of the system. In general, the revenues for development and operation of the EMS Services come from various sources including tax subsidization, reimbursement, subscription service and patient out-of-pocket payment (Karnganasoot et al. 2003; Satitniramai 2007; Swor 2002). Funding is usually made available initially by central government authorities to use as a catalyst to establish and run demonstration services. Ownership is later shifted to states or local governments whereby arrangement of their own administration can occur, including establishment of ad valorem tax districts, fee for vehicle registration and fee for traffic violations, which can then

contribute to resources to meet local needs such as out-of-pocket expenses or special equipment to improve efficiency and effectiveness.

A number of factors can be involved in implementing a charge for services which include types of dispatch service, medical supervision, level of response available, medical equipment and medication utilized, and the extent of distance travelled (Swor 2002). The cost of EM Services to the users can be as varied as the number of the places where it is being run. The increasing number of volunteer services and EMS providers, aging populations and cases of billing fraud were among the reasons for an increased requirement to reimburse EM Services (Overton 2002). These factors, to some extent, distort pricing structure as they relate to the basis for fee schedule variation in different countries. Differences in context and fee schedule structure also affect the way the public use the system. For example, rural residents may have fewer alternatives for transportation to hospitals and ambulances may transport some beneficiaries whose conditions do not allow for Medicare reimbursement in the USA.

EMS normally charge for the range of medical interventions provided including transportation (Satitniramai 2007; Swor 2002), and these subsidization issues can have some impact on EMS performance (Overton 2002; Overton & Stout 2002). Reimbursement has been reported to be crucial for viability of EMS by Overton (2002). However, without proper control, it can also burden the provision of the EMS (Overton 2002; Swor 2002). According to Swor (2002), an increase of utilisation trends is associated with many factors such as level of subsidization, poverty and age of the users and these factors are subject to consideration as to whether they are cost-effective or not.

Frameworks for EMS assessment have been adapted from Donabedian's foundation of structure, process and outcome which has been described in Cayten (2002) and Block (2006b). Outcome measures are most important even though they are not easy to measure in the early stage of emergency care. There are a number of severity indices used in determining immediate outcome measures after the pre-hospital stage, such as the Trauma Score (TS), Injury Severity Score (ISS) and Trauma Injury Severity Score (TRISS). EMS operation can also be assessed by auditing pre-hospital care clinical care and documentation, although there are some validity and reliability problems and the correlation between process indicators and patient outcomes may be weak (Snooks, Halter & Palmer 2005). The involvement of a medical authority is essential to the management of EMS, where environments are less controlled than the hospital setting (Ryan 2002).

To maintain quality in EMS provision, ongoing monitoring systems must be maintained for the processes of care continuum in the EMS response. Pre-hospital care reports or treatment records are essential to develop an effective and sustainable system since they can be used to collect information at all steps in unit actions or processes of care in the EMS Episode of Care model. As discussed in Section 2.2.1, these steps or intervals occur in 6 stages: detection and report, travel to scene, patient assessment, on-scene treatment, patient removal, and transportation. Treatment records also include demographic data, identification of the responding unit, response time, type of incident, patient conditions, and outcome of care. Information about outcome of care includes not only clinical outcome, but also financial outcome, patient satisfaction and quality of life after receiving treatment (Walburg 2006) as can be seen in Table 2.5.

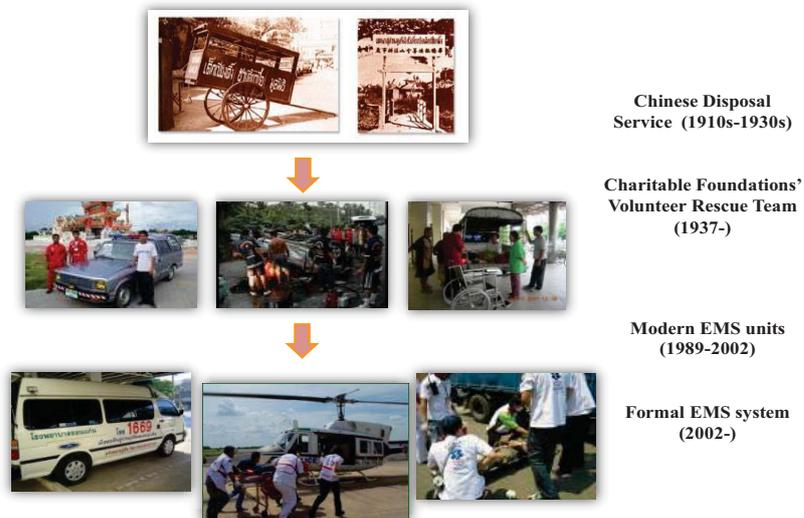
2.4.2 Pre-hospital emergency medical services in Thailand

Development and recognition of the value of a comprehensive EMS system had been neglected for many years in Thailand. Following an increase in road injury victims during the 1980s and acknowledgement by health professionals that out-of-hospital care facilities were lacking, injury and emergency authorities initiated a program to provide better medical care for injured patients at the post-crash stage, outside the formal care facilities. However, since 2002, following substantial review, the Ministry of Public Health succeeded in establishing an improved pre-hospital EMS with a universal national emergency contact number and greater access for urban and rural patients.

A number of publications have documented and reviewed the establishment and structure of the Thai EMS (Sethasathien 2008; Suntorntham 2008), and the example set by EMS in KK Province (Chadbunchachai 2004, 2008c; Suphanchaimat et al. 1998). These studies demonstrate how the history of the EMS has influenced its current operation, and can be related to the social factors which affect EMS performance and ultimately patient outcome investigated in this research.

The history of the current Thai EMS system has been similar to that which has evolved in many developed and developing countries (see Figure 2.9). It was started by a group of Chinese businessmen named “Tai Kong Hong Disposal Group” in 1909 (King Rama V) as a disposal service for unidentified corpses from the diarrhoeal pandemic (Tanprasert et al. 2000:153). It was then developed and improved to serve the community as both a disposal and rescue service in the late 1930s. This service has expanded throughout the country as a volunteer-based activity but it has not been formally managed (Satitniramai 2008; Sethasathien 2008; Tanprasert et al. 2000).

Figure 2.8: The historical development of Thailand pre-hospital health services



As the 1980s progressed and the number of road trauma victims increased, there were a number of unsafe and unethical rescue interventions reported in relation to poor roadside assistance by unskilled bystanders and disreputable volunteer-based rescue services (Sethasathien 2008; Suphanchaimat et al. 1997; Tipsoonthornsak, Chadbunchachai & Tungkulboriboon 2000). Negative consequences of unprofessional services, including unethical behaviour and shoplifting, were noted (Chadbunchachai 2008a; Sethasathien 2008; Tipsoonthornsak, Chadbunchachai & Tungkulboriboon 2000). However, proper standardisation and control of the services was difficult since many of the staff were itinerant and unofficially registered. It became obvious that it was necessary to have a formal emergency care arrangement managed by appropriate involved authorities with a proper control over the volunteers.

Attempts were made over the years (1989-2002), to set up a formal hospital-based model for pre-hospital services in both urban and rural areas (Choteklom et al. 2004; Sethasathien 2008). A budget was allocated to the Department of Medical Services in the Ministry of Public Health to

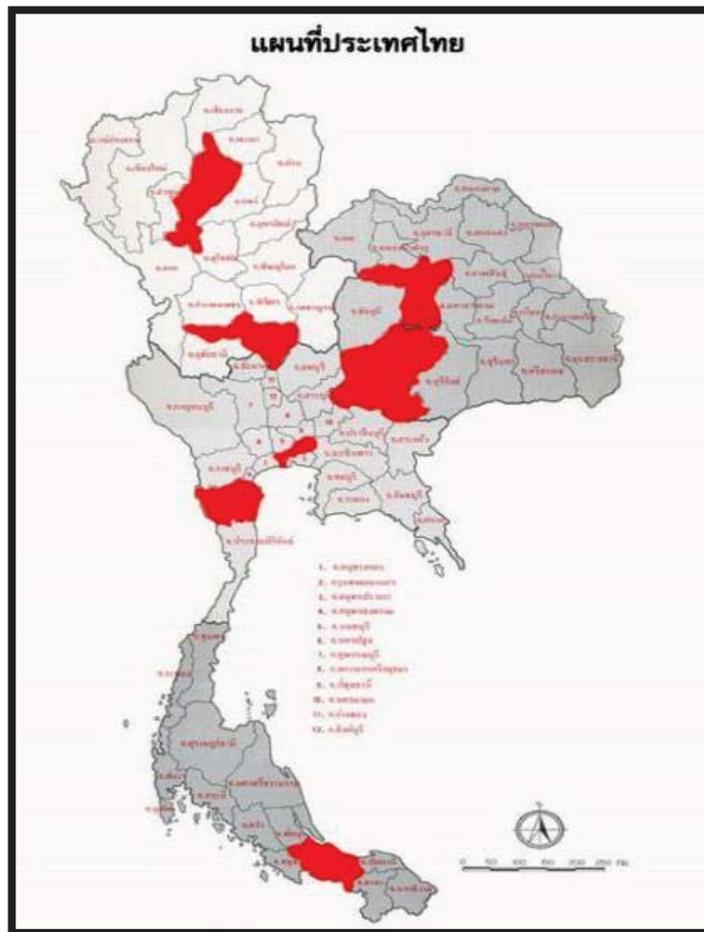
establish a formal EMS for the country by means of a series of “demonstration projects” which were the first formal EMS established in the Bangkok metropolitan area at Rachavithi Hospital in 1989 (which was later named “Narenthorn Centre”). Others followed at several general hospitals in Bangkok and in a few demonstrated Provinces including Khon Kaen in 1994 (Bureau of Emergency Medical Service System 2004:2). Subsequently, a national EMS system was launched with the 8th National Economic and Social Development Plan (NESDP) between 1997 and 2001.

The reformation of the Thai health system under the instigated management of the National Health Security Office (NHSO) into the Universal Coverage (UC) Scheme in 2001, played an important role in establishing the formal national EMS system as it is today. Revenue from the UC scheme at USD\$0.38 (10 baht) per capita (n=47 million) was allocated to activate this early EMS restructuring (Karnganasoot et al. 2003; Leesmidt et al. 2005). The number of patients attending emergency departments throughout the whole country was used to calculate the number of EMS units and the funding required. The official national EMS system was then established in 2002, with the administrative body being the “Narenthorn Centre” to manage contracted EMS providers (Sethasathien 2008; Suntorntham 2008).

Since the announcement of the launch of the new national EMS in 2002, EMS models have been developed in the pioneer Provinces of Nakornrachasima, Nakornsawan, Petchaburi, Lampang, and Songkla as well as Bangkok and Khon Kaen, (see Figure 2.9). The Khon Kaen EMS innovation has been nominated as one of the leading country examples since this time and has influenced the structure of all modern Thai EMS. EMS were established in another 15 Provinces in 2004, followed by a further 16 Provinces later in 2004. Complete distribution to all 76 Provinces was finalised in 2005. The community-based EM Services commenced to work in harmony with the hospital-based system in 2003. It could now be said that Thailand is one of the few countries to be

developing a national service according to the WHO recommendation (World Health Organization 2005a).

Figure 2.9: The first seven pioneer Provinces in establishing Provincial EMS



Source: Choteklom, Tiemklang et al. (2004)

Khon Kaen EMS (KK EMS) is undoubtedly one of the most successful and well-developed EMS systems established to reduce the traumatic impact of road traffic injuries, especially at the out-of-hospital stage, in Thailand (Sethasathien 2008). The initiation of the Accident Control and Prevention Project which commenced in 1989 has been reported by Suphanchaimat, Chadbunchachai et al. (1997) to include the KK EMS as one of its key components.

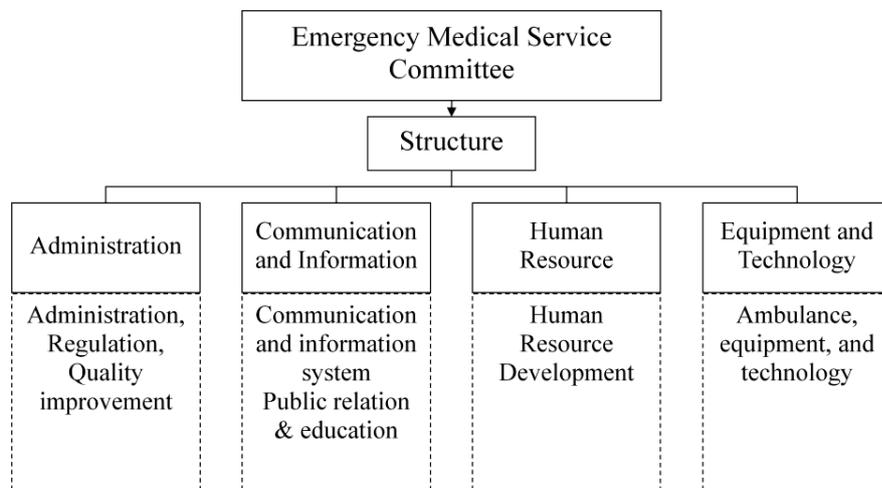
EMS development in Thailand, and Khon Kaen in particular, has been assisted by many international organizations providing human resources and expertise (Chadbunchachai 2004). In 1996, an investigation by Swedish International Cooperation Agent (SIDA) advised that Thailand should improve its EMS system (Tipsoonthornsak, Chadbunchachai & Tungkulboriboon 2000). The expansion of the national Thai EMS was a timely response to this challenge. Technical and practical support from the Japanese International Cooperation Agency (JICA) and the Australian New South Wales Ambulance Service assisted the KK EMS management teams to implement changes to its emergency care services. The World Health Organization, which supports the work of injury prevention and control at an international level, hosts a number of programs such as “*The Violence and Injury Prevention training program*” and “*The Third country training program on pre-hospital care*”.

Promotion of the KK EMS at the early stages of its inception has been documented by Tipsoonthornsak, Chadbunchachai et al. (2000) and Satitniramai (2008) where activities primarily involved distribution of information in local newspapers, local radio stations, posters, stickers, leaflets and official letters. Studies conducted in Thailand during 2002 and 2003 by Saranruthichai, Buranakij et al. (2002) and Chadbunchachai, Amornpetsathaporn et al. (2004) found that communities received most of their information about the new EMS by word-of-mouth and this was at a fairly superficial level. A misuse of ambulance units for other transportation purposes, based on misinterpretation or lack of information about the EMS, was also noted.

Sethasathien (2008) also reported in his review of the Thai EMS that the management of Thai EMS seemed to lack firm control over EMS units in the absence of formal rules and regulations. The Emergency Medical Services Act 2551 (2008) was declared in 2008. The Bureau of Emergency Medical Services System was transformed to become the Emergency Medical Institute of Thailand

(EMIT) following the announcement of the Act. As a result, all administrative tasks are currently managed and controlled within this new organization. At a local level, Thailand has the Provincial EMS Office existing as a local administrative or lead organization. Some places such as Khon Kaen have the regional hospital acting as the EMS lead agency to manage the main administrative areas as described in Figure 2.10 below.

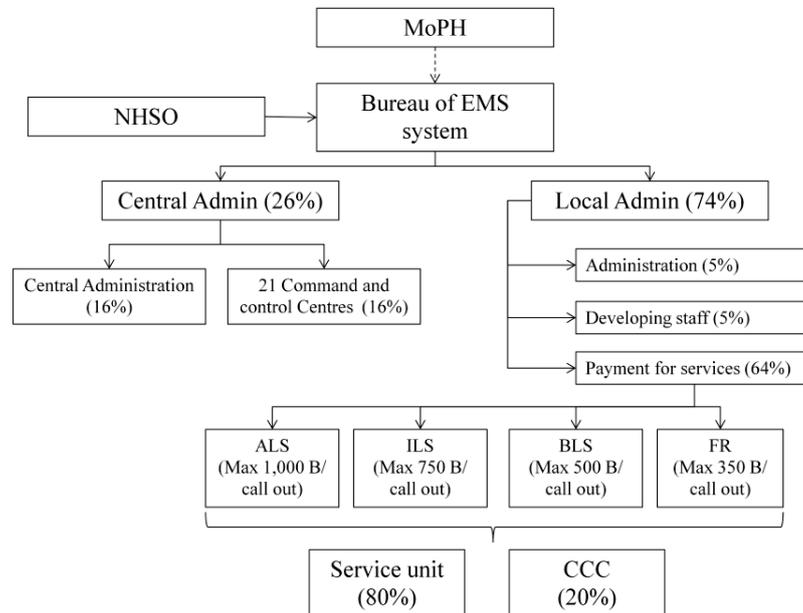
Figure 2.10: Emergency medical services structure use in Thailand



Source: Adapted from Chadbunchachai (2008b)

Funding for the Thai EMS was initially provided by the NSHO via MoPH as discussed previously. The source of revenue for this organisation comes from the 47 million population estimate registered in the NHSO system (Karnganasoot et al. 2003). The budget is distributed through the Narethron Centre and divided into central and local administration (see Figure 2.11). Payment for services provided accounts for 64% of the total allocated funds. Of this, 80% is allocated to maintain EMS unit operation and the other 20% goes towards maintenance of Command and Control Centres (CCC). Ngowsiri (2008) reported that as a result of improper use of EM Services, there is also an anticipation to control the utilization of EM Services and obtain more financial support from other stakeholders, such as revenue from local administrative organisations.

Figure 2.11: An expected financial plan for EMS establishment and administration in Thailand in 2002



Source: Narenthron Centre (Karnganasoot et al. 2003)

The government supports and controls any compensation for services provided, without other co-payments, by using a pay-for-performance principle. The management uses performance-based financial control (pay-for-performance) to handle the use of EM Services. The subsidies for EMS operations are made in terms of a pay-for-performance format where a portion of provider reimbursement is tied to a set of standard processes of delivery (Karnganasoot et al. 2003). In 2007, the standard of payment received for an EMS response was changed slightly as a result of changes in local context such as an increase in the number of community units, the number of call outs and petrol prices, as seen in Table 2.6 below.

Table 2.7: Fee schedule for EMS operation by level of care, 2008

Principle	Severe				Non-severe		Non-severe	
	ALS		ILS		BLS		FR	
	Fee	% (paid)	Fee	% (paid)	Fee	% (paid)	Fee	% (paid)
Called out								
Missed/cancelled/death before arrival	200	20	150	20	100	20	100	30
Called out and treated								
Treated and transported (HN)	-	-	-	-	300	60	250	70
Treated, but not transported	600	60	450	60	-	-	-	-
Called out with/without result								
With result of treatment	200	20	150	20	100	20	-	-
Without result of treatment	0	0	0	0	0	0	-	-
Total	1,000	100	750	100	500	100	350	100

Source: Adapted from Ngowsiri (2008)

The dispatch centre or Command and Control Centre (CCC), is located in either the Provincial Health Office or the Provincial hospital, depending on the decision of the Provincial EMS committee. Thailand uses for emergency the medical number 1669, local health facility landlines, and a VHF radio system to access CCC (Chadbunchachai et al. 2006a; Karngasoot et al. 2003; Tipsoonthornsak, Chadbunchachai & Tungkulboriboon 2000). Dispatchers work under direct medical supervision and strict protocols.

In Thailand ground transportation is preferred because of cost and the fact that there is ready access to district hospitals in most areas within an hour of an emergency. Ambulance usage is categorised into 2 levels: basic and advanced. Minimum sets of standards for both levels of ambulance were accredited by EMIT rules and the regulations of the Thai Police Office (Chadbunchachai et al. 2006b; Karngasoot et al. 2003).

2.5 Thai management context

As Thailand's health services are predominantly publicly funded, there are multiple layers of government organization with responsibilities for various health services. Central administrative functions of various ministries including the Ministry of Public Health (MoPH), at Provincial Administration level, are supervised by the Provincial Health Office. At the local level, based on decentralization of the Local Government Organisation Act B.E. 2542, state duties are handed-over to Local Administrative Organizations (LAO) at Provincial and sub-district (Tambon) level. Recently, some of the health centres have been transferred to LAOs (Leesmidt et al. 2005). The development of the Thai Health System and its determinants are discussed below.

2.5.1 Thailand country profile

Thailand is situated in the middle of the continent of the South-East Asian region on the Indochina Peninsula and is surrounded by Myanmar, the Lao People's Democratic Republic, Malaysia and Cambodia, as shown in Figure 2.12 (Wibulpolprasert 2004). It has a population of approximately 64.23 million living in an area of 514,000 square kilometers. More than 90 % of the Thais have Thai nationality and use the Thai language as an official language. Most of the Thais are Buddhists and the majority of these practices Theravada Buddhism (Mulder 1994; Sheehan & Egan 2007; Wibulpolprasert 2004). The landscape is dominated by plain areas in the middle, with mountainous areas to the north and south-east, and with highlands mostly in the northeast. Changes from farming for household purposes to commercial and export purposes have altered the lifestyle of the people since the 1980s. Traditionally having a rich resource-base and cheap labour costs, nearly 50% of the Thai workforce remain in the agricultural sector, with the other 50% divided between the service and industrial sectors (Sheehan & Egan 2007:286).

Figure 2.12: Map of Thailand and Indo-China peninsula



2.5.2 Thai health service and its management

Classified as a middle income country (WHO 2009a), the living standard in Thailand has improved although there have been several economic crises over the past four decades. The disparity of income distribution between the richest and the poorest increased 14.8-fold in 2006 and 9.6% of the population were living in poverty (defined as an income of 20,000 baht (USD\$769) per household per year) in 2006. Of these, eighty-six percent of the impoverished live in rural areas, two thirds of whom reside in the northeast region of the country (Wibulpolprasert 2008).

Thai health service development has been shaped by both internal and external pressures over time. The Thai biomedical health service had developed over the years through support from the King and elites who studied abroad. Health services had been centrally set up in the country for decades before the establishment of the Health Department in 1897 (Wibulpolprasert 2008, 2004). External pressures such as the Second World War and American supremacy enormously affected Thai health services development. Influence from the USA changed health service provision in the country, leading to establishment of the MoPH, licensing of medical doctors and establishment of

cultural authority (Khumthong 2003:147-148). However, progression made in the health service system had faltered following control by the military dictatorial regime over many decades. Almost every business including the health services was used as a political strategy to build a strong nationalist state.

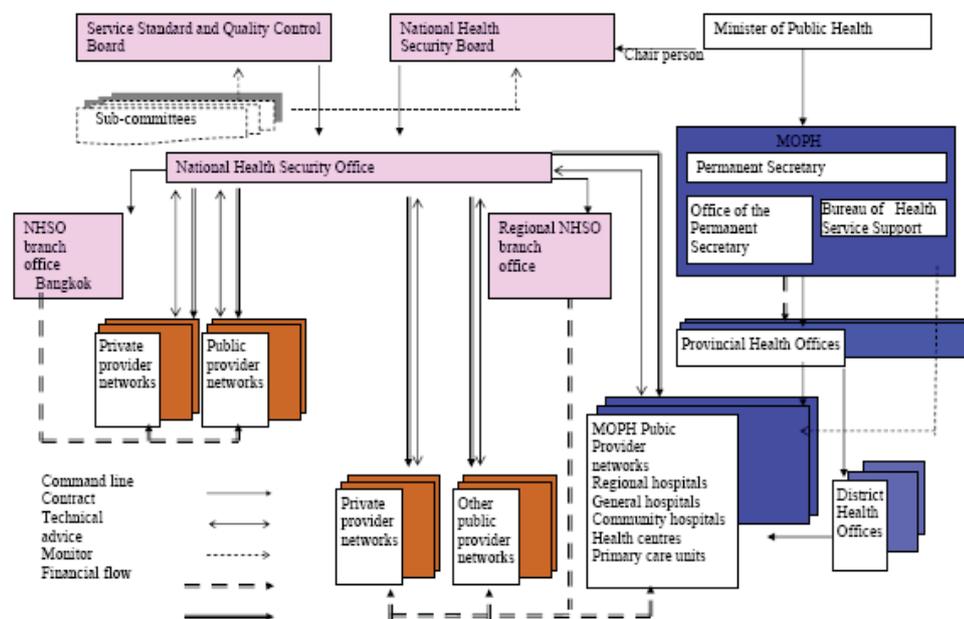
The Thai health system became a more important tool for capitalist colonization after the World War II (Khumthong 2003). Capitalist ideology created a high-priced health care service, which could be provided only in the city area (Wibulpolprasert 2004). However, during this high-price period, there were also efforts to expand to a more affordable public health service, especially in rural and remote areas, with support from a group of rural doctors (Wibulpolprasert 2002). An expensive hospital-based medical service thus was changed into a more publically available health and social medicine system, and many public health campaigns and community programs have been initiated since 1980 (Kauffman & Myers 1997; Tangcharoensathien, Srithamrongsawat & Pitayarangsarit 2002). With the introduction of the public health approach, there were difficulties, especially of accessibility and equity, in provision of health care, and high cost medical interventions continued to be more available in city areas (Ekachampaka & Wattanamano 2008).

These remaining accessibility and equity problems were instrumental in the reform of the health service system in 2002. Per capita budgeting was implemented and aimed at gaining accessibility and equity in the utilisation of the health services (Leesmidt et al. 2005:12). The Universal Coverage (UC)² scheme was introduced and implemented (Tangcharoensathien et al. 2007).

² The Universal Coverage scheme is one of Thai health insurance schemes, which is managed by government in order to organise same basic health services to all people, particularly who have no formal health insurance. It is integrated with existing Thai formal health insurance schemes (Civil Servant Benefit Scheme, State Enterprise Medical Benefit Scheme and Social Security Scheme). The payment per capita per year is paid from tax revenue, parts of which are paid to the health care facilities and services, according to the number of local residents who are registered with them, hence to be served.

Following implementation of the UC Scheme for insurance, the Thai Health Service System, for the most part, consisted of two main organizations which work collaboratively, MoPH and NHSO. This meant that 47 million people could now access medical insurance. The NHSO uses this per capita budgeting scheme to fund health services within the Ministry of Public Health and some other public and private health facilities (see Figure 2.13). The pre-hospital care system received part of this capital to establish the National Institute of EMS institute and continues to receive fund to support ongoing management of the EMS system (Karnanasoot et al. 2003).

Figure 2.13: MoPH and NHSO relationship in the Universal Coverage Scheme Insurance



Source: Leesmidt, Pitayangsarit et al. (2005)

Jurisdiction location

With a dense population relative to a small land-mass, Thailand has different operational stresses on the health care system compared to a large and dispersedly populated country such as Australia (Mickan & Boyce 2006). Thailand is administratively divided into 76 Provinces, which are further divided into districts, subdistricts (Tambon), and villages. At present, the country's administrative

system can be divided into three major sectors (Sheehan & Egan 2007; Wibulpolprasert 2004:13-20):

- **Central Administration** which consists of the King as head of state, cabinet or council of ministers and the central administrative system (Ministries)
- **Provincial Administration** which contains 76 provinces, 795 districts and 81 sub-districts
- **Local Administration** which has 75 Provincial Administrative Organisations (PAO); 1,129 Municipalities; Bangkok Metropolitan and Pattaya Administration; and 6,742 Tambon or Sub-district Administrative Organisations (a Tambon is a small commune containing 10 villages).

Various sizes of government health facilities exist at different levels and include regional hospitals, provincial hospitals, rural community hospitals, primary care units, and health service units at local government level. Health care personnel often remain working in urban areas where they may experience better motivation and professional development (Nishiura et al. 2004). Faramnuayphol, Ekachampaka et al. (2008) and Wibulpolprasert (2008) reported that the Thai health service may not have obvious accessibility problems in providing services to people in isolated settings, however, the mal-distribution of health resources hinders accessibility significantly.

The unequal distribution of health service resources, particularly of skilled staff in rural and remote areas, led to the establishment of community involvement programs, such as the Village Health Volunteers (VHV) in the 1980s, and community EMS such as One Tambon One Search and

Rescue (OTOS)³ (Chadbunchachai, Tipsuntornsak & Choteklom 2005b; Kauffman & Myers 1997; Mokkhavesa 2009). The initiative of community involvement to provide better access to health services has improved the mal-distribution problem, especially in remote areas (Chuengsatiansup & Suksit 2008). However, poor accessibility to health facilities based on differences in geographical positioning remains a problem (Mahaisavariya 2008).

Decentralisation of health services and involvement of the local government

The decentralization of health services under the Local Government Organizations Act of B.E. 2542 (1999) and the National Health Security Act B.E. 2545 (2002), aims to increase the role of LAOs and boost local self-reliance in providing public health services. Such health service provision would cover health promotion, medical treatment, health prevention and rehabilitation, and involvement in sharing information and resources as well as being a contracted health provider of the NHSO (Leesmidt et al. 2005:28). This decentralisation can be represented as a number of options as shown in figure 2.15 (Jindawatthana, Pipatrojanakamol & Ekachampaka 2008):

- 1) LAO acting as a sub-purchaser
- 2) LAO and MoPH work together
- 3) LAO provides partial health care operation
- 4) LAO provides full health services.

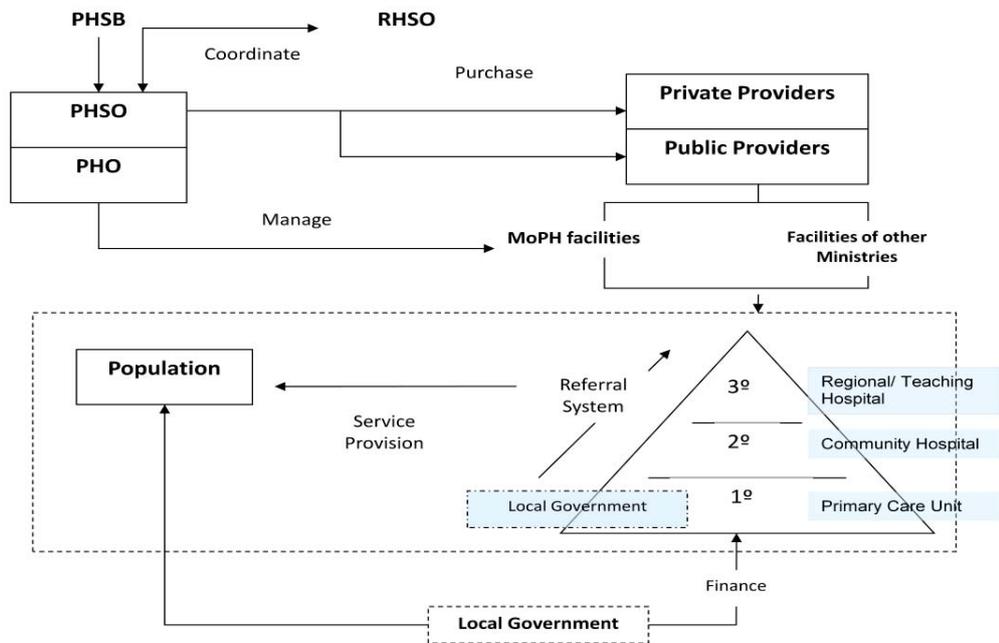
The Pre-hospital EM Service is also a subset of LAO public health services. There are four main types of LAO-based contracted EMS units (Choteklom et al. 2004):

- 1) Contracted EMS units operated by LAO employees;
- 2) Contracted EMS units operated by LAO employees and the village leaders;

³ One Tambon One Search and Rescue (OTOS) is a project launched by Department of Disaster Prevention and Mitigation (DDPM), Ministry of Interior, to persuade local authorities to set up their own Search and Rescue (SAR) team with necessary tools and equipment to protect their people and their community from a small-scale disaster.

- 3) Contracted EMS units operated by Primary Care Units (PCUs); and,
- 4) Contracted EMS units operated by private groups within localities.

Figure 2.14: Local government (LAO) involvement role in provision of health services



PHSB: Provincial Health Security Branch
 RHSO: Regional Health Security Branch
 PHSO: Provincial Health Security Office
 PHO: Provincial Health Office
 Source: Adapted from Leesmidt, Pitayarangsarit et al.(2005)

Economic influences

The UC health care policy implemented in 2002 aimed to increase equity and accessibility to health services, particularly for those living in poverty (Tangcharoensathien 2008). In 2002, health insurance coverage had risen to 92.5% of the Thai population including 74.2% under the UC scheme, 6.6% under a Civil Servants Medical Benefits Scheme, and 11.5% under the Social Security Scheme. Health expenditure in Thailand has also dramatically increased from 3.8% of GDP in 1980 to 8.3% in 2006 as a result of implementation of the universal health care policy (Wibulpolprasert 2008, 2004). Part of this expenditure was used for funding EMS by distribution to local governments to run their own services.

On the other side of the coin, a subsequent effect of economic growth can also be described as causing public health problems such as road traffic injury. Tanaboriboon and Satiennam (2004; 2005) showed that an increase in road traffic injuries can also be anticipated along with expansion of the economy. They described a fluctuation of road traffic injury trends by using economic time lines and showed that an increase in the road toll in Thailand was associated with increased fuel consumption rates during 1993 and 2002.

Technological influences

Health care in Thailand, as in many countries, is heavily dependent on technological advancement (Mickan & Boyce 2006) since advances in technology represents quality and efficiency of resources and performance of the service provided. However, use of greater technology also increases the technological costs and increases economic pressure on health organisations. Ekachampaka and Wattanamano (2008) inferred that an inadequate mechanism to select and control use of high-cost technologies resulted in a rise in cost of the imported medical supplies and equipment for Thailand from 2.5 to 15.8 billion baht between 1991 and 2005. The unequal distribution was noted with an increased discrepancy (Faramnuayphol et al. 2008). This mal-distribution of health technologies also happens with pre-hospital services where the high cost of technological equipment and high maintenance is not yet situated in all hospital-based EMS units (Brown et al. 2004; Choteklom et al. 2004).

Thai management

Many studies have reported on the social impact on and the context of management within organizations. For example, MacLachlan (1997) and Hofstede and Hofstede (2005) noted that the 'world view' or way in which people see and do things is learned and derived from their social environment, including religious beliefs and customs. Managers who want to best manage and

improve organisations in any particular society find it beneficial to do things in that context. Hence, the nature of the Thai worldview and its impact on management of health service provision should be examined and understood.

The key components accredited to “Thainess” by Sheehan and Egan (2007) include nation building, Buddhism, and existence of the Monarchy. Thainess has also been strengthened by other influences. Adoption and support of Theravada Buddhism from Mon and acceptance of the Indian Hindu hierarchical societal system from Angkor has occurred since the thirteenth century (Baker & Phongpaichit 2005; Sheehan & Egan 2007). The concept of *Thammaracha* from Theravada Buddhism has controlled the style of governing of Thai rulers since the Sukhothai dynasty (17th century). Thai culture and management can be said to be dominated by Theravada Buddhism principles (Ritjaroenwatthu & Yodmalee 2009; Soommaht, Boonchai & Chantachon 2009; Sowattanangoona, Kotchabhakdib & Petrie 2009). Buddhism is one of the key components in the foundation of Thai characteristics and ways of life. At present, approximately 94% of Thais are Buddhist.

The monarchy supported the reforms of the country in administration, education and communication networks (Owen 2005) to a more westernised style (Jongudomsuk 2005). Monarchical efforts have also inspired modern changes, such as the abolition of slavery, an end to royal absolutism and the beginning of a constitutional monarchy in 1932. However, even following the announcement of the new political system in 1932, the military has played a powerful role in the modern Thai era and has influenced many activities of nation-building, including health, administration and political systems (Mulder 1994; Sheehan & Egan 2007; Wallop Khumthong 2003) where many businesses have been influenced by military rulers and used by them as political

tools. An acceptance of a hierarchical and feudal order still remains in a paternalistic administrative pattern inside the mind of both the nobility and the public (Mulder 1994; Sheehan & Egan 2007).

Another more recent influence is that of Chinese Confucian concepts which were extensively integrated into Thai culture following the major migration of Chinese people during war time in the reign of King Rama V in the late 18th century (Tanprasert et al. 2000). Confucianism is a complex system of moral, social, political, philosophical, and quasi-religious thought that has had a tremendous effect on the way of life in East Asian countries. Its governing principals are based on virtue in all levels of honest ritual relationship. The positive sides of this concept have been attributed to the success of Japan and the “four tigers” (Korea, Taiwan, Hong Kong and Singapore) (Crowell 2005). On the other side of the coin, the uniqueness of virtue and ritual relationship without application of proper laws creates cronyism or nepotism which can have negative effects on organizations such as giving favours by paying inducement to those who help lubricate their business wheels and appointing ill-qualified outsiders or their own relatives as their secretaries or advisers, as reported by Tanprasert, Kanokpongchai et al. (2000) and Arasli, Bavik et al. (2006).

In summary, the Thai world view can be described as a combination of influences from the involvement of the monarchial figure, the national religion Buddhism and Thai nation-building (Komin 1988:165). Thais have practically assimilated local worldviews by combining selective external influences such as Indian Hindu hierarchical societal concepts, Chinese Confucian values and other influences from Western culture (Sheehan & Egan 2007). The involvement of those influences has resulted in a unique Thai worldview and management style as documented by Baker and Phongpaichit (2005) and Owen (2005). These influences are represented in key Thai socio-cultural factors such as high-power-distance and individualistic characteristics, high ego (face), and social harmony behaviour, which affect patron-client relationships and present-world orientation.

High power-distance and high hierarchy

Influenced by monarchist, aristocratic and military forces ruling the country, an acceptance of paternalistic administration can be seen as example of the high-power-distance characteristic of the Thais. Thais are indoctrinated to respect and obey elders and authority figures, particular their mother, as a protective person during their childhood period. Mysterious forces and Buddhist karma have been used as strategies to indoctrinate Thai children not to make confront authoritative figures who are pictured as wise, moral and all powerful, such as those epitomized in mother or teacher (Hofstede 1997; Mulder 1994). This power-distance and social hierarchy creates greater power for authorities and must be taken into consideration in management, where subordinates can be much influenced by their seniors and may be reluctant to question them or instigate conflict with them (MacLachlan 1997; Mead 1990).

Social inequality has remained a part of the Thai fundamental belief system for hundreds of years. In a bureaucratic administrative system the internal influence of social hierarchy can be seen as “Sakdina” in the workplace and even the Thai language demonstrates a particular social status value (Pongsapich 1998:39; Sheehan & Egan 2007:281). This also influences the socially unequal relationship in the wider Thai environment. Consequently, individuals are usually seen as either younger or older, weaker or stronger, subordinate or superior, and rarely equal in relation to one another (Pongsapich 1998:39). The Thai social process of respect and obedience naturally comes with being on a higher status of wealth, seniority or rank. Superiors are normally respected by their subordinates. Thais therefore rely upon superiors, an attitude which creates an unpredictable and loosely constructed social process (Sheehan & Egan 2007).

Sheehan and Egan (2007) reported that Thais normally manage their power collaboratively with compassion. ‘Pradej’, the use of power and authority, and ‘Prakhun’, the use of compassion and

sympathy, are usually sensibly and concurrently applied (Sangchai 1976 cited in Sheehan & Egan 2007). The use of force or 'Pradej' can insult lower status or vulnerable individuals and lead to less achievement from them. The use of compassion or 'Prakhun' seems to make the authoritative figure more accessible. The supervisor who balances these roles will receive the privilege of being called 'Baramee' (a form of the culturally preferred leadership style) gaining their subordinates' loyalty and respect. These terms are very important for a benevolent-paternalistic Thai style of management.

Social harmony or cool-hearted behaviour

Power distance and conflict-avoidance behaviour also creates a stereotype of 'social cosmetic' display (Philips 1965 cited in Mulder 1994). Thai people are more likely to avoid conflict with their superiors. While ever Thai superiors display their 'Pradej' and 'Prakhun', this automatically makes employees feel uncertain and restricted in expressing their opinions or feelings to their employers. Subordinates are socially constructed to perceive that it is better not to confront their superiors in case their superior's power will be activated in revenge against them (Mulder 1994). This is not only with associates in the workplace, but also with strangers.

These cultural defense mechanisms can aid smooth and pleasant social and workplace interaction, but later inhibit individual initiative and creativity and can lead to repression (Komin 1988; Sheehan & Egan 2007). Avoidance is represented by application of 'social cosmetic' display to bypass conflict in social interactions, such as by remaining indifferent, 'Choei,' or making fun, 'Sanuk,' of it (Mulder 1994). 'Mai Pen Rai' (never mind) and 'Krengjai' (reserve and consideration for another person's feeling) are words commonly used in this sort of situation (Komin 1988; Mulder 1994; Sheehan & Egan 2007). However, these concepts can mask problems such as underground uncooperativeness, gossip and anonymous physical and verbal attacks, which

are impediments to collaboration and problem-solving in knowledge-based organisations (Sheehan & Egan 2007).

Patron-client relationship and high self-image (presentation of self)

Chinese Confucian philosophy also creates another unique Thai patron-client relationship. The goodness or 'Bunkhun' from 'Prakhun' (the goodness given) that elders or friends have given to others needs to be repaid and taken as a social obligation (Pongsapich 1998:48). In Thailand, the repayment of the 'Bunkhun' from the employees can be represented in terms of ways in which to please their bosses or elders because they expect to receive favours (Sheehan & Egan 2007).

This type of patron-client relationship, in the presence of a weak institutional structure, can cause secret cooperation, corruption and subservient behaviour (Mulder 1994). This relationship can be found more in collectivist societies especially with close long term commitments to extended relationships, for example in family, extended family, or the workplace (Hofstede 1997). Seeking ways to please their seniors may cause problems, such as 'cronyism' and 'nepotistic' relationships in the workplace, especially where this close relationship may override other workplace rules and regulations. This causes an impediment to horizontally and performance-orientated growth in hierarchically orientated organizations (Sheehan & Egan 2007).

The above features of Thainess also affect the external expression of people in social positions, leading to behaviour such as excessive pride in personal or organizational appearance, grooming and vanity, at the expense of their intrinsic values (Mulder 1994; Sheehan & Egan 2007). The egocentric and intolerable concept of losing face or presentation of self is represented as 'form over content'. Moreover, if the measure of self-image is money and power, this characteristic may create negative forms of social face-saving behaviour. Thais can display their status over others by

building up resources without worrying about the processes used to gain that status. As Mulder (1994) notes, excessive misuse of resources, profiteering and the corruption may be used to gain or regain face.

High individualism or self-reliance

Piker cited in Mulder (1994) and Pongsapich (1998) observes that Thai people also have a high inner sense of self which is claimed to be inherited from Theravada Buddhism's aspect of individualism. This aspect emphasizes that individuals need to put forward their own effort in order to achieve their spiritual enlightenment. This shapes the importance and value they place on the self as independent, creating self-centeredness, and a lack of social engagement or recognition of others.

This individualism can be said to lead to some degree of competitive relationship and a weakness in interpersonal cooperation, which can create a looseness of structure in Thai organizations (Mulder 1994; Phutharaporn 1998). Mabry (1987) states that Thai people seem to lack teamwork and cooperation among equals, which is covered by an exhibition of social politeness. Sheehan and Egan (2007) concludes that this was one of the major challenges to effectiveness in managing Thai bureaucracy, where individualism is masked by power distance, collectivist and conflict avoidance traits.

Present-world orientation

The concept of Karma originating in Theravada Buddhism has been attributed to the Thai short-term perspective on facing present and future contingencies (Mulder 1994:112). Thais live in the 'here and now', take the good karma and try to be free from problems as much as possible. This concept of self-attainment in the Thai character leads them to take advantage of personal

opportunity whenever it comes, but give less commitment to long-term social obligations (Embree 1950).

According to Hofstede (1997), who developed indices for comparing management cultures, Thailand was ranked as a high power distance country with culture exhibiting a high collectivist, moderately strong feminine society with strong uncertainty avoidance. Understanding of the differences in the local worldview, which influences organisational management, can be seen through the view of power gradients, relationships between individuals and society, gender differences and means of dealing with conflict (Hofstede 1997:13). These factors generally characterize the Thai way of seeing and doing things.

The four main characteristics of Thai management culture and their implications can be described as follows and are based on the findings of Hofstede (1997) and Hofstede and Hofstede (2005).

- 1) A high power distance can lead to employees working obediently and submissively
- 2) Thai collectivism can mean that social networks and loyalty may be valued above efficiency and that confrontation is normally avoided.
- 3) The feminine culture in the Thai workplace means that employees prefer to relate to others co-operatively rather than compete with them.
- 4) The uncertainty avoidance trait leads Thai people to be reluctant to accept ambiguous situations or challenges.

In terms of management, these characteristics may create inhibition and reservation in lower levels of the workplace hierarchy which influences capacity for learning and improvement processes (Hofstede & Hofstede 2005; Schermerhorn & Bond 1997; Sheehan & Egan 2007).

The characteristics mentioned above are valuable in understanding the Thai world view and its implications for Thai management. Selective assimilation of external forces with past traditions has been instrumental in forming the uniqueness of modern Thai society. Understanding Thai culture and the way people do things in Thailand will not only be important for interpreting EMS personnel interviews but also for accurately understanding why events and processes occur in the Thai EMS. These impacts can be used to better evaluate and identify various issues associated with management strategies used in the KK EMS.

2.6 Summary

The context of the Thai health and social systems influences road traffic injury patterns and the way EMS is constructed and managed. An understanding of KK EMS management from local EMS staff is important for improving EMS management because of the influence of the local Thai context. Contingencies in EM Services, EMS inputs, processes, outcome measures and the social environment, have significant effects on the EMS of RTI in KK province is managed. This has broader application to other regions of Thailand. There are many variables in the KK and Thai context that shape EMS staff and individual understanding and utilisation of the EMS system.

The present studies regarding EMS of RTI have been conducted in terms of risk factors identification rather than combining this data with a review of the broader EMS system. This has a better possibility of trying to find implications or solutions. Today, most of the current campaigns used to prevent and reduce road traffic injury severity have been relatively ineffective in solving this problem. Little information is available on the suggested improvements for EMS especially from staff working in the service. The following chapter will discuss the study setting and describe a mixed methods approach using quantitative and qualitative methodology to address this knowledge gap.

Chapter 3 Study setting and methodology

3.1 Introduction

As discussed in Chapter 2, the provision of EMS is somewhat new to Thai health services and has been implemented as a formal system since 2002. The Khon Kaen (KK) EMS, in association with the KK Trauma and Critical Care Centre team, are responsible for implementation of this system in Thailand. The growth and development of the system is now viewed as a prototype which provides the best example of the Thai pre-hospital medical care system in rural and urban settings. Concurrently, Road Traffic Injury (RTI) remains one of the most common causes of death and injury occurring in Thailand where victim trauma severity can be reduced by proper out-of-hospital medical care. Exploring better management of these RTI problems in KK may provide appropriate answers for future management of EMS and, in particular, of the RTI problem in Thailand.

This chapter will first describe the study setting and is followed, in the second section, by a justification of the mixed methodology used in this thesis. A mixed methodology was used in order to gain a more complete understanding of issues associated with EMS management of RTI which is the focus of this study. The following sections describe the quantitative and qualitative research components used in the study. Finally, the researcher's personal reflections of the research process are discussed.

3.2 Study setting

3.2.1 Khon Kaen Province and its health facilities

Khon Kaen (KK) is the second-largest Province (*Changwat*) of the north-eastern area of Thailand (see Figure 3.1). KK is located 445 kilometres northeast of Bangkok and has an area of 10,886 square kilometres. This province is subdivided into 20 districts (*Amphoe*) and 5 minor districts

and neighbouring Provinces (see Figure 3.3). There are a total of 25 hospitals and hundreds of private clinics and primary care units serving the population.

Figure 3.2: Khon Kaen Province and its districts' geographical environment.



Urban or city area



Urban and rural mixed areas



Rural and remote mixed areas

Source: Pictures taken during fieldwork

KK has five main hospitals in the KK City municipality area including the regional hospital, Khon Kaen Regional Hospital (KKRH). It was founded as a designated referral centre for KK districts and surrounding Provinces, a tertiary university hospital and three other private hospitals. It also has twenty community or general level hospitals that serve every district outside KK City

municipality area. Primary care units are set up in every ‘Tambon’ (sub-district). These hospitals and health facilities are controlled by the Ministry of Public Health (MoPH), National Health Security Office (NHSO) and local governments. The NHSO purchases health services managed by MoPH and the local government organisations (see Section 2.6.2).

Figure 3.3: Khon Kaen Regional Hospital, KK district hospital and community health facilities.



Khon Kean Regional Hospital



Ban Phang Community Hospital



Primary Care Unit (PCU) and Local Administrative Organisation (LAO)

Local governments, called Local Administrative Organizations (LAOs) at both provincial and communal level, were established to govern local communities after the Decentralization Act was promulgated. A Provincial Administrative Organization (PAO) looks after the entire province,

whereas each commune, which consists of 10 villages on average, and total populations ranging from around 5,000 to approximately 20,000 people, is administered by a LAO called ‘Tambon’ Administrative Organisation (TAO). Each of these LAOs has a public health department which is responsible for the health of the localities and administering community health services in harmony with the local MoPH health service and, in particular, primary care units and EMS system.

The number of vehicles registered over the same period of the study indicated a fluctuating pattern in the various types of vehicles registered. There were approximately 631,000 vehicles on average registered in KK Province each year during 1998 and 2005 and of those, motorcycles accounted for between 66.17% - 84.12% of all vehicle registrations per year. Incidentally, these numbers reflect only the vehicles registered during that time and do not include the significant number of unregistered vehicles used on roads in outlying areas.

The KK Provincial Health Office (PHO) has to report RTI cases to MoPH every month. This dataset is a separate set to the IS database, which is collated from only KKRH, and sourced from the entire KK province hospital. In 1999, KK HPO reported that there were 492 fatal (28.30 per 100,000) and 20,894 non-fatal (1,199.23 per 100,000) RTI related injury cases in KK province. Fatality showed a decrease in trend to 340 cases (19.23 per 100,000) in 2003 whereas non-fatal injuries rose to 21,092 cases (1,193.23 per 100,000). However, as mentioned in the MoPH data section in chapter 2, this set of data does not provide as much detail as the IS data from KKRH. Both datasets do indicate the scope of the problem.

3.2.2 Khon Kaen Emergency Medical Services

KK EMS has been serving local communities in KK Province since 1994. KKEMS was originally established by using pre-existing hospital-based services in combination with local volunteer

foundations and served the population mainly in the KK city municipal area. The system was later expanded to include district hospitals in 1998 and was finally hybridised to include community-based services with the hospital-based system in December 2001 (Chadbunchachai, Tipsuntornsak & Choteklom 2005b:2-3).

At the provincial level KK EMS is controlled by a provincial EMS office and linked to the provincial Command and Control Centre. KK EMS committee was established to run from an office on the fifth floor of Sirinthorn Trauma Complex Centre, Khon Kaen Regional Hospital. It covers an area within all KK Province and sometimes bordering areas of neighbouring Provinces. A multi-tiered EMS system was designed for better public access to health services. Hospital-based EM Services have been established in every KK district hospital since 2003 with a hospital EMS team consisting of designated physicians, registered nurses and Emergency Medical Technicians (EMTs).

At the community level, community-based EM services were spreading their services to more than 50% of the communes (Chadbunchachai 2004), which primarily consists of First Responders (FRs) trained employees. The use of the community EMS system has become more common and plays an important role in pre-hospital service in KK rural communities. The Contracted EMS unit operated by LAO employees is the main type of the contracted EMS unit currently operating in cooperation with hospital-based EMS units in KK Province.

EMS providers in KK Province consist of three main levels of EMS personnel: First Responders (FR), Basic Life Support team (BLS) and Advanced Life Support crews (ALS). First Responders are two-day (16 hours) trained laypersons who can simply assess patients, providing first aid and

transport patients to the health facilities. Basic pre-hospital trauma care may also be provided by other levels of EMS personnel.

The BLS team consists of Emergency Medical Technicians with 2 levels of training – Basic (110 hours and Intermediate (2 year). Emergency Medical Technicians have a more sophisticated knowledge to assess injured patients, provide stabilising care, perform a wider range of medical intervention and determine whether patients need to be transported to a fixed health care facility. However, they are not allowed to perform invasive medical procedures. There are not many EMT-Basic staff currently active in the KK EM Services.

In KK EMS Advanced level EMS staff have a wide range of roles including call-taking, triaging, and dispatching tasks. Presently, professionally trained paramedics to fill this role are not available and KK EMS is now using five-day paramedic specially trained registered nurses called paramedic nurses and, sometimes physicians attending ER or three-year residency trained emergency physicians, to provide this level of care. Provision of care allows transport of patients in a more fully-equipped ambulance.

There are two levels of ambulance care used in the KK EMS. The basic level ambulance is an ambulance arranged for those First Responders. Ambulances used in this level are often modified pick-up trucks with a covered back where a minimum amount of medical equipment is carried on board. Advanced level ambulances are set up with facilities comparable to care in the hospital-based system providing advanced medical care with physicians and/or paramedic nurses. Although hospitals providing EMS have the best equipped ambulances, they may often be underequipped due to the lack of resources or maintenance.

Whenever there is a report of an emergency coming in via the emergency number 1669, KKRH landlines, EMS unit landlines or radio receivers, the KK EMS call-taker will start to record details in a report document. Each interaction will be recorded in respect to ongoing processes in the case. The first-hand information given by the caller is used to triage the patient by the paramedic nurse or doctor in charge. After the triaging process, a dispatcher will then allocate which EMS crew to send out. The most appropriate fixed-station EMS unit will receive brief information about the patient and travel to the scene, give medical care, and/or transport the patient to hospital if needed. Records are documented at all steps in the episode of care by EMS crew, from first emergency call until discharge of the patient at the scene or arrival at a receiving health facility. The data is then submitted to the KK EMS office and the Narenthron Centre to be kept, analysed and used in management of the service.

3.3 Research design

The aims of the study were to investigate EMS management of RTI within the current health care system in order to understand how management of RTI by EMS could be improved in KK Province. The data used to inform such an analysis of the health care system relies on the available injury data and interviewing EMS personnel. The Khon Kaen EMS system was chosen because KK has undertaken injury surveillance and injury prevention programs for many years as well as pre-hospital EMS. It has now become one of the most advanced institutes in injury prevention control and pre-hospital care in Thailand. The KKRH EMS, and many of the staff, have been responding to RTI for many years. KKRH itself is not only a trauma center and a referral hospital for this region, but also the WHO Collaborating Center for Injury Prevention and Control in the South East Asia region.

A study design suited to conduct an in-depth exploration of a unique situation is the case study (Teddlie & Tashakkori 2009b; Tharenou, Donohue & Cooper 2007:74-75). A case study focuses on the 'how' and 'why' aspects of the event of interest (Woods, Clark & FitzGerald 2002; Yin 2003). Moreover, a case study can use a combination of quantitative and qualitative evidence. A case study was used to investigate the current management of RTI by EMS in KK Province. This involved a sample of the KK EMS staff who have been responding to RTI since 1994. A quantitative cross-sectional survey and qualitative in-depth interviews were used in tandem to gain a more inclusive understanding of KK EMS management of RTI related issues.

Research questions

The focus of the study was to seek information on how patient outcome could be improved following road traffic injuries. The main research question is stated below:

How can Emergency Medical Services for road traffic injuries be improved?

WHO (2005) reports that pre-hospital trauma care is required to be strengthened throughout the world. However, the lack of evidence to support the development and improvement of pre-hospital EMS is a significant issue. This study therefore uses available information to prove and disprove the benefits of EMS management of RTI in KK Province. The aims of the study are presented below:

- (1) To assess the available road traffic injury and emergency medical services data to describe characteristics of road trauma and provision of emergency medical services currently existing in KK province*
- (2) To explore the perceptions of EMS personnel in order to identify contributory factors associated with road traffic injury and management of EMS response*

(3) To identify how EMS management and patient outcomes could be improved following road traffic trauma.

A quantitative cross-sectional survey was used to assess the underpinning profile of injury and EMS responses in KK. The injury surveillance and EMS database provides information about a number of variables which can be used to develop a profile of injury and EMS processes and, moreover, to provide evidence of current problems. However, the limitation of a quantitative approach can be its failure to fully explain social complexities of the problem and readily identify workable solutions. Often more information is required to form an accurate picture about what the problems are and how they may be solved in the wider context of EMS policies and practices. The lack of information about social and cultural factors in the quantitative data can be supplemented by use of qualitative data (Creswell 2003:16). Patient outcomes from the RTI problem and EM Services responses are complex and interdependent. RTI and EMS issues may be associated with many factors which may not have been documented and presented within the databases currently available. This problem may be better solved with a deeper understanding of issues presented and interpreted from a number of different viewpoints (Creswell 2003:12; Tharenou, Donohue & Cooper 2007:75).

3.4 Quantitative research methodology

This section describes the quantitative research methodology employed in this study. Providing evidence based information from large data sets is important in making recommendations for change. The context of current practices needs to be clearly revealed in order to gain better understanding of how the EMS system can be changed and improved. This evidence can be used to highlight problems of the past and then set up the criteria for changing these in the future

(Wilderspin & Bevan 2006). The following section will outline theoretical and other aspects underpinning the quantitative cross-sectional component.

3.4.1 Theoretical framework

Post-positivism is the philosophical assumption underpinning the quantitative or scientific paradigm belief that outcome or output can be ‘objectively’ manipulated by its cause and related measureable variables. The deduced sets of measureable variables can be analysed by using numerical data and statistical analyses to test the hypotheses originating from theories or concepts (Creswell 2003:7; Teddlie & Tashakkori 2009b:23). Therefore, the knowledge gained from this paradigm is shaped by the investigator’s planned set of variables through their inferential version of measurement.

In this study, the descriptive secondary data of both RTI and EMS operation is used to descriptively develop a profile of KK road trauma and EMS operation. The study uses two existing data sources and the numerical data are summarised to present and describe a profile and explore possible relationships among variables within RTI and EMS management of that injury. At present, these two datasets have been used in many studies and presentations at national and international level (Chadbunchachai et al. 2006a; Suphanchaimat et al. 1998; WHO 2005). This thesis builds on this by linking the two data sources and trying to find the gaps from using them together in managing EMS of RTI.

Case series: Trauma registry and EMS database

To better inform injury control, information regarding characteristics of injury and responses needs to be available in a recordable form (Mock 2001:168). The distinctive feature of injury, hence, can be recorded into various categories, such as clinical presentation and aetiology. These

characteristics are based on recorded sets of signs and symptoms. They can provide necessary information to construct knowledge about injury manifestations which can then be used to set up prevention programs. The extended case series, which continuously record the data samples over a number of years, can be used to explore the size and chronological pattern of the problem.

Secondary datasets were used as there were logistical difficulties in getting original data on road trauma injury using the survey or diary method. Using a survey or diary was likely to be a resource and time consuming activity and could have put more burdens on the EMS units. It was anticipated that a primary survey approach would capture only a limited number of cases of the total injury cases (Mueller 2001:47; Stewart 1984). As a result the available secondary data sets in KK, which were accessible as an extended retrospective case series of data arising from the trauma registry and an EMS database were used. The routinely measured variables collected for surveillance and administrative purposes were used to answer the questions posed by the study (Mueller 2001:47; Wilderspin & Bevan 2006:41).

The two sets of case series data were used to identify etiologies and patterns of relevant disease and illness. They may not apply to or explain the whole Province RTI rate since it comes from the numerator etiological data of patients attending one referral hospital. Although they may not collect data on all required RTI and EMS cases, they can be used as a starting point for identifying real gaps and misunderstandings in the existing knowledge from databases about the injury and its management (Stewart 1984:14-15).

A published version (Trauma Registry) of Injury Surveillance (IS) and EMS datasets is a continuous standard versions of the case series over time (Mock 2001:171). The *KKRH Trauma Registry Report* is a compilation of data from the IS system which was published and developed for

handling injury problems in each sentinel injury surveillance site in Thailand. The number and characteristics of patients who are at risk is available input for the EMS system, and can be utilised to further establish road traffic injury countermeasures. The information can also be used to assess efforts of injury prevention strategies and response in relation to specified injury events (Mock 2001; Santikarn et al. 1999). However, information about many variables which are important for injury prevention and control, such as physical and social environment factors, may not be made available, and this is a recognized limitation of using secondary data.

The Emergency Medical Service is a post-impact emergency care facility at out-of-hospital settings following the occurrence of an injury. Any EMS has many points of responsibility or “steps” within the process of care including activation of units, provision of medical care at the injury scene through transporting to the health care facility. A set of measurable variables in the EMS care processes was systemically recorded and used to describe characteristics of the process of care provided. However, this version fails to illustrate many variables important for EMS improvement including EMS patient outcome.

The RTI data presented in the published Trauma Registry and the EMS data available as computerised dataset at KKRH were used to describe an injury profile and identify important trends of RTI and EMS operation in KK Province. The source of these two sets is presented in the next section.

3.4.2 Quantitative data source

The first set of quantitative data was obtained from the routinely available Trauma Registry reports published by KKRH as de-identified injury cases attending Khon Kaen Regional Hospital over an eight-year period from 1998 to 2005. The second dataset was sourced from the EMS database

which recorded the EMS responses and routinely collected data for the EMS system at KK Provincial office from 2003 to 2007. Forms used to collect these two data sources are found in Appendix 1 and 2. The numbers in each data set are given in Table 3.1. Cases could be reported in more than one dataset. Prior to this study the relationship between databases had not been mapped.

Although the KKRH Trauma Registry is limited to inpatients, the data also includes the inpatients who were transferred by the EMS teams. However, there might be some anticipated limitations according to limitations of each dataset (Mock 2001). The 18 variables shown in Table 3.2 are only part of the more than a hundred variables collected by the IS and EMS system. These variables were used as these were readily available and could allow comparison with other published studies. The variables documented in each database are described in Appendix 5 and 6.

Table 3.1: Expected data sources

Databases	Source of Information	Comments
KK province ER database	Hospitals in KK Province	Not available
EMS database	KK Province EMS office	Available (on line, in detail)
KKRHER database	KKRH Emergency department	Available (not in detail)
KK Trauma Registry	KKRH Injury surveillance	Available (part of KKRH ER database but more detail provided)

Table 3.2: Variables used in this study

Databases	Variables
Khon Kaen Regional Hospital Trauma Registry	<i>Age and sex</i> <i>Agent</i> <i>Type of injured person (road user)</i> <i>Bodily region</i> <i>Geographical location</i> <i>Occupation of injured person</i> <i>Helmet use and alcohol involvement</i> <i>Alcohol related road traffic injury</i> <i>Seasonal and day of week variation</i> <i>Treatment and financial cost outcomes</i>
Khon Kaen Emergency Medical Services	<i>EMS Units</i> <i>EMS Personnel</i> <i>EMS Ambulance types</i> <i>Level of call outs</i> <i>Number of call outs by type of units</i> <i>Channels called</i> <i>Classification of cases</i> <i>Response times</i>

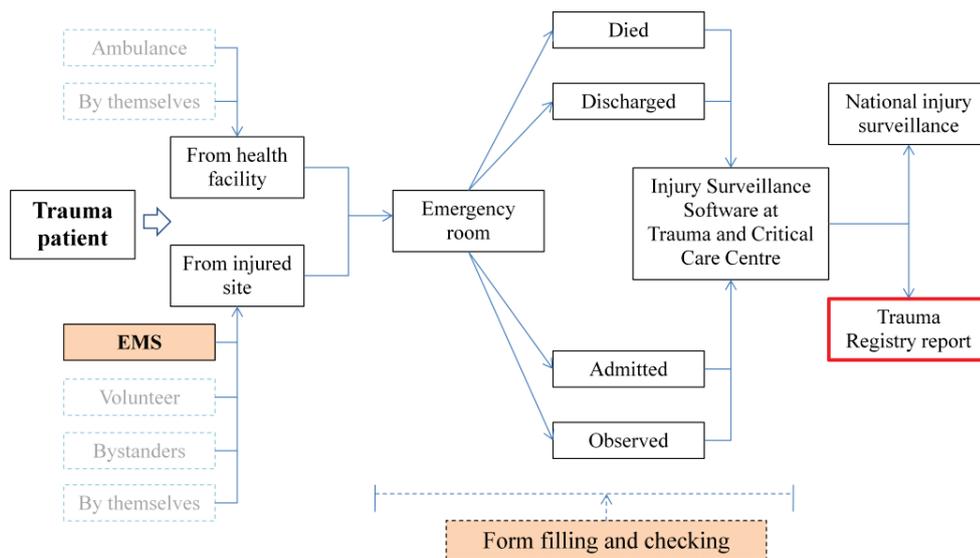
Trauma Registry data gathering process

Khon Kaen has been using a national IS program since 1997. Although an injury surveillance system at the national level combines the data from every sentinel site, the 35 tables containing ICD-10 codes V01-V89 (see Appendix 7) were compiled and produced as the annual Trauma Registry Report for each sentinel site (MoPH 2006:11).

The process or flow of the data remains similar to what was locally conducted during 1989-1996. Medical professionals at sentinel sites were authorized to record data on the fatally and acutely injured patients who presented at the sentinel site within seven days after the injury occurring. The variables collected in the IS form include patient demographic and general injury information about the trauma patient (see Appendix 1).

Figure 3.4 explains how the data are collected when an incident is registered. The data are documented by health care personnel working in ER while the patient is treated at ER, and by nurses following admission. The information is then checked, coded and completed by the assigned nurses at Khon Kaen Trauma and Critical Care Centre. The data entry operators enter the data documented in computer software to generate output, namely IS files. The file and codes used in the IS system are attached (see Appendix 7). The file is again manually compared and checked to generate a final output at the Trauma and Critical Care Centre. The quality of data is controlled by regular evaluation by the technical supervision team and IS data system evaluation committee (MoPH 2006).

Figure 3.4: The data flow of the *KKRH Trauma Registry*



Source: Adapted from *Manual for Data Collection: Provincial injury and surveillance, Thailand* (MoPH 2006)

Emergency medical service database data gathering process

The second data source was obtained from the 2003-2007 EMS system data sets, which are routinely collected and documented within the EMS database of the KK EMS. In Thailand, an EMS profile is normally collated by the provincial EMS Command and Control Centre (CCC) and

sent on to the Bureau of EMS or 'Narethorn Centre' in Bangkok (now called EMIT). Khon Kaen, and its health catchment region in particular, have their own EMS database information system established at the 10th and 12th regional health catchment EMS centre. KK forms are basically similar to the previously used national level format (see Appendices 2-4). The current KK EMS data base has its regional centre in Mahasarakam Province. The recorded data is first collected and sent online, along with the other seven Provinces in the region, to Mahasarakam before transferring to 'Narethorn Centre' or 'EMIT' in Bangkok.

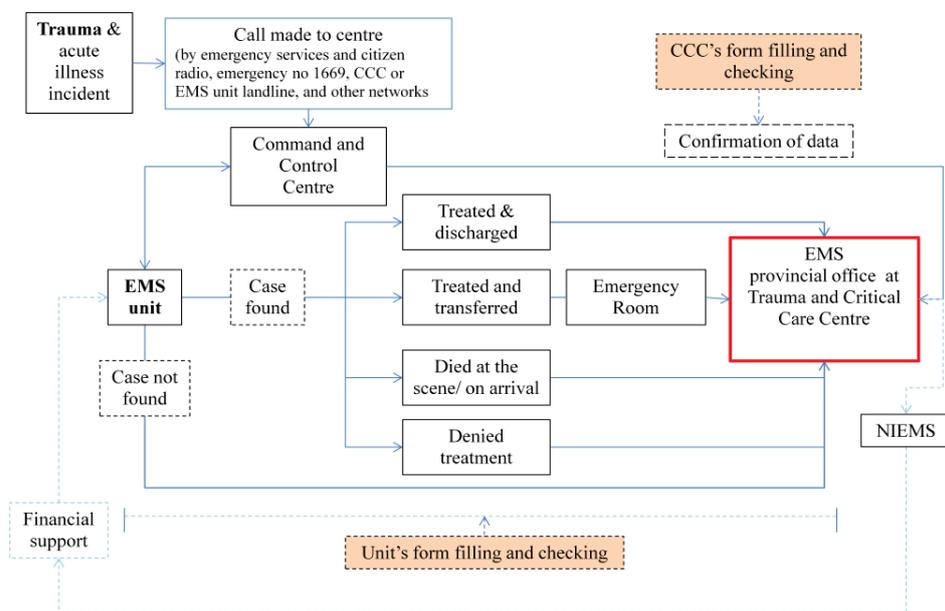
The regional centre was established in 2002 and began to collect the EMS profile of this catchment in 2003. This current computer-based EMS information system in KK has been used since late 2003. The data were collected and transferred online by authorized Provincial EMS officers. This data set was obtained for the study by contacting with an authorised key person who provided the data in their comprehensive format.

Throughout the data collection process, there were two different data formats which were merged and rechecked to assess the correctness of information received after EMS unit activation (see Figure 3.5). There are two data entry operators entering different files; the first is the data entered at the CCC, while the other is entering data at the unit. Both documents consist of general information about the response such as, response time, incident type, patient signs and symptoms and result of the response. Codes used are also attached (see Appendix 6)

The EMS information is collected whenever a caller activates the system. The caller information is gathered at the CCC and then passed to the EMS database (see Appendix 2). The data from the forms of the EMS unit (comprising response time, patient and incident information, criteria for transferring, procedure evaluation and treatment outcome) are documented by the EMS team. This

data can vary according to the capacity of the EMS unit responding to the event (see Appendices 3 and 4) because the information needs to be completed during and after response to an emergency incident. The EMS document is then submitted at the receiving hospital. The copy is filed at the EMS unit to be rechecked with the CCC's information later for financial administration purposes (see Figure 3.5).

Figure 3.5: The data flow of cases entering the EMS database



Source: Adapted from *Emergency Medical Service System Guidebook 2004* (Karngasoot et al. 2003:12,20)

Data entry and statistical analysis

A description of the *KKRH Trauma Registry* as well as KK EMS was considered from the perspective of EMS management. Variables presented include the available RTI data published in the *KKRH Trauma Registry* report and EMS data used to manage the current system (Mock 2001). A profile of RTI was developed from using the variables of age, sex, agent, type of injured person, occupation of injured person, bodily region involved, and location. The characteristics of the KK

EMS system were described in terms of available ambulance services, personnel and incident responses.

In the quantitative study, available RTI and EMS data was transcribed by the researcher from the KKRH Trauma Registry reports and EMS database by the researcher into Excel data spread sheets using the Microsoft Excel version 2007 software. RTI related information was collected and analysed from the published trauma registry from 1998 to 2005 at KKRH. The cases were those who were recorded as trauma patients in the national injury surveillance program. Variables related to age, sex, cause of injury, agent involved, organ involved and protective device used were collated in the data spread sheets. Descriptive analysis was conducted and the frequency tables were produced to obtain a descriptive profile of road transport injury data. At the time of sample selection, over the period of eight years from 1998 to 2005, 162,078 fatal and non-fatal injured patients were identified. Of those 71,805 injury notifications were from road traffic injuries attending the KKRH emergency department.

The other set of information was obtained from the KK EMS database. These cases were all responses by units following a call. The information includes profiles by type of patient, level of care needed, and the processes of care provided. Descriptive analysis was conducted and frequency tables produced to obtain a descriptive profile of data. From the data selected over a four year period from late 2003 to 2007, 100,201 callouts were registered in the system from all over KK Province.

Following analysis, an attempt was made to identify characteristics of RTI and patterns of EMS response. In order to develop a more complete picture of KK RTI and EMS functioning, some variables of interest were noted and a greater focus was given to some variables, for example

motorcycle injury. EMS response data were then reviewed in terms of EMS resources and processes. Odds ratio accompanying the use of confidence limits was also applied to express the risk of mortality of fatal road traffic injuries (Cummings, Koepsell & Roberts 2001; Sackett et al. 1991).

3.4.3 Validity and reliability of quantitative component

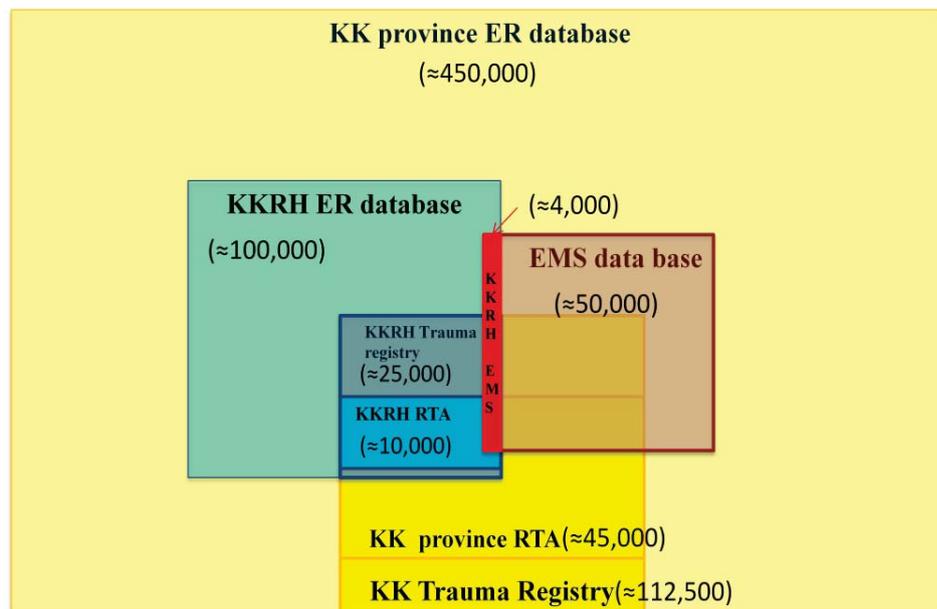
Teddlie and Tashakkori (2009b) suggest that high-quality data is required for answering research questions. In using quantitative methods, validity and reliability of the data is important. These two considerations were met by the quality of the KKRH Injury Surveillance Program implemented to collect the injury data, which is a World Health Organization Collaborating Centre and adheres to the definitions from International Classification of Diseases in relation to transport accidents (ICD 10, V01-V89). As they are the primary sources for both RTI and EMS, data were validly constructed since they were created for and are being used for managing injury prevention and control and EMS. Although the data collected by the KKRH Trauma Registry may not be completely representative of the whole Province, it can be used as a valuable source of information for ongoing injury prevention programs.

These datasets can be classified as a criterion-based data collection. The data collectors and authorities have extensive training to ensure standardised measurement and recording of variables. There are also several levels of data cleaning and checking processes conducted in the Trauma Centre where the data collection administered. Missing, miscoded data and variable of coding techniques are managed by KK Trauma and Critical Centre evaluation processes (Chadbunchachai, Suppachutikul & Santikarn 2002). Moreover, these datasets were also used and presented in many local, national and international conferences. Hence, the reliability of data is already in place.

3.4.4 Limitations

In analysis of the existing databases, a number of limitations were found to exist in the data sets which are detailed below. Accurate case numbers for specific locations cannot be calculated because of overlaps in the data sources (see Figure 3.6), for example transfer of severe trauma patients from rural areas to KKRH. The EMS database also had limited application to RTI specifically as these cases were not isolated from all other emergencies.

Figure 3.6: An overlapping of existing RTI in Trauma registry and EMS datasets (An estimated number of cases)



3.4.4.1 Limitations in the KKRH Trauma Registry in this study are as follows:

1. The data from the KKRH Trauma Registry may not apply or explain the whole Province road traffic injuries profile since it comes from the numerator etiological data of patient attending one referral hospital, not the whole Province (Mock 2001:172).

2. As a result of being a referral Trauma Centre, the data registered into this trauma centre include those who were referred. As a result, the registry is more likely to have a higher proportion of the cases with more serious injury complications.
3. The RTI data are retrospective and may not reflect the present situation. There is a time lag from injury data entry to publication. This delays analysis of data by some years. Using published hospital-based Trauma Registry data may provide a simplified version of the Trauma Registry. It does not include or show important data such as those outcome predictors which are also filed in the database.

3.4.4.2 Limitations due to the use of EMS data are as follows:

1. The system was established initially to be used internally for administrative purposes and monitor the number and type of missions and channels used for calls. This could be used to evaluate performance of the service.
2. Specific detail about road traffic injuries was not available. The current EMS data collection was not developed for injury prevention purposes so therefore specific details about injury such as road traffic trauma were not available.
3. The existing EMS data collation started as an official service in 2002 and is in its infancy period. While the data collected has been widely used and demonstrated to the public, comprehensive reports or documents are not available.
4. EMS information has been kept in a file server in another Province and the accessible online data is not user-friendly. Although, access to the database can be achieved online, the programmer generates data for outside inquiries. This can cause difficulty in obtaining the required data set.

3.4.4.3 Limitations in linking the two data sets.

1. Differing time frames existed between the two data sets which only overlapped for the years 2003-2005. The published Trauma Registry reports experienced administrative problems and had ceased publication in 2005. The EMS profile used started its central gathering in 2003 and had been rapidly evolving its EMS data collation; therefore, there are only three years in the same time frame.
2. The limited availability of the various data sets following initiation of the research. The Trauma Registry (Injury Surveillance) data was found to be available for only KKRH hospital whereas the EMS data set was collected from a whole Province. Moreover, these two data sets were used separately.
3. The coding used in the two data sets is different. The code used for the KK Trauma Registry was derived from internally standardised ICD10 whereas the EMS data set has not been standardised yet to a similar code.

The limitations of using Trauma Registry and EMS database were considered. The analysis performed in this study on the existing databases identified some gaps, problems and possible solutions in using secondary databases to investigate management of EMS of RTI. The data from all hospitals caring for road trauma patients in KK area would be a preferred population-based dataset to give a more complete picture of road trauma across the Province. However, this would require considerable resources to ensure standardization of data collation across all rural hospitals and is beyond the scope of the resources available for this study.

3.5 Qualitative research methodology

While quantitative data can be valuable for monitoring, assessing and improving the existing health care service, they may not reveal the 'how' and 'why' factors that arise in such a complex and

contextual bound health care system (Miller, Dingwell & Murphy 2004:326). Quantitative research may examine the relationship between input and outcome of health services in terms of factual evidence, but may not demonstrate more detailed information. In-depth information can be gained from users and/or providers who share organisational knowledge, and witness on a daily basis, the impact and consequences of setting up a particular approach to service provision (Walburg 2006 23). Understanding the workers' perspectives can help to explain why the system works as it does and such detailed information can be useful in directing change in current practices (Miller, Dingwell & Murphy 2004; Walburg 2006). This section discusses an eclectic approach to interpretivist phenomenology and the qualitative methodology used in this study. A justification of the research design and method used is presented.

3.5.1 An eclectic approach to interpretivist phenomenology

Phenomenology, the way to understand shared subjective information about individuals developed through their lived-experiences and interactions with other people, and their cultural and historical norms, underpins this qualitative study (Creswell 2003:8; Liamputtong & Ezzy 2005; Schwandt 2000:192). According to Schwandt (1997, 2000), there are three main options of epistemological stances. Schwandt suggests that the first option (Interpretivist) focuses on understanding a particular social action in terms of the context where it belongs, another option (Hermeneutics) focuses on the collective features of sociopolitical life as evident in primary concern, and the last (Existential) focuses on describing the experience of everyday life based on constructionist views.

One of the major differences between an interpretivist point of view and other approaches, according to Schwandt, is the emphasis on understanding the phenomenon from its context (Schwandt 2000). An interpretivist phenomenology focuses on increased understanding of the social conditions of the phenomenon studied. Something that is typical in that particular setting

should be understood in its context. If things can be understood in their common way of interpretation, the existing problems revealed can be more clearly understood and be easier to solve in that situation. Moreover, according to Travers (2001), an interpretivist approach could be used to understand how the people compare between being ‘insiders’ and ‘outsiders’ in that setting.

One of the assumptions of the qualitative component of this study is that interpretation of the meanings which constitute social action should be viewed within the system in which they belong (Schwandt 2000). An individual should be considered to be continually interpreting actions taking place within their environment as well as being influenced by the interpretations expressed by others. This process requires a deeper appreciation by the researcher of the real intention and meaning of comments made by interviewees.

Management of EMS in relation to RTI in Thailand is contextually tied to the Thai cultural setting. The researcher has to look for the social conditions associated with complex subjective views of staff and then interpret these within the participants’ context (Creswell 2003:8; Gubrium & Holstein 2003:216; Thrope & Holt 2008:95). Qualitative analysis allows us to have a much greater understanding of the subjective matters at a micro-perspective level. The issue also requires explorations of causes for the phenomenon of interest. This can be triangulated with quantitative information to understand the case (Bullock, Little & Millham 1992:85).

3.5.2 Thematic analysis

The qualitative component of the study utilized methodological principles of thematic analysis. Since there is little available information about the experiences of the EM personnel in relation to EMS management of road traffic injury problems, thematic analysis was considered an appropriate method for the study as it allows exploration of new aspects and phenomena (Liamputtong & Ezzy

2005; Schwandt 1997; Wilkinson 2004). An eclectic approach to interpretivist phenomenology was used in this study. Underpinning the use of thematic analysis is an emphasis on interpretivist phenomenology which provides a framework that assists the analytical interpretation of the data. From this perspective, construction of an individual's experience provides a basis for understanding different views about experiences regarding EMS as well as RTI from the perspective of EMS personnel.

Thematic analysis in combination with content analysis

Thematic analysis, in combination with content analysis, was used to analyse the data. Thematic analysis is based on a set of guidelines that stem from the original work of Glaser and Strauss, although modified in more recent years to provide a range of tools to assist researchers to discover issues and themes connected with a particular phenomenon (Minichiello, Aroni & Hays 2008). The guidelines emphasise a number of processes that require an inductive approach to present themes which emerge from the phenomenon studied (Teddlie & Tashakkori 2009b). A thematic approach focuses on generating emergent themes based on the process of interpretation (Boyatzis 1998). While thematic analysis is used to find the emerging themes, qualitative content analysis is used to seek dominant patterns within the findings (Ryan & Bernard 2000). It can also be said that content analysis can be used to make an inference by identifying the main characteristics revealed by the collected data (Bazely 2003).

Thematic and content analysis were combined to code, sort and organize data (Bazely 2003; Liamputtong & Ezzy 2005:265; Wilkinson 2004) The interpretative analysis of a phenomenon can be analysed by using a summarised interpretative approach to the data as described by Wojnar and Swanson (2007). The modelled processes includes: (1) reading the interviews to obtain an overall understanding; (2) coding for emerging codes in a number of cycles; (3) identifying common codes

from coded transcripts; (4) clarifying disagreements in interpretation; (5) identifying common themes and patterns and making inferences from them; and (6) selecting sample quotes to illustrate the themes which emerged.

This approach may allow insights into the way in which documentation of participants' experiences could help to depict successes or failures within current interventions and provide guidelines to an improvement of the current health system (D'Angelo & Halpern-Felsher 2008; March & Yancey II 2002). The management of the entire range of EM care in relation to RTI including prevention, treatment and post-treatment care could be better understood via the experiences of health professionals who, in general, may have a genuine desire to improve patient outcomes and the operation of EMS (Miller, Dingwell & Murphy 2004; Walburg 2006; Wilderspin & Bevan 2006).

While presentation of the results occurs in a different form, both thematic analysis and content analysis require information that is textual, systematic, compares and contrasts and enables analysis to occur within the social context of the participants (Boyatzis 1998; Ryan & Bernard 2000; Schwandt 1997, 2000). The quality of information gained is dependent on the process of data sensitivity, which relies on the capacity and resources of the researcher and the ability to determine what is important in the interpretation of data (Liamputtong & Ezzy 2005). The researcher's background also shapes his conceptual empathy and interpretation.

3.5.3 The qualitative design

Sampling and recruitment strategies

The aim of this section of the study is to understand factors related to management of RTI by EMS based on perceptions of EMS personnel. Therefore, the selection of the sample was designed to

choose EMS personnel who have different backgrounds and professional roles when dealing with RTI problems. These people constitute an appropriate sample since they are close to and familiar with the problems being studied. They have a working knowledge of the subject matter. They are required to interact both with local communities and health service facilities in their daily jobs.

Sampling, for that reason, was initially undertaken using a purposive sampling design which guided the selection of participants to fit the aim of the research (Kemper, Stringfield & Teddlie 2003; Liamputtong & Ezzy 2005). Construction of a purposive sampling framework helped develop target categories for the inclusion of participants, who had experience, on a regular basis, within EMS work and road injuries. The categories of participants were based on their experience and professional care levels within the EMS system. As a point of comparison, the categories for inclusion of personnel included, as the research progressed, one physician and a number of nurses, Emergency Medical Technicians (EMTs) and First Responders (FRs) who have worked with hospital and community EMS.

The recruitment processes were initiated when the researcher introduced himself to the KK EMS Provincial office to gain approval and guidance for the study. A printed overview of the study was given to the institution which was then passed on by the management to the potential participants (see Appendix 8). The targeted participants were asked by the researcher if they were willing to participate. After the volunteer participants indicated their willingness to participate, each of them was contacted by the researcher and the interview was arranged at a mutually convenient place and time for the participants.

Data collection

The research required careful thought to be given to strategies considered appropriate to approach participants working in the KK EM service in KK Province where there is a perception of an existing power distance between different groups of staff and in-group values. The participants may not have wanted to give information to someone they considered lacking in experience of their situation or who may criticize them in any way, especially if they felt inferior (Hofstede 1997; Mead 1990). As the researcher is a Thai medical doctor, the social and cultural background may have influenced communication since most of the participants were more likely to position themselves as his subordinates (Burdess 2004; Embree 1950; Mead 1990:9; Mulder 1994; Sheehan & Egan 2007).

Establishing rapport and trust from the participants, therefore, was very important in order to gain the best information through more open and free conversation (Leech 2002:665). The first few months of data collection was spent trying to convince the team in KK that the researcher was going to listen to them, understand their point of view and value the information they offered. This was an important stage of the research in order to establish rapport with a number of the EMS team (Flick 2006b:119). This time was also spent in engagement with the interviewees' context. By being part of the community, the researcher was able to match perceptual language while undertaking data collection which gave the researcher an 'interpretative practice' as described by Holstein and Gubrium (cited in Minichiello, Aroni & Hays 2008).

The participants were selected purposively through recommendations given by the management of KK EMS. A consent form was given to and signed by the interviewee before the interview (see Appendix 9). Eighteen interviews with 20 EMS personnel were conducted in KK between 2007 and 2008 at venues mutually agreed on by the researcher and the participants. There were two

interviews that had two participants involved at the request of the interviewees. Interviews followed a semi-structured format that relied upon central topics when asking questions. The approach to the interview followed an informal conversational style with prompts to get more in-depth information (Leech 2002:667). The interviews varied in length between approximately 30 to 60 minutes. The face-to-face interviews were recorded by a digital recording device.

Notes during and at the end of the interviews were also taken by the researcher. All participants were given the opportunity to turn off the recording and delete unwanted parts when sensitive information was revealed. Only a few of the participants were concerned about sensitive information during the interviews and those parts were deleted from the interview transcripts. The interview process commenced with the following steps:

- 1) introduction and informed consent completion;
- 2) collection of background information and demographic data of the participants;
- 3) question and interview phase with prompts; and,
- 4) conclusion and thanks.

Semi-structured interview

The in-depth interview is a method used to understand the human experience through face-to-face interaction in an interview process (Liamputtong & Ezzy 2005:58; Minichiello, Aroni & Hays 2008:11). In this study, available resources and a limited time frame, meant that semi-structured interviews were conducted in an individual face-to-face manner. This was preferred to focus group methodology as participants in different parts of the health system could express their views in the presence of an independent person (Minichiello, Aroni & Hays 2008). This is particularly relevant to a workplace with a high power-distance. Considerable efforts were also made to reduce any perceived feeling of power distance by the participants towards the researcher so as to encourage

free speech. The researcher made himself accessible to the participants and expressed a sincere commitment to learn from them. A trusting relationship and an environment of confidence, including empathy were created in the first few months for the data collection period.

Semi-structured interviews were used not only to obtain verbal clues, but also used to check that the interviewees felt comfortable enough to speak freely. The researcher started the interview informally with general comments about issues to be covered during the interview period. This was followed by the first question, as per the interview guide (see Appendix 10). Questions were asked to gain a more complete coverage of the topics discussed. In order to not miss any vital topic information, the questions used were allowed to be flexible in order to cover areas of interest (Minichiello, Aroni & Hays 2008:51). The probe questions were used when EMS staff were required to clarify issues that could be misinterpreted or misunderstood by the researcher. The following question: ‘Could you please tell me more about that?’ was used, for example, to gain more information from the participants. Observations and notes, which included non-verbal clues detected by the researcher, were recorded to increase the value of the words spoken directly by the participants (Liamputtong & Ezzy 2005:58; Minichiello, Aroni & Hays 2008:63, 82). The participants were thanked and asked to feel free to delete, correct and approve the information if they wished. The transcripts were not given to the participants.

Analysis of data

The researcher undertook the transcribing of all interviews. A de-identified case number was linked to each interview. All transcripts were checked for accuracy and errors against the original recordings a number of times. Verbatim transcriptions were made as soon as possible after the interviews. The progress of processing of the first five interviews was supported by a supervision team. The researcher and supervision team read and conducted an independent preliminary

analysis. These interviews were used as a trial to test the interview process. Differences were discussed till agreement was reached. The analysis of the findings was conducted through the processes mentioned below.

In this study, the researcher immersed himself in the data and open-mindedly coded the emerging themes. Manual coding was utilized by the researcher, instead of a computer program, in order to fully understand the range of data supplied (Saldaña 2009b:22). The researcher concluded that the computer programs were overwhelming to use in this small-scale qualitative component and did not support Thai transcripts. The transcripts used in analysis of emerging themes were in Thai, and later translated into English, since the meanings of the comments could lose their more subtle nuances in the act of translation (Thrope & Holt 2008:106). This process was time consuming and needed to be reassessed in the cross-cultural setting where this type of research was conducted (Miller & Glassner 2004). Results of the analysis were managed by the use of five-column formatting pages (see Appendix 11).

There were many repeat cycles conducted in analysis of the qualitative component of this study. The Thai transcripts were read and reread many times to check coding of themes and comments in relation to issues raised. The findings were coded by using a descriptive-exploratory coding method (Saldaña 2009a). In the first cycle of coding, an holistic and line-by-line coding method was used initially to look at the story as a whole and reveal some emerging patterns (Saldaña 2009b). The preliminary patterns which emerged from this coding were then refined and reviewed to identify middle-order ideas of the issues concerned (Miles & Huberman 1984 cited in Dey 1993). The line-by-line coding method was then performed to refine preliminary codes into defined codes, to ensure that the similar coded data were grouped and less common codes were checked and then documented. The pattern coding method was later used as the second coding cycle to

present patterns which emerged from cross-case analysis into final themes (Flick 2006a; Patton 1990). The common codes were assembled together to describe the major common themes which emerged (Saldaña 2009c:153). Tables were constructed to assist grouping of comments made by participants based on the codes. The frequency of these codes can be seen in Appendix 12 which was then used to further develop the themes.

The excerpt quotes from the participants were used to provide statements which support those themes. Themes were then explained as they are in the participants' context. The translations and codes were also read and checked by the supervising team in an attempt to reduce subjective bias on the part of the researcher. Participants were not asked to review any section of the transcribed material. This decision was made in order to prevent any changes being made to original comments (Gumperz & Berenz 1993 cited in Lapadat & Lindsay 1999).

3.5.4 Rigour and trustworthiness of qualitative component

The value of a qualitative study is related to the rigour of research processes undertaken and the data obtained. While rigour refers to validity in quantitative research, theoretically it is also associated with soundness of data and the methodological and analytical decisions used (Liamputtong & Ezzy 2005). This is because the qualitative component holds an interpretative paradigm and assumes that the knowledge of phenomena is contextually tied. Therefore, qualitative research quality can be difficult to evaluate for validity and reliability, but can be maximised through accurate understanding and interpretation of the subject and the worldview of the people interviewed.

Theoretical rigour of this section of the study can be accounted for by an employment of appropriate methods to seek the answer to the research questions (Liamputtong & Ezzy 2005). The

researcher established rigour of method by spending time within KK collecting data from various sources and various perspectives. The researcher was aware that his role could dominate the interview and influence the participants. The data collection was enhanced by creating a trusting relationship and an environment of confidence, and demonstrating empathy. After introducing himself to the target participants, the researcher also expressed a sincere commitment to learn from the participants and the participants were encouraged to convey their perceptions regarding the study matter. This was a time and effort consuming process.

Furthermore, methodological rigour was conducted in every aspect of the research process by the researcher (Liamputtong & Ezzy 2005). Efforts were made to learn about and listen to the participants to probe for additional data. Valuable data was achieved by the use of probes to delve deeper on some specific issues emerging from the conversation. The interviews were carefully transcribed and the transcripts were also repeatedly analysed. Throughout the analysis, the participants' comments were patternised and demonstrated as sets of quotations to further illustrate their meaning.

Presentations of the findings were made at various conferences in Thailand, Malaysia and Australia, for example at the International Convention of Asia Scholars (ICAS) and the Post-graduate Research Conference, UNE, as they were being developed. These meetings provided discussions with peer colleagues about the relevance of the findings. The coding and theme concepts were facilitated by feedback obtained from the supervision team in the form of comments on the representativeness of the analysis. This triangulation amongst the research team increased the trustworthiness of the data. When an issue of inter-rater trustworthiness of the interpretation was demonstrated, the research team discussed these differences in interpretation. Similar themes were identified across future cases and then reinterpreted at future research team meetings.

Additionally, further triangulation occurred with discussion, with feedback received from colleagues, friends and other interested people as well as the feedback received from conferences. This was helpful for refining and incorporating information into the method of analysis and increasing the trustworthiness of the study.

Interpretative rigour and trustworthiness may be enhanced by allowing other researchers to check the adequacy of methods used (Liamputtong & Ezzy 2005). The thematic analysis can be used to offer new insights and understanding. The themes which emerged were reviewed to ensure their originality throughout the study processes. Memos were written and rewritten to make sure that findings and themes were significant enough to explore further.

The reliability of the researcher's assumptions and interpretations were continuously assessed as well as the ability to extract and uncover assumptions in the data. This also influenced the process of interpretation and reflections.

3.5.5 Limitations

A reflective approach can improve interpretative rigour and fine tune the concepts presented in this study. The individuals who were interviewed for this study worked in a specific health area where EM services have been implemented for some time and thus have been exposed to many injury prevention and control projects. A comparison with other locations with a less well-established EMS would increase the comprehensiveness of the present study. Moreover, the study was also limited to perceptions from the health professional side. EMS consumers and other EMS professions that interacted in the EMS were not considered. A comparison with health consumers would be useful to expand the knowledge of EMS utilization from a user perspective. Further

research exploring differences between locations and external consumers could provide extra insight into the dynamic underpinning interactions of RTI and EMS issues.

3.6 Inference and inference quality

To describe mixed-methods result, inference and inference quality comes into play. While inference refers to validity in quantitative research and refers to authenticity in qualitative study (Teddlie & Tashakkori 2009a:295-300), inference used in mixed methods research has two aspects used in quality assessment, which are a design quality or rigour in application of research and an interpretive rigour in interpretation (Teddlie & Tashakkori 2003:37).

This study was carefully designed to make sure that data triangulation would be achieved. Multiple sources were used to improve the credibility of the study. The sources of quantitative and qualitative data are interrelated. Data triangulation was achieved through individual interviews and the quantitative data. The information from the quantitative component was used to present a characteristic of the RTI and EMS situation in KK Province, whereas the qualitative data present the perceptions of the EMS personnel on the situation they have faced.

3.7 Reflection on the researcher experience

Reflection rigour also has to be considered in qualitative studies. The researcher was himself an instrument of the research and was immersed in the setting, context, and culture he was trying to understand (Liamputtong & Ezzy 2005). I spent six months in KK Province observing and taking part in many events as part of the team to understand people's worldviews. Reflections on self and the discourses impacting upon the researcher's and the participants' views are now discussed.

3.7.1 The researcher's roles

This section aims to reflect on the role of the researcher in this study. Any interpretation by an individual can be impacted by the researcher's experience and background (Crotty 1996). The analysis of the information can be helped by pre-understanding and the experience of the researcher regarding the subject matter and can enhance the rigour and trustworthiness of the study (Patton 1990). This requires an honest exploration of the researcher's subjectivity and critical analysis of how his subjectivity may influence the process of research inquiry. The researcher therefore has to be aware that he must attempt to limit any bias that may come from his interpretations.

3.7.2 Professional and research distance

This study emerged from the researcher's concern and professional interest in improving EMS service for RTI and a wish to focus on patient outcomes. The researcher had wide experience over a number of years as a general practitioner in rural environments. His role was a medical practitioner and a public health related project co-investigator in the setting equivalent to a primary care unit, a general hospital and a tertiary care medical school hospital.

There were many occasions when the researcher had an experience of transferring traumatic patients to the higher health facilities in places where there was no formal pre-hospital EMS available. On occasions, the researcher recalls going on an unequipped volunteer modified pick-up truck with a covered back to send severely injured young motorcyclists to the nearest referral hospital. The experience of transferring these road trauma patients was where the researcher's interest in the topic of assisting road traffic casualties in out-of-hospital settings originated.

The experience had also inspired the researcher to seek to improve the existing EMS system which involves far more than just medical training and undertaking a Doctor of Health Services Management (DHSM) qualification. The researcher also decided that quantitative measures may not explain many social complexities of the EMS system. A critique of social science research methods influenced my understanding of health services and inspired me to use qualitative research methods to identify factors associated with health service provision. A qualitative approach can help in explaining why people make decisions to access health services. If these social influences cannot be understood, public health problems may not be adequately solved.

The researcher reflected on the difficulties which could be encountered by entering the research area. This indicated that careful consideration was necessary. It was realized that a number of issues may influence the type of approach taken to gain accurate information. This includes availability of and methods used to access data, and physical environment and social context differences within the study population.

The researcher's role in this study was to use all currently available data and gather information about social conditions in EMS management of the area studied. Both quantitative and qualitative components were used to investigate the current EMS and RTI situation in Khon Kaen Province. The availability of the data was an important factor and the decision to use secondary data arose after the researcher realized that the creation of a new survey would be impossible where time was a constraint and resources were not available. A survey could be more of an imposition to the participants and it may have been impossible to obtain enough cases and rich subtle information within limited time frames. Although the use of secondary data is subject to limitations, it can be used to describe present problems and to develop hypotheses for further research (Stewart 1984:13).

Further investigation and confirmation of the findings is an important role of the qualitative research of this study. Gaining access to participants was supported by management, but obtaining the right information was considered to be more problematic for the researcher. The researcher was very aware that his professional role and socio-cultural condition could affect reactions and answers from the participants. This is also the case in many countries as the medical doctor is placed at the highest prestige end of social stratification of the workforce (Grbich 2004; Pasa 2000). In Thailand the worldview is valued with a high power-distance, strong uncertainty avoidance, collectivist and feminine culture (Hofstede 1997; Verluyten 1997). These dominant cultural dimensions together with some social conditions explain the main characteristics of the Thais, such as high self-centeredness, concern for social harmony, and present-world orientation which can be quite different from western countries. These factors could mask the real perceptions of the participants if they felt that the researcher, as a medical doctor, had more power over them. The researcher then spent more time engaging with EMS crew in the field and placed himself in a position to act as an advocate to facilitate changes.

3.8 Ethical considerations

The study was granted ethical approval from the University of New England (HREC approval number HE07/106) and permission from the Thai Health Authority (Khon Kaen Regional Hospital approval number 8928/2007) (see Appendix 13). As the quantitative component required no recruitment of participants and entailed collection of data from de-identified, already documented and published datasets, there was no risk of any harm to participants. The KKRH provided de-identified data in all measures to ensure confidentiality of data were undertaken. All of the electronic and printed data files for both the quantitative and qualitative components were stored in

a locked filing cabinet which limited access to the researcher only. This data will be securely stored for the next seven years.

Participants in the qualitative component received both verbal and written information regarding the study before being asked for their consent (see Appendix 8 and 9). An informed consent was required in written format in both Thai and English versions for initial data collection and for any follow-up sessions. There were no cases which were interviewed over the telephone or via other internet-based communication activities. The participants were asked for voluntary participation. They were able to stop the digital recorder during the interview process and also had the right to withdraw, stop, delete or change the recording at any time without experiencing negative consequences.

A number of ethical considerations became evident throughout the course of study. In the KK EMS area identification of EMS personnel may be possible. Discussion of RTI and EMS management issues, which can impinge on the vested interests of management, could have raised a number of concerns for the respondents in lower social stratifications (Dickinson-swift, James & Liamputtong 2008). The participants were advised that they could contact their local health facilities or counselling services if they became distressed. There were no complaints made that the researcher is aware of.

3.9 Summary

This chapter has presented an outline of the rationale and techniques of the research methods used. In conducting research associated with EMS management of RTI problems, one of the strengths of the study was the use of the mixed methods approach. This approach ensured a more detailed cross-examination of the topic from different perspectives. Hence, the present study relies on both

methods to provide assorted descriptions for EMS management of RTIs. The following chapters present the findings that resulted from the study.

Chapter 4 Investigating road traffic injuries in Khon Kaen Province

4.1 Introduction

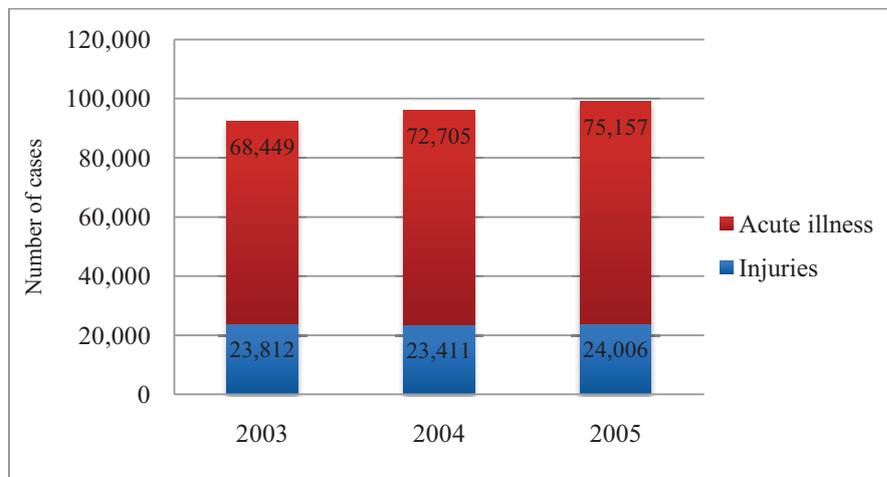
This chapter analyses Trauma Registry reports to describe RTI in the KKRH and its catchment. KKRH is a designated referral and level II Trauma Centre in its catchment area and sources a large number of patients. It principally covers a population of approximately 370,000 within the KK City area. Patients are also referred from other KK districts and neighbouring Provinces. Of the patients attending KKRH emergency department, approximately 1.5% of patients treated are brought in by the EMS and, of those, approximately 49% were road traffic injuries (Chadbunchachai, Tipsuntornsak & Choteklom 2005a:7).

This chapter comprises three sections. The first section demonstrates a pattern of the use of Khon Kaen Regional Hospital (KKRH) Emergency Room (ER). The second section presents an overview of the injury situation in the Khon Kaen Regional Hospital catchment area using the KKRH Trauma Registry. The third section focuses on road traffic injuries. The data used derives from Trauma Registry Reports of the Khon Kaen Regional Hospital for the period 1998-2005.

4.2 The use of KKRH Emergency Department

Profiles of injury patients attending KKRH ER, especially road traffic injury, are described using KKRH Trauma Registry reports. A total of 287,540 patients attending hospital Emergency Rooms (ER) were recorded in the KKRH ER database and Trauma Registries from 2003-2005 (see Figure 4.1) and there has been an increase over the years from 92,261 in 2003 to 99,163 in 2005. Of the total KKRH ER cases, injury patients accounted for 24.77% (n=71,229). The majority of patients were in the acute illness categories such as those associated with medical diseases and accounted for 75.23% (n=216,211) over the three year period.

Figure 4.1: Total number of fatal and non-fatal KKRH ER cases for the period 2003-2005



Source: Adapted from KKTR and KKRHER database

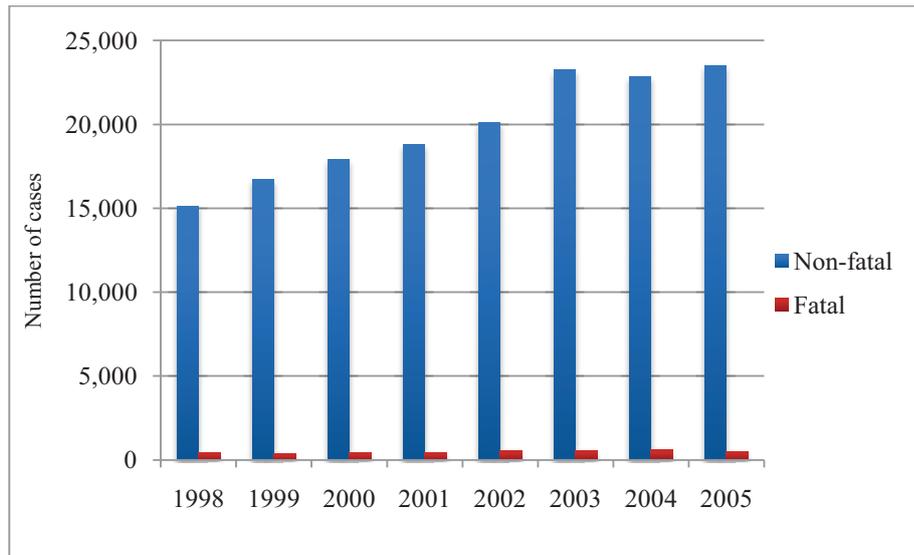
4.3 KKRH Trauma Registry 1998-2005

The data recorded in KKRH Trauma Registry or Thai National Injury Surveillance Program is defined as “any person immediately injured or killed or dying within 7 days as a result of injury”. All of the defined cases are kept in the sentinel sites’ database (29 general- and regional-size hospitals registered in the surveillance system) such as KKRH. Additionally, the severe cases classified as deaths before arrival, deaths in the emergency department, and observed or admitted cases are also reported to the MoPH Bureau of Epidemiology. This contributes to national injury data and surveillance. The following section demonstrates the characteristics and trends of injury patterns occurring in the KKRH catchment area using KKRH Trauma Registry Reports data from 1998 to 2005.

A total of 162,078 fatal and non-fatal injuries were recorded in the KKRH Trauma Registry from 1998 to 2005. As shown in Figure 4.2 the number of injuries increased from 15,581 cases in 1998 to 24,006 cases in 2005. Although the total numbers of fatal and non-fatal injuries appear to increase over the years 1998 to 2005, the ratio of fatal to non-fatal injuries appears to remain

constant at about a 2% rate (see Table 4.1). In 1998 there were 445 fatal cases and this increased to 585 in 2004 with a decline to 506 in 2005. The non-fatal percentage has remained at 97% rate over the eight year period.

Figure 4.2: Total number of fatal & non-fatal injuries per year registered in the KKRH Trauma Registry for the period (1998-2005) (n=162,078)



Source: Adapted from KKTR and KKRHER database

Table 4.1: Proportion of fatal and non-fatal injuries per year reported in the KKRH Trauma Registry for the period 1998-2005 (n=162,078)

Year	Fatal		Non-fatal		Total
	n	%	n	%	
1998	445	2.86	15,140	97.14	15,585
1999	383	2.24	16,702	97.76	17,085
2000	434	2.37	17,903	97.63	18,337
2001	440	2.29	18,773	97.71	19,213
2002	538	2.61	20,091	97.39	20,629
2003	544	2.28	23,268	97.72	23,812
2004	585	2.50	22,826	97.50	23,411
2005	506	2.11	23,500	97.89	24,006
Total	3,875	2.39	158,203	97.61	162,078

Source: Trauma Registry Reports (1998-2005)

The main causes of injury are shown in Table 4.2. Of the total injuries RTI remains the most common cause of fatal and non-fatal injury. There were a total of 71,805 cases of *traffic related injury*, 44.31% of all cases. The number of RTI increased from 7,701 cases in 1998 to 10,302 in 2003 and dropped down to 9,818 cases in 2005. This averaged out at 8,976 cases per year over the eight year period.

The second most common cause of injury was described as *inanimate mechanical forces* (n=27,908), which includes being struck, hit or jammed by objects. This category accounted for 17.22% of the injuries, an average of 3,489 cases per year, and increased from 2,514 cases in 1998 to 4,238 cases in 2005. *Falls* (n=21,268), *exposure to animate mechanical forces* (n=17,180) and *assaults* (n=15,302) were the next common types of injuries. All these categories show an increase in annual total over the eight years.

Table 4.2: Number of fatal and non-fatal injuries per year by injury types in the KKRH Trauma Registry (1998-2005)

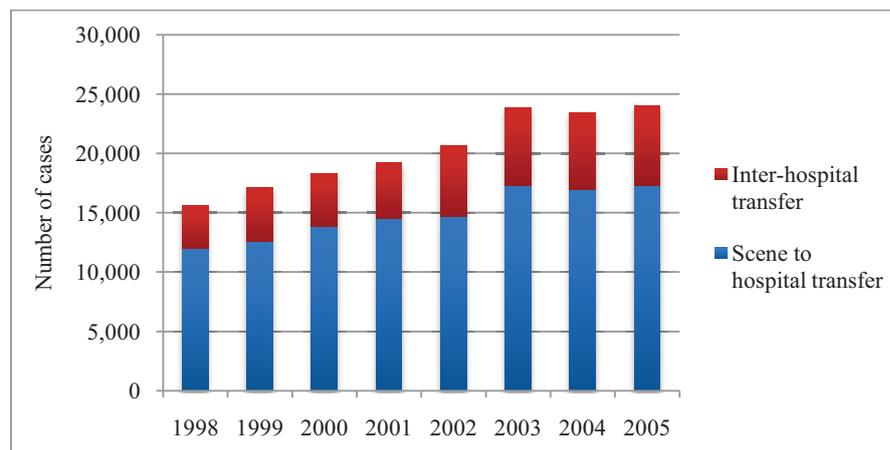
Injury Type	Year								Total	
	1998	1999	2000	2001	2002	2003	2004	2005	n	%
Traffic injury*	7,701	7,886	8,210	8,600	9,538	10,302	9,750	9,818	71,805	44.31
Exposure to inanimate mechanical forces	2,514	2,982	3,337	3,247	3,550	4,068	3,972	4,238	27,908	17.22
Falls	1,953	2,225	2,285	2,609	2,614	2,988	3,245	3,349	21,268	13.12
Exposure to animate mechanical forces	1,521	1,771	1,993	2,067	1,987	2,457	2,636	2,748	17,180	10.60
Assault	1,163	1,386	1,552	1,628	1,797	2,812	2,500	2,464	15,302	9.44
Intentional self-harm	246	288	350	276	312	388	403	377	2,640	1.63
Contact with venomous animals and plants	121	170	232	268	359	352	375	458	2,335	1.44
Others	366	377	378	518	472	445	530	554	3,650	2.25
Total	15,585	17,085	18,337	19,213	20,629	23,812	23,411	24,006	162,078	100.00

Source: Trauma Registry Reports (1998-2005)

The data for KKRH Trauma Registry is sourced from two main patient transferral types. One is patients transported to ER from the scene (n=119,125, 73.50%) and, the other, is the inter-hospital transfer cases (26.50%, n=42,953) (see Figure 4.3). Both types of patient transfer have increased over time. Of the patients transferred directly to KKRH in 2004 and 2005 (n=34,252), approximately 75.28% were transferred by bystanders and 8.50% were transferred by EMS teams.

Of the inter-hospital transfer patients, the majority (n=31,494, 73.49%) were those transferred from district hospitals within KK Province. A small number of transfers came from the neighbouring Provinces where specialist treatment was not available. The inter-hospital transfer process is arranged between hospitals and may utilise EMS ambulance vehicles but is not registered in the EMS database as a callout. A quarter of these cases were transported from Chum Phae (n=2,882, 9.15%), Nam Phong (n=2,736, 8.69%), Ban Phai (n=2,606, 8.27%) and Nong Ruea (n=2,275, 7.22%) district hospitals. These districts all have the main highway passing through them.

Figure 4.3: Fatal and non-fatal injuries registered in the KKRH Trauma Registry for the period 1998-2005 by type of transfer and year (n=162,078)



Source: Trauma Registry Reports (1998-2005)

4.4 Road traffic injuries in KKRH 1998-2005

Of the total injury RTI remains the most common cause of fatal (74.89%) and non-fatal injury (43.55%). Of the total 71,805 RTI cases, there were 2,902 (4.04%) fatal and 68,903 (95.96%) non-fatal RTI cases over the period of 1998 - 2005.

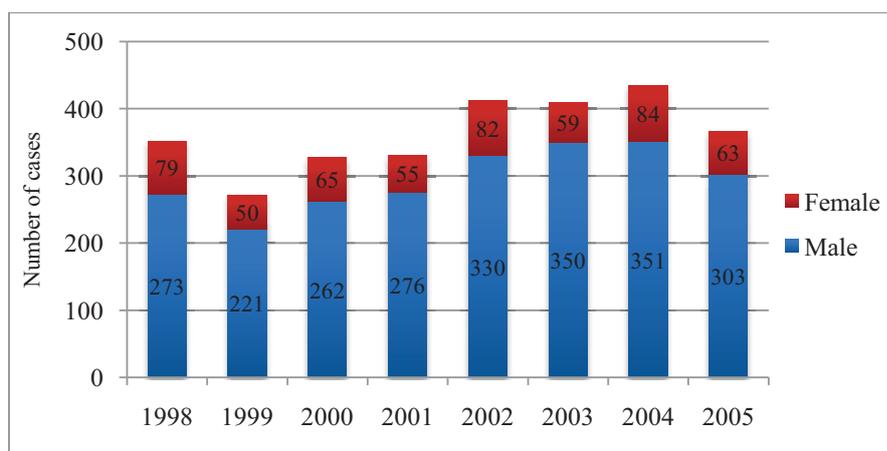
4.4.1 Fatal road traffic injuries

There was a total of 2,902 fatal RTI reported in the KKRH Trauma Registry for the period 1998-2005. The total number of deaths fell slightly in 1999 and then rose steadily until 2003 and dropped slightly again in 2005. The characteristics are investigated in terms of age, sex, agent, type of injured person, occupation of injured person, bodily region involved, and location.

Age and sex

Of the total 2,902 fatal RTIs recorded in the KKRH Trauma Registry, 2,366 (81.53%) cases were male and 536 (18.47%) were female (see Figure 4.4). The proportion of males and females remained constant at approximately 4:1 over the eight-year period.

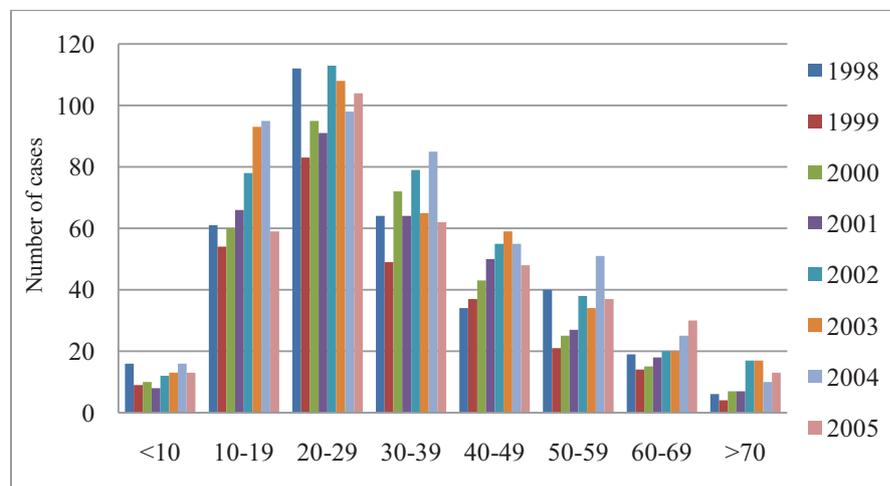
Figure 4.4: Total number of fatal RTIs per year registered in the KKRH Trauma Registry for the period (1998-2005) by year and sex (n=2,902)



Source: Trauma Registry Reports (1998-2005)

Among the fatal RTI cases, the number in each age group tends to increase over time. Figure 4.5 and 4.6 shows that trend in 10 year age groups, the 10-19, 20-29 and 30-39 age groups, have the highest number of fatalities. They accounted for 19.50%, 27.71% and 18.61% of the fatalities respectively and totaled 65.82% of all fatal cases over eight years. Most of age groups show a general increasing trend until 2004; however, some age groups show a small decline in cases for 2005.

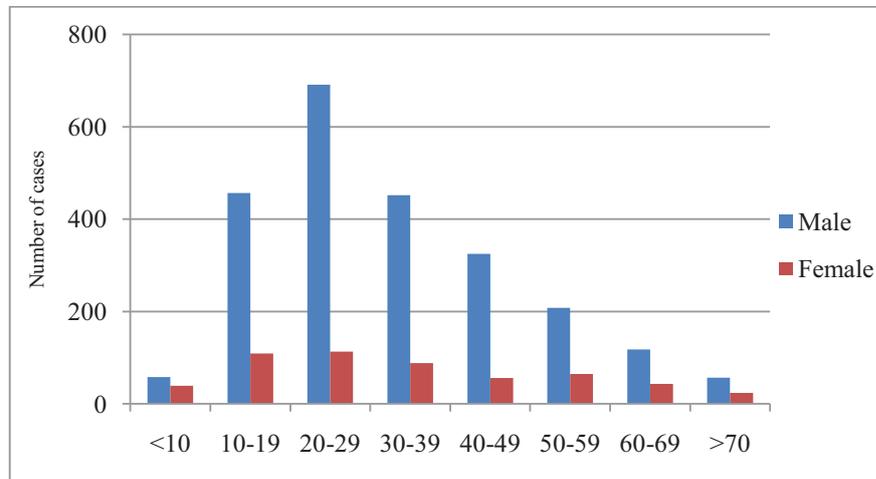
Figure 4.5: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period (1998-2005) by age and year (n=2,902)



Source: Trauma Registry Reports (1998-2005)

The number of male fatalities dominated female fatalities in each age group. The proportion of males to females was approximately 4:1, 6:1, 5:1, and 6:1 in the 10-19, 20-29, 30-39, and 40-49 year age groups respectively (see Figure 4.6).

Figure 4.6: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period (1998-2005) by age and sex (n=2,902)



Source: Trauma Registry Reports (1998-2005)

Agent

As can be seen in the Table 4.3, motorcycles are by far the most frequently involved vehicles in fatal injuries. They accounted for 2,253 fatalities or 77.64% of all deaths on the road. The number of *motorcycle* related deaths tends to increase over time from a minimum of 211 in 1999 to a maximum of 332 in 2003 (see Table 4.3). *Pedestrian* and *van/truck* related injuries were ranked at the second and third most common agent-related RTI death accounting for 6.86% (n=199) and 7.20% (n=209) of fatalities respectively. These numbers tended to fluctuate annually over time. Most of the agents show a general increasing trend from 1999 until 2004; however, some agents show a small decline in cases for 2005.

Table 4.3: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by year and agent (n=2,902)

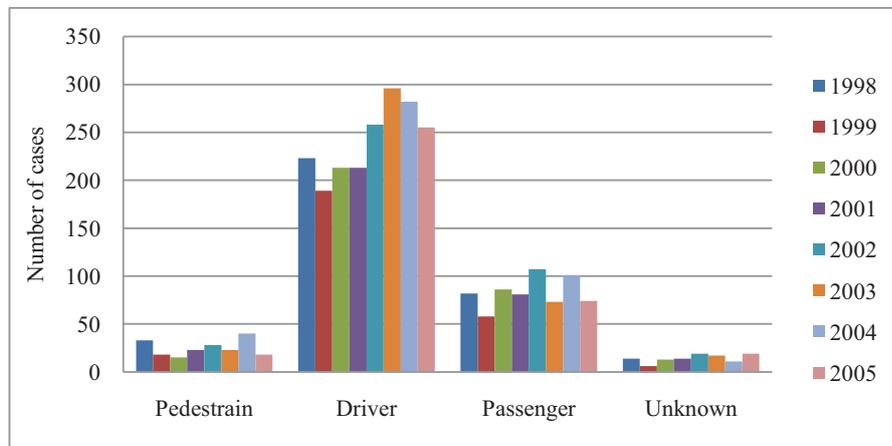
Year	Pedestrian	Bicycle	Motor-cycle	Tricycle	Sedan	Van, truck	Other	Total
1998	33	5	257	2	6	30	19	352
1999	18	7	211	1	10	12	12	271
2000	15	6	244	5	9	37	11	327
2001	23	1	261	3	3	25	15	331
2002	28	3	323	2	5	31	20	412
2003	24	8	332	6	3	18	18	409
2004	40	7	329	6	6	28	18	434
2005	18	9	296	0	1	28	14	366
Total	199	46	2,253	25	43	209	127	2,902

Source: Trauma Registry Reports (1998-2005)

Type of injured person (road user)

The *drivers* and their *passengers* are the most commonly involved in fatal road traffic injuries. They accounted for 1,929 (67.47%) and 662 (22.81%) cases of RTIs respectively. The number of *driver* fatalities tends to increase over time (see Figure 4.7), ranging from 189 cases in 1999 to 296 in 2003. The number of *driver* fatalities showed a slight declining trend after 2003 by 41 cases in two years. *Pedestrian* fatalities accounted for only 6.86% (n=199) of all fatal cases over the eight-year period.

Figure 4.7: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by type of injured person and year (n=2,902)

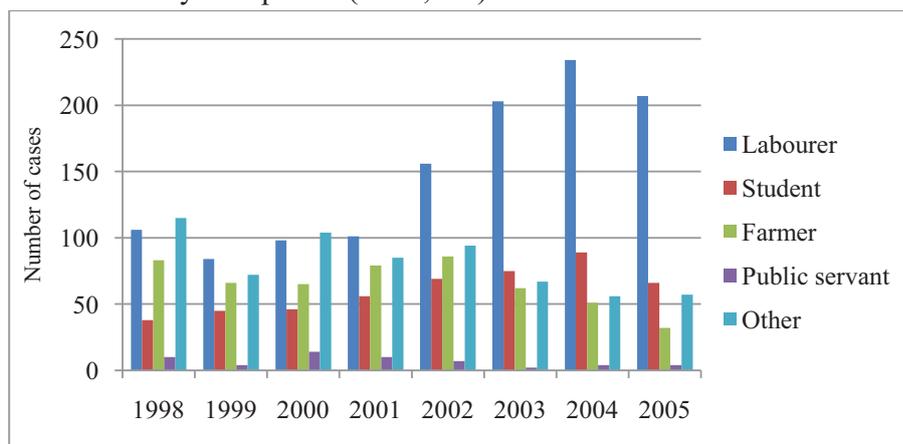


Source: Trauma Registry Reports (1998-2005)

Occupation of injured person

Of the occupational groups, *labourers*, *farmers*, and *students* were more likely to be injured on the road. They accounted for 1,189 (40.97%), 524 (18.26%) and 484 (16.68%) fatal cases respectively. *Labourers'* and *farmers'* numbers tend to increase over the eight-year period from 84 *labourers* and 45 *students* in 1999 to 207 *labourers* and 66 *students* in 2005, while the *farmers'* numbers tend to decrease from 66 *farmers* in 1999 to 32 *farmers* in 2005 (see Figure 4.14).

Figure 4.8: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by occupation (n=68,903)

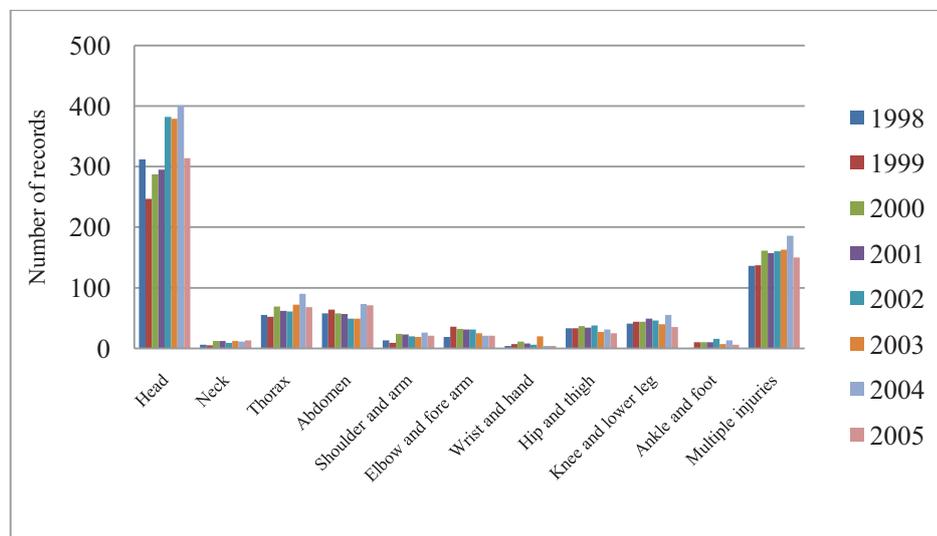


Source: Trauma Registry Reports (1998-2005)

Bodily region

Figure 4.9 shows that the most significant bodily region associated with fatalities was the *head* which accounted for 90.18% (n=2,617) of all RTI fatalities. *Multiple injuries* accounted for 43.07% (n=1,250) fatalities and were the second most significant bodily region associated with RTI fatality. Other body regions such as the *thorax*, *abdomen*, and *knee and lower leg*, were involved in 18.23% (n=529), 16.51% (n=479), and 12.20% (n=354) of RTI related fatalities respectively.

Figure 4.9: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by bodily region involved and year (n=2,902 cases*)



Source: Trauma Registry Reports (1998-2005)

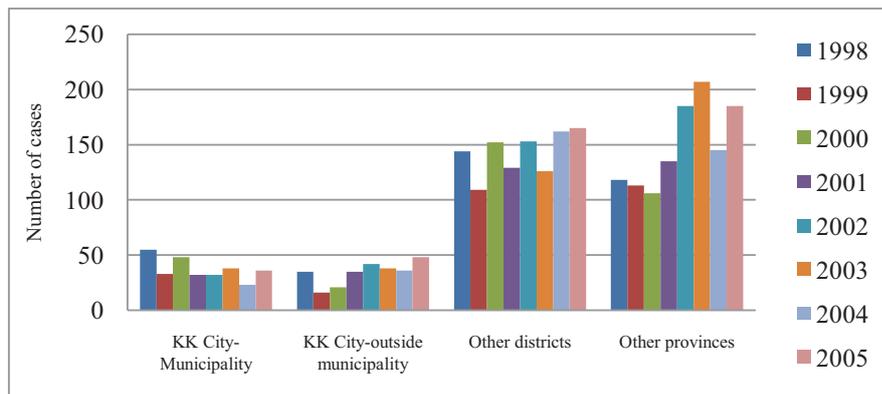
Note:*There were more records (6,076) than cases due to classification of more than one injury per case

Location

According to the location classification in the Trauma Registry, most fatal injuries occurred in *other districts* and *other Provinces*. There were 996 (34.21%) fatalities occurring in *other districts* and 1,076 (37.08%) in *other Provinces* over the period. The time and processes taken to transfer more serious RTI victims from other Provinces and districts may explain the higher number of fatalities in remote areas (see Figure 4.10). Other factors may also be involved as discussed in

Section 4.5. The fatal injury profile is considerably different to the non-fatal profile where most cases were those transferred from within the KK City area.

Figure 4.10: Total number of fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by jurisdictional location and year (n=2,902)



Source: Trauma Registry Reports (1998-2005)

Fatal injury summary

The patterns of these fatal crashes are significant and useful for preparing medical services response to future RTI related injury cases. Young males, labourers, motorcyclists, patients with head injury and transfer cases from surrounding hospitals have higher risks of fatality due to their injury. Further details about fatalities are discussed below.

4.4.2 Non-fatal road traffic injuries

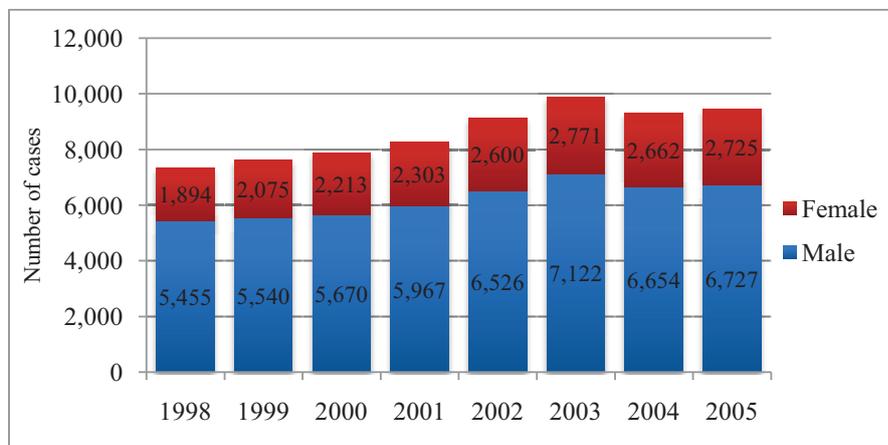
Non-fatal injuries need to be investigated to provide a more complete picture of RTI in Khon Kaen. The impact of RTI can be analysed by policy makers and community leaders to appropriately provide resources or implement effective preventive campaigns. There were a total of 68,903 non-fatal RTI reported in the KKRH Trauma Registry for the period 1998-2005. It follows a similar pattern to the fatal RTI profile. The total number of non-fatal injuries has been steady rising from 1998 to 2005 as shown in Figure 4.11. The characteristics are defined in terms of age and sex,

agent, type of injured person, occupation of injured person, body region involved, and location at which RTI occurred by jurisdiction.

Age and sex

Of the 68,903 non-fatal RT injuries, 72.07% were male and 27.93 % were female. The ratio of males to females remained constant at approximately 4:1 over the period (see Figure 4.11).

Figure 4.11: Total number of non-fatal RTIs per year registered in the KKRH Trauma Registry for the period (1998-2005) by year and sex (n=68,903)



Source: Trauma Registry Reports (1998-2005)

More than 57% (n=39,763) of non-fatal road traffic related injuries occurred in the 10-29 year age group (see Table 4.4). The over 50 age groups accounted for only 8.99% (n=6,194). There has been a general increase in number of injuries for each age group over the eight-year period, in particular for the 10-19 and 20-29 year old groups which had increased by 48.93 % from 1,870 in 1998 to 2,785 in 2003 (see Figure 4.12).

Table 4.4: Non-fatal RTI cases reported in the KKRH Trauma Registry for the period 1998-2005 by year and age (n=68,903).

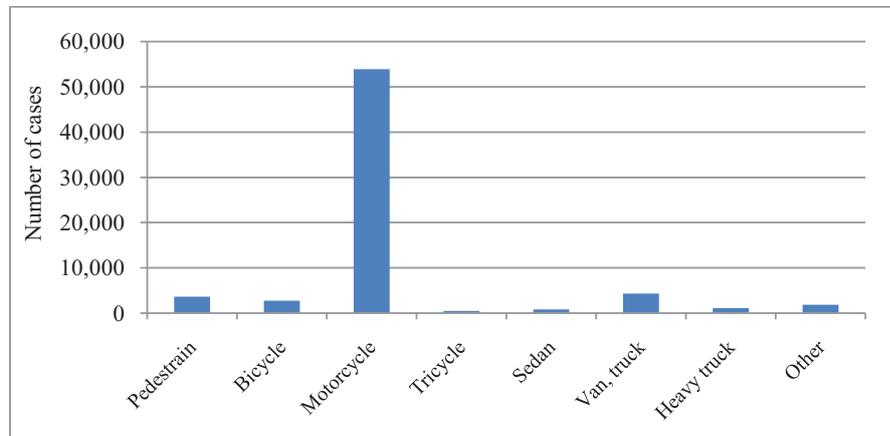
Age group	1998	1999	2000	2001	2002	2003	2004	2005	Total	%
<10	513	569	574	610	620	637	606	600	4,729	6.86
10 - 19	1,870	2,032	2,005	2,231	2,428	2,785	2,699	2,648	18,698	27.14
20 - 29	2,373	2,455	2,454	2,495	2,812	3,009	2,682	2,785	21,065	30.57
30 - 39	1,232	1,293	1,368	1,358	1,524	1,593	1,459	1,488	11,315	16.42
40 - 49	705	681	789	828	948	1,010	950	991	6,903	10.02
50 - 59	403	364	452	484	500	525	598	590	3,916	5.68
60 - 69	181	159	183	203	212	233	227	240	1,638	2.38
>70	72	62	58	60	82	101	95	110	640	0.93
Total	7,349	7,615	7,883	8,269	9,126	9,893	9,316	9,452	68,903	100.00

Source: Trauma Registry Reports (1998-2005)

Agent

Motorcycles were the most common agent associated with non-fatal RTI. They accounted for 53,890 non-fatal RT injuries or 78.21% of non-fatal road traffic related injuries (see Figure 4.15). *Van, truck* accounted for 6.25% (n=4,303) of non-fatal RTI. Interestingly, contrary to popular belief, *bicycle, tricycle and pedestrian* accounted for only a small percentage of RTI related non-fatalities (10.08%, n=6,942).

Figure 4.12: Total number of non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by agent (n=68,903)

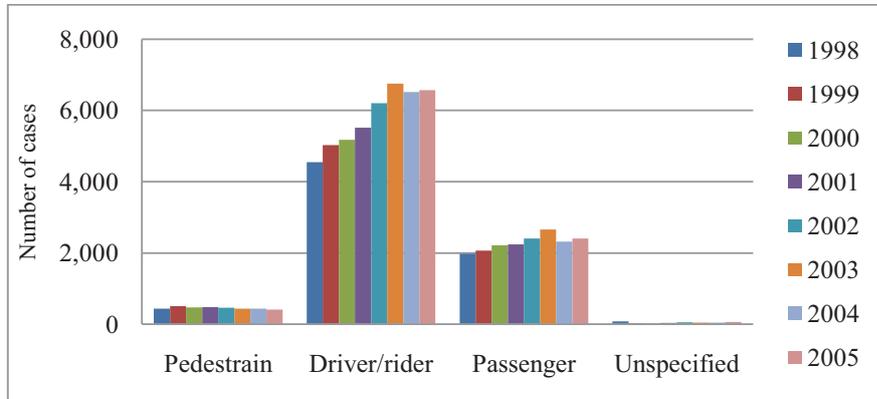


Source: Trauma Registry Reports (1998-2005)

Type of injured person (road user)

Drivers and *passengers* were again most commonly associated with non-fatal injury. They accounted for 46,623 (67.66%) and 18,280 (26.53%) of non-fatal RT injuries respectively. The number of *drivers* and *passengers* shows a tendency to increase over time from 1998 to 2003 (see Figure 4.13). There has been a general increase in the number of injuries for these drivers and passengers over the eight-year period. In 2005, they had increased by 44.44% and 21.88% respectively from 1998. Non-fatal pedestrian injuries were significantly lower accounting for less than 5.32% (n=3,663) of non-fatal injuries.

Figure 4.13: Total number of non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by type of road user and year (n=68,903)

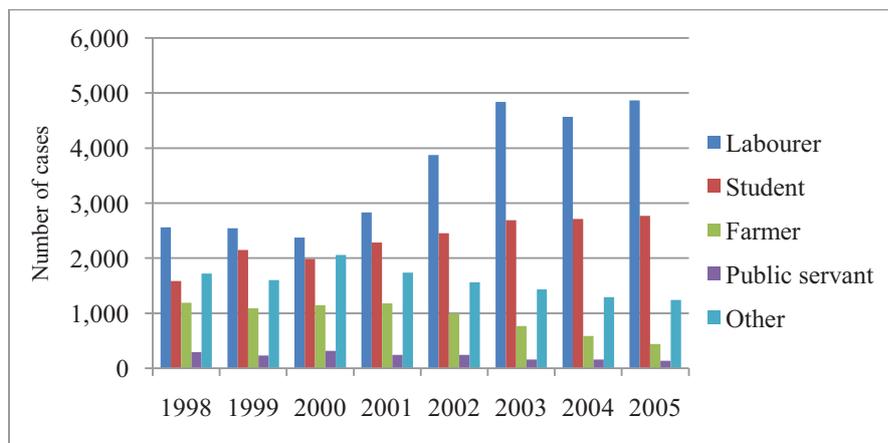


Source: Trauma Registry Reports (1998-2005)

Occupation of injured person

Of the occupational groups, *labourers* and *students* were more likely to be injured on the road. They accounted for 28,450 (41.29%) and 18,629 (27.04%) non-fatal cases respectively. Their numbers tend to increase over the eight-year period from 2,559 *labourers* and 1,583 *students* in 1998 to 4,864 *labourers* and 2,771 *students* in 2005 (see Figure 4.14). These show an approximate 70-75% increase from 1998.

Figure 4.14: Total number of non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by occupation (n=68,903)

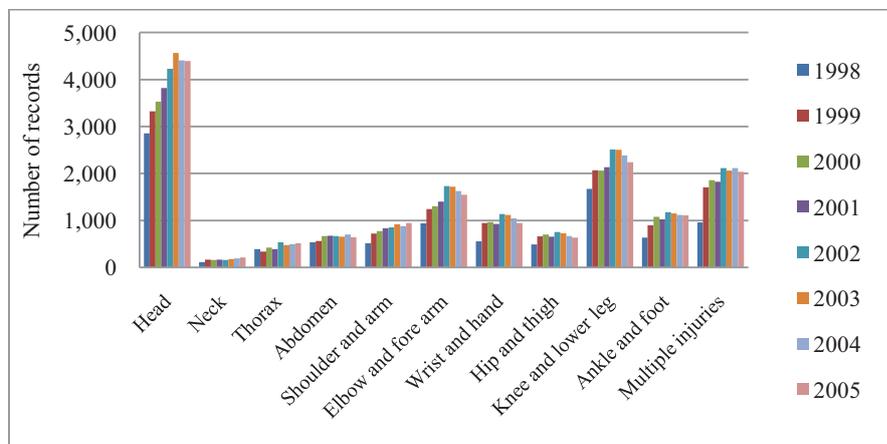


Source: Trauma Registry Reports (1998-2005)

Bodily region

Head, knee and lower leg, and multiple injuries were the most common body regions injured among the non-fatalities. They accounted for 45.18%, 25.50%, and 21.31% of non-fatal RT injuries respectively (see Figure 4.15). Most non-fatalities (82.24%, n=7,435) were extremities related injuries.

Figure 4.15: Total number of non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by bodily region involved and year (n=68,903 cases*)



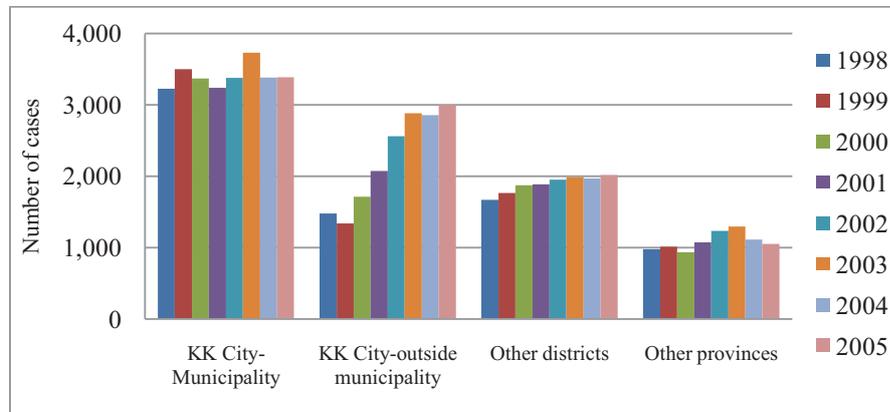
Source: Trauma Registry Reports (1998-2005)

Note:*There were more records (112,912) than cases due to classification of more than one injury per case

Location

According to the jurisdictional location of road traffic injury site, patients from within *KK City municipal* and *outside municipal area* accounted for 27,207 (39.49%) and 17,895 (25.97%) non-fatal cases respectively. The number of the non-fatal RT injuries which occurred outside *KK City municipal* area increased steadily over the eight-year period from 1,479 cases in 1998 to 2,997 cases in 2005 (Figure 4.16). The non-fatal injury profile is considerably different to the fatal profile where most cases were those transferred from surrounding hospitals outside the *KK City* area.

Figure 4.16: Total number of non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by location and year (n=68,903)



Source: Trauma Registry Reports (1998-2005)

Non-fatal RTI summary

The majority (96%) of RTI related injuries in the KKRH catchment area were non-fatal. More than two thirds of the cases were transported from the incident scene to KKRH from within Khon Kaen City areas. Otherwise the non-fatal RT injury profile is similar to the fatal injury group. Young males, motorcycles, labourers, and head injury are key characteristics of the non-fatal RT related injury risk. Further details about motorcycle related injury are covered in Sections 4.4.3 to 4.4.6.

4.4.3 Motorcycle injury

Motorcycle users (both two and three wheeler) have been described as the most vulnerable road users because these people are driving or riding on exposed vehicles. They face an increased risk in using and crossing the road where the road is built for travel at fast speed (WHO 2009a). For the period 1998-2005 there were a total of 56,143 (2,253 fatal and 53,890 non-fatal) motorcycle-related road traffic injuries. Table 4.5 shows that among fatal and non-fatal motorcycle injuries, younger people aged between the age of 10-29 (64.33%) and 30-39 (16.38%) were more likely to

be involved in a motorcycle injury. The number of each age group tends to increase over time (see Figure 4.17).

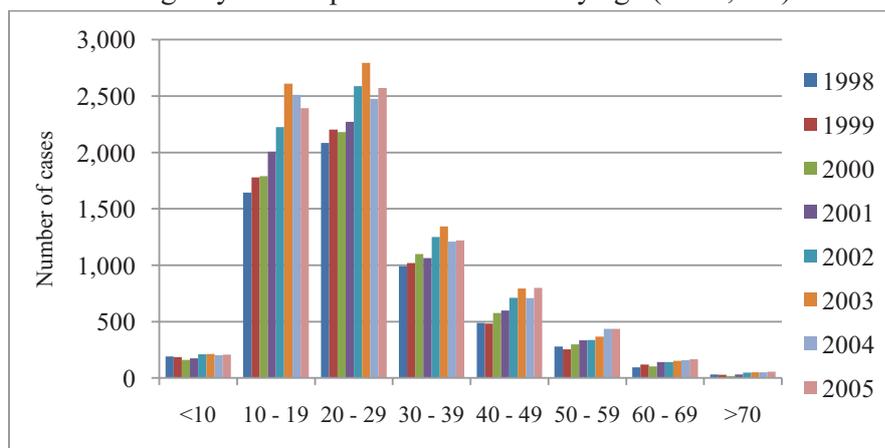
Table 4.5: Fatal and non-fatal motorcycle injuries registered in the KKRH Trauma Registry for the period 1998-2005 by age (n=56,143)

Age group	Fatal	Non-fatal	Total	%
<10	29	1,516	1,545	2.75
10 - 19	511	16,441	16,952	30.19
20 - 29	712	18,453	19,165	34.14
30 - 39	415	8,781	9,196	16.38
40 - 49	272	4,886	5,158	9.19
50 - 59	178	2,560	2,738	4.88
60 - 69	104	974	1,078	1.92
>70	32	279	311	0.55
Total	2,253	53,890	56,143	100.00

Source: Trauma Registry Reports (1998-2005)

Figure 4.17 demonstrates that the number of motorcycle-related injuries has increased over the eight year period in most age groups, but in particular for the 10-19 and 20-29 year old groups which increased by 45.65% and 23.32% from 1998 to 2005.

Figure 4.17: Total number of fatal and non-fatal motorcycle injuries registered in the KKRH Trauma Registry for the period 1998-2005 by age (n=56,143)



Source: Trauma Registry Reports (1998-2005)

Of the total number of motorcycle injuries, 43,664 (77.77 %) occurred to *riders* (see Table 4.6). The proportion of riders has shown an increase over the 8 years from 4,505(8.02%) in 1998 to 6,174 (11.00%) in 2005. The riders are more likely to have fatal injury when compare to the passengers (The odds ratio is 1.26 (95% confidence interval, 1.13 to 1.41)). There was no data on type of person injured for each age group available to identify characteristics for each age group.

Table 4.6: Fatal and non-fatal motorcycle injuries registered in the KKRH Trauma Registry for the period 1998-2005 by type of person injured (n=56,143)

Type of person	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Rider	1,775	78.78	41,889	77.73	43,664	77.77
Passenger	394	17.49	11,705	21.72	12,099	21.56
Unspecified	84	3.73	296	0.55	380	0.68
Total	2,253	100.00	53,890	100.00	56,143	100.00

Source: Trauma Registry Reports (1998-2005)

Table 4.7 shows that of the total number of motorcycle injuries, 27,962 (49.80 %) were collision related. There were 10,792 (19.22%) cases involved in *collision with motorcycles* and 9,910 (17.65%) cases involved in *collision with van, truck. Collision with sedan, animal, and building/object* added up to only 12.93% of total motorcycle injuries. Non-collision related injuries accounted for 21,628 (38.52%) of all motorcycle related injuries. Of the non-collision related group, 20,864 (37.16%) were *overturn injuries* and only 764 (1.36%) were *fall from vehicle*. The overturn of motorcycles was the most common single mechanism of all motorcycle related injuries followed by the *collision with motorcycle and van, truck*.

Table 4.7: Fatal and non-fatal motorcycle injuries registered in the KKRH Trauma Registry for the period 1998-2005 by mechanism of injury (n=56,143)

Mechanism of injury	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Collision with/by other vehicle						
<i>Motorcycle</i>	372	16.51	10,420	19.34	10,792	19.22
<i>Van, truck</i>	444	19.71	9,466	17.57	9,910	17.65
<i>Sedan</i>	71	3.15	3,095	5.74	3,166	5.64
<i>Animal</i>	41	1.82	1,924	3.57	1,965	3.50
<i>Building/object</i>	155	6.88	1,974	3.66	2,129	3.79
Total collision related	1,083	48.07	26,879	49.88	27,962	49.80
Non-collision related						
<i>Fall from motorcycle</i>	41	1.82	723	1.34	764	1.36
<i>Overturn of motorcycle</i>	605	26.85	20,259	37.59	20,864	37.16
Total non-collision	646	28.67	20,982	38.93	21,628	38.52
Other	524	23.26	6,029	11.19	6,553	11.67
Total all	2,253	100.00	53,890	100.00	56,143	100.00

Source: Trauma Registry Reports (1998-2005)

Motorcycle helmet use

Table 4.8 shows the number and proportion of fatal and non-fatal motorcycle injuries and related helmet use. Of the total 56,143 motorcycle injuries, 79.40% were not wearing a helmet when they were injured. At least 72.79% of motorcycle fatalities occurred where the injured person was not wearing a helmet, while 23.17% of fatalities had helmet use *unspecified*. The motorcycle injuries without helmet wearing have greater chance to of having serious injury. The odds ratio of fatality while using motorcycle with no helmet compared with using with helmet is 3.79 (95% confidence

interval, 3.07 to 4.69). A high proportion (79.68%) of non-fatal motorcycle injuries also occurred to those who were not using a helmet.

Table 4.8: Fatal & non-fatal motorcycle related RTI registered in the KKRH Trauma Registry for the period 1998-2005 by helmet use (n=56,143)

Helmet use	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Helmet used	91	4.04	9,036	16.77	9,127	16.26
No helmet	1,640	72.79	42,937	79.68	44,577	79.40
Unspecified	522	23.17	1,917	3.56	2,439	4.34
Total	2,253	100.00	53,890	100.00	56,143	100.00

Source: Trauma Registry Reports (1998-2005)

Motorcycle and alcohol use

Table 4.9 shows the number and proportion of fatal and non-fatal alcohol related motorcycle injuries. Of the total motorcycle related injuries, 34.4% of fatalities and 37.4% of non-fatalities were *alcohol-related*. A high proportion of motorcycle related fatalities (33.47%) had an *unspecified* alcohol involvement (blood tests were not undertaken) making it difficult to accurately compare the proportion of fatal motorcycle injuries with alcohol involvement. When compared the odds of alcohol related fatal motorcycle injuries with those without alcohol involvement, the odds ratio of is 1.67 (95% confidence interval, 1.51 to 1.85). In this case, the motorcycle related injuries have 1.67-fold greater chance of having life threatening trauma if they are alcohol related.

Table 4.9: Fatal & non-fatal motorcycle related RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by alcohol involvement (n=56,143)

Alcohol involvement	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Non-alcohol related	724	32.13	31,448	58.36	32,172	57.30
Alcohol-related	775	34.40	20,176	37.44	20,951	37.32
Unspecified	754	33.47	2,266	4.20	3,020	5.38
Total	2,253	100.00	53,890	100.00	56,143	100.00

Source: Trauma Registry Reports (1998-2005)

Motorcycle related injury summary

Motorcycle related injury is the major RTI problem as it -- involved more than three quarters of total RTI cases and is overrepresented in both the KK Trauma Registry statistical fatal and non-fatal data. Young road users aged 10-29 years therefore were more likely to be involved in motorcycle related injuries and 50% of injuries involved a collision with another party. Helmets were not worn in the majority of both fatal and non-fatal motorcycle injuries. Only one third of motorcycle related injuries had specified that alcohol was involved, but in 33.47% of fatal motorcycle related injury alcohol involvement was unknown.

4.4.4 Alcohol related RTI

Table 4.10 shows the number and proportion of all fatal and non-fatal of alcohol related RTI injuries measured by blood alcohol level at the time of injury. RT injury cases may also have been coded as alcohol-related following detection of an alcoholic smell by ER staff.

Of the total 71,805 fatal and non-fatal road traffic injuries, 32.31 % were coded as being *alcohol-related*. The odds ratio is 1.48 (95% confidence interval, 1.35 to 1.62) when compared the odds of alcohol related fatal road traffic injuries with of those without alcohol involvement. Therefore, the

RTIs have 1.48-fold greater chance of having life threatening conditions if they use alcohol. There was a greater proportion of fatalities where alcohol level was *unspecified* (31.94% compared to 3.95% of non-fatal RTIs) which makes it difficult to accurately compare the proportion of fatal injuries with alcohol involvement and the proportion over time.

Table 4.10: Fatal and non-fatal RTI registered in the KKRH Trauma Registry for the period 1998-2005 by blood alcohol level (n=71,805)

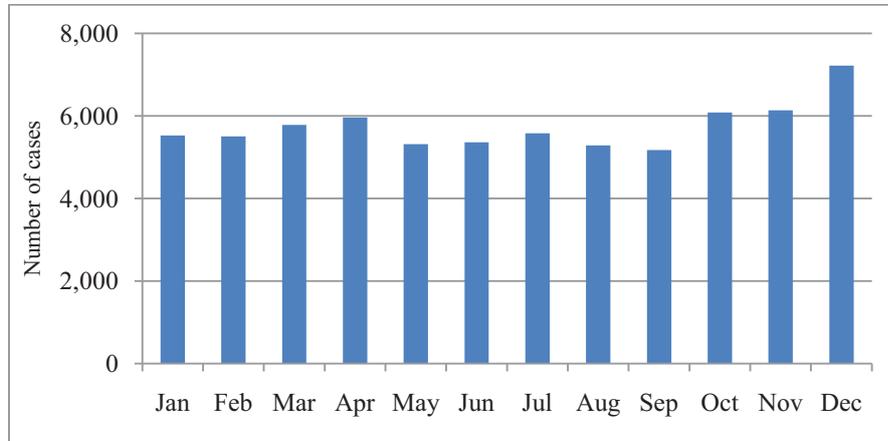
Alcohol involvement	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Non-alcohol related	1,125	38.77	43,836	63.62	44,961	62.62
Alcohol -related	850	29.29	22,347	32.43	23,197	32.31
Unspecified	927	31.94	2,720	3.95	3,647	5.08
Total	2,902	100.00	68,903	100.00	71,805	100.00

Source: Trauma Registry Reports (1998-2005)

4.4.5 Seasonal and day of week variation

In Thailand the season varies from the dry and cool season during November to February to the rainy or monsoon season between July and October. The main holidays are the New Year holiday in the first week of January and the week-long Thai New Year (Songkran) holiday in mid April. Figure 4.18 shows that the greatest number of fatal and non-fatal RTIs occurs in the October to December period and in April. Late December is a period when Thai people travel prior to their New Year holiday. The number of RTIs per month remains at an average of approximately 5,000-5,500 cases/month over the eight years but this rises to more than 6,000 per month over the peak periods.

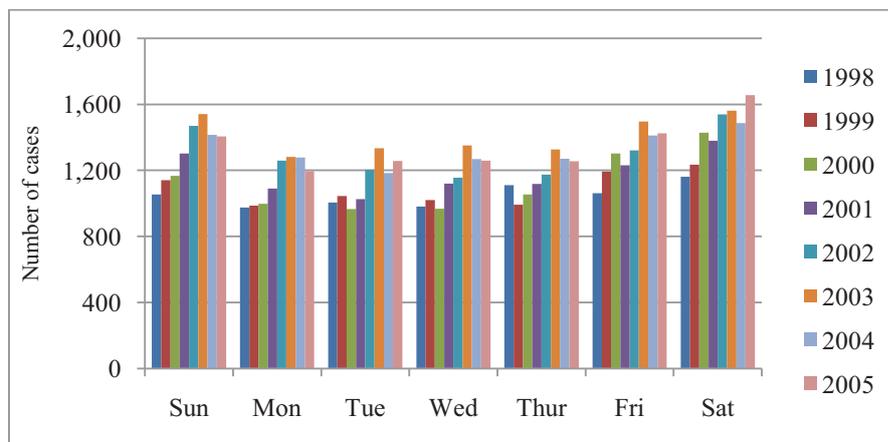
Figure 4.18: Total number of fatal and non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by month (n=68,903).



Source: Trauma Registry Reports (1998-2005)

The Thai working week is Monday to Friday. A greater number of fatal and non-fatal injuries also occur on weekends (see Figure 4.19). The number of injuries occurring on weekends (Friday-Sunday) accounted for 32,384 (47%) of the RT injuries over the eight years. There is a general trend for each day of the week of fatal and non-fatal cases to show a general increase over the period.

Figure 4.19: Total number of fatal and non fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by day of week and year (n=68,903).



Source: Trauma Registry Reports (1998-2005)

4.4.6 Treatment and financial cost outcomes

More than half of the non-fatal RT injuries were treated as out-patient cases and approximately 45% were admitted to the wards. Of the fatal injuries 16.44% were classified as deceased in emergency and 83.56% were admitted before their death. When compared the odds of patient outcome in relation to fatality of those admitted cases with those treated as out-patient cases, the odds ratio is 6.19 (95% confidence interval, 5.60 to 6.84). The road traffic injuries hence have approximately 6-fold greater chance of having serious trauma if they are admitted.

Table 4.11: Total number of fatal and non-fatal RTIs registered in the KKRH Trauma Registry for the period 1998-2005 by patient outcome (n=71,805).

Patient outcomes	Fatal		Non-fatal		Total	
	n	%	n	%	n	%
Outpatient	477	16.44	37,829	54.90	38,306	53.35
Admission	2,425	83.56	31,074	45.10	33,499	46.65
Total	2,902	100.00	68,903	100.00	71,805	100.00

Source: Trauma Registry Reports (1998-2005)

Of the total 21.7 million dollars spent in the seven-year period on RTI, 78.18 % was allocated to motorcycle injury patients (see Table 4.12). Motorcycle associated injury is by far -- the most significant cost to the health services. The next most costly agents are *vans*, *trucks* and *pedestrians*, which accounted for 7.49% and 5.02% of the total cost respectively.

Table 4.12: Total number of fatal and non-fatal RTIs registered in the KKRH Trauma Registry for the period 1999-2005 by agent of injury and cost (AUD\$)*/**.

Agent	Fatal and non-fatal injuries		\$ spent 1999-2005*	
	n	%	n	%
Motorcycle	56,143	78.19	16,985,733	78.18
Van, truck	4,506	6.28	1,626,235	7.49
Pedestrian	3,857	5.37	1,089,629	5.02
Heavy truck	1,127	1.57	477,193	2.20
Bicycle	2,818	3.92	379,919	1.75
Other	3,354	4.67	1,547,473	7.13
Total	71,805	100.00	21,726,262	100.00

Note: * (AUD\$1=26 baht) currency rate calculated June 2009
 **based on hospital costing from the admission to discharge
 Source: Trauma Registry Reports (1998-2005)

Of the total RT related injury, a large number of fatality cases had an unspecified BAL level (31.94%) which was greater than the unspecified proportion in non-fatal cases (3.95%). A greater number of RTI occurred in April during the Thai New Year holiday and December when Thai people travel prior to the New Year holiday. A large number of RTIs occurred on weekends when people were not working.

Of the total patients sustaining a fatal injury, 16.44% died in the emergency room and 83.56% died later following admission to a ward. Of the non-fatal cases, nearly 55% of patients were discharged following treatment in the emergency department only and 45.10% had injuries severe enough to require admission to hospital.

Motorcycle related injuries incurred the greatest medical expense (78.18%) to KKRH when compared with other RT injuries.

4.5 Key findings and discussion related to road traffic injury in Khon Kaen Province

The analysis presented in this chapter shows that road traffic related injury remains a major public health problem in the KKRH catchment area. The total annual number of fatal and non-fatal RT related injuries has increased from 1998-2005.

RT related injury was the most common cause of injury in the KKRH catchment area, accounting for 44% (n=71,805) of total injuries. It can be said that KKRH had approximately 25 RT related injury patients attending KKRH ER daily on average over the eight-year period. Of these RTI patients, 46.65% were admitted and treated as inpatients. Non-fatal RT injuries made up the majority of cases while fatal injury cases accounted for only 4.04% of the total RTI patients. However, RTI related fatalities accounted for as much as 75% of the total injury related fatality tally over the eight-year period.

As a result of being designated as a trauma care centre and referral centre for its catchment area, KKRH has to receive a large number of transferred patients from both surrounding district hospitals within Khon Kaen Province and hospitals from its neighbouring Provinces. KKRH ER receives more transferred cases, which would be, to some extent, more severe patients who were treated prior to their arrival at KKRH ER. This referral pattern means that the KKRH database comprises local plus the more severe referred cases.

Contributory factors related to road traffic injury found from the KKRH Trauma Registry Reports are similar to factors found in many developing countries where the majority of the road users are vulnerable road users (WHO 2009a, 2009b) . Being male, young and aged 10-29 years, riding a motorcycle, and working as a labourer are among the main risk factors associated with RTI. More

attention needs to be paid to these groups. Human, vehicle and environmental factors should be taken into consideration in order to achieve effective change.

The agent most commonly involved in RT injury was the motorcycle which was associated with 77.64% of fatal and 78.21% of all non-fatal injuries and the greatest cost to the health service (78%) of all injury costs. Young males aged 10-29 years were the group (64.33%) most at risk and head injury was the most common type of fatal (89.59%) and non-fatal (45.18%) RT related injury. The majority of RTI fatalities (80.42%) were those transferred from outside the KK city municipal area.

The motorcycle is used as the most common transportation method in KK, its popularity being attributed to low initial cost and fuel efficiency. As in other Asian low to middle income countries, most of the people cannot afford cars, therefore the motorized two-wheeler is used as a family vehicle. However, the use of this type of vehicle increases exposure to the RTI risk and crash severity. The increase in number of motor vehicles, especially motorcycles, on the road increases the risk of road traffic injuries (WHO 2006:28-29). KK Provincial Transport Office reported that motorcycles account for between 66.17% and 84.12% of all vehicle registrations per year from 1998-2005. In 2003, for example, there were 735,970 motorcycles registered for the year, while in 2005 there were 319,577 registrations. Incidentally, these numbers reflect only the vehicles registered during that time and do not include unregistered vehicles of which there could be a significant number (Erickson 2004).

Commercial motorcycle advertisements are used to increase sales volume. These advertisements are very powerful and have also been playing an important role in shaping Thai social values (Warunpitikul 2008:54-55). Modernity, success, freedom and leadership are delivered to

consumers by using images of celebrities shown in motorcycle advertisements. These values now, to some extent, represent the new social values of teenagers. These advertisements may encourage this young, male, at-risk group, which has less experience, to express themselves, feel invincible and show more risk-taking behaviour concerning road safety, as shown in other studies (Chamnarnsuk 2008; WHO 2009b). An attitude-change program regarding motorcycle use may positively affect the behaviour of this group.

Young people and labourers are among the most economically productive groups in society. As a consequence of their inability to afford cars, these groups frequently use motorcycles as their main transportation in the area, where public transport is inconvenient. Moreover, a motorcycle is easy to possess as a low down-payment campaign has been promoted (Warunpitikul 2008:48-49). However, the economic burden incurred by injury to these age and occupation groups includes lost income to the injured family in addition to the health care cost. This group is a priority in terms of a preventive road traffic program.

In this study, head injury is of concern as it contributes to a large numbers of cases resulting in death or severe ongoing disability. This has been found in other studies (Henriksson, Ostrom & Erikson 2001; Kumar et al. 2008). It impacts greatly as a cost to health services. The cost to health services for motorcycle associated injury in KKRH during 1998-2005 was nearly AUD\$17 million compared to AUD\$4.7 million spent on all other agents involved in RTI combined. The fact that helmets were not worn in the majority of fatal (72.70%) and non-fatal (79.68%) motorcycle injury cases is a significant public health issue. Road safety strategies for increasing helmet use and enforcement of helmet-wearing laws appear to be of major importance for health prevention (WHO 2009b:27).

In addition, severe head injury from road traffic injury requires a proper pre-hospital trauma care and at fixed health care facilities (Bhatoe 2000; Henriksson, Ostrom & Erikson 2001; Kumar et al. 2008). These require optimal care in time with transportation time, level of care required, and specialty skills to adequately assess head injury brain damage. A proper head and neck emergency medical care course must be prepared for EMS personnel at all levels and training given.

While 32.11% of RTI fatalities were coded as having a positive blood alcohol level, another third of fatalities were coded as having an unspecified blood alcohol level which may indicate that a significantly larger proportion of fatalities involved alcohol intake. Data relating to RTI victim blood alcohol level needs to be gathered more thoroughly. Collecting more precise data will enhance the decision making performance of both medical staff and policy makers in providing proper medical care and in further managing alcohol consumption related RTI problems. Thailand has no compulsory blood alcohol concentration testing for all drivers involved in RTI. There are only random breath-testing, police alcohol check points and police-requested blood alcohol testing available in Thailand (WHO 2009b:25). Moreover, the decision to test is normally made by the traffic police, not health professionals. Therefore this lack of data is due to processes involving notification and consent which may not be obtainable from severely injured or unconscious RTI victims. Alcohol breath and blood testing for all drivers involved in car crashes may need to be seriously considered in Thailand, as it is in other countries.

Attention has been paid to promoting road safety with campaigns and advertisements over the festival periods and weekends, where the traffic volume is higher and alcohol is more frequently used. Except in December, the number of RT related injuries occurring during the normal period did not appear to vary greatly from those special occasions. The number of RT related cases during

the week remained constant over the period. Road safety campaigns probably have to be conducted continuously to achieve effect.

Most injury cases presented at KKRH emergency department over the period of 1998-2005 were those transported from the area within the KK city area. However, the disparity of the characteristics between fatal and non-fatal injuries is reasonably different. Fatal injuries, in particular, were inter-hospital cases sent in from other districts within KK and other Provinces, whereas most of the non-fatal RT injuries were those transported from the scene within KK City area. Most of the fatalities were transferred from outside KK city municipality and outer districts where a large proportion of the KK population live.

The large number of fatalities transferred from outer city areas or districts may be associated with the large number of people living in or using roads outside KK city areas (there are approximately 1.45 million people residing in outer districts compared to around 300,000 people living in KK city). Many factors related to using roads or living outside city areas may influence exposure to risk, crash involvement and crash severity and these need to be taken into account. These include use of two-wheeled vehicles as a result of economic standards, availability of public transportation, being unprotected road users in areas that have a mixture of high-speed motorized traffic, less law enforcement, defects in road design, layout and maintenance, and the availability and quality of post-crash pre-hospital care.

These fatal RT injuries would have been partially treated before transferring to KKRH either at the injury scene by local EMS or in the local hospital before arriving at KKRH. The data provided by the local hospitals about these fatalities was inadequate as the Trauma Registry was not used at those hospitals and there was insufficient information about these cases. Therefore, data on

fatalities not arriving at KKRH are incomplete. A trauma death audit in a sample of district hospitals is needed to give a better picture. Data about these patients and their condition after the injury might be important for use in managing pre-hospital medical responses and prevention. Standardised injury surveillance programs covering an entire province will assist policy makers in determining areas which would benefit from road safety campaigns and other strategies.

Motorcycle related injury which did not involve collision was the most common cause of motorcycle related injury in this study. This finding is worthy of more attention. This single vehicle crash is more likely to be associated with alcohol consumption. Motorcycles are much easier to overturn without a collision or another party involved, depending on the rider's condition, terrain and quality of the road. Road quality and environment issues related to the large number of vehicles using the roads need to be further investigated.

4.6 Limitations: Trauma Registry and injury profile

Trauma registry data can be seen as an extended case series which gathers data in a standardized format and can be used to address injury aetiologies, clinical care processes for trauma patients and the effectiveness of injury prevention interventions (Mock 2001:171). As registry data are gathered on a continuous basis, they can normally be used in quality improvement processes, especially for the above preventive measures, but it is limited to a particular hospital or area zone. However, despite the register combining local and referred patients, this data set shows a typical aetiology of RTI, the outcomes of treatment and aspects of factors associated with RT injury patients attending KKRH ER over the years 1998-2005. A more detailed description of the difference between KK city and outer districts is needed to better describe injury in outlying regions.

Internationally it is recognised that case series or trauma registry data cannot provide as valid data as those population-based injury studies which define both numerator and denominator (the denominator is not well defined in trauma data). However, a trauma registry can provide some important aetiological data that can be used in injury control strategies. Implementing a wider Provincial trauma registry would assist in more accurate calculation of injury or death rates in the KK region.

One major limitation of the KK Trauma Registry Report is lack of data on Injury Severity Score (ISS). A standardised ISS is one of the best sources for assessment of clinical outcomes of injuries (Mock 2001:171). The data, therefore, can be used to compare the outcomes of different groups of patients and monitor success of intervention strategies over time by making comparisons between initial injury severity of trauma and outcomes. In the main Injury Surveillance system, there is Trauma Revised Injury Severity Score (TRISS) (a combination of Revised Trauma Score (RTS) and Injury Severity Score (ISS)) methodology used to estimate the survival probability of the injured patients. However, the published trauma registry report used in this study does not provide any data on AIS or ISS. The initial severity of injury and outcomes of patients could not be compared in this study. The mechanism of injury and interventions of emergency care hence cannot be evaluated. For research evaluating outcomes of intervention strategies, it is recommended that ISS coding should be made available for analysis.

One of the concerns raised by many researchers is the difference in proportions of direct admissions and referred patients (Mock 2001:173). These figures can influence an interpretation of the injury profile in the population, for example, referred patients who are then hospitalised compared to local patients (Waller, Skelly & Davis 1995 cited in Mock 2001).

From this study, it can be seen that data about death and injury from RTI cases registered in the KKRH Trauma Registry area is less meaningful if considered as a whole. When the proportions of the direct admissions and referred are considered, it can be seen that most of the fatal cases were patients transferred from outside the KK city area. The direct admission RTI fatalities must be much lower in proportion when compared to the total number of RTI patients who attended KKRH ER. Moreover, if there is an injury surveillance program available at local hospitals, the KK RTI injury profile must be different from this existing one.

The Trauma Registry has been invaluable through its contribution to planning and trauma care. It is useful to health care providers, health administrators and injury researchers in this Province and in Thailand as a whole. It is vital that the quality of the data and the integrity of the current database is maintained and supported for these purposes. This data set tends to have at least a 3-4 years time lag during the most recent years before this study. There was no Trauma Registry published in KKRH after 2005.

4.7 Summary

Factors related to road traffic injuries are described in many ways. Risk factors involved can be classified as factors influencing exposure to risk, crash involvement, crash severity and post-crash outcome of injuries. Factors identified in this trauma registry are generally those categorised as risk factors influencing crash involvement and crash severity, or more specifically being a motorcycle rider, young, male, working as a labourer and not wearing a helmet while riding two-wheeled vehicles. The consumption of alcohol may also be a risk factor associated with RTI fatality.

The risk factors shown in the profile need to be considered, especially given the predominance of the one agent (motorcycles) involved in RTI, in relation to improving the EMS system and providing proper medical intervention for this trauma. Existing RTI prevention and EMS need to be improved to reduce the number of and severity of road traffic trauma patients in KK Province.

The lack of resource availability, technical and financial support and human resources of the nearby districts create data gathering limitations for these districts. To improve injury data availability in non-sentinel sites, a recommendation would be to conduct a death audit and case file audit of injury in district hospitals. The data collected from all Thai injury surveillance sentinel sites including KKRH Trauma and Critical Care Centre may represent only 27.7% of fatalities and 5.5% of non-fatalities of all RT injury reported at the national level (Bureau of Non Communicable Disease 2006). The national data will have a reporting bias towards sentinel sites collecting information. However, this information is valuable to health providers to guide programs to reduce RTI and focus on the main problems such as motorcycle injury and the need of proper prehospital emergency services at both inner and outer KK city municipal areas.

Chapter 5 Investigating pre-hospital emergency medical services data

5.1 Introduction

This chapter describes data from Khon Kaen Emergency Medical Services (KK EMS) database regarding call out cases which were registered in the system to present a picture of the pre-hospital emergency care service operations and resources in KK Province. Understanding the processes of care from the EMS database can identify gaps that can improve the existing EMS.

The data presented below shows resources of the EMS in KK Province, operating processes from incident scene to hospital arrival, and total costing of services covering the years 1994 to 2007. As mentioned in Chapter 2, when EMS was first developed out of KK hospital in 1994, the data on EMS was collected by KKRH hospital staff in the emergency room. The central database of the 10th -12th health catchment area EMS was established during 2003, so the first complete year of centralised data as presented below is 2004. Both sets of data are included in the following profiles.

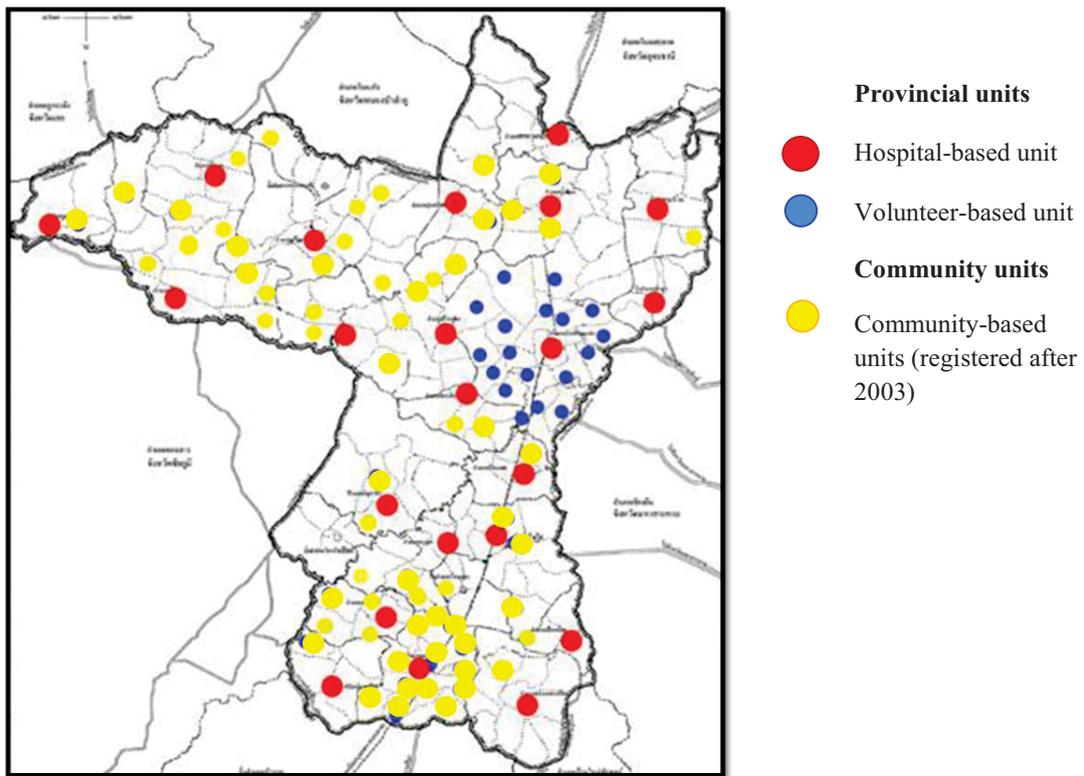
5.2 EMS Resources

The inputs of the EMS system include available ambulance services, personnel and incident calls. The data below show that there has been an increase in the availability of KK EMS services since they were initiated in 1994.

5.2.1 EMS units

EMS services in KK Province consist of services operating out of Provincial units which were first established in the Province in 1994 and are based in KK municipality hospitals, district hospitals and volunteer groups in the KK municipality area. Community units were established in 2002-2003 to further develop the services in the community and are based in local government contracted community groups. Figure 5.1 shows the area distribution of EMS units in KK Province.

Figure 5.1: Number of EMS units registered in KK EMS system 2007



Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

Provincial level EMS provide all levels of care, whereas the community units operate as First Responder level units providing basic level of care only. There were a total of 124 units registered as operating throughout KK Province by 2007. The 43 Provincial EMS units were established between 1994-2003, and include 30 hospital-based EMS units from all over the Province and another 13 volunteer EMS units based within the KK municipal area. The community or sub-district EMS units managed by local government organizations were established from 2002.

5.2.2 EMS ambulance types

EMS Provincial units have ambulance fleets which consist of advanced, intermediate, and basic level ambulance vehicles depending on the equipment supplied and level of use. EMS community units have only basic level ambulance vehicles which may be modified pick-up trucks.

Ambulance services available in the KK area have expanded correspondingly to the increase in available units. In 2003, there were 14, 57 and 35 ambulances registered as Advanced, Intermediate, and Basic level respectively. However, only basic level ambulances (75 units) were registered in the system after 2003. The number of new basic level ambulances registered corresponded with the number of new First Responder units from 2003 -2007 (see Table 5.1).

Table 5.1: Number of new EMS ambulances registered in KK EMS system by type of ambulance for the period 1994-2007

Type of ambulance	1994-2003*	2004	2005	2006	2007	Total
Advanced	14	0	0	0	0	14
Intermediate	57	0	0	0	0	57
Basic	35	18	32	13	22	120
Total (new registrations)	106	18	32	13	22	191
Total ambulances registered	106	124	156	169	191	

Note: * database operating in hospital system.

Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.2.3 EMS personnel

EMS personnel consist of emergency physicians, paramedic nurses, emergency medical technician-Intermediate (EMT-I), EMT- Basic (EMT-B), First Responder (FR) and other allied health professions registered in the system. Each job category requires various levels of training to be registered. First Responders are often itinerant workers so the turnover of these positions is high.

The number of EMS personnel registered annually over the years 1994-2007 totalled 2,368 as shown in Table 5.2. Of these, 1,349 personnel were registered before 2003 in the Provincial KK EMS system. A large number of community level FRs were recruited and trained after 2003 to meet the regulation that each EMS unit has to have at least 10 registered staff to run the service. There was a total of 1,010 First Responders registered in the system during 2004-2007

Table 5.2: Number of new EMS personnel registered in KK EMS system for the period 1994-2007 by employment role

Role of employment	1994-2003*	2004	2005	2006	2007	Total
Emergency Physician	22	0	0	0	0	22
Paramedic Nurse	538	4	1	0	0	543
EMT I	68	0	0	0	0	68
EMT B	45	0	0	0	0	45
Technical Nurse	23	1	0	0	0	24
Public Health Officer	17	3	0	0	0	20
First Responder	636	219	467	84	240	1,646
Total (new registrations)	1,349	227	468	84	240	2,368
Total EMS personnel registered	1,349	1,576	2,044	2,128	2,368	

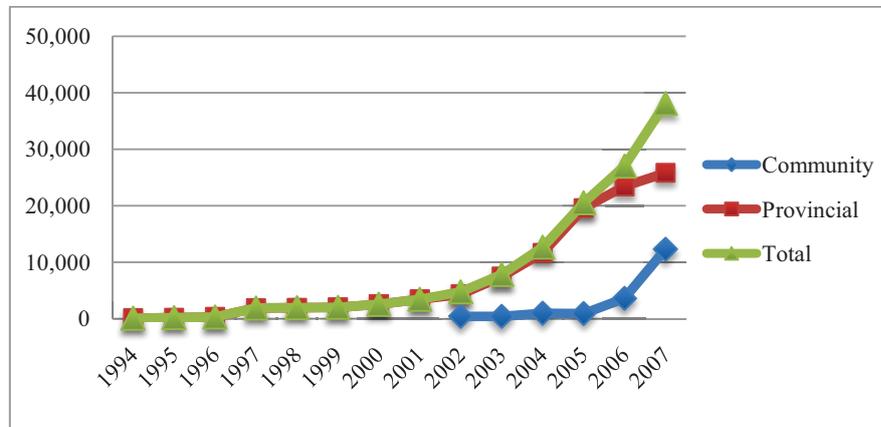
Note: * database established in hospital system.

Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.3 EMS Processes

Khon Kaen has been operating its pre-hospital EMS since 1994. The system has been developed in different stages. Resources have been built, recruited and retained in the system since 1994. This first stage of development was called the Provincial EMS team. It started with the service of the KKRH EMS team working in collaboration with a local volunteer foundation and then with local hospitals afterwards. The hospital and volunteer EMS mixed system operated exclusively from 1994 to 2002 until a combination of community-based EMS was established in 2002. This change occurred in order to increase accessibility and equity of health services for more people. From Figure 5.2, it can be seen that there were only KKRH EMS units providing services during 1994 and 1996. In 1996, local charitable foundations began to operate their official EMS and there were 966 cases in their first year. Srinakarindra (Khon Kaen University's) hospital and other district hospitals started their EMS in 1997 and have continued functioning until now. The establishment of community based EMS in 2002 made the services available for 431 cases in that year.

Figure 5.2: Number of EMS call outs registered in Provincial KK EMS system by type of unit for the period 1994-2007

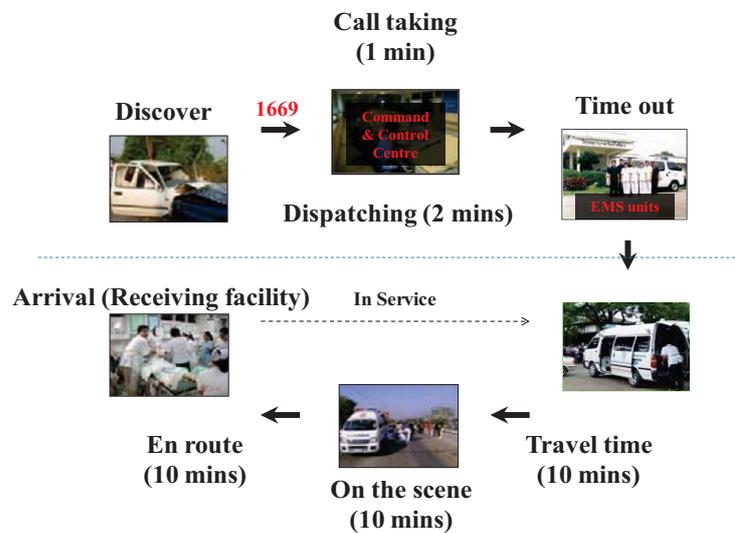


Source: KK EMS system, Trauma and Critical Care Center, KKRH (1994-2007)

KK EMS operates under a tiered response system which is recorded and evaluates ambulance response interval times. These records can be used to evaluate demand on the services from callers and to assess the arrival of patients at the receiving health facility.

Each step in the response interval times has its benchmark (see Figure 5.3). The call-taking interval is expected to be completed within 1 minute. The ambulance has to be dispatched from the station or centre within 2 minutes. As far as the travel time is concerned, the ambulance crew is anticipated to arrive at the scene in less than 10 minutes. When a scoop-and-run scheme is more likely to be used in the KK EMS system, the ambulance crew should spend about 10 minutes on the scene and waste no more than 10 minutes to transport the patient to the appropriate fixed health facility.

Figure 5.3: Expected response-time in KK EMS systems



Source: Adapted from Khon Kaen EMS system

5.3.1 Number of call outs

People making contact with the KK Provincial Command and Control Centre (CCC) following an emergency medical situation are registered in the database as *call outs*. There was a total of 100,201 call outs taken by the CCC over the period of five years and the number of calls shows an increase each year. Approximately 84% percent of all call outs over this time were made to Provincial units. The number of call outs to community units increased significantly for 2006 and 2007 and comprised of 32.26% of all *call outs* in 2007 (see Table 5.3).

Table 5.3: Number of EMS call outs registered in KK EMS system by type of unit for the period 2003*-2007

Type of Unit	2003*	2004	2005	2006	2007	Total
Provincial	1,917	11,663	19,576	23,414	25,817	83,967
Community	0	990	937	3,592	12,295	16,234
Total	1,917	12,653	20,513	27,006	38,112	100,201

Note: * Partial year - EMS System established late 2003
 Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.3.2 Method of calling

Although the Provincial EMS office is trying to encourage people to access EMS by dialling 1669 for emergency situations, there are many channels and methods used to access the pre-hospital EMS system in Khon Kaen. All calls, as listed in Table 5.6, are routed to KK Command and Control Centre (CCC) where an initial assessment of triage is made to determine the level of service required.

There were 98,288 calls made to CCC over the four-year period (Table 5.4). Of those calls 54.53% were accessed through the EMS number 1669. The number of calls accessed through 1669 and EMS unit direct landline have shown more common use over time. In 2007, 59.70 % of calls were made by EMS number 1669 and 22.44 % by EMS unit landline.

Table 5.4: Number of EMS call outs registered in KK EMS system by channels used for the period 2003*-2007

	2003	2004	2005	2006	2007	Total
1669	NA	4,737	11,077	15,029	22,753	53,596
CCC landline	NA	3,979	4,107	2,487	61	10,634
EMS unit landline	NA	14	570	3,759	8,552	12,896
Radio	NA	2,720	3,298	3,719	2,828	12,566
Networks	NA	1,202	1,461	2,012	3,914	8,589
Total	NA	12,653	20,513	27,006	38,112	98,284

Note: * Data not available 2003

Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.3.3 Dispatchers' triage classification of cases

The initial assessment of triage is made by the EMS call-taker or dispatcher who determines the type and level of unit needed. Of the 100,201 call outs from 2003-2007, 9.55% were classified as *Emergency*, 62.58% as *Urgent*, and 27.87% *Non-urgent* respectively. Cases triaged as *Non-urgent*

demonstrated a far more dramatic increase in the number of call outs than those triaged as *Emergency* and *Urgent* for the same period (see Table 5.5).

Table 5.5: Number of EMS call outs registered in KK EMS system by triage classification of case for the period 2003*-2007

	2003*	2004	2005	2006	2007	Total
Emergency	299	1,951	2,176	2,372	2,787	9,585
Urgent	1,618	9,711	16,996	15,888	18,480	62,694
Non-urgent	0	990	1,341	8,746	16,845	27,922
Total	1,917	12,653	20,513	27,006	38,112	100,201

Note: * Partial year - EMS System established late 2003.
Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.3.4 Level of response

As described in the table above, cases are identified as *Emergency*, *Urgent* and *Non-urgent* patients by the CCC and are given a designated level of response. The designated levels of response are *Advanced Life Support (ALS)*, *Intermediate Life Support (ILS)*, *Basic Life Support (BLS)*, and *First Responder (FR)*. The response level *First Responder* was initiated in 2004 for community-level units.

According to the database, there were 7,009 cases which required an advanced level of medical care from 2003-2007 (Table 5.6). The most common level of response is *Basic Life Support* but the proportion of BLS has decreased (84.40% of call outs in 2003 down to 48.49% of call outs in 2007) in recent years as more cases have been allocated to *First Responder* level (0.01% of callouts in 2004 up to 44.20% in 2007).

Table 5.6: Number of EMS call outs registered in KK EMS system by level of response for the period 2003*-2007

Level of response	2003*	2004	2005	2006	2007	Total	%
ALS	143	1,055	1,656	1,788	2,367	7,009	6.99
ILS	156	896	520	584	420	2,576	2.57
BLS	1,618	10,701	16,996	15,888	18,480	63,683	63.56
FR	0	1	1,341	8,746	16,845	26,933	26.88
Total	1,917	12,653	20,513	27,006	38,112	100,201	100.00

Note: * Partial year - EMS System established late 2003.
 Source: KK EMS system, Trauma and Critical Care Center, KKRH (2003-2007)

5.3.5 Response times

The EMS response sequence is broken down to a number of intervals from time of call to arrival at hospital. The expected response-time for each interval is benchmarked. These include:

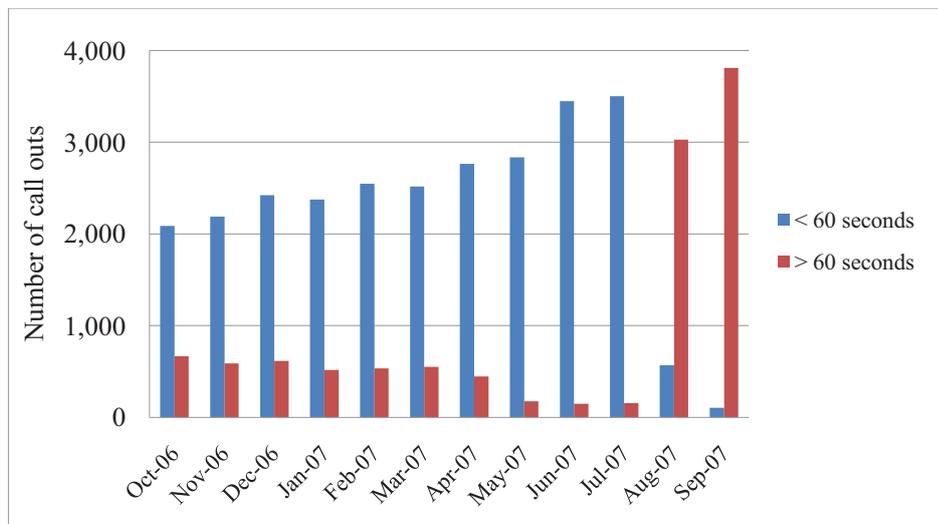
1. Call-taking and dispatching
2. Travel time from base to injury scene
3. Time at injury scene
4. Travel time from injury scene to hospital

Call-taking and dispatching

Call-taking is the time spent for call-taker or dispatcher to obtain the information from a call. The call response time is important and may be affected by many different scenarios such as panicking of the caller, training of the dispatcher, and community awareness. Dispatch time refers to time from completion of call to take off. This can be affected by availability of appropriate unit, staff and supply.

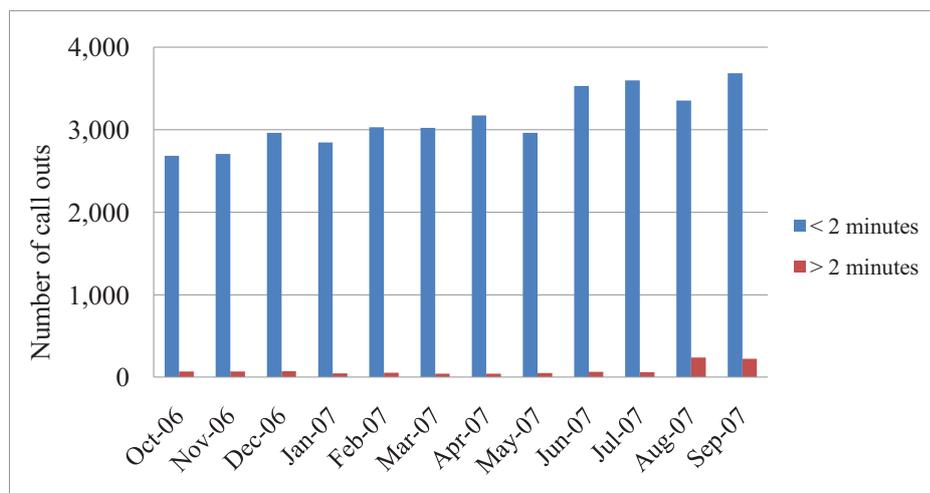
The majority of calls are taken within one minute. However, in August-September 2007 it appears that most calls took more than one minute (Figure 5.4). Dispatch time usually took under two minutes. In August-September 2007 there was a rise in dispatch time to over two minutes (Figure 5.5).

Figure 5.4: Number of EMS call outs registered in KK EMS system by *call taking time* for FY 2007 (October 2006-September 2007)



Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

Figure 5.5: Number of EMS call outs registered in KK EMS system by *dispatch time* for FY 2007 (October 2006-September 2007)



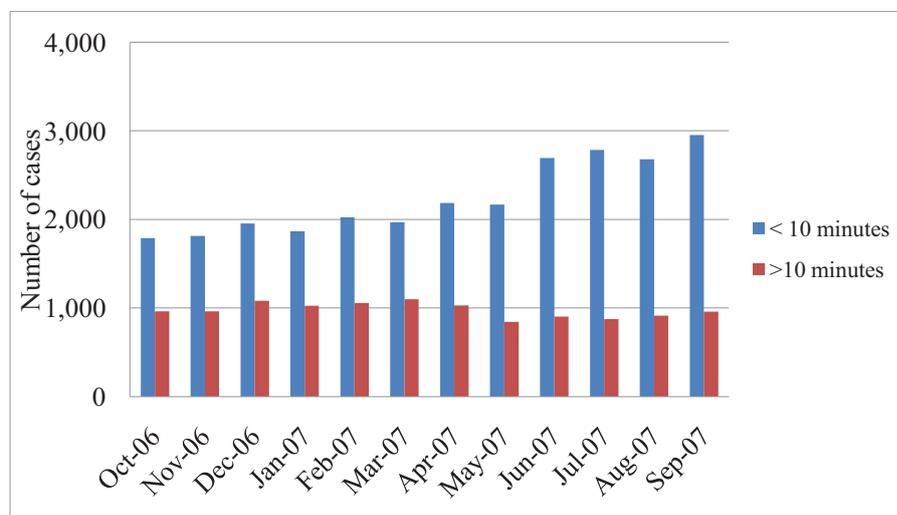
Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

Travel time from base to scene

The travel time from base to scene may differ from place to place. It can be prolonged in rural settings where the population distribution is scattered and further from medical facilities. It can also be extended in urban areas as a result of unavailability of resources and traffic congestion. However, the response time can be reduced due to an increase of the number of EMS units and improvement of operational protocols.

The majority of cases (64.19-75.65%) have a travel-to-scene time of under ten minutes. There was a general increase in the number of cases which were recorded as having a travel time of under 10 minutes, particularly from June to September, showing that a greater proportion of all call outs were taking less than 10 minutes to travel to the scene (see Figure 5.6).

Figure 5.6: Number of call outs for EMS registered in KK EMS system by *travel time from base to scene* for FY 2007 (October 2006-September 2007)



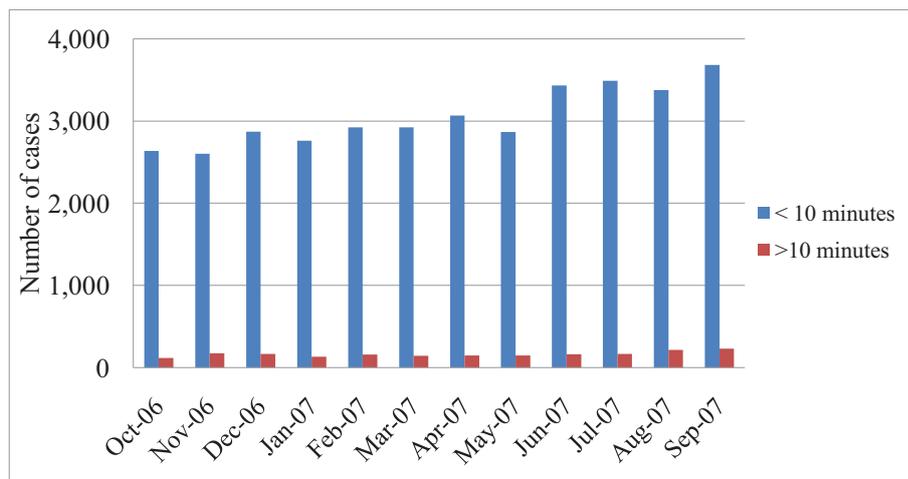
Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

Time at the injury scene

Time at the injury scene is the time spent by the EMS units at the scene for providing medical care to the patient. Less than 6.23 % of cases recorded ten minutes or more time spent by EMS units at

the scene (see Figure 5.7). These cases were most likely those associated with a need for a more advanced level of care at the scene. As shown in Figure 5.7 the proportion of ALS registered response level was approximately 6 % of call outs in 2006 and 2007.

Figure 5.7: Number of EMS call outs registered in KK EMS system by *time at injury scene* for FY 2007 (October 2006-September 2007)



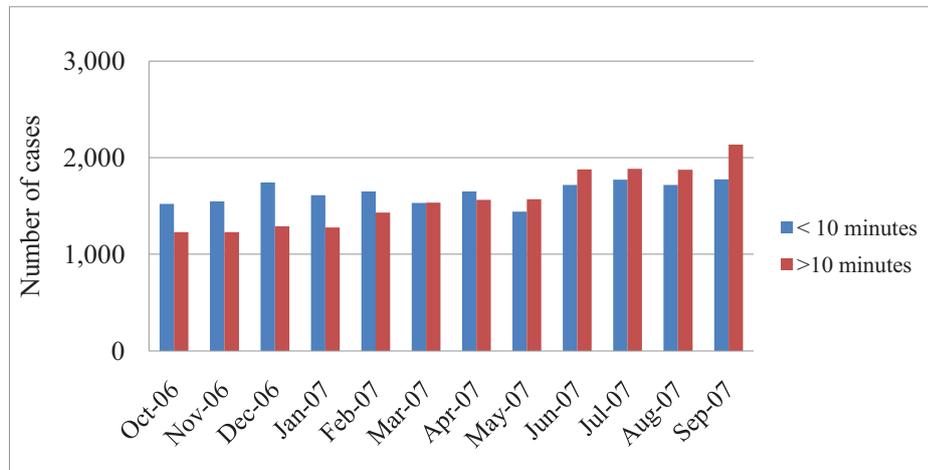
Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

Travel time from injury scene to hospital

The time taken to transport patients to the nearest appropriate hospital is shown in Figure 5.8. Of the total cases in the period from October 2006 to September 2007, 51.16% were transported to hospital within ten minutes. There was an increase in the number of cases taking more than ten minutes transport time to hospital during this time.

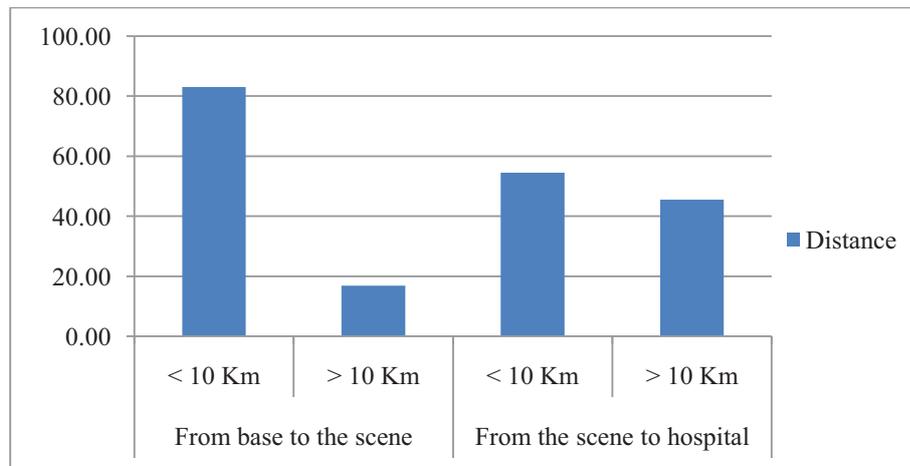
The time taken to transport patients away from the injury scene to a hospital often involves longer time intervals and greater distances than the distances travelled from base to scene as indicated in Figures 5.8 and 5.9. Eighty percent of call out responses travelled less than 10km to the scene whereas a little more than half of total call outs (55%) travelled less than 10km to hospital. This would be particularly relevant to community EMS unit travel times and distances.

Figure 5.8: Number of EMS call outs registered in KK EMS system by *travel time from injury scene to hospital* for FY 2007 (October 2006-September 2007)



Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

Figure 5.9: Percent of EMS call outs registered in KK EMS system by *travel distance* for FY 2007 (October 2006-September 2007)



Source: KK EMS system, Trauma and Critical Care Center, KKRH (FY 2007)

5.4 Key findings and discussion related to emergency medical services in Khon Kaen Province

An analysis of the findings above shows a picture of the existing KK EMS system situation which assists the researcher in identifying the context of EMS being studied (Rubin & Swor 1993:204).

This data can also be used to highlight areas for an effective program for improvement (Smith 1993b:205). While the data relate to all injuries handled by EMS, the service provided was applied to RTI which is a small proportion of all cases handled by EMS.

Resources

The review of EMS resources showed that they were widely distributed over the KK catchment area covering a population of 1,752,414 in 2007. The latest Provincial EMS administration policy aims to have one EMS unit per commune in order to increase accessibility and equity of the localities and the population. To this point, available EMS units are dotted throughout the Province in a disordered way. This lack of uniformity is perhaps due to the voluntary nature of implementing EMS service by each local government without regional coordination. Although they are not equitably allocated, they thus far cover most of the regional areas.

The number of new resources directed towards Provincial-based EMS units in KK Province have in effect ceased as more focus has been given to community EMS. The number of community-based units, resources and use has shown a rapid increase, while Provincial-based resources have not been updated, as can be seen in tables 5.1-5.3. Specifically, resources are lacking to renew and update Provincial services with more advanced levels of care.

Lack of review and updating of the resources of existing EMS was not evident in documentation recorded on the system. Therefore, management may not know what has to be improved or reorganized. Situational change may lead to organisational change. An increasing workload or change in pattern of emergency responses may demand new technology or resources and can possibly create innovations out of the existing system. Perhaps, an increase of non-urgent cases

will lead to an initiative of using community ambulances as a transportation service or a new EMS use scheme to reduce the number of non-urgent cases.

Improvements needed may include training and refresher courses. As a result of changing situations such as the pattern of EM cases and availability of community-level EMS services, training or refresher courses may have to be adapted to meet the real needs of the community. Details or types of diseases or illnesses should be identified and prioritised. Training or refresher courses for each level of EMS teams must meet these needs.

An escalation of community-based units with FR responses represents an increase of accessibility, but can also mean that there is a lower proportion of qualified units. This may represent a lack of efficiency in the utilisation of the service. The service was established to provide emergency medical care for those who are facing an emergency medical condition and to attempt to reduce morbidity and mortality (Overton & Stout 2002:115). In terms of increasing accessibility and equity in providing services, Khon Kaen EMS office has made good progress.

There has also been a dramatic increase in the FR level of non-urgent responses in recent years. The community-based units may have personal relationships and community ties as they operate within small communities and thus have less rigid controls in place. As a new service the community-based EMS are under pressure to meet the needs of the communities who may not be well-informed about the functioning of the service. Too much pressure on the services may reduce the system's efficiency. Resources and their needs may have to re-evaluate for efficiency and effectiveness.

It is possible that there is a misuse of emergency services for non-urgent cases. EMS unit systemic evaluation in terms of both quantity and quality may have their roles. There must be a movement of

resources available in KK EMS. The movement of resources, such as the registration or termination of the ambulance, with promotion and relocation of the staff, needs to be closely monitored and updated. This will assist managers in making a decision to recruit or retain resources.

Processes of care

The efficiency of the system can be evaluated by using data about volume of call outs and classification of cases (Smith 1993b:217). It can be seen from the available data that the number of non-urgent cases has dramatically increased in the last couple of years. This may indicate that the system is being used for situations where there is not a real emergency medical condition. This inefficient use of EMS can affect the rest of the system as a whole. An increase in workloads of the call-taker, dispatcher and, moreover, ambulance crew can waste resources. It may be life-threatening if ambulances respond to non-urgent cases while others have a real emergency and their response time is delayed. Furthermore, unnecessary use of EMS from those non-urgent cases causes considerable cost to the system, funds which could alternatively be used for improving the existing EMS system.

Access for members of the KK community to the existing local EMS system is best achieved by use of citizen access to the KK dispatch centre (CCC). Encouragement to use the emergency service through promotion of the centralized emergency number 1669 is a priority. However, access to EMS via the use of emergency number 1669 appeared to increase over the years although there was also an increased use of local EMS unit landlines. This may be a result of encouragement from KK EMS Provincial office and the promotion to contact the local units themselves. While the Provincial EMS office has tried to endorse the use of number 1669, the local EMS units, especially the community ones, have encouraged their locals to use the direct landline number so that the

EMS personnel can speak to people they know and who are more knowledgeable about local conditions. This may be perceived by the villagers to be a better way to operate the EMS, but it is a less effective and less inefficient way to deploy and use EMS resources and manage the system.

Every call made should be routed directly through CCC where the call taker and dispatcher have a standardised interaction with the callers. This is designed to control the quality of the services by using a trained dispatcher. The same triage criteria are used to make sure that all patients will get the proper care (Gunderson 2002:100). A set of questions is asked by the dispatcher during the conversation to gather the best information to make a clinical decision. Often information required by the caller taken during the critical minute of a call is received in part and extra time is taken to calm the caller down. Incomplete data collection can cause an erroneous decision to be made by the dispatcher which in turn then causes an incorrect response with delayed travel time interval.

Call-taking and dispatch time within one minute is the optimum response. However, in August and September 2007 the response times were mostly taking more than one minute. Obtaining contact details and place where the communication centre has Computer Aided Dispatch (CAD) to divide responsibility of call-taker and dispatcher or the Global Positioning Satellite (GPS) in place may increase the accuracy of the triage and the data obtained (Clawson 2002:175; Mears & Zalkin 2002:268) .

Pre-arrival triage and post-arrival triage

While the data available indicates that EMS responses are to some extent adequate for the requirement of emergency calls, in some cases, inefficiency may exist. Records were not available to show the comparison between severity indices at pre-arrival triage and post arrival or pre-evacuation triage as a result of change of clinical status over time. Therefore patients' clinical

status and outcomes cannot be traced (Cayten 2002:279-286). This process can be tracked by looking at the level of unit sent out compared to the unit evacuating the patient. For example, in the case of an under-triage classification, a first basic unit sometimes needs to be changed to a unit with a higher level of care. This kind of information could be documented to assist evaluation of the system.

Travel time interval

While the time interval from the EMS station to the emergency medical scene was less than 10 minutes for the majority of the cases, the time spent travelling from the scene to the fixed health care facility was often over 10 minutes. This could be explained by more units being available at the local level, but the higher level fixed health facilities remaining in the city area. Travel time may be affected by distance and shape of the service area and traffic congestion, etc. (Overton & Stout 2002:123). To reduce the time interval from the scene to a particular health facility, alternatives such as reviewing recorded material on times and time intervals, using primary care units located in the community for non-urgent cases, and setting up a formal dual system for the provision of advanced levels of care, may be considered. On the other hand, review of response to non-urgent cases may also be necessary, since there is no need to rapidly transfer the patient.

5.5 Limitations: EMS database

In this study, a profile of available EMS resources in KK is outlined. However, data regarding new registrations, resources, personnel and units, only are presented and data on those expired or renewed are not. This may affect the management of the EMS system and local operations.

The quality of data collected will affect the accuracy of conclusions drawn. The existing EMS datasets have a practical, well-structured and defined dataset in all four broad categories: (a)

patient information, (b) surveillance data, (c) current diagnostic/physical monitoring and (d) interventions. This database system uses internet-based information systems where EMS data can be entered, analysed and used to generate reports through an internet-based method. However, paper documentation and error checking at data entry point at the front-ended programs is still essential (Mears & Zalkin 2002:271).

Although response-time information is required to be collected and analysed, clinical performance and economic efficiency are also important tasks that need to be documented and compared for system capability and management (Overton & Stout 2002:120). Without proper management of one or two of these three components, the consequences to patients may be detrimental. The KK EMS dataset provides response-time interval, but not clinical performance and economic efficiency. Response-time standards must be calculated to meet the needs of a particular triage level of care at the time, not the expected time-response reliability.

The cost of EM Services could be controlled to achieve at least equal or better service at lower cost. The data on the cost of the EMS was not available in detail. As there was no clinical outcome measurement documented, it is impossible to prove the achievement of financial control. Efficiency of EMS provided could be reported.

A correlation between the EMS data above and the KK trauma registry injury profile is required to be developed. Although it is difficult to have the same unique identifier across databases, it is possible (Mueller 2001:55-57). The linkage of these two datasets will create improved information to assist existing EMS quality improvement programs. Clinical performance and economic efficiency may be more easily revealed.

Limitations of using the available data include an omission about what monetary and non-monetary incentives EMS personnel receive in the EMS. This includes, for example, the level of monetary incentive received, level of training and attendance at refresher courses, professional development and health and safety issues. Updated information on these issues may add value to human resource management in the EMS. These monetary and non-monetary incentive issues influence the motivation to work of health care personnel (Kontodimipoulos, Paleologou & Dimitris 2009).

5.6 Summary

To monitor the EMS system in KK, the KK EMS Provincial office has implemented a registration system for not only registering new units, but also for monitoring the EMS system itself. At the beginning stage of this expansion, accessibility to the EMS for communities is more important. Establishing new EMS units or promoting more involvement from stakeholders, particularly local administrative organisations, is a big challenge when they are in the initial stage of the new EMS services. Understanding the context of the system is the best way to identify possible improvement strategies.

The EMS units operate under a fee-for-service system which is originally paid to them by the Thai National Health Security Office (This fee is now paid by the Emergency Medical Institute of Thailand, EMIT). There was a marked escalation of call out volume and, consequently, fees paid to community EMS units have been supported by the National Health Security Office for KK EMS in 2007. The payment of services by the government is possibly an incentive to local contractors to oversupply EMS in rural areas, which is perhaps indicated by the increase in the number of non-urgent calls. However, other non-financial incentives may have to be taken into account as an intrinsic motive for those local governments who volunteer to run the local services.

Conceivably, a tight control over quality of care with the aim of having optimal emergency care at pre-hospital stage could assist in improving EMS even further. Quality control needs to be conducted in every type of emergency process. There is no identical response toward each emergency health condition. Assessment of EMS provision should focus on each process of EMS, for instance, information received from the callers, information sent from the dispatcher, the level of care need, etc. This quality control includes clinical performance, response-time reliability and economic efficiency.

Measurable performance indicators should be clearly identified, defined, and developed for other components of EMS and for specific purposes, such as road traffic injury patients, cardiac arrest patients, etc. Connectivity among datasets and interrelated processes must be implemented. Outcomes measurement including clinical, functional, patient perceptions and cost of care process should be made available to measure the effect of care process and compare with quality of care delivered by different providers or EMS training level of personnel (Moore 1993:130). These issues are linked to EMS improvement processes.

Chapter 6 Perceptions of emergency medical services personnel about factors contributing to RTIs and EMS patient outcomes

6.1 Introduction

In the last two chapters we explored quantitative data concerning road traffic injuries and processes within the KK EMS system. This chapter builds on earlier data by presenting qualitative information that describes the views of EMS employees and their perceptions relating to road traffic injury and functioning of the KK Province EMS.

The chapter provides an insight into how EMS personnel perceive management of current RTIs and the existing EMS units and how problems may be improved. The complexity of management of RTI and the EMS is also explored. RTI and EMS management issues which contribute to RTI patient outcomes are identified. There is a need to consider effects within the local EMS context and management style which impact on road safety and the use of EMS. The findings reflect the experience of EM personnel who are exposed directly to the environment where RTIs take place and their response to EM situations. The perceptions expressed are valuable for assisting development of a more holistic picture of managing the existing EMS system.

This chapter comprises three main sections. The first section illustrates a profile of participants in this study. The second section presents perceptions of the EMS workers employed in various roles about RTIs. The third section focuses on perceptions of the workers about EMS.

6.2 Participant profile

This section provides a summary profile of the EM personnel who participated in this study. Participants identified themselves as EMS personnel. The profiles of participants are displayed in Tables 6.1 to 6.4.

All EMS personnel were employed within the KK Province EMS system. Participants were aged between 21 and 53 years, with the majority of them aged between 31 and 40 years. Males comprised 70% of the participants. All female participants were nurses. Most of the participants had spent more than 5 years in either a health care service or EMS area. There were only seven participants who were employed as First Responders who had less than 5 years experience in the health service arena.

The physician and the registered nurses participating had gained a higher education level than the other occupational groups. When categorising the participants by employment role within EMS, the profile included a physician who was working in a management role within the EMS system. The EMS nurses who worked in the hospital emergency department also needed to join with the ambulance team on various occasions. The nurses included a nurse working in the health department of a local government organisation and five other paramedic nurses from KKRH.

There were six personnel employed as First Responders who were based in community units. Seven Emergency Medical Technicians-Intermediate who are on-ground EMS personnel, have jobs based at ambulance stations, but have to practice in the emergency department. Most of the diploma level participants were EMT-I who had graduated from the two-year EMT course. The rest are those FRs who have yet to obtain at least primary level of education.

Table 6.1: Participant profile by employment role and level

Employment role	Employment level	No. of staff
Physician	Advanced/Management	1
Nurse	Advanced/Front line manager	6
EMT-Intermediate	Intermediate/ Front line manager	7
EMT-Basic	Basic	-
First Responder	First aid	6
Total		20

Table 6.2: Participant profile by age and gender

Age	Male	Female	Total
21-30	2	1	3
31-40	8	2	10
41-50	3	3	6
51-60	1	-	1
Total	14	6	20

Table 6.3: Participant profile by education level

Education level	No. of staff
Primary*	1
Secondary**	5
Diploma***	7
Undergraduate****	2
Postgraduate*****	5
Total	20

- * Primary = under grade 6
- ** Secondary = under grade 12
- *** Diploma = 2 year EMT curriculum or equivalent
- **** Undergraduate = Bachelor of nursing or equivalent
- *****Postgraduate = Master of nursing, sub-specialty or equivalent

Table 6.4: Participant profile by experience in health service and EMS

No. of year	Experience in Health Service (Year)	Experience in Emergency Medical Service (Year)
0 to 5	7	8
6 to 10	5	10
11 to 15	4	1
more than 15	4	1
Total	20	20

6.3 Perceptions about road traffic injuries

The participants willingly discussed their views. Some prompts were given only when they started to discuss other subjects. Some probes were asked to follow up on issues. When questioned about the factors which they believed to be associated with road traffic injuries and how these injuries could be prevented, a number of common themes emerged. These themes are discussed in detail

below and summarised in Tables 6.5 and 6.6. Patterns of similarities and differences between different personnel groups are also investigated.

Table 6.5: Perceptions of KK Province EMS staff regarding road traffic injuries

	Themes	Relevant issues
Factors associated with road traffic injuries	Involvement of alcohol is a major factor in road traffic injury	Severe injuries Unlawful behaviours Bigger problem during festival and night times Motorcycle use
	Bad road conditions contribute to road injuries	Types of roads and roads use Road lighting and road surface Road works
	Poor road safety awareness of public	Poor road safety education Personal and public safety
	Poor law enforcement	Inadequate resource and policing
	Young people are commonly involved	Risk taking behaviour Skill and maturity Motorcycles and speeding
Suggested solutions to reduce the road traffic injuries	Better law enforcement	More restrictions in alcohol consumption Better patrolling and policing of alcohol problem
	Promotion, education and better public awareness	Practical and tangible education campaigns at school age level
	Greater involvement of community, local and national governing bodies involvement	Managerial involvement Local authorities involvement
	Improved road conditions	Traffic (civil) engineering Road work control Improved vehicle registration inspection

6.3.1 Emerging themes regarding factors associated with road traffic injuries

A number of common perceptions emerged from the interview responses about factors associated with road traffic injuries. Most of these were related to the experiences of the EMS personnel in their day-to-day work where they had witnessed the direct and indirect causes of road traffic

injuries. Many of the factors perceived by the interview participants were interconnected with and related to other factors. The key factors which emerged were the involvement of alcohol, bad condition of the road, poor risk awareness, inadequate law enforcement, and young road users.

6.3.1.1 Alcohol: a factor in road traffic injury

Most participants identified involvement of alcohol as a factor in road traffic injuries, often in association with other factors such as young road users and festival time. Alcohol was discussed first, and usually another statement followed about other contributing factors.

Alcohol was considered to be one of the most common factors involved in road traffic injuries and was perceived to be associated with both two and four wheeler vehicles by EMS personnel. For example, some of the EMS personnel said:

Most of the accidents are about drink driving. (EMT14)

In our community, most are alcohol related. (FR20)

Mostly found alcohol related cases for both motorcycle and passenger cars. (FR19)

...the driver himself is not in a condition to use the road. He drank and had not enough sleep, used no protective equipment and used an unqualified vehicle. These will affect the patients... (NU12)

Alcohol is also seen to be associated with the more severe injuries witnessed by EMS personnel. Alcohol consumption was perceived to lead to unlawful and risk-taking behaviours such as speeding which would cause injuries of greater vehicle impact and more severe trauma. For example, a nurse who was working as a middle-level manager and had more than ten years experience in ER commented about alcohol consumption:

It's clear that alcohol has a huge influence. A bit of alcohol can cause troubled behaviour. They (teens) could speed up to 130 km/hour on their bikes without any fear under the influence of alcohol. (NU02)

Some other nurses said:

We thus have a lot of teenage students and these people are at risk....especially when they drink and drive or ride. That will make the RTI outcome more severe than it is supposed to be. We often see this group of patients... (NU05)

We found more injury cases over the weekend. And, of course, most of them are alcohol related.... The cases presented at ER are more severe at night. The same as in those referral cases from outside the municipal area. (NU09)

Other EMS personnel commented that alcohol consumption was also associated with a large number of less severe injuries such as motorcycle overturns. For example:

However, what is normally found in this community are overturned motorcycle related cases with alcohol involvement. (FR13)

It's motorcycles overturning. Most of them are drunk and overturn. (FR18)

Alcohol involvement was also seen to be associated with traffic law violations and greater injury.

EMTs describe the influence of alcohol as follows:

Human behaviour...Drink driving, speeding and no protective equipment used. I used to see teen riders without a driver's license. They presented with alcoholic smell, no rider/driver licence and no helmet worn... (NU02).

I think... the first thing in my mind is drink driving and then followed by disobeying the laws such as driving against the lane or making a u-turn without signalling... (EMT15)

Alcohol consumption is also directly related to other factors seen by participants as contributing to injuries. Many participants talked about injuries occurring in festival periods, at night time or on weekends. In nearly all comments by EMS personnel these factors are associated with alcohol consumption. Comments by EMS personnel included:

Teenagers and festivals... After drinking they won't be able to control themselves. I think that 70-90% of the cases that I used to see were under the influence of alcohol.

Most occur during 6.30-9.00 pm and then 2-3 am. But I don't know their alcohol level, just the smell. Most severe cases were those alcohol related injuries. (EM T15)

Number of RTI is increasing during festivals. However, what is normally found in this community are overturned motorcycle related cases with alcohol involvement. (FR12)

I think RTI is a driver's issue. Drink or drunk driving cases are found at night. The day time cases are those acute illnesses, the accidents are the minor injuries...Teenagers, alcohol and party. They are those living outside the city. (FR07)

In addition to the clear perception of EMS staff that alcohol is a key contributor to road injuries, local road conditions, as described below, were also seen as a factor.

6.3.1.2 Local road conditions

Road conditions were seen by EMS personnel as significantly contributing to the occurrence of road injuries and the injury rate. Physical environment, road planning and road environment in particular, were identified by most of the EMS personnel as some of the common factors contributing to RTI. General comments by EMS staff about the physical environment include:

Physical environment is incorrect. (NU04)

Vehicle and person and also road or physical environment on the road...construction site, all can cause injuries. (FR06)

Poor design and planning of roads was blamed for increasing the risk of having an injury. One of the nurses described an example of bad design:

We used to have double carriageways without refuges or bridges in front of our hospital. There was no traffic light or road light at all. But after we mapped out the collision points and fixed them with the assistance of an engineering team, things've got better. (NU02)

The FRs who live and work within rural communities explained that injuries occur on particular road intersections and sections in local villages. They were asked to clearly identify certain risk areas such as:

We know that this curve is very dangerous. The accidents always occur at this curve, particularly in the rainy season... (FR19)

At the intersection, motorcyclists are trying to cross the main road. They don't want to go to the u-turn which is far away from that. Most of these are villagers. (FR17)

It's quite severe injury when it happens on the main road. Perhaps, because of the speed they used. (EMT14)

Inadequate lighting at night time was seen as contributing to a number of road injuries. Some participants comment that:

Some places are too dark. Some places have no traffic light. These are all related to RTI. (NU04)

There's inadequate lighting at night. Injuries happen again and again at the same area. (FR20)

Road surface is seen as another contributing factor involved in RTI in this area. One of the EMTs describes the road surface and explained how it affects motorcycle users in particular. He explained:

Unqualified roads and lack of city planning create problems. Build then use then rebuild and use....use then fix. This creates a rough paved surface. Many of the motorcycle related injuries occur here. Many of these were vehicle overturns ...The road surface is not in a good condition they do not really meet the standard, especially those that belong to LAO responsibility. (EMT01)

A FR also perceives that road condition and surface can cause RTI at a community level, particularly in villages. One of the EMS workers said:

What I found was road quality and road surface, especially at the entrance of the village. Lots of holes...we often pick them from there. We get patients from that area quite often. (FR18)

Road work was mentioned many times during the interview process. Many participants stated that improper signage at road construction sites can contribute to the RTI problem.

Two nurses believed that the construction sites and objects left behind unsecured on the road contributed to injuries. They explained:

...construction safety signs. We lost one of our staff after his collision with a left-behind pipeline at the construction site with no safety sign. It's because it was dark and there were no safety signs around that area. (NU02)

During the (road) construction period, there were a lot of problems including traffic jams and road injuries occurred in the areas close to the construction sites. There was no or unclear safety sign seen in that area. Well, their staff (construction employers and employees) didn't pay much attention to the construction site safety signs. Their employee was one of the victims... They (construction companies) must have a safety plan for the construction site safety. (NU05)

Although the construction site safety signs were posted, there were not put in the right places. The EMTs commented about such situations:

The construction site doesn't have construction safety signs... sometimes has, but too close to the site. (EMT14)

Unclear traffic safety signs for construction sites. What I have seen, they just put things beside the site. (EMT10)

Information from grass-roots level about poor road conditions sent to the authorities is believed by some participants to be ignored by the authorities. A number of participants commented that information about RTI-associated problems that they had reported or complained about was not actually taken up by the bodies involved. For example:

We (EMS) gave them (road safety stakeholders) information and feedback. It seems to be ignored by those other stakeholders in the road safety area. (NU16)

For the road surface and holes on the road, we have been complaining to our local government for many times and it's not been fixed yet... Road condition correction can be done by the local responsible body. But we have been complaining about it many times. It seems to be ignored. (FR06)

I see that they're mapping out the injury sites. So far, I have not seen them (injury prevention staff) use those data to correct those injury sites... They have to look at it in detail and look for the causes of each injury. (EMT08)

6.3.1.3 Awareness of road traffic injury risk

Lack of awareness of risk and poor safety education was another theme. The medical doctor who had worked in injury prevention and control for some decades believed that human behaviour is the starting point of RTI. He said:

The human being accounts for 90-100% of the factors, both direct and indirect related to RTI. Bad vehicle, bad road and bad environment factors are created by humans. People are the origin. They ignore road safety issues. They don't change their brake light. They don't design the road for safety issues. They don't replace or repaint road traffic lights and signs. (DI13)

Lack of safety awareness was perceived as one of the factors that impacts on the road user. The nurses perceived that people in general have poor safety awareness. They noted:

People don't think that their and their family safety comes first. (NU02)

I believe that 90% of RTI is derived from human error. If they have a sense of awareness, injuries won't happen. (NU16)

People don't have a sense of safety awareness. They keep driving while they are under the influence of alcohol....drunk, lack of awareness, disregarding the traffic laws... they aren't really concerned about injuries. (NU04)

Some of the EMTs stated:

The other important thing that came to my mind is human behaviour. (EMT01)

Lack of safety awareness, being unfamiliar with the road and speeding, and alcohol related... If a person himself is not in a proper condition to drive or ride (they're drunk or lack awareness), the injury will happen no matter what the road or vehicle condition is. (EMT03)

Lack of safety awareness was perceived to also cause public safety problems. One of the EMTs talked about the risky behaviour of the motorcycle users, while they are attempting to turn without giving a signal. He said:

People here don't think about the others. They turn left or right when they want to turn without using signals. Motorcycles are the main problem. (EMT08)

Another nurse mentioned construction safety issues. She added:

Well, their staff (construction employers and employees) didn't pay much attention on the signpost for construction site safety. There was no or unclear safety sign seen in that area. (NU05)

Many participants thought that people will react against the traffic laws and enforcement because they are not really concerned about their safety. Another nurse reflected what people think about the traffic police.

For human stuff, it depends on the person's awareness. Some, who don't have it in mind, may not be happy with the police random checking campaigns whenever they are being checked. (NU12)

One of the FRs thinks that risk-taking behaviour, such as speeding or driving without a license, is a common characteristic of road users in Thailand, and this causes difficulties for road safety campaigners. One of the FRs commented that role models are setting poor examples by promoting alcohol consumption. He notes:

Our role models such as teachers or celebrities are still drinking alcohol and smoking in front of our kids. That makes difficulties for road safety campaigners. (FR19)

Changes in road safety administration are perceived to be a factor affecting road safety strategies aimed at improving awareness of people in the Provinces. The director says:

We now do not have good administration. We practically used to have it, but it faded - - after the first two years of the establishment of the road safety control centre. This

job was assigned to the ex-Deputy Prime Minister. The responsible body was changed after he finished his term. It was handed to the Ministry of Interior (MOI) people. The Ministry of Interior, by chance, has to do this job because they have a Department of Disaster Mitigation... Unfortunately they don't know anything about road safety. The government didn't really pay attention to this problem anymore after it was established. When the government didn't order, these people (Interior) didn't do anything...they didn't know how to do it. They aren't technocrats...Our Provincial injury prevention committees have been changed. The structure and strategy was destroyed. It can be seen from the festivals' campaign conducted last year. Our death rate used to be in the lowest group (of RTI deaths). (DI13)

One of the EMTs also observed that if management saw RTI as a problem, they would pay more attention in order to influence road users. He explained:

I think this is not working well because of the management of the central government. If they really think that injury causes losses for the country, they would do more to solve this problem... (EMT10)

6.3.1.4 Inadequate road safety law enforcement

Comments about lack of law enforcement regarding road safety covered a number of issues. EMS staff perceived that enforcement of laws related to drink driving, helmet use and licensing was not sufficient. There were two main law-related problems perceived to be associated with road safety: inadequate enforcement of the laws and poor policing.

Many EMS personnel commented that traffic laws were commonly broken or ignored and that enforcement methods were not adequate. For example, they mentioned:

Most of the injuries occurred at night. Mostly from disobeying the traffic laws. (EMT08)

I think the laws and law enforcement are not strong enough. What I have seen are many of the younger generation patients, including students and youths, had no driver's licence...That's an issue of inadequate enforcement. (NU04)

The laws and enforcement of the laws were perceived to be not strong enough to control unsafe road-using behaviour. Money and other forms of influence or power were used to influence policing and reducing the intensity of the laws. A number of participants made comments such as:

Local government vehicles should comply with the traffic laws and the police should enforce traffic laws to these people. They (the police) turn a blind eye when they know these people are working for local government, especially, when they park their local government vehicles in the area that is not allowed or if it is a risky area. (NU05)

Their (police's) problem is about enforcing the laws with someone who has more social power and refuses to be arrested in the area. (EMT13)

Imagine, pubs are everywhere, but I hardly see the police patrols around the pubs area, I frequently see them in front of our hospital. (NU05)

There was criticism of the police force itself in enforcing the laws. For example:

I don't think they (police) really do their job. For example, helmet use law...there is no one enforcing it. They seem to ignore it. (NU02)

They resist the police for the helmet safety campaign. They think the police did the enforcement for the money, and do not really enforce the rules (NU02)

The issue of police having problems with resources or ability to act was also mentioned.

We cannot control them (teens' driving behaviour). If we (police patrol) stop or block this route, they will use the other routes. (EMT08)

Moreover, the difficulties with law enforcement were observed by some participants, with the doctor observing that policing of the alcohol-related laws, in particular, is inadequate:

Police is just ok at enforcing the laws... They are actually not good at enforcing all of the transport-related laws and haven't done well on alcohol-related laws. They do better only on the helmet one, the rest are about average. (DI13)

The need for attention to be given to other infringements, such as, driving without a licence or helmet wearing, was also commented on:

They focus more attention on drink driving, but not on driver's licence. (NU04)

Differences between city and rural areas were also noted. The policing in rural areas was perceived to be inadequate to cover the jurisdiction areas needed, so that the opportunity was available for road users to ignore or break the rules.

It seems to me that police don't continue doing their job. Drinkers still drive.... The police cannot patrol every day while the restaurants are open every day. If we do that strict enforcing, we can reduce those drinkers. (EMT14)

The traffic police patrols are available. However, they do not really enforce the traffic laws and cannot cover the entire area. (EMT15)

The police are doing well in some particular areas within the city area. We hardly see them working in outlying areas.... It's good when they're enforcing the laws. (EMT08)

6.3.1.5 Young people

Young people were perceived to be frequently involved in road traffic injuries and often under the influence of alcohol while speeding. The risk of injuries to young people was also seen as being related to the large number of young people attending secondary and tertiary education institutions in the KK area. The number of facilities offering night entertainment, such as pubs and restaurants, has been rapidly increasing to serve the younger generation. EMS workers made the following observations:

We have a lot of education institutions and also night entertainment places in our area. We thus have a lot of teenage students and these people are at risk....especially when they are drunk and drive or ride. That will make the RTI outcome more severe than it is supposed to be. We often see this group of patients. (NU05)

Lots of teenagers presented at ER because we have many educational institutions around here. (EMT08)

Risk-taking behaviour such as speeding, driving without a license and excessive alcohol consumption, was believed by participants to affect the RTI situation. EMS personnel noted:

Teenagers are at risk. Their riding or racing behaviour... They modified their fleet for racing purposes. They (teens) normally have night races over the weekend. (NU09)

Young people and their speeding behaviour. This causes a severe impact. (EMT14)

...Teens' risk-taking behaviour... Disobeying laws, lack of awareness and alcohol-related issues were found in those cases. (FR19)

More severe injuries were often associated with this group.

We know that the more brutal problem is related to teenagers with alcohol at night... Drunken teens are most commonly found in this group. (EMT10)

Teenagers and their speeding behaviour... This causes a severe impact. (EMT14)

Alcohol consumption of young people and the resulting behaviour was perceived to precipitate the chance of having an injury. The participants stated:

We know that the more severe problem is related to teenagers with alcohol at night... Drunken teens are most commonly found in this group. (EMT10)

A bit of alcohol can cause troubled behaviour. They (teens) could speed up to 130 km/hour on their bikes without any fear under the influence of alcohol. I interviewed them and they said that they have to do it. (NU02)

Teenagers have a number of characteristics which place them at risk. Lack of skill in handling situations on the road, including poor judgment, which was increased by risky driving behaviour, was commented on by the personnel. For example:

What I have seen are many younger generation patients including students and youths had no driver's licence. They have poor judgment and lack of skill. (NU04)

I found a girl who had not enough riding experience, had no idea about traffic rules, and poor decision-making. She tried to cross the double carriage ways. She was trying to cross the double carriageways as the villagers were trying to shorten their distance, but she couldn't make it. (FR17)

The use of the motorcycle seems to be one of the problems associated with RTI of young people, in particular, as well as RTI of the general public. Motorcycles are used in KK Province as the prime

means of daily family transportation, including commuting to work and school. Many participants directly refer to motorcycles and the injury associated with the use of unprotected vehicles.

We thus have a lot of teenage students and these people are at risk...especially when they drink and drive or ride. That will make the RTI outcome more severe than it is supposed to be. We often see this group of patients. (NU05)

What is normally found in this community are overturned motorcycles with alcohol involvement. Collision is not significantly important. Teens and their gangs remain the RTI problem in this community. (FR12)

6.3.2 Solutions to the road traffic injury situation

A number of common ideas emerged from the interview responses about solutions to the road traffic injuries. Many of these would have been based on the experiences of the EMS personnel in their day-to-day work. Some of the key solutions which emerged were: better enforcement of traffic related laws, improved RTI risk awareness campaigns, greater involvement of local and national responsible bodies, and improved road conditions. These themes are discussed below.

6.3.2.1 Road safety law enforcement

Law enforcement and legislation in general was seen by most participants to be an effective means by which injuries could be prevented.

... It's good when they (police) are enforcing the laws. (EMT08)

They (users) wear a helmet in the day time. They're wearing it because they are aware of being arrested by police. They are not really caring about their brain. (EMT01)

Enforcement may have big effects on RTI. Although they may not change their attitude, they (people) may be afraid of being arrested or losing money. (NU16)

Random alcohol-testing patrolling remains useful. The EMS personnel observed:

Having traffic police patrols can definitely reduce the number of RTI related cases. (EMT03)

During the festivals...The drink driving campaign or the use of random alcohol breath test may make them more concerned about their behaviour. (NU12)

Better legislation and more tightly enforcing traffic laws was generally perceived as one of the most important activities that could improve the RTI situation. Comments included:

Laws here need to be more strictly enforced. People need to comply with the rules. (EMT01)

Enforcement may have big effects on RTI. Although people may not change their attitude, they may be afraid of being arrested or losing money. (NU16)

However, there was a need to improve the current situation especially with respect to drink-driving and driving without a licence. The nurses put forward the idea of comprehensively enforcing the laws.

The enforcement officers could do better enforcement. Don't let them (riders or drivers with no licence) drive... I want them to pay attention to both of them and consider a continuous program....not only during festivals. (NU04)

It's good to have a drink driving unit patrol. It'll be better if people continue.... They're doing it and set it as a nonstop campaign or policy, not only during festivals, weekends, or some places. ...I want them to do more enforcement, such as to in the public transport area. (NU05)

More specifically, they stressed that improved law enforcement should be applied to drink driving.

For example:

The police have to stand on their feet. Don't have to worry about anything. Drink driving patrol has to be set up within the pubs' area. (DI13)

Although using alcohol has rules and regulations to control it, we need to strictly enforce them. Heavy fines or punishment may make them aware of it... We should have some control over pubs and alcohol stores. (EMT10)

Stricter enforcement of existing traffic laws, including those that cover alcohol consumption, helmet use, and speeding remain the main preventive measures suggested by participants.

They have to really enforce it, things will be ok. What can be seen is they don't wear a helmet at night because there is no police, but they wear it in the day time. (NU02)

Laws need to be strictly enforced. Preventing people from getting drunk will be the solution. We need to prevent our people from using alcohol. (EMT14)

Some of the participants also discussed enforcement of laws by means other than by using enforcement officers. One of the nurses suggests that blood alcohol testing could be undertaken by health personnel at their discretion rather than relying on the presence of police. This could act to deter drink driving.

When there is no police present at the hospital, can we 'health personnel' check their blood alcohol level and pass it to the police? If we can prove it by ourselves, they (intoxicated drivers) will probably be more aware of drinking and driving. (NU09)

6.3.2.2 Education and public awareness programs to change road safety attitudes

Better public awareness of RTI risk was seen as a solution to improve the RTI situation by many participants. RTI education and promotion was seen to be one part of an attitude change program which was necessary to reduce RTI. The EMS personnel generally believed that having a better attitude towards road safety can improve the RTI situation. For example, they noted:

I believe that 90% of RTI is derived from human error. If they have a sense of awareness, injuries won't happen. (NU16)

We should pay attention to normal drivers' and drink drivers' sense of safety awareness. Need to create the sense about drink don't drive. I think it is about road users' attitude... (EMT15)

My team and I used to go to the schools give kids road safety education. It worked. We pointed out the problems of not wearing a helmet and road injuries. The cases that we used to have prior to the lecture being given disappeared. (EMT01)

This safety awareness could be improved in terms of public education and campaigns. Many participants commented that educational programs for school-aged children would be preferred.

This sort of public education program was believed to be more effective by influencing children at a young age:

We have to start promoting safety awareness at school level. It should start before they can get a driver's licence. Let them know the effect of RTI. We need to educate our people when they are very young. We must let them know how serious is the problem, what the effects are, and how these can affect families and a community. (EMT14)

Campaigns used are at the end of the river, not the beginning..... We then educate them, change our next generation's attitude on RTI from the time they are children. Attention should be paid more to education rather than campaigning. (NU09)

We should give them a new attitude towards drink and drive. It should start when they are children. The campaign being used now is okay although it doesn't hit the point. We should probably add it into primary school level. (EMT15)

Education programs with more emphasis on the consequences of road injuries were perceived to be effective by EMS personnel as they created a more realistic sense of awareness. The EMS personnel supported this from their experiences by comments such as:

Study tours for primary and high school students worked very well. Let them see the reality, the patient suffered from injuries. That built up their sense of awareness (NU04)

We have to know what they want or what they need and add them into the educational system. I may create a self-discipline lesson or a role model for them.... Give it to them when they are children. This may take 20 years but it'll work. For adults, we can just temporarily change them, but not the kids. (NU09)

6.3.2.3 Greater involvement of stakeholders

To improve the RTI problem, participation from various road safety stakeholders was believed to be an important strategy. Many EMS staff perceived that these organisations needed to take more action. For instance, they observed:

If they really think that injury causes losses for the country, they will do more to solve this problem. Many stakeholders should pay more attention to this problem and work as a team. Police, health and other stakeholders are important. These people have to

take part in it. Seminars may need to be held at different levels from students to community leaders. (EMT10)

A multisectoral approach is needed. We have to make an understanding, see the same problem and be proactive on this problem.... Let them know what will be the result of alcohol intoxication. We should build their sense of safety awareness up. (EMT14)

An integration of multiple organisations including a Department of Mitigation and our local government by having our governor as a chair has improved road safety results... Enforcement, engineering, education and EMS all participated. We, community EMS, can help the patient just in time, which is different from the past. It reduces complications from unskillful bystanders who assist. (NU12)

Attention paid by those in a management role was perceived as a requirement; managerial involvement was seen as a key factor to bring stakeholders together. For example, the director noted:

A Secretariat team (road traffic prevention and control) is important since the leader is often changed. These people remain in the Province. The strength of this team is very important. They have to have strong will, knowledge, and communication skills to coordinate with the other stakeholders to bring them together. (DI13)

From the perspectives of EMS personnel, local involvement is very important. Local ambassadors and authorities have a huge influence on local people and communities. Many things are possible when conducted through local or community networks. The EMS personnel noted:

Generally, I think we have to start with community. We are closed. Let these health volunteers look after community. (FR06)

Teenagers' stuff needs to go through the heads of the village and then parents. If the parents don't know that their kids are having a problem, they won't do anything. Make it a community thing. (FR12)

Road safety worked well last festival because a letter from the district office was sent telling the heads of villages and family to look after their subordinates. (FR19)

Some more specific suggestions were made. For example:

Campaigning or promoting by using broadcasting tower in community. Head of the village should do this role. He'll be the most suitable person to do this role. (FR12)

Using local role models may be another choice, local seniors or Buddhist monks. Strengthening at family level may help. Generation to generation attitude change. (NU09)

Personally, I want the parents to ensure that their kids are good enough to use their bikes, particularly those who want to cross the main road. (FR17)

6.3.2.4 Improvement of road conditions

Upkeep of road maintenance was a matter of concern for many EMS staff. Modification and maintenance were seen as a key to improve these. Comments on the quality of roads include:

Road condition has been improved from the past but it still needs to be upgraded. You may see substandard roads in the community. They will not last that long. They need to build roads that meet the standard. (NU11)

Road quality has to be improved. On the main road, the surface has to be smoothed, limit speed use and lighting. However, this may be impossible since it may use a lot of the budget. (EMT14)

What I have seen working is the modification at one of the junctions. After setting up the traffic light, those things have been improved. (EMT08)

Construction site safety also needs to be strictly controlled. Safety planning and clearer signposts were seen to be important. The EMS personnel noted:

They (construction companies) must have a plan for the construction site safety. (NU05)

The construction site needs to have clearer safety signs. The road condition where it has a rough surface needs to be improved. (EMT10)

6.4 Perceptions about emergency medical services

This section describes the perceptions of EMS employees which relate to provision of emergency medical services in KK Province. When questioned about the factors which they believed could affect the outcomes of EMS patients and how these patient outcomes could be improved, a number

of themes emerged. These themes are discussed in detail below and summarised in Table 6.6. Patterns of similarities and differences between different personnel groups are also investigated.

Table 6.6: Perceptions of KK Province EMS staff regarding emergency medical services

	Themes	Relevant issues
Factors which affect outcomes of EMS patients in KK Province	Communication problems	Poor public awareness and cooperation EMS communication process problems
	Performance of EMS unit	Inadequate training Unprofessional behaviour Shared facilities Equipment support and maintenance
	Unsatisfactory job conditions (lack of motivation)	Lack of financial motivation Professional development Hazardous working environment
	Administration and management issues	Direction/leadership Cooperation Quality control
Suggestions to improve emergency medical services	Improved performance	Improved training and professional development for EMS personnel Improvement of resources for EMS units
	Improved management	Better direction from a single leading organization with local supports Improved assessment of service/quality control Closer links between workers and Administration
	Better work conditions	Local network involvement Better financial support Recognition from colleagues
	Improved communication	Increase public awareness Improvement of EMS communication system

6.4.1 Factors which affect outcomes of EMS patients in KK Province

A number of common perceptions emerged from the interview responses about the factors which affect outcomes of EMS patients. Most of these were related to the experiences of the EMS personnel in their employment where they had observed the operation of the units and the problems

arising in their workplace. Matters contributing to EMS patient outcome, which were perceived as important by the participants, included issues such as public awareness and cooperation, performance of EMS units, working conditions of the EMS staff and administration problems.

6.4.1.1 Communication problems

There were two main problems discussed by EMS personnel regarding communication and road traffic injury procedures which affected EMS patient outcome. One was awareness, attitude and cooperation of members of the public from the initial stage of contact at the EMS Command and Control Centre (CCC) to the transfer of trauma patients to a hospital. The other problems related to the functions of the EMS communication system which included call-taking processes and dispatching, and channelling of calls while units were en route to the injury site and a hospital.

6.4.1.1.1 Poor public awareness and cooperation

Most of the participants identified poor public awareness of, and cooperation with, EM service operation as one of the main factors affecting patient outcomes. Poor public awareness and lack of knowledge about the functioning of the EM Services was seen as a major problem. There was a lack of basic knowledge about what to do in an emergency such as how to seek assistance from the emergency number, 1669. Knowledge to recognise critical medical and warning conditions was perceived to be unavailable to the public in general and, in particular, to people in high risk groups for emergency medical conditions. For example, EMS personnel said:

The info from caller is incomplete and sometimes not true. I once had a call out telling us that we have to get a fatigued patient. When we got there it was a patient in shock who was unconscious. I had to change my treatment plan and had to consult. If we got the right information, we should have sent our advanced team out. The information received affects our decisions and the patient outcome. (EMT08)

People don't know how to report or make a call. Therefore, we cannot identify how bad the situation is. (EMT01)

The callers don't know the patients. They saw someone on the floor, they didn't know what it is, didn't know patient's symptoms. Mostly those are bystanders. If they (the callers) are relatives, these relatives know nothing about their patient. They cannot tell how bad the patient is. (FR06)

EMS personnel believed that the quality of information received from the callers, who have only some degree of accurate information about the patient, can cause service provision problems such as sending an inappropriate response team. They commented:

The callers who have no medical background may not be able to report the real thing. They don't know anything about it. A severe case can be a non-urgent one and a non-urgent can also be fatal... (NU09)

Relatives sometimes have no information about the patient. They sometime could not assess the patient. Their unconsciousness and medical unconsciousness are different. They don't know how to medically describe it. (EMT03)

People (villagers) don't really know about how to make a call to the system. Although we asked or informed them, they aren't really concerned about name, address and patient's condition. It can be worse or better. They have to know their patient first. (NU09)

The callers gave us incomplete information. For example, I just drove pass the scene, have no idea about it, don't know their conditions. If the patients need advanced care and we sent an FR unit out, that will affect patients' outcomes. (EMT15)

The information from the caller is sometimes unclear. This being unclear makes us spend more time to find the scene. If they can come out and get us, they will probably get good care. (FR07)

Not only the callers were perceived to be giving incomplete information, but comments were also made about the call-taker and dispatcher's skill in obtaining the most effective information out of the frightened callers. As the EMS personnel commented:

The caller and the call-taker or dispatcher. The call-taker asked the caller about a patient. If the caller has no idea about it or gives inadequate info, it will affect response time and level of care provided. This problem is sometimes created by the dispatcher. (EMT03)

The call-taker is also part of this problem. (NU09)

Info from callers affects our quality of care and level of response. The info may be incomplete since they (callers) are panicking. They informed CCC that a patient was in shock whereas in reality the patient had just fainted. (NU11)

Communication can cause problems. If we didn't get proper information, we need to check with or reassure the team or give them feedback. (NU16)

Lack of knowledge regarding the purpose and functioning of the EMS was perceived by many staff to adversely affect patient outcome. Although the KK EMS Provincial office aims to make the service available and more accessible to the people in high-risk groups, the EMS staff see problems with this accessibility. There was a perception that the service is being used for inappropriate or minor trauma which creates an inappropriate use of the service. They noted:

People don't think about real emergency. They came to EMS because they don't have to pay for the service or hiring a vehicle to transport. These cases could come again in the morning as other out patients... How can we reduce those unneeded cases? We gave them free services at first, we then had to get them to pay. No one wants to pay, if he or she used to pay nothing. (NU16)

We let them give services to every case. This made our people realize that if they call us, they will get it and the EMS unit will get financial incentives. (NU04)

EMS personnel also believed there was a lack of cooperation from the public while EMS units were on the road. Road users were not stopping or moving over to allow ambulance units to travel quickly to injury sites. EMS staff were also crowded at injury sites by the public hindering their ability to work. Due to their lack of knowledge about EMS trauma care processes, bystanders and relatives interfered with EMS work. For example, comments made by EMS personnel included:

They (road users) don't care or sometimes ignore and don't give us space to overtake them. They (people) don't recognize our siren and light... Police hardly help us unless we ask for help to clear our route to hospital. (EMT01)

They don't understand what we're doing or our treatment plan. They always rush us. Never give us chances to do a primary survey. They want us to -- just load and go,

particularly the severe ones. In case of those who used EMS before they may tell the others about letting us do our job. (EMT08)

It's ok while we do the practice. In reality, we cannot control any of them. At the Kud Kwang mass casualty even, hospital ambulance got 6-7 walking patients while the volunteers' ambulance was loaded with 4-5 mixed conscious and unconscious patients. What would happen to them? They may take that rescue role to help us and we take our life saving roles. (EMT14)

FRs, talking about their experiences at the scene, said:

Bystanders always rush us. They don't want us to do anything. They want us to just send the patient to the hospital. If we don't do anything and the patient is going to be disabled, we then will be blamed...We tried several times to explain our processes. Most of them didn't listen to us. Although the patient can talk and is fully conscious, they still rush us. (FR19)

The villagers don't understand us. They just want us to get the patient to the hospital as soon as possible... They keep pushing us, especially the injury case. We then have to load him up and give first aid on the car. For someone who knows about us, he will not touch us and will explain to the rest. (FR20)

Bystanders help the patient by carrying his four limbs. We told them not to do it. They should have waited for us to see the patient before doing that. (FR07)

The doctor perceived that this lack of co-operation stems from a widespread ignorance about the EMS and how it operates. He mentioned:

We have had less cooperation from our people. I can say that there is no hand offered while we are on the road or at the scene. No one give us space for the ambulance... There are a lot of people out there who don't know about this. I believe that there will be a lot of people who do not know 1669, in particular those in the Provinces without EMS development. (DI13)

6.4.1.1.2 EMS communication process problem

Processes in internal communication were also seen by the respondents to be causing problems. The two main issues regarding internal communication processes were associated with the call-taking process and the communication devices being used.

Many of the comments concerned the use of FR units as local operators. The lack of communication skills of the FR personnel was seen to be a contributing factor to poor information being received about the victims and at the CCC. They noted:

It happens because they gave their number to villagers not ours...when the villagers call them and then they tell us. We don't know what really happened to the patients. (EMT15)

They may lack proper communication skills.... (NU05)

Volunteers or FRs couldn't assess patients. They thus don't know when they have to call for help. (EMT15)

While the more experienced EMS personnel saw FRs as lacking in skill, the FRs themselves perceived that the communication between the CCC and the units is also part of the problem. Some FRs observed:

We couldn't get clear information... Communication system problem... Speaking too fast. Unclear messages... What we need is his/her (victim's) contact number. We know our area best. Telling us his/her address by name is more helpful than telling us a number. (FR18)

Communication between CCC and our team sometimes has a misunderstanding. CCC didn't give us proper detail... (FR12)

Apart from the processes mentioned above, technical issues regarding communication processes were also perceived to add to inefficiencies and connection related problems. This issue was mentioned by the participants.

I myself used to have a very bad experience with it. I spent half an hour dialling 1669, and couldn't connect. (NU04)

The other thing that I found more often is being unable to connect CCC. (NU11)

This issue is also involved in the communication between the dispatcher and the units. Problems are related to the resources of units, especially community units, since they are sometimes limited by the capacity of the devices and their communication skills.

Communication system is ok here (KKRH). We so far can cover every single telephone or radio frequency...The communication equipment at CCC is excellent compared to those at community level. They couldn't send info to us. We may need to improve those community communication systems. (NU09)

The caller asked for advanced level of care but we sent the FR unit for sizing up the scene instead. If we sent the advanced level out and communicate with CCC or we sent an advanced unit out to see the first unit at the middle of the way, the result would have been better. (NU05)

Community units are sometimes acting like CCC. They receive a call, dispatch by themselves, ask for response number, give first aid and transport patients to hospital. They may or may not be able to contact us at first because of the technological insufficiency or whatever. Community units usually lose connection while they are on the way... They sometimes just load the victim on their modified ambulance and transport them to hospitals without giving any medical care...We have difficulty in contacting them while they are en route via 1669 or their car radio. Their radio cannot reach us... (EMT15)

6.4.1.2 Performance of EMS Units

Inadequate human and EMS resources in KK Province were other important factors mentioned by participants as contributing to the outcome of EMS patients. The existing human resources were often perceived as inadequate because personnel, particularly FRs, were not properly trained and recruitment processes were problematic. Available equipment and maintenance of equipment was also perceived as insufficient.

For example, general comments about the lack of professional human resources included:

The problem is about quality of staff ... (FR12)

We don't have enough human resources in the system. (EMT01)

We have a lot of difference in EMS providers... there is a wide range of quality in each level of care because we are at the beginning stage. Have to accept that the incident happens in different places and will receive different services according to local diversity. It's not reaching a stage of having uniformity... The hospital unit that we think is the best in our existing system still has heaps of things to be improved. Although we have many staff, we cannot send our physician out in every severe case. (DI13)

We, principally, don't have professional paramedics who can look after their area themselves. We're using physicians and nurses to do that for them. (DI13)

6.4.1.2.1 Inadequate training

Although the aim of the new FR units available in the community is to increase public accessibility to EMS, the quality of the units was seen by EMS staff in general as lacking because of insufficient training or qualifications of personnel.

FR level people cannot do the right things for their patients. It's because they had only a two day training course. They rarely give us details of how the injury happened or what they found over at the scene. (EMT01)

FR units were perceived to have considerable problems with quality of clinical care as EMS providers. Many of the participants commented on the fact that FRs did not have adequate training to properly assess the patients. This criticism was shown by staff in all personnel roles including people employed as FRs themselves. For example, comments by nurses include:

It's great to have their (community) participation. However, improving their performance, particularly in clinical care, to be more professional remains a big problem. (NU09)

I think FRs are new to the EMS system. They cannot properly assess their patient. They received only some hours training. Trauma care is ok for them because they can see a wound. But they cannot recognize advanced level care need cases. They couldn't recognize confused or arrested cases. (NU05)

There were only some of those advanced cases brought in by FRs which didn't receive proper care... They may not know or not recognize that advanced care was needed. (NU02)

An EM Technician said:

We trained them in a very short period to have them all in the community. They may not get all out of it...When they are in the emergency situation, they may not want to take that risk (patient). If we have plenty of unqualified EMS units, they will be fruitless. What I saw when I received the patient from them at the middle of the way was there was nothing done to the patient, no collar support and no bleeding control. (EMT14)

People employed in an FR role were also able to identify problems with the quality of their own level of care such as:

Our knowledge is not enough. We want to have more including about equipment used here. (FR18)

I think we're ok with minor injury. We can do splinting. But, in a seizure case, we have no idea how to handle it, especially when CCC told us to go to check the case. (FR19)

I cannot tell about those FRs. It depends. Some are good, some are not. (FR07)

The performance of the trained FRs was also perceived by some participants to be associated with a poor recruitment process. These participants thought that:

Recruitment is important. Backgrounds of these pioneers are important. These ones (EMT) may not think about their future when compared to their juniors. I think this pioneer group should have more idea about their future. (NU16)

Some of the selected or accidentally volunteered LAO people couldn't even read or write. (EMT14)

6.4.1.2.2 Unprofessional behaviour

Unprofessional behaviour of some EMS personnel was also noted by some participants. Behaviour such as lack of ability to deal with the situation, lack of professionalism and improper dress code were seen to affect EMS outcomes.

They (volunteers and FRs) are itinerant staff. It's a fashion for these people... The new ones get in and work without training. We know because they wore the ex-staff's

uniform... They need to have ID card with their photos with them (FR)... Moreover, they may have to dress properly to show how professional they are. That well-dressed thing may increase value in them. (NU16)

I can say that, for example, there are only two of the volunteers who were trained a couple of years ago left in the team, the rest are new untrained faces.... I think these guys were taught by using their word of mouth. We don't know anything about what they were taught and have no one to oversee them at the scene and have no refresher course for them... Some of them never meet the criteria. They hardly wear a uniform, wearing thongs and shorts. They barely have format information for giving us patient information. They're doing as those volunteers. We used to fix it, but it will get back to the same problem soon. (NU04)

FRs were considered to be similar to the volunteers and so were viewed poorly as a result of ill-mannered behaviour of the volunteers in the past. The previous volunteers were not officially trained and had no systemic control and support. Confidence and trust in the ability of these people was poor, as the participants said:

We cannot control them (volunteer units). We work with them (one of the foundations) who were established earlier than us. Educated people don't want to get on their (volunteer) vehicles. They could even send the patient directly without telling us. (EMT14)

They (people) don't trust us, in particular those volunteers. The volunteers have created many negative issues ever since. (EMT01)

Discussion about lack of professional conduct by the FRs and volunteers included:

However, I later found that there were a lot of non-urgent cases that came to our ER with the community EMS system. (NU16)

I think if they were trained, they should have done something with the patients. So far I haven't seen any of them do what they have to do for the patients who need emergency care at their level. They may not be able to do it in the real situation... They couldn't assess patients. (NU04)

Some EMS personnel talked about the motivation behind EMS work. Comments were made about encouragement of local leaders to operate the service because of political motivation and also misuse of the service by community units for non-urgent cases to gain financial benefit.

Establishing EMS in communities and the funding provided from the government also benefits local leaders. The resulting political leverage was mentioned by some of the participants:

To set up an EMS unit in community we need to talk to the head of LAOs... He'll be happy to do that because he'll get support from the villagers in his next election. The villagers will love him because he set this up for them. (NU02)

It's also about a favour that the head of LAO will receive from the villagers after having this sort of services. He may get elected next term if he does it (managing EMS) well. (EMT14)

Comments made by the respondents about use of the EMS for non-urgent cases were also common.

For example:

They (FR units) always think about the financial incentive received from the system. If we think about increasing accessibility by sending the community EMS out, but cannot do anything to the patients, that won't work and won't differ from transport by their relatives... They took part in because of the policy or an order made from central. They didn't expect to go out there providing medical care. They did it as a result of financial incentive. This is what I heard from their instructors... We now pay for it (EMS), LAOs don't care about it. They want that financial incentive. (EMT14)

Community units sometimes pay more attention to financial incentive rather than patient condition. (EMT08)

6.4.1.2.3 Shared facilities

The pre-hospital EMS system in KK Province is required to share facilities with other local health organisations. Although the shared or tiered resource model is designed to assist provision of existing EMS, this strategy was perceived to affect EMS patient outcomes.

Adverse effects such as delay of service delivery were discussed. Both hospital and community based EMS units were delayed while waiting for the EMS crew to assemble.

We now are separated into two groups. The drivers belong to central management and we are attached to ER. We should control our team...it shouldn't be a shared system. For basic cases, we have to wait for each other. For the advanced case, they (ER) sometimes don't have a designated nurse or doctor to come with us. We hence have to wait for them to decide. We have no clear cut plan. (EMT10)

Readiness of the team may delay our response. We have drivers on EMS duty. However, these people have to do other jobs as well. (EMT08)

Some of the participants commented specifically on the availability of community units. This was because community units were not only working in their EMS roles, but were also being used in other LAO jobs. Comments about service provision interruption in community units due to shared facilities include:

The vehicle that FR unit used sometimes was being using in another local government job. We may need to call the near unit out instead. (EMT 08)

... The unit located in the rural community may not be ready or may be delayed for service since they may have to play many roles. This problem is solved by using the unit next door. (NU09)

Because we do not stand by at the ambulance, we sometimes are at our staff room which normally takes a few minutes to get to the ambu. (FR07)

Shared staff resources were also seen to affect quality of EMS performance. The use of staff resources from partner departments could have an effect not only on the department's performance, but also on the partner department's staff resources. Some of the comments about adequacy of staff are shown below.

Our EMT won't be able to handle those severe cases as well. We now have no real EMS professionals to look after their own professionals. We're now using trained nurses called paramedic nurses who have their own regular duty at ER. These nurses are coincidentally registered in the system... (DI13)

In advanced cases, they use our nurse in ER. Even though we are busy, we give them priority. We can manage our ER workload. (NU05)

6.4.1.2.4 Insufficient equipment and resources

Inadequate resource allocation was another area commented on by EMS workers. Both inadequate maintenance of medical equipment and lack of it, including EMS fleets, were seen as factors influencing EMS patient outcomes. Insufficient human resources in the system were seen to affect the provision of care including quality of care, equity and accessibility.

Inadequacy of available EMS equipment in various levels of care was commented on by many of the EMS personnel. Participants talked about poor equipment support and maintenance in both hospital and community based EMS units.

We lack equipment and knowledge use here. We want to have the same standard here. We want to have the same standard ambulance as those hospital level units have. We don't really know how to use and maintain them but we can share resources with the hospitals. (FR20)

Insufficient resources of community EMS may impede them to do their job. They didn't do anything to the patient. (EMT14)

For example, some of the participants complained about insufficient equipment available at the hospital level.

Equipment used is not qualified. We want to get the best out of it, but the equipment is under standard. (EMT01)

Many problems found originated from lack of equipment on board. You cannot go without an ECG monitor. They need to be well-prepared. (NU16)

They (community EMS unit) had only once support for their equipment for the services. They have been using what they get and no replacement. This is inadequate. (NU04)

Maintenance of available resources was another problem worrying EMS personnel. Many problems with equipment maintenance were mentioned:

Equipment is another problem. The ambulance is not ready; AED's battery is dead and running out of medical supplies. (EMT03)

Equipment used has created some errors. The blood pressure measuring thing on board has a problem. It doesn't work very well. It was ok while we're en route but when we measure by the one at our ER, the patient's blood pressure had dropped. The defibrillator's battery also has problems. It cannot keep or hold power. It sometimes doesn't work when we need it. Spinal board has to be removed from the patient in order to get it back in the ambulance. We used to have a complaint from an orthopedist about this changing spinal or long board. By the way, we have to use it. (EMT14)

Equipment used here is not qualified. It now needs to be fixed. It takes a very long time to get it fixed. The stretcher being used today cannot be adjusted. It's not good for our health and safety, especially when we have to carry a patient who weighs more than 100 Kgs from the second floor. If it's adjustable, we could adjust it to be a chair stretcher and come down by using the lift. (EMT08)

Comments on insufficient and poorly maintained resources were also made by EMS staff:

We're running out of equipment to use. (EMT10)

We sometimes cannot turn the siren on because its noise disturbs people. It's ok for not turning it on when we have a non-urgent patient. It's not ok for those emergency cases. If we can turn it on and lower the noise down for every single case, that's better. (EMT08)

Staff and equipment are not ready. We're running out of equipment used such as splints and long boards. If we have double incidents, we won't be able to handle the second. We need to adapt local material to use. We use plywood as a material for making splints and long boards. (FR06)

Urban and rural differences were also observed to affect availability and distribution of EMS resources:

We know the difference between low and high technology, accessibility between urban and rural area, and between developing and underdeveloped province. (DI13)

We have different contexts. Each community has a different interest. As long as their heads see how important EMS is, they will support it... It remains difficult to create equity here. The smaller LAO may not have enough budget to spend on EMS. If we want to have the same standard for the entire Province, it'd be a Provincial level task. (EMT01)

EMS personnel perceive that differences in context could affect the management of the service provided. The size of the local government body was seen to affect the delivery of service:

I want to have a new fleet. Our car is small and doesn't have enough equipment. We are the smallest level of LAOs. It's difficult for us to have them on board. (FR20)

We're in the lowest level of LAO. We may not be able to have a standardized ambulance like those bigger LAOs. (FR19)

6.4.1.3 Unsatisfactory job conditions

Many of the responses given by the EMS personnel to the question about factors affecting EMS patient outcomes were about staff job satisfaction and motivation. These issues were believed by EMS personnel to affect their attitude to work (which then had influence on patient outcomes) and covered three main areas. These included financial motivation, professional development and working environment.

6.4.1.3.1 Lack of financial motivation

Unsatisfactory financial support was perceived by the EMS personnel to affect EMS performance and two major concerns regarding monetary motivation were raised. These concerns were that staff were not paid enough for their work as employees with EMS and the hours of work were not adequate. For example, an FR said:

Financial incentive is a problem. When we transport the patient here, we (staff) never get financial incentives. It (incentive) sometimes is delayed. We hence have nothing to spend on equipment and supplies. This also affects our motivation to work. We now get 100 Baht per shift (12 hour shift). If we get good pay, we'll have more motivation to work. (FR06)

Inadequate financial support was seen as a reason to forcing EMS personnel to work extra hours, often in other employment. This meant that people had to have at least two jobs to make enough income, and were therefore not performing properly on the EMS night shift. Some personnel explained:

We, ourselves, are now working without motivation. We have to work in ER because we have no choice. If we have no overtime payment, we won't be able to survive. Debt, family...we need this financial incentive. We're working for one day at a time. Some of us have to ask for night shift instead of the day time since they use the day time for their business. That will definitely affect performance. If we can get a good deal, good incentive, we will have more passion to work. This explains why we participated less than usual. (EMT14)

I also think that they (EMTs) have to do other jobs because of their financial incentive. Not enough financial incentive probably burdens them. They have to work outside the hospital to earn more money for their family... There are many times that they go to work for a hospital outside the hospital setting with other organisation and don't get anything back. No one really looks after them. Finally they may not want to work for the system. (NU16)

The interviewed EMS personnel also noted that people would be reluctant to take on, or keep, employment with the EMS and undertake the job properly. They would also be less likely to undertake professional development and further training without adequate financial incentive.

If we're talking about motivation and EMS people, these people have less motivation to work. There is no inspiration for them to improve. Imagine...trained (100%) and partially trained (80%) staff receive the same amount of financial incentive support... The civil servant won't get any extra money for their extra job. Who wants to be trained? There is no competition....no improvement. (NU04)

Doing or not doing their jobs receive the same amount, who'll want to do...? (NU05)

6.4.1.3.2 Lack of professional environment motivation

Apart from financial support dissatisfaction, motivation for professional development was seen as an important issue from the EMS staff perspective. Since they did not have a clear career pathway

available, employment in the EMS did not seem as attractive as in other jobs, especially for those employed as EMTs. For instance, the EMS nurses stated:

I think even at the Ministry level, we don't have a career pathway for them. They (EMTs) don't know where to go. Some of them moved away from this EMT lifestyle and turned to be nurses or public health officers. They will see more about their future. (NU05)

There is no career pathway for EMT. I think if they can have their own career path they will have their clear future. Nowadays, they have to cross the area. It's not what they were trained for. (NU02)

We have almost everything except professional human resources. We now have these two year trained (EMT) people. If we can have a bachelor degree (we don't have paramedics), are we going to have a place for them (EMT) to grow? (NU09)

The feelings of the EMTs themselves about their motivation to pursue their career were also described:

We have no revised course. We're working just day-to-day basis. There is nothing (future) for us. If we don't have any improvement, we may miss something (patient care) out there. (EMT10)

There is nothing being prepared for us. We all want is to be registered as civil servants. It's our self-assurance for life. There has been no one registered in the system since 1998. ...Being casual staffing may not attract them to stay in the system if they have an opportunity with private hospitals. (EMT01)

Some of the participants mention the lack of recognition received from hospital staff. They complained:

They (hospital staff) don't know who we are, don't trust us. I want them to understand our roles. (EMT01)

For our overtime job at ER, we feel like slaves. We are always told to do something. I come here to work with boredom. I have no energy to work... Fulfilling my responsibility is just for surviving. (EMT14)

Teamwork and respect for participation was also mentioned by one EMT.

During the job, if we can work as a team, things will definitely go well. As long as we understand each other and do one's role, the patient will be saved. If we don't respect the others in the team, the patient will receive the result of it. We now think differently.

We don't understand one another. They always have their own problem about not taking part in our monthly meeting. (EMT03)

6.4.1.3.3 Hazardous working environment

Some EMS personnel believed that they were working in hazardous conditions and that occupational health issues were not adequately addressed. This situation included danger at the injury scene and the condition of workplaces such as in an ambulance. Both the physical and the psychological environment were seen as capable of affecting the performance of the units.

Comments included:

EMS personnel are working in a risky zone. Although they are at the same level as some health personnel, their job is more dangerous. (NU05)

...the cleanness of our ambulance. We don't have disinfectant to clean our ambulance, especially after transporting contagious patients. We cannot protect ourselves and our patients. We could think but couldn't say. (EMT14)

EMS is ok, but I need something to protect ourselves. We sometimes have to park our ambulance in the middle of the road, especially when it's raining. We need traffic safety cones. We need a spotlight. I have to decide how to park the ambulance. We know that it may not be the right choice but we have to do it. We sometimes get some help from the volunteer people. These people do some traffic control for us. (FR07)

Knowledge and skills of EMS personnel are important. Having knowledge without having experience you may not be able to manage the situation out there. You can be taught about this case but in reality it is different. You'll be overwhelmed by the uncontrollable situation. You have to decide and immediately manage it. (NU02)

6.4.1.4 Administration and management issues

Another area seen by interview participants to affect patient outcome was administration and management. Lack of direction from the management was noted as one of the important issues affecting EMS performance. The influence of higher levels of management was believed to be essential to efficient running of the system.

6.4.1.4.1 Lack of direction

It was generally perceived that there was no master plan being used, and that there was a lack of direction, in management of EMS in KK Province. Since there was a perceived lack of planning from the central administration, participation from localities was seen as deficient:

We so far have no standardization and no uniformity. Even KK EMS itself does not have standardization... We're away from having a master plan on direction and control over quantity, standard curriculum, and quality of EMS institutions. (DI13)

We lack control and good governance. We (EMS organizations) have different ideas on quality assurance (QA) and quality control (QC). There is no clear cut documentation from central about which standard criteria that we will use. They change it every year. (DI13)

The situation was seen to be deteriorating due to a lack of guidance from higher levels of management. It was perceived that when there was no superior support, there would be no action:

Although we have a system here, there is no unity or equity. (NU16)

Some of the LAOs, their heads don't really pay attention because if they don't receive an order from the management, they won't be keen to do it. They want clarification from central. They want to see an order from their ministry (Interior). (NU05)

I do believe that both direct and indirect medical oversights were mostly not really concerned by local medical directors. There would be mainly transportation provided from the scene to hospital without consultation. We do have a protocol. I don't think most of them follow and use the protocol developed from Narenthorn (Central) or from us, KKRH. (DI13)

When we had our ex-boss things went very good. After we've got a new boss, everything is different. This guy seems to ignore us. He doesn't want to join us and doesn't want to be invited. (NU11)

6.4.1.4.2 Lack of cooperation

With poor unity and guidance from management, getting assistance from other stakeholders was perceived to have become severely delayed. The lack of support and coordination mentioned above

included assistance at the injury site from relevant organisations such as rescue activities and extrication of trapped casualties. For example, EMS staff perceived that:

In a road crash situation, if we can get a helping hand from other organizations (extrication vehicle) and they come with us, that will be good for the patients trapped. Practically, we cannot do it. In a real situation we cannot do anything even control the victims and may have to call police. (EMT14)

Extrication always comes late. It's because they hardly have a job to do. When they have to do it it always takes time for them to get permission from the authority. (FR06)

There is a delayed assistance from the rescue team when we need them. It takes half an hour for them to get through their internal process. (NU09)

Lack of cooperation can also be represented in terms of the cooperation among emergency stakeholders such as police and local government. As the participants said:

...As long as they don't know or are not aware of what we are doing, no one (a local government) will take part in it. (NU09)

It's not only us (EMS), but also the others, police and rescue. It wastes my time when I have to wait for them. (NU02)

6.4.1.4.3 Poor quality control system

Another problem perceived by EMS workers had to do with quality control. The quality of EMS was difficult to assess since the situation occurs outside hospital settings. EMS workers perceived that the current evaluation was freely made by the EMS evaluators. They also perceived that there was a lack of quality control being implemented by the relevant management bodies. EMS staff comments about inadequate service evaluation included:

The assessment is difficult to make since we cannot see them when they are at the scene. The form used is documented at the ER, which is hard to determine their performance. (NU09)

We cannot control them (volunteer units). We work with them (one of the foundations) who were established earlier than us...In a real situation we cannot do anything even control the victims and may have to call police. (EMT14)

If we give a job to someone and there is no one to chase it up, things will be the same. We need to have an evaluation. (EMT10)

Other EMS personnel commented:

The problem is about having a poor control system. No responsible body to look after the system and resources... We didn't know whether they did something to the patient or not. Although we don't have a systematic data collection to present the efficiency of the system, we do believe that they do the right thing to the patient out there. (DI13)

I don't think we have reached the targeted standard, but we allow them to do. We are more flexible in controlling the standard...We know that they did not reach the standard. However, we have to let them do it because we need them to work and be a model for the rest of the system. (NU04)

Do we have any system to assess or evaluate our EMS? Can we have a good standard of care or human resources? (NU04)

Evaluation from within the system was believed to be required. EMS staff believed that feedback following complaints was not given and action not taken. For example:

The responsible body didn't see it. We need a good communication from the bottom to the top end. We reported, but nothing really happened. He just talks with no action. Things remained the same. (NU04)

Authorities never pay attention to this small stuff. We (EMTs) were complained about using siren by the people and our boss told us to turn the siren off while we are on the road. (EMT01)

The assessment is difficult to make since we cannot see them when they are at the scene. The form used is documented at the ER which makes it hard to determine their performance. (NU09)

6.4.2 Suggestions to improve emergency medical services

A number of common perceptions emerged from the interview responses regarding suggestions to improve outcomes for EMS patients. Most of the suggested improvements were based on their day-

to-day work of the EMS workers during the interview period. The solutions to advance EMS patient care relayed by the interview participants included issues such as: improve EMS personnel performance; EMS management and quality control; better working conditions of the EMS staff; and improve EMS communication methods, both with the public and within the EMS organization. The areas discussed are described below.

6.4.2.1 Improve performance of EMS personnel

A need to improve performance of EMS workers was one of the key themes which emerged from the interviews of EMS personnel when they were asked about suggestions to improve EMS patient care. Many of the suggestions were about professional development for EMS ground staff. EMS personnel perceived that an improvement to human resource training would result in an improvement of the performance of EM Services and better patient care:

The growth rate should be slow but more sustainable and look at quality rather than quantity. (EMT14)

6.4.2.1.1 Improved training and professional development for EMS personnel

A recommendation to give additional training courses to EMS personnel, particularly at the EMT and FR level, was the most common recommendation given by the interview participants. They believed that extra training courses were necessary to improve performance of existing human resources:

Human resource improvement is very important. I think if we can improve them, they can do the rest. They can develop and improve their own job. (NU09)

I think the best way is improving human resources. Give them a refresher course...retrain them. Set them up. Get them back here and retrain them with the same understanding... A five-day course for FR... a course for paramedic nurses. (NU04)

Both nurses and EMTs recommended that EMTs, in particular, were in need of extra training and needed to be kept up to date with refresher courses:

We need to give them (EMT) an extra tutoring or refresher course. Most are set for physicians or nurses, not EMT. Moreover, if we can upgrade EMTs to paramedics, that'd be great. (NU05)

We need refresher course for them (EMT). (NU16)

One of the EMS personnel employed as an EMT noted the importance of additional training courses:

We want to do more than we are allowed to do. We cannot administer medication or IV fluid without permission from the doctor. Asking for permission is time consuming. I used to wait for it until we arrived at the ER. (EMT15)

Another EMT notes the absence of training courses for EMTs in comparison to FRs:

We (EMT) should have a year plan. We hardly have it at present. Mostly training courses were set for FRs. (EMT10)

The requirement to have additional or refresher courses was frequently discussed by people employed as FRs also. For example, they mentioned:

We just set up for a year. If they can attend a skill improvement program, they will gain more confidence. (FR12)

We want more training courses. What we were trained for was mainly about trauma care. We know nothing about medicine, DM in particular. (FR20)

We need an annual refresher course. If they can set up a training course for the community FRs, they can also arrange it for us. (FR07)

We want to have twice a year refresher courses. We don't know how to deal with seizure cases, injury is ok. We mostly found simple cases.We can have a one day course combining with other 5 LAOs. (FR19)

Need to have refresher course every 2-3 months. We have not too many cases to do. Imagine 10 villages/ 150 households per village. How many cases per month do you have?...I think the knowledge provided should be a more practical one.(FR06)

6.4.2.1.2 Improvement of resources for EMS units

It was suggested that the equipment to provide EM services, particularly ambulance units, was in need of improvement. This included EMS station facilities and other equipment used:

Ambulances should be upgraded and have more than what we initially got from NHSO. (FR06)

Ambulance station and its maintenance have to be improved. (DI13)

Improved ambulance facilities were seen as being necessary not only to improve the quality of service, but also to gain public confidence in the service:

They will trust us more if we have a better ambulance, not a volunteer like ambulance. Nowadays they complain about not having this, not having that. (FR18)

6.4.2.2 Improved management

Better managerial direction and better assessment procedures were seen by the EMS to be important for improving the service. Moreover, closer links between the management and on-ground EMS staff were identified:

We need to have a single leading agency to create uniformity and standards. ...need to have same system for the country, but we now don't have it. When we have it whoever runs the service has to follow this standard. (DI13)

We don't know who actually looks after us. We need to have directions or a leader. We don't have a clear system here. We want to form a team... We should take control of our office. We should work together as a team. Everyone should know about our office. Files and documents need to be kept systematically. We should have our own boss (EMT boss) to look after us. We don't know who is responsible ...we don't have anyone to consult...Our team now has to work here in silence. There is no direction for us. (EMT10)

6.4.2.2.1 Better direction from a single leading organization with local supports

There was a need for stronger guidance and administration from central management. KK EMS staff said:

In KK, the management team saw the importance of having EMS in place. It supports the office, human resources and other hardware. Whereas this has not happened in the other places where there was nothing assigned from the responsible body. (DI13)

KK EMS is better than in the other places in this country. It has been developing for years. We have a strong leader and good support. The management is now trying to meet the needs of the community. (N04)

Direction from one management authority was seen as being necessary to improve efficiency of management. More direct guidance and firm policy from central administration with support from local authorities was particularly required. The order or the direction from the central and local authorities was required to activate stakeholders. When proper guidance is given, they will do their job properly.

The need for better guidance by central authority was mentioned by several EMS personnel:

We lack control and good governance. I hope that EMIT will set the standard up. (DI13)

I think the authority must be the one who controls us. The growth rate should be slow but more sustainable and look at quality rather than quantity... (EMT14)

They took part in it because of the policy or an order made from central. (EMT14)

EMS here can run because the people here are willing to do it. It'll get better if the government supports us. As long as the Minister or the Permanent Secretary sees this as an important issue, things will go well. (NU02)

However, EMS staff also see that involvement of local authorities is very important in running local services. There is a need to have the local authority take part in local issues:

I think we need an authority or the Governor to come on board with us...support us. We should take the lead here and they should be our assistance. We must work collaboratively. (EMT14)

I do want LAO to take part. If they participate, EMS will be sustained. They should send their local people to study or train and go back to work in their community. These people know their community best. They know geographical difference and can improve or develop their own unit. (NU09)

It was not only top-down management that could affect EM Services, but also it was about how local management could influence EM care as the local leaders are well respected within their communities:

Hospital EMS is working because our boss sees its importance. If we don't have him, it may not be like these days... KK is good. We have a good network. That's because we went to see heads of the local governments. When the community runs its service, the people know and support it. They are happier to have their local people help one another out. (NU02)

I want our boss to pay attention to us. I think she has to ask us about our life balance. How about our financial situation, family, and so on? We need a supporting word from our boss... Unfair financial treatment causes conflict among the team. This destroys the team system. If we can have a fair deal from the leader, our job will be done better. (EMT03)

6.4.2.2.2 Improved assessment of services/quality control

A number of EMS workers believed that improved service evaluation and standards of care were required. They commented that:

We need to have same standard and indicators. The indicators or benchmarks must be the same every year. Now they change them every year. (DI13)

We need to have a standard. I don't mean international standard. We should use patient-centred care concept and cover from the scene or before the injury happened to hospital. This doesn't mean the patient saved has to have survived. It means we have to do our best to save his life under our limited resources. (NU09)

Should have had an evaluation for each case and learn from it. (EMT10)

Do we have any system to assess or evaluate our EMS? Can we have a good standard of care or human resources? (NU04)

The doctor saw that evaluation was essential to improve EMS and could be more effective if linked to funding applications to run the services:

Financial control can be used as a tool for standardizing the system. This EMS needs to be well monitored and used effectively and efficiently by local authority. The unit providing unsatisfactory services, such as using unregistered staff, may not be able to get financial support. Provincial Health Office has to look after this financial control system, which we don't have at the moment. We may need to tightly control the use of EMS and find monetary support from other stakeholders. (DI13)

Some reference was also made to the need to correct misuse of EMS for non-urgent cases and provide a quality of care rather than greater quantity. For example:

Misunderstanding about financial incentive needs to be corrected. They (community) have to work for their people, not money...Quality and quantity. We have to encourage them to be aware of their quality of care, not the money they will get. (NU04)

We now pay for it (EMS). LAOs don't care about it. They want that financial incentive. (EMT14)

6.4.2.2.3 Closer links

Closer contact with management was perceived by EMS staff to have a beneficial impact on provision of EMS. For example, one of the nurses said:

I think that if there is some attention from the management or superior in that area, these EMS personnel will be more active. I can see that from the seminar in one of the districts that I went to. (NU16)

I want management role to come down and touch the base with us. Even heads of LAOs are hardly found paying attention to this service. (EMT01)

I want our boss to pay attention to us. I think she has to ask us about our life balance. How about our financial situation, family, and so on. We need a supporting word from

our boss... Authority should pay more attention to and be responsible for the services. (EMT03)

6.4.2.3 Local network involvement

Apart from suggestions to involve authorities, suggestions to utilise local networks were also raised by EMS staff to improve EM Services. Local networks such as hospital, local rescue teams and other stakeholders were seen as important to provide local knowledge and efficient response times. For example, comments include:

Staff working here are local. They will know where to go as long as they get enough info, especially when the callers locate some specific areas, temple or head of the village's place, within their community. (NU11)

We are localities, we know where they are. We can always be there before the hospital's team. We can reduce half of the time spent for the response. We also sometimes get support from our local primary care unit. (FR19)

As a result of being local people, we know where we are going. We know the main points of having us in our community. (FR12)

We filled up the problem of distance by using community EMS units. (NU09)

This network issue can counteract the problem of inadequate human resources and equipment used. Shared resources were also seen to have positive effects on EM Services. EMS staff saw that the use of local health facilities could possibly improve EMS performance, shortening time spent by the unit to the scene and correcting the communication problem. They perceived that:

It must be great if we can use community hospitals as our sub-CCC. They are closest to the community, have better communication, and get to the community faster than us. (EMT15)

In severe cases, we will see the hospital team at the middle of the way. (FR20)

...Having paramedic nurses or physicians go out there or standby for consultation is helpful. (NU02)

Could we get community primary care units in the system? They have brains and higher medical equipment while LAO has human resources. They can work collaboratively. However, if the patient is not severe, we may not need PCU people. (EMT14)

This was also about working with the volunteer groups:

Onlookers sometimes also cause problems. We have the volunteers to help us and set up a working zone for us. (EMT08)

It's good to have rescue teams working with us out-of-hospital. They're helpful in sizing up and securing the scene for us, especially when we are helping RTI patients in the middle of the road... An injury case is more exciting. It's because the scene may not be really safe. But we always have the volunteers there to help us. (EMT03)

6.4.2.4 Better work conditions

Most EMS personnel recommended that financial incentive and adequate rewards for their work would result in a greater passion to work, especially because of the risks undertaken in their occupation:

Motivation, job satisfaction may need to be taken into account. Financial support due to extra EMS related courses needs to be reasonably concerned. (NU04)

We cannot have enough money, we (EMT) need to get extra hours overtime from ER or rotate us out to community hospitals. (EMT08)

Many comments were made about improvement of financial incentive. Adequate and fair financial compensation was required. Interviewees said:

I think if we get more incentive, we will do a better job... No one wants to do a morning job because there is no incentive for it. (EMT14)

If they can have extra incentive on top of their normal salary, it will be better...If we can set a health and safety foundation up for them, that will gain more motivation and morality. (NU05)

If we can have more incentive and knowledge, it'd be good. If it's possible, monthly payment is preferred. (FR17)

We (system) should have something for them (new graduates). If they know that their life and job is being guaranteed, they will be satisfied to work. (EMT01)

Recognition by management was also seen as a factor influencing EMS staff performance. The issue of recognition and support from peers and management was shown in comments such as:

It depends on the management. If the management doesn't listen to the voices of their subordinates, what the lower levels fight for will be useless. Everything here depends on the authority. (DI13)

The management here has not seen how important we are. I do want him to go to the monthly meeting. I do want him to listen to the plan. It is because we, alone, cannot make any decision. If he sees this, he will get more votes in the next election. (FR19)

They (hospitals) don't know who we are, don't trust us. I want them to understand our roles... Warm support is important and is a sort of motivation for us to work. We're now just working on a daily basis. We did our best but received nothing or sometimes blame (EMT01)

Lastly, the physical environment and occupational health and safety issues were raised as needing improvement:

I'm concerned about my safety issue. Safety cones and spot light are needed. (FR07)

Injury case is more exciting. It's because the scene may not really safe for providing medical care. However, we got support from our networks. I think we need to talk about this scene safety. (EMT03)

We have nothing to support us, life-insurance or ambulance insurance. We have nothing to insure our life. The management should do something for us in other hospitals. (EMT01)

6.4.2.5 Improved communications

The need for better communication systems both externally and internally between the public and the EMS system was seen as an area for improvement. Externally, many EMS personnel recommended means to promote better public awareness and understanding. Improvement of internal communication systems was also seen as an essential improvement to the EMS.

6.4.2.5.1 Increase public awareness

Lack of awareness of an emergency medical condition and the use of EM Services was noted to affect the chain of survival of EMS patients. For example:

We must make our users know how to use EMS. When and what condition that they can use EMS... explain to our people about their role and responsibility. (EMT14)

They (people) don't know our process. The most important thing is to do the promotion. (FR12)

Our emergency light is ok, but the siren cannot be adjusted. Its noise disturbs the people while they're working. We then have to limit the use of it. If we can turn it on all the time, that'd be great. The road users can notice it easier than just turning the light on. We should promote or educate them. (EMT10)

Education and promotion campaigns were seen as paramount in effectively increasing the public's awareness of emergency medical conditions. These were believed to be better if conveyed to the younger generation:

It is about public education, public relations and increase of accessibility for our people. (DI13)

We need to set this sense of public awareness or attitude up. This must be started with our children. The process may take 20 years but is worth it. (NU09)

We need to educate our next generation since they are young at primary and secondary level. First aid or simple care process should be taught once a week. This will increase the understanding of our people. (EMT08)

There should be widespread public awareness campaigns to promote better understanding of EMS processes and what to do in an emergency situation. EMS personnel perceived that this could be promoted through mass media, health care professionals and, in particular, community authorities.

They suggested:

The use of EMS has to be promoted at the community level. Go through the heads of villages. Let them know who they have to talk to, how can they do it, what sorts of info

they have to report. At this stage, they know the number but don't know how to call. (EMT08)

First Responders suggested that it would be better to use local authorities:

We then have to promote how to call 1669 and use EMS. We have to do this campaign through heads of the villages and should promote the number, how to assess patient, and how to give first aid at pre-arrival stage. (FR06)

To do this promotion, we have to do something locally by using local broadcasting media, community centres, co-op shop, using authorities living in community. (FR06)

Also let the villagers and road users understand our job. Traffic is important. We need to inform or promote who we are and what we do... We did tell them and let them use word of mouth to tell the others to understand what we are doing. (FR18)

I do want the head of village, local leaders and seniors in the family to understand our process and then tell their localities to inform us. Moreover, they should give community EMS personnel a hand when they are helping the victim. (FR17)

6.4.2.5.2 Improvement of EMS communication system

Communication methods and devices used in KK EMS system were seen to require improvement.

The use of local hospitals as a sub-command centre to keep a call connection while units were en route, and improvement of dispatch and communication skills were discussed as strategies to improve this problem. EMS staff mentioned:

We need good communication while they're on the way. So we can continue treating patients. (EMT01)

Communication needs improvement. Sub-CCC or using the community hospital as local CCC will help. (EMT15)

The communication process, in particular the dispatcher role, was commented on:

Staff acting as dispatchers need to pass a dispatcher course. This has to be initiated by the management. Being a dispatcher needs to have a standard. (EMT08)

In the case of a long distance, CCC should give pre-arrival instruction to the callers or bystanders while they're waiting for the arrival of the ambulance. (FR06)

... If we didn't get proper information, we need to check or reassure with the team or give them feedback. (NU16)

6.5 Summary

This chapter has highlighted that the unique local environment and management context play an important role in needed management of EMS and its role in primary and secondary prevention of RTI. The perceptions of the EMS staff were not focused mainly on the process of care itself. It was clear from the interviews that internal and external contingencies of EMS management play a vital role in influencing the management of the situation of road trauma and quality of care.

Many of the issues raised were about the local physical environment and the social contexts stemming from the way the EMS has been developed. Local influences such as awareness of localities, the way people use alcohol, the way the roads are used, police patrolling and law enforcement issues, the issues of local road design and maintenance and the way local road safety management see the problem, were among matters of concern for EMS staff regarding RTIs. Public awareness, EMS communication processes, resourcing of EMS units, staff working conditions, and management guidance were all perceived as important issues for EMS.

The suggested solutions covered various aspects of RTI and EMS problems from both inside and outside the processes of EMS care. Firm but appropriate guidance or involvement of authorities was considered important in managing the current EMS and RTI situation in KK Province. The complex issues revealed by this component of the study have implications for how the system can achieve a better quality of patient care in KK EMS following road trauma, and this topic will be discussed in the next chapter.

Chapter 7 Discussions and conclusions

7.1 Introduction

This chapter presents the conclusions of the study which investigated EMS management of road traffic trauma in Khon Kaen Province, Thailand. The purpose of this research was threefold:

- (1) To assess the available road traffic injury and emergency medical services data to describe characteristics of road trauma and provision of emergency medical services currently existing in KK province*
- (2) To explore the perceptions of EMS personnel in order to identify contributory factors associated with road traffic injury and management of EMS response*
- (3) To identify how EMS management and patient outcomes could be improved following road traffic trauma.*

In this chapter, the major findings from each component of the study are reviewed to gain a more complete picture of KK EMS management of RT trauma. The results are presented by use of the Haddon's Matrix Model and Outcome (Performance) Management Approach to further describe and assess the management of road traffic injury by KK Province EMS. Steps for improvement of the current KK EMS, specifically related to road traffic trauma, are outlined. The chapter also discusses implications for policy, practice and research in relation to RTI and EMS in the KK context. The limitations and strength of the study are examined. In addition, the contribution this research may make to the body of knowledge about EMS management of road traffic trauma and RTI prevention in the Thai rural context is discussed.

7.2 Drawing the thesis findings together

Use of the Haddon model, as well as an epidemiological and health outcome management approach, can facilitate a process whereby predictions can be made about particular details of EMS

management of road traffic trauma (Barnett et al. 2005; Runyan 2003; Spaite et al. 2001; Walburg et al. 2006). These approaches can be used to provide a useful framework to analyse and understand associations between RTI and EMS over the time of the crash in a small manageable area. This means that relevant improvement could be undertaken with more specific information and in a more manageable manner. Health authorities can encounter road traffic related trauma step-by-step at all three levels of injury prevention: the prevention of the injury, the reduction of injury, and the treatment of injuries. Evaluation can also consider three broad factors: host, agent, and environment, and include the relevant social context (Runyan 1998, 2003).

The use of mixed methods in this study provided a more thorough means by which to understand EMS management of road trauma in KK Province. Chapters 4 and 5 highlighted the characteristics of road traffic injuries and EMS utilized in the KK context. This addresses the first objective of this study, which aimed to determine the current situation of RTI and EMS response. The distinctive features of KK RTI and the functioning of EMS in the KK context are consistent with studies that showed road traffic injury and servicing of RTI by EMS is a significant public health issue (Chadbunchachai 2003; Suphanchaimat et al. 1998; Tanaboriboon 2004; Tipayarangsarit 2005).

While chapters 4 and 5 tackled the first objective of the study, the findings in Chapter 6 also addressed the second study objective which was to evaluate management of the existing KK EMS system based on the perceptions of EMS staff, with particular focus on road traffic trauma response. The information received from the EMS personnel in the qualitative component indicated that, as a result of dealing with KK RTI and exposure to the environment where the injury was occurring, EMS staff identified a number of approaches to better manage EMS following RTIs in the physical and social environment. These findings illustrated additional physical and social environment issues which influenced the patterns of EMS management of road trauma that are also

described in many management studies (Gómez, Kirkman & Shapiro 2000; Khorasani-Zavreh et al. 2009a, 2009b; Levine et al. 2007; Pasa 2000). The recognition of factors associated with RTI and EMS response, from the perceptions of EMS personnel, can help develop recommendations to improve EMS management in Thai rural areas.

The quantitative data provided evidence about factors associated with RTI risk and response processes of EMS units. The qualitative data described the perceptions of EMS workers and validated some of the risk factors illustrated in the quantitative data component. More importantly, the qualitative data provided extra detail about RTI risk and EMS management issues. A number of complexities which presented within the social context of the Thai rural community demonstrated that EMS staff were concerned about both internal and external contingencies.

7.2.1 The role of KK EMS in RTI

While there are some limitations in the availability of the KKRH Trauma Registry and EMS database data, the information generated from these datasets remains important to demonstrate some significant features of road traffic trauma, and to a lesser extent, EMS processes. The information is valuable for health providers and policy makers to use to reduce the impact of RTI and improve existing pre-hospital emergency services to appropriately respond to this problem in KK Province. The roles of EMS in RTI are discussed below.

The RTI situation

Factors related to patient characteristics play an important role in determining patient care process and outcomes by contributing to the understanding of road injuries and their effects (Lemmens 2006:118-119). Although the data in the study was available from KKRH, the evidence shows a uniqueness of characteristics of RTI which can be applied to KK Province. Many important risk

factors were identified which include being a motorcycle rider, being a young male, working as a labourer, not wearing a helmet while riding two-wheeled vehicles, festival and weekend periods, and rural location. Clearly, EMS staff did not only relay information about risk factors in relation to road users, but they also focused on factors at play in the physical environment and social context where the injury took place. The social and managerial context surrounding KK road safety authorities was also discussed by the participants.

The quantitative data demonstrated that motorcycle injury was by far the most significant form of road traffic trauma. The motorcycle, as an agent, was associated with approximately 75% of fatal and non-fatal injuries and therefore incurred the greatest cost to the KKRH health service. Young male motorcycle riders were seen to be the most at-risk age group in this dataset. EMS staff also believed that young male riders were a significant at-risk group and were able to provide extra information about causal factors for these victims. EMS staff revealed that there was a large number of young people attending schools, colleges and universities in this area. As the most common vehicle used for family transportation in Thailand is the motorcycle, there would be more motorcycles used on the roads of KK and therefore more injuries occurring with this vehicle. Injury risk is increased by using these unprotected vehicles (Waranpitikul 2008a, 2008b).

Based on the interviews, the consumption of alcohol was also perceived by the EMS staff to be a major contributing factor in RTIs and resulting trauma. Alcohol was seen to be associated with greater risk of having an injury and also with increase in the trauma severity. However, the involvement of alcohol as a causal factor was not readily evident in the quantitative data due to the large number of cases where Blood Alcohol Concentration level was unknown. There were indications that there could be gaps in the data collection process or the criteria used for identifying alcohol-related cases. As long as the information about involvement of alcohol in RTIs is not

evident in the data and while consumption of alcohol is socially accepted as described by Litt and Eggar (Litt & Eggar 2008) it will remain a problem.

Head injury was also associated with an increased risk of trauma severity. Head injury was found to be associated with 89.59% of fatal cases and only 45.18% of non-fatal cases. As with the issue of the involvement of alcohol, information on helmet use was not available in the database as a result of the large number of cases where helmet use was unknown. EMS authorities could assess the available data on head injury and investigate the development of preventive strategies in relation to head injury. Not only should EMS training programs be adopted to manage head injury, but also public education and law enforcement on helmet use by motorcycle riders has to be improved (Finnoff et al. 2001; Sosin, Sacks & Holmgreen 1999). A more detailed profile of head injury may need to be reviewed and then presented in EMS training programs for staff.

The EMS staff gave further explanations for other factors behind the RTI situation in KK Province, many of which were interrelated. Young male riders were seen to be at greatest risk as a result of their poor road safety awareness and risk-taking behaviour such as consumption of alcohol and speeding. Also local law enforcement could be seen as an effective means of control, but it was inadequately policed and failed to make the road users restrict risky behaviours. Poor local road environments including road planning, design and maintenance were also discussed as contributing to illegal use of the roads (Islam, Ponboon & Boontob 2006).

The Trauma Registry data showed disparities among fatal and non-fatal cases which were associated with body region injured and jurisdiction location where the injury had occurred. The figures were similar to what was happening in other rural and remote areas (Sheehan et al. 2008). Most fatalities were sent from outside the KK city area with death occurring after admission, while

most of the non-fatalities were transported from within the KK city area and treated as outpatients. Could this mean that a more severe injury occurs outside the city area? It is more likely that severe trauma cases from all the surrounding areas were sent to KKRH which, as a regional hospital, had the facilities to manage these cases. If the rural fatalities were disproportionate, RTI prevention and a higher level of pre-hospital care should be allocated outside the city area. However, as a result of the lack of detail in the available injury data from outside the KK city area, the estimation could not be made. Better data sources could be established or linked to gather information about the real need and demand for level of care to efficiently allocate EMS resources (Mueller 2001).

EMS staff believed that improper law enforcement and inadequate policing made people more at risk of RTA. Comments about enforcement were perceived to originate from the way the police currently enforce the existing laws. The police were unable to perform their job properly as a result of often being lenient with traffic offenders in the KK social context. This phenomenon has also been reported in other countries (Khorasani-Zavreh et al. 2009b; Schafera & Mastrofskib 2005).

Local road authorities were also criticised for a lack of responsibility in adequately maintaining the local roads adequately for road users. Moreover, bodies responsible for road safety were perceived to lack motivation to solve the problems due to changes in government and unclear guidance. Complaints from subordinates or villagers were perceived to have not been responded to unless an injury had taken place. Instead of establishing and maintaining injury prevention and road safety promotion campaigns, well-kept roads and law enforcement, authorities were seen to inadequately control road users. The participants observed that these inadequacies descended from a KK managerial context. Introduced road safety campaigns seemed to be unable to generate a more widely spread sense of safety awareness unless better guidance and an overview from the road safety authorities were presented.

The perceptions of the EMS personnel on RTI issues shed light on why rules and regulations may be less able to be effectively enforced in Thailand. A study to examine how police officers made decisions in the course of traffic enforcement, particularly regarding sanctioning of leniency, could be useful. The factors identified need to be used to significantly better road traffic injury prevention and adherence to rules and regulations. The perceptions of EMS workers on the existing EMS will be reflected in the following section.

The Role of EMS

Based on the information from the available EMS database, EMS units were widely distributed over the KK catchment area to increase accessibility and equity for all localities and the rural population. An expansion of community-based units with FR level response capacity represents the means by which the increase of accessibility was achieved. However, expansion of new resources has been directed towards community-based EMS units at the expense of the hospital-based centres who have not been receiving new equipment or ambulance units. Records also show that time intervals from EMS station to the emergency scene were less than the standards set for the majority of cases. This could be a result of an increase use of CCC or phone triage services (Dunt et al. 2007). However, the time intervals from the scene to fixed health care facility were often over the benchmark.

The access to EMS CCC by use of emergency number 1669 appeared to have increased over the years of the study even if there was also an increased use of local EMS unit landlines. While the available data indicates that EMS responses are to some extent adequate for the requirement of emergency calls, in some cases inefficiency may exist as a result of a dramatic increase of non-urgent cases in the past several years. The mixed channel calls could affect the quality of information received and the call out pattern (Augustine 2002). This may indicate that the system

had been used for situations where there was not a real emergency medical condition. The misuse of the system was raised by the EMS staff who had commented on the lack of public awareness of people in the community, the problems and implications of the government funding system and the call-taker/dispatcher's skill.

While the quantitative data available from the KK EMS highlighted the community-level resource expansion and EMS processes, the issues of concern uncovered in the qualitative data had corroborated those findings and also provided additional pointers for further improvement, particularly regarding quality of care provided. EMS staff saw that the inequitable allocation originated from the decentralization of local administrative organisations and the management of each LAO's leader. Resources given to EMS units tend to be dependent on policy trends, where the central government attempts to hand over responsibility for service delivery to local governments. However, as commented on by the EMS workers, the aim of having better equipped EMS units to improve patient outcome seemed to be compromised by political motives and the wish to gain more votes for upcoming elections (Tanprasert et al. 2000) and to reduce health expenditure by local government (Chadbunchachai et al. 2004).

The EMS workers were concerned about the poor public understanding regarding the functioning of the EMS and public awareness of the EMS role. Many callers had insufficient knowledge about how to handle an emergency medical situation and how to make use of the EMS system even though the system has been in place for more than thirteen years. In particular, they saw that the EM Service was being misused as a taxi service to transfer many non-urgent patients rather than purely for the emergency medical purposes as previously found in Thailand (Chadbunchachai et al. 2004). The general population on the whole was unable to provide proper first aid and proper information to efficiently activate the EMS. Lack of awareness of EMS operation caused

interruptions and delays in the EMS process, such as blocking the road, while the ambulance was transporting the patient. A problem emerging from an involvement of untrained population was also found in other studies (Khorasani-Zavreh et al. 2009a; Li, Galvin & Johnson 2002).

While some of the qualitative information was not evident from the quantitative data, knowledge about these service issues is most important in a review of EMS management and design of initiatives to improve service provision. Performance of the EMS units was another area of comment for EMS staff. The performance related issues perceived to be problematic by EMS staff were about quality of inputs to the EMS system including human resource and equipment use which were also commented by Liberman et al. (2003). This information could be validated by the EMS quantitative data which had also shown that no new advanced care level ambulances were registered since 2002 as resources had been directed towards basic level community units in rural areas.

Many staff also commented on the lack of adequate training, particular for community EMS staff, which was seen to be inadequate to sustain a satisfactory level of EMS care. The more experienced EMS staff expected FRs to provide the same level of professional expertise as they had been given in training, but they also believed they were not given enough training. There were other ways in which the more highly qualified EMS staff expressed negative attitudes towards FRs. Unprofessional behaviour of EMS staff, particularly at the FR level, was also raised. FRs were perceived to show unprofessional behaviour and to misuse their position, as well as being untrained and unemployed as found in an early stage of Thai EMS development (Chadbunchachai et al. 2004).

Although administrative function of the EMS leading agency was not commonly criticised, it was noted by the EMS staff that its improvement could affect EMS outcomes. Lack of clear-cut guidance and direction in many aspects of the EMS system was seen as a crucial factor influencing EMS delivery (Black & Gruen 2005a). These comments on administrative issues, which also included job dissatisfaction, occupational health and safety concerns and other comments about work motivation, were seen to be inadequately addressed by the authorities. Better development of training programs and adherence to policy, standards and accreditation, need to be significantly improved if the organisation is going to function at a more efficient and effective level. These findings tend to suggest that KK EMS may not be sufficiently advanced or mature in terms of organisational expectations of the neo-institutional theory, particularly at the inter-organizational fields, and that the application of more consistent and improved policies, standards and training should be a high priority.

7.2.2 Reflection on perceptions of emergency medical service workers

Reflections on road traffic injury

The perceptions of the interviewed EMS personnel about RTI shed light, and placed emphasis, on important factors which need to be further investigated in KK Province. These factors were primarily concerned with the lack of safety awareness of the public, especially young road users, consumption of alcohol, disregard for traffic laws and perceived behaviour control as found in many research settings (Khorasani-Zavreh et al. 2009b; Nabi et al. 2007; Rutter & Quine 2004b; Sosin, Sacks & Holmgreen 1999). The findings obtained from the interviews suggested that a number of approaches to management of EMS regarding road trauma, including physical and social environment, is required.

The EMS staff discussed possible solutions which were primarily associated with improvements in road safety awareness. This issue was raised by most of the EMS workers in every occupational group. The suggested solutions were mostly about changing attitudes towards road use and behaviour control, such as modifying road environments, boosting law enforcement and policing, and providing public education programs to foster change in the behaviour of road users. Furthermore, instead of using a fragmented approach, an inclusive approach to RTI prevention between road users and relevant road safety organizations was suggested as noted by Henderson (1991).

Being unconcerned about personal and public safety seems to be part of the problem in the KK, and probably the wider Thai, context. Thai road users were seen to be unaware of personal safety risk and they paid more attention to avoiding penalties determined by road safety authorities rather than to real injury and injury risk. Hence, a greater involvement from road safety authorities, particularly law enforcement officers and local community authorities, was seen to be required as stated by Suriyawongpaisal and Kanchanasut (2003). The presence of local authorities, the police and law enforcement activities in particular, was perceived by the participants to be an effective strategy to handle the RTI problem, even though they commented that the current policing and law enforcement efforts were sometimes disregarded. Rules and regulations were in place but they seemed not to be working effectively in KK Province as the enforcement officers were lenient in enforcing the laws (Cheurprakobkit, Kuntee & Denq 1997; King 2005; Sosin, Sacks & Holmgreen 1999).

Thai road users often seemed to be undeterred by the consequences of breaking the law. This was evident from the remarks made on many occasions during the interviews. Without a police presence, helmets were not worn, alcohol was consumed at dangerous levels and speeding

occurred. If individuals and the road safety organisations do not perceive that this risk-taking behaviour is creating a public health problem, these behaviours will remain socially acceptable (Rutter & Quine 2004b). Possibly, some of the staff had been involved in RT injury prevention campaigns and were more likely to think about these strategies. This may explain why many suggestions from the EMS staff were about improving road users' attitudes and behaviour concerning road safety by means of focusing on law enforcement, policing and education campaigns, particularly for young people. They believed that improvement could be made by trying to increase behaviour control and by informing road users that drink driving and speeding should not be seen as socially accepted behaviour as suggested by McDermott (1978), Richter, Elihu et al. (2006) and Lewis et al. (2007).

Wider community involvement was another aspect of the suggested solutions discussed by EMS staff. While formal education, engineering and law enforcement can be effectively used to deal with the problems, parents and community leaders who have close associations with the road users were also seen as potentially valuable road safety campaigners in the community. This implies a strategy that could be used in a collectivist country where laws are in place but may be less effective than the in-group relationship between members of a community (Hofstede 1997; Hofstede & Hofstede 2005).

While comments related to social norms about road safety were often given, an upgraded and improved road environment was another solution suggested. Road authorities and local governments were perceived to ignore the physical environment and road maintenance issue. Roads were believed to be more properly designed for industrial use, but inadequately designed and maintained for local road users and rural communities. Moreover, roadwork sites were perceived to be neglected and left unsecured. The responsible bodies were perceived to pay little

attention to the local road users' complaints. More focus was seen to be necessary for road authorities to properly perform their job by controlling traffic within a roadwork site (Allpress & Leland Jr 2010). Building local roads to shape road users' behaviour and to suit local users was strongly recommended. This has also been demonstrated by de Waarda et al. (1995) in The Netherlands.

Although the participants perceived that an empowerment in each relevant area of road safety such as education campaigns, road traffic engineering and community authority was important, the ability to work together was required to solve the RTI problem effectively, and that a multidisciplinary approach was required to change social norms (Henderson 1991; Zaal 1994). Team work or cooperation among stakeholders was currently seen as insufficient and dependant on the lead agency. This may be associated with the Thai high-ego characteristic which can create a lack of cooperation among individuals and organisations if they perceive they are of equal status (Mabry 1987). Direction from an accepted and strong lead agency was seen as beneficial, and a requirement for clear guidance from above necessary (Odero, Khayesi & Heda 2003). This direction would be most important in developing acceptance and use of national standards, policy and training that would provide greater legitimacy of the EMS organisation and allow it to respond more effectively to other environmental uncertainty. This approach also responds to the certainty needs of the embedded Thai organisational culture and should promote properly trained and developed local management to be capable of managing and responding to staff more effectively and with certainty.

This approach responds to the suggestions from study participants who were clear about the need for and use of an authoritative role by responsible bodies, and the development of closer links between authorities and communities to solve RTI-related problems. Police, teachers, engineers,

celebrities and local legends were suggested as role models for using their authority to influence, in a positive way, road users' behaviour and attitudes. Police should also maintain the sanctity of law, and solutions using engineering and road design could lower injury risk. Road safety education must be continued and, to be effective, may need to be conveyed to young people in school. Local engineers should also take part in these programs. Together with the above efforts and powers, participation from community networks and fostering of closer in-group links must be used to strengthen well-researched strategies on road traffic injury prevention. Howat et al. (2001) also suggested that involvement of local committees was central in development of successful road safety programs.

Reflections on Emergency Medical Services

The prime topic areas believed to contribute to EMS patient outcomes by EMS workers were related to communication problems with the general public and within the EM system: availability of EMS resources within the EMS system, and administration issues which included unsatisfactory job conditions for EMS staff. While discussing the factors contributing to EMS patient outcomes, the EMS workers also suggested possible improvements which would reduce severity and volume of injury. The suggestions included improvements in current resource management and improvement of public education about a range of emergency response issues, such as what to do in an emergency and how to use the EMS.

Communication problems, particularly with the general public, were one of the most common issues discussed by EMS staff in the interviews. EM personnel believed that the lack of knowledge to handle EM situations, even at a first aid level, could delay and interrupt the EM chain of survival, which would increase risk and severity of trauma (Khorasani-Zavreh et al. 2009a; Li, Galvin & Johnson 2002). The KK public may benefit from being educated and exposed to more

public awareness campaigns to assist them to better recognise EM conditions and appropriate use of the EMS (Palazzo et al. 1998; Rowley et al. 1982), including appropriate communication with the CCC, and how to provide initial medical aid and cooperate with the EMS units while at the scene and while they are travelling on the road.

Another issue discussed by the EMS staff was related to the performance of the EMS units. Improvements of training and professional development of EMS personnel were strategies commonly recommended by the EMS participants. Standards, policies and procedures and training must be used to greater effect to produce increased and consistent standards and service. Many studies also support staff development training as a sensible approach to enhance workers' self-efficacy, improve teamwork processes and performance and organisation outcomes (Augustine 2002; Mathauer & Imhoff 2006; Sahinidis & Bouris 2008; Salas et al. 2008). Improved performance was of most importance for FRs and EMTs in particular, since EMS staff believed that FRs did not have a sufficient level of expertise. Although KK EMS normally conducts monthly meetings where emerging problems are raised and resolved, this activity was not perceived by the EMS staff interviewed to be part of a learning experience and as adequate to their needs. These perceptions suggest a strengthening of human resource approaches and improved policy standards and training are required.

Attitudes towards FRs or community level units were another matter of concern. FRs were perceived to have provided inadequate EM Services. In reality, they had only been trained to provide a basic first aid level care which is one of the lowest training levels in the EMS system (Chadbunchachai 2004; Iles 2005:53). Also, because of all the new FR registered staff in the community units, a large proportion of the new EMS staff would have had basic level training only and would have worked in different areas where the demographic differences may affect their

knowledge and skills (Tanigawa & Tanaka 1998). While a two-day training course is provided to laypeople employed as FRs, the course may not be extensive enough for them to meet the expectations of the public. Moreover, staff employed as FRs were more likely to have a short employment with the EMS system and hence were not very experienced. When the system has been established for a longer time-frame, the FRs should become more skilled in their roles.

The undervaluing of FRs by the other higher level EMS professionals may also be because different sets of approach and knowledge have been shown to affect the perceptions about others' behaviour (Harris, Harris & Johnstone 2006; Isouard et al. 2006b). The level of professions and their limitations may need to be clarified and understood for what they are, at that level, by all staff. An acceptance of profession differences may lead to a more responsive, innovative and flexible EMS with regards to local emergency needs (Wearing 2004).

There were also other ways in which the more highly qualified EMS staff expressed negative attitudes towards FRs. FRs were perceived to show unprofessional behaviour and to misuse their position, as well as being untrained and unemployed. This perhaps was a result of the reputation of the community units and of the fact that the FRs were perceived by some EMS workers to be equivalent to rescue volunteers, who have long been seen as unskilled, dishonorable and discreditable rescue workers by the public (Chadbunchachai 2004; Sethasathien 2008; Tanprasert et al. 2000). FRs were also not respected as they were perceived by many EMS staff to be used for political purposes by local governments to please their communities. There appeared to be some resentment by the more established units about the more newly initiated community units. It was believed that some LAOs used the community units solely to get reimbursement from the government rather than to improve patient outcomes. The suggested solutions presented by the EMS staff on this issue hence were primarily to systematically improve EMS performance by

providing EM training courses, offering adequate incentives and improving quality of care and professionalism across all EM Services. This is similar to what was reviewed by Dubois & Singh (2009). These measures would also improve public confidence in all EMS units (Iles 2005).

Apart from training and professional development, access to adequate medical resources was another area for improvement and was seen to significantly effect the performance of health personnel (Mathauer & Imhoff 2006). The participants believed that current EMS performance could be significantly improved if they had better equipment and maintenance of their units. However, as long as this perceived need was not recognised by management, the staff commented that improvement would not take place. They also noted that supply of EMS resources in KK was the responsibility of the authorities who made those decisions without input from the EMS personnel.

Creating greater satisfaction in current working conditions was another topic frequently discussed by EMS workers. Many comments were made about motivation factors affecting EMS personnel, such as the reward-effort discrepancy, health and safety issues, job security and levels of respect and recognition by colleagues and management. It was believed that if the health employees' basic needs were not met, even in lower layers of job hierarchy (Iles 2005:25), they would not be motivated to seek movement to more skilled areas or perform to meet higher goals. EMS personnel hoped that those associated with EMS management could be more accessible, create closer links with lower level workers and recognise the value of staff input and feedback (Hofstede & Hofstede 2005). Any desire to create new interventions in management structure of the service may not be successful if workers do not feel appreciated or content in their jobs (Wearing 2004).

It is clear from the suggestions mentioned above that improved management was another major area for comment and that administration and management issues were perceived by EMS staff as factors contributing to patient outcome. EMS management goals and values appeared to be important as guidance for EMS staff, but they were not satisfied with the current situation. Moreover, performance assessment and review of EMS personnel and team skills by management were perceived to be inadequate. The respondents commented that assessment criteria were unclear and leniently evaluated. This showed a lack of emphasis on training and standards, so not exhibiting the hallmarks of an institutional approach (DiMaggio & Powell 1983). Implementing this approach would also improve competence of volunteers and staff. Again the descriptors normally associated with neo-institutional theory are all evident in the perceived needs of EMS staff, indicating improvement in these areas is required to gain greater organizational legitimacy.

Apart from improving competence of EMS staff, closer links need to be created with better direction and greater commitment towards organizational goals. Without proper feedback, an improvement loop will not be accomplished and the organisation may continue to underperform (Gómez, Kirkman & Shapiro 2000). Existing hierarchies of staff may have to achieve reduction if the management wants to secure greater initiative from EMS staff. This is similar to countries where a power-distance exists and where leadership from authority figures is important and effective in management (Pasa 2000). This may be a result of the Thai tendency to be more collectivist and to avoid conflict, which could influence the way management rates good and bad performance (Sheehan & Egan 2007).

A profile developed from the EMS staff interviews shows similarities and differences across interviewees. Status of professions and degree of structure in the clinical problem they were asked to comment on appeared to be influenced by level of staff (Iles 2005). EMS staff in lower status

groups had some difficulties talking about administrative components of EMS management of the road trauma issue which could be a result of working in a high power distance context (Sheehan & Egan 2007). The varying of levels in the structure of the EMS system also contributed to different levels of understanding and clinical descriptions. For example, FRs were more likely to focus on issues at the community level while the nurses focused mainly on patient care in a hospital setting. Moreover, an undervaluing of skills and knowledge was also evident between different levels of employment of EMS workers. The recognition of role and skill difference was also seen to be required by EMS staff, particularly for those who have less skill. An openness to shared values, norms and structures in approaches for various levels of EMS could help with engaging in interactive processes between the different professional roles and promote more harmonious working conditions (Gray 1991 cited in Pollard, Sellman & Senior 2005; Wearing 2004).

In conclusion, to ensure that EM Services become mature and effective organisations, greater emphasis needs to be applied at the national level to improving policy, standards and training, while at the local area level managers need to be more effectively engaged with staff and network with stakeholders in order to see more effective use of EMS and greater inter-agency focus on RTI occurrence. Therefore neo-institutional theory has demonstrated relevance at a national and organisational level and improvement at those levels would allow more effective use of managerial and EMS staff in response to local environmental contingencies and to address common EMS and RTI issues with local stakeholders.

7.3 Presentation of Emergency Medical Services management of road traffic trauma in Haddon's matrix and outcome management approach

Linking the profile developed from the KK Trauma Registry data with the EMS database information might allow greater confidence to use the Registry data to estimate the magnitude of

road trauma risk, availability of EMS response and factors influencing patient outcomes. Moreover, relating these databases with a profile developed from the EMS staff interviews could add insight into causal factors and mechanisms in relation to road injuries and EMS response which may improve management of EMS in relation to road trauma. Haddon's matrix and the Episode of Care Model in the Outcome Management Approach are used to evaluate the response of KK EMS and road traffic injuries based on data gathered from both the quantitative and qualitative sections of the study.

7.3.1 Haddon's matrix and EMS management of RTI

In this study, Haddon's matrix is used as a guide to assess the management of EMS response to road trauma in KK Province. The complexity of EMS management of road injury can thus be reviewed in a systematic manner. By filling the matrix with the findings from this study, the researcher can identify a range of associated risks and suggested solutions that are of concern to the system and EMS personnel. The management area is divided into 12 more manageable areas according to Haddon's matrix as described below. *Host, vehicle, physical environment and social environment* were taken into consideration at *pre-injury, injury* and *post-injury* stage. The inputs of both current problems and suggested solutions, based on the EMS interviews, are presented in Table 7.2.

Pre-injury stage

Haddon (1968) maintained that the pre-injury phase can be seen as a preventable event involving a susceptible host and a causal agent. From the study, some degree of 'victim blaming'⁴ seemed to be evident in both the quantitative and qualitative findings. Victim-related factors seemed to be

⁴ Victim blaming is a concept claiming that the victims of a crime or an accident to be in whole or in part responsible for what has happened to them.

associated with seriousness of the injury. However, the suggested solutions were focused on improvement of surrounding environments to influence victims' risk-taking behaviours as well as better guidance from management. The countermeasures that the EMS workers believed could be effectively implemented to improve the situation were associated with changing physical and social environments, for example better patrolling and policing, better law enforcement, restriction of alcohol consumption, improved public education and better road design and planning.

Injury stage

At this 'impact of the factor concerned before the crash and the susceptible structures' stage, the problems were found to be more apparent regarding the adequacy of physical and social environments in relation to EM Services (Haddon 1968; Runyan 2003). The issues associated with EMS preparedness raised by the EMS staff included poor public awareness, especially about helmet and alcohol use, inadequate training of EMS personnel, poor EMS resources availability, poor communication and lack of EMS staff motivation. The suggested countermeasures in this stage of the model were perceived by EMS staff to be about improving the above mentioned factors, particularly by means of closer links between road safety authorities and administration.

Post-injury stage

The post-injury stage is close to the injury stage or can be reviewed as an extended/sub-acute injury stage. It is related to minimizing damage after injury has occurred (Haddon 1968; Runyan 2003). What was perceived by EMS staff to affect patient outcome were factors associated with medical assistance and transportation of the patient to a health facility, such as poor public awareness, communication skills and readiness of EMS units. Quality assessment and control of EMS' response was also seen as a main issue. The suggested solutions were associated with an involvement of management to improve EMS management issues regarding quality control of

EMS and human resource management. Comments on improving post-crash etiological investigation such as blood alcohol level detection were also made by EMS staff.

Table 7.1: Presentation of EMS management of RTI in Haddon's matrix with current status and suggestions for change based on EMS staff interviews

	Victim	Agent	Physical Environment	Social Environment
Pre-injury (Problems)	Severe injuries Unlawful behaviours Poor public awareness Bigger problem during festival and night times Personal and public safety Risk-taking behaviour Skill and maturity Motorcycles: head injury and speeding	Motorcycle use	Types of roads and roads use Road lighting and road surface Road works Inadequate resource for law enforcement and policing	Poor road safety education Inadequate resources for law enforcement and policing
Pre-injury (Solutions)	More restrictions on drink driving	Improved vehicle registration inspection	Better patrolling and policing of alcohol problem Practical and tangible education campaigns at school age level Traffic (civil) engineering Road work control	More restrictions on alcohol Consumption, eg. Blood Alcohol Concentration testing Managerial and local authorities involvement Closer links between workers and administration
Injury (Problems)	Poor public awareness	-	Lack of interagency Cooperation EMS communication process problems Inadequate training Shared facilities Poor equipment support and maintenance Hazardous working environment	Unprofessional behaviour Lack of financial motivation Lack of professional development Poor direction/leadership Lack of cooperation

Injury (Solutions)	Increase public awareness	-	Improved training and professional development for EMS personnel Improvement of resources for EMS units	Better direction from a single leading organization with local supports Closer links between workers and administration
Post-injury (Problems)	Poor public awareness	-	Inadequate training Shared facilities Poor equipment support and maintenance Hazardous working environment	Poor quality control
Post-injury (Solution)	Increase public awareness Blood Alcohol Concentration testing	-	Improved training and professional development for EMS personnel Improvement of resources for EMS units Local network involvement Improvement of EMS communication system	Improved assessment of service/quality control Closer links between workers and administration Better financial support Recognition from colleagues

7.3.2 The Outcome Management Approach and EMS management of RTI

Following adaptation of factors associated with KK EMS at pre-injury, injury and post injury stages, to fit Haddon's matrix, the Outcome Management Approach is also used to better understand the areas for action for health authorities, where the episode of care is the KK EMS response to RTI. This approach will be adapted to analyse all three levels of EM Service: actions before the injury takes place, the reduction of injury at the site, and the transportation of the injured. The information gathered from the KKRH Trauma Registry, EMS database and EMS staff interviews was used to evaluate the model.

A study used a model developed on the basis of the episode of care model in an outcome management approach to assist understanding of the isolated effects of EMS response to RTI prior to the hospital treatment was used. In this process the EMS episode of care is defined as a pre-

hospital interval model modified from the time-interval model used by Spaite et al. (2001). The model was constructed and simplified to cover a time-dependent outcome approach such as in an EMS care response. The intervals that need attention are grouped under six titles which include *injury risk detection, EMS activation, patient assessment, on-scene treatment, patient removal and patient transportation* (see Figure 7.1).

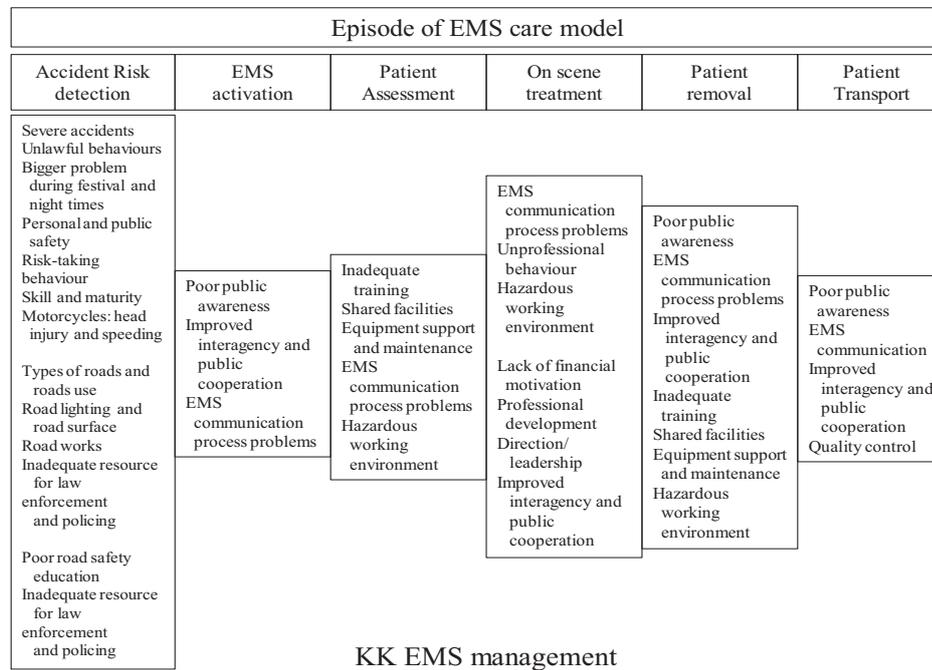
Injury risk detection is the stage of assessing relevant transport injury risk to an individual. The factors identified from the study data relevant to this stage were use of a motorcycle, being a young male, road user's risk-taking and unlawful behaviour, which included drink-driving and speeding. Inadequate resources for law enforcement and policing, poor road safety education and poor road environment were also blamed. However, the situation was believed by the EMS staff to be able to be improved by changing road safety attitudes, promoting law enforcement, improving road environments, and preparing a well-planned EM Service (Australian Transport Council 2000). These areas for suggested change were also believed to require an involvement of the road safety authorities (World Health Organization 2009b; Zaal 1994).

Among the EMS processes of care *EMS activation* is one of the most important stages. The information collated and sent to the dispatch centre by the bystanders is crucial. The interviews with EMS staff indicate that often callers were not readily understood by the CCC, or were not familiar with the sort of information that was required to be given to call-takers. Poor public awareness and EMS communication processes, including specialised training of call-takers, may require review. The level of knowledge about what EMS is, and how to use it, and current public awareness programs being implemented within the community may have to be evaluated so that strategies are developed to be most effective (Augustine 2002; Gardner 1990).

Patient assessment and *on-scene treatment* are the next two intervals of importance to the EMS staff. Performance of EMS units was shown to be a matter of concern for EMS staff who identified a lack of adequate training and equipment supplied to meet the appropriate level of care. Apart from these physical needs, staff motivation factors, such as financial and non-financial incentives, were raised by staff, although the role that these factors play may be less important strategies to improve EMS patient outcomes (Mathauer & Imhoff 2006; Stone 2002a).

Following patient care at the scene, the next stage in the episode of care is *patient removal* and *transportation*, where an involvement of bystanders was perceived to be a barrier for service provision by EMS staff, particularly at the FR level. The main factors identified were associated with an FR level lack of knowledge at the scene and bystanders' inadequate understanding of the EMS provision (Khorasani-Zavreh et al. 2009a; Li, Galvin & Johnson 2002). The lack of knowledge of bystanders and passers-by was perceived to be a potential risk factor which could increase severity of injury by the giving of inappropriate first aid and blocking patient transportation (Khorasani-Zavreh et al. 2009a). The public may need to be better informed on how the EMS units work and how to best allow proper processes of care to be rendered to road trauma victims.

Figure 7.1: The episode of care (outcome management) applied to EMS response to road trauma



7.4 Steps for improvements in Emergency Medical Services management of RTI in Khon Kaen Province

As the major aim of this thesis was a focus on how to improve EMS management of road traffic trauma, the concentration of this section is toward EMS management rather than RTI causal factors. Although the Thai EMS has expanded its services in KK rural areas, EMS personnel in KK Province are assumed to have more experience in handling patients with emergency medical conditions at out-of-hospital settings or injury scenes. EMS personnel are in the position, in their work, of being where they are exposed to both physical and social environments where the road traffic injuries occur. Many EMS employees are closely connected with their communities where they have first-hand information about the behavioural patterns of victims and actions that place them at risk for any emergency medical events.

In the KK context, it can be seen that there were many common themes put forward by the EMS staff about how to improve the current EMS. Most of the staff expressed a common will or desire to change EMS management of road trauma, but they believed that their complaints would not be acknowledged by their leaders. EMS staff seemed resigned to the fact that they were dependent on changes coming from management rather than from themselves.

The higher-ranking authorities and/or leaders could be responsible for gathering information about the views and aspirations from all the stakeholders: patients and users, the local public, staff and partner agencies, as well as all levels of hierarchy within which the EMS organization functions (Wilderspin & Bevan 2006). Closer links between management and all stakeholders were believed to be necessary by EMS staff at all levels. Involvement of management was perceived to be greatly significant in developing future strategies for performance assessment and change, particularly in the KK context. It would appear that a requirement for management would be to listen to the voice of the on-the-ground staff, reflect the common attitudes about changes, and make improvements based on appropriate information available from personnel (Iles 2005). The recommendations should be about creating an environment which encourages learning and placing a value on being a better informed environment for both staff in the EMS system and the general public. Any recommendations should be based on existing EMS structures and processes. However, it was clear that social norms are already institutionalized in EMS management.

Inputs, problems and suggested possible solutions, identified from the KKRH Trauma Registry profile, the EMS database and information given by EMS workers can be used to develop guidelines for recommendations to improve EMS management of road trauma in KK Province. The following guidelines and recommendations to promote change in the KK EMS system are based on

the progressive steps put forward by Wilderspin and Bevan (2006) to set the scene for performance improvement (see Chapter 2).

Step 1: *Build the will for change*

Although the findings from this study revealed only some aspects of EMS management of road trauma, they produced shared views on the current strength and weakness of the present EMS management. The findings in this current study could be used to set the scene for EMS management improvement since they contain evidence from the past which can be used to make plans for the future.

It was evident from the interviews that the will for change already exists in the EMS staff. Unfortunately, there were indications that many problems were associated with poor targets and directions from management. Wilderspin and Bevan (2006) stated that it should be the task of the leaders to make this shared will and the 'picture of success' clear and obvious. As this shared aspiration is about where improvement should be focused, the problematic and potential areas for improvement identified in this study include variables in relation to EMS and road traffic injury type and mechanisms which could be used by management leaders as yardsticks for improvement. For example, the situation on drink-driving and what could be done to reduce road trauma associated with alcohol consumption, or what is going to be done to improve the utilization of EMS Services. The findings also reflect key values of EMS management where some staff felt that they were undervalued and the management was overrated.

The lower level EMS staff also saw that guidance from management to solve the on-ground problems was required. This is similar to countries where a large power-distance exists and the influence and directive form of influence of the leaders is essential and effective in management

(Pasa 2000). It was perceived that guidance from authorities was quite important to the way services were directed, provisioned, coordinated and assessed (Cook 2004). The leaders, therefore, should review the data obtained from stakeholders closely to develop, prioritise and specify clear performance improvement initiatives.

Step 2: *Generate evidence and ideas*

The key concerns and shared goals to improve KK EMS identified by EMS staff should be used to set up new frameworks to measure the performance of EMS management of road trauma (Wilderspin & Bevan 2006). However, one of the main problems, for both the general public and health service providers, was associated with the availability of quality information (Hovenga & Lloyd 2006). Information seemed not to be completed for many aspects of the traffic-related injury and EMS functioning and was not linked to the system's goals in reducing morbidity and mortality.

The current data collection system hence could reveal more information about RTIs and the functioning of the EMS, which would be of more value to EMS management and stakeholders. The areas which were perceived as lacking or important by the EMS staff, especially alcohol consumption, could be focused on in the dataset and better monitored (Rivara 2001). A death audit and case file audit of injury and EMS in district hospitals could be conducted to gain more precise information, which could be analysed and generated to stakeholders and the public (Thomson & Sacks 2001).

Moreover, the way the targets of existing organisation were monitored was also perceived to be ineffective. The evaluation processes of the KK EMS could be improved to get more useful information which could specifically target areas of underperformance. The evaluation measurements undertaken should ensure that any perceived targets which have been identified by

staff in the EMS are well standardized or can be compared with the ‘international standard’ (Hovenga & Lloyd 2006). An understanding of the goals of such an evaluation must be demonstrated in advance so that the assessment can be professionally undertaken according to the targeted goals (Moore 1993).

The datasets will be more useful when they can be merged to investigate the RTI risk factors and their relationship to EMS responses. This was suggested by the EMS staff who commented that there information gathered and shared with partner agencies and the public to manage EMS response to road trauma in KK Province was inadequate. Better information about EMS response could include the type of injury and mechanism of the service. Each care interval and relevant information should be reviewed and considered for improvement. Communication within the EMS also needs to be explored. Resource supplies and maintenance and human resource management and information associated with EMS responses are also issues which could be collected from audits or surveys to ensure that resources are adequate and available. Mueller (2001) added that these potential uses and benefits of secondary data have to be used with an understanding of confidentiality and availability of quality information.

Step 3: *Build on the voice of the customer*

In many ways the voice of the customer has more effect on the service than the organisation’s needs. Feedback from customers, the general public and EMS staff have considerable value and can shape the management of public services (Smith 1993a; Wilderspin & Bevan 2006). The means by which this information is gathered is important. It must be a true presentation of opinions and be useful. From the interviews, it was clear that the evidence obtained from the existing databases did not meet the needs of internal customers (EMS staff) and also did not represent the real needs of the general public. A situation analysis of both internal and external customer needs

could to be conducted. Issues that are perceived and prioritized by the EMS staff should be evidenced by the quantitative data and, at the same time, what is seen in the quantitative profile can be evidenced by the qualitative information if it is available. This would produce a significant benefit to EMS management in terms of social influences that extend beyond clinical and practical aspects of the system (Smith 1993a:214). Focus group discussions and surveys of the EMS staff should be conducted to explore and better evaluate EMS management of road trauma.

The perceptions of EMS staff about EMS users are another area of interest. The EMS perceived that there were misunderstandings about the EMS and how to use it. The descriptions of emergency conditions, and the conditions that require pre-hospital care, seem to be poorly understood by the EMS users and this affects patient outcome and service utilization patterns. Public meetings or workshops and surveys could also be conducted within communities, especially where services are new, to discover areas where knowledge about EMS is low. Misuse and appropriate utilization rate of EMS should be identified and used as evidence to support how these events affect EMS management. The quality improvement feedback loop could be used to assess EMS users regarding the existing EMS system and to modify their behaviour (O'Connor & Megargel 1994).

It could be seen that the feedback by customers can provide benefits to the organization. Many problems and expectations are commonly discussed by EMS personnel. If the needs of the customers are met and linked, there would be more chance for improvements to the organisation to succeed. The acceptance of their feedback may create better alliances and positive experiences to improve the current service (Conrad et al. 2008; Wilderspin & Bevan 2006).

Step 4: *Execute change*

According to the findings of this study, the processes of EMS response to RTI could be re-evaluated and targeted to meet the needs of both internal and external customers to enable them to better use the EMS system. Feedback from the public and staff could be used to help direct and evaluate processes within the EMS. The public, especially, are required to properly communicate and act in response to 'emergency road trauma', whereas the EMS management may need to understand better how to access information from the staff about problem areas. However, to obtain accurate messages, the local social context (particularly the large power-distance influencing comments from those who perceive themselves as subordinates) and degree of structure in the clinical problems, which may affect clinical description, must be kept in mind. If the customers can be better involved in aspects of the improvement process (Wilderspin & Bevan 2006), the conflicts of interest, particularly the misuse of community units, which have emerged with current EM service utilization could be slowly enhanced.

After the target areas of the study are prioritized, planned, conducted and analysed, proposed target area information would need to be re-evaluated in order to locate more specific problem areas and identify what aspects of KK EMS processes should be focused on (Wilderspin & Bevan 2006). The management could then communicate the collated information to both the public and the workers in the EMS system. Public education to increase EM awareness could be promoted on evidence and more accurate information gained from EMS staff and the public (March & Yancey II 2002; Overton & Stout 2002). Any such promotion or awareness programs may have to be put in place by using problem-based strategies. However, these initiatives may not be achieved if the employees have no motivation to do so.

The KK EMS requires leaders or management that can create closer links with staff and be available to listen to and work with staff to explore reasons why the present situation may not be working efficiently and how things could be improved for both internal and external customers. The current hierarchical mode of practice, which is normally used to instill obedience in the employees and control direction, could be negotiated. Generally, the leaders would be required to create a receptive context, foster mutual respect and develop incentives amongst clinicians and other professions, bring about a transformation in performance, and create attractions with flexible strategies to cope with the fast-moving changes in health service provision.

The learning process should be commenced as an initiative of the authorities. Without their initiative, improvement would not be possible. The perceptions expressed by the EMS staff in the interviews showed that improvements would not be carried out if the leaders were not ready for change. The organization could implement leadership development programs which can improve leaders' ability to embrace the change and make the change happen at every level (Wilderspin & Bevan 2006).

Step 5: *Engage the whole system*

Generally, the internal customers may be seen being as important as the patients and viewed as the services' greatest asset, people who need to be enfranchised in order to successfully improve processes (Wilderspin & Bevan 2006). Professional teamwork was perceived by EMS staff, especially those employed in the higher professional roles such as nurses and EMT, to be very important and it should be respected to gain commitment from staff across the whole system. The views from different levels of the health staffing stratification need to be appraised and engaged with. The differences of staff at all levels should be valued, accepted and treated as they exist (Iles 2005; Wilderspin & Bevan 2006). As long as the staff feel that they are a valuable part of the

organization, and that their efforts in the services are understood to be well motivated, collaboration to improve performance of the service provided will be better (Chang et al. 2010; Willing & Pearce 2007).

EMS staff perceived that their dedication was affected by their notions of being disenfranchised, undervalued and poorly equipped. They needed to be empowered, valued and fairly treated. For example, the EMS staff perceived that they were only partly engaged in the system and that there was no useful appraisal system in place for them to provide input. Therefore, at this stage, a survey or focus group discussion across the KK EMS in relation to differences in perceptions or views across the staff hierarchy to evaluate areas of dissatisfaction and ideas for improvement would benefit the organisation (Dobson et al. 2009; USAID Center for Development Information and Evaluation 1996).

Step 6: *Sustain Change*

To manage the EMS system and road traffic related injury in Thailand, the area of socio-cultural influences may need to be taken into account for sustainability (Hanlin & Muraguri 2009) and should be taken one step at a time (Umar, Litaker & Terris 2009). It can be seen that the worldviews of Thai people are embedded in certain behavioural patterns. To better implement and sustain campaigns in this area, it may be necessary to modify and adapt EMS infrastructure to better suit the Thai social context. Some campaigns which have worked well in individualist and moderate power-distance countries may be less successful without modification in Thailand. Many leaders who use western world management strategies, where they would normally expect to see team-oriented, interactive, respectful and responsive staff members, may have to reconsider how to deal with the complex and subtle staff interactions evident in the findings of this study (Cianci 2003).

The suggestions emphasised by the EMS workers were closely related to the importance of the authoritative role of responsible bodies and communities in management of the EMS, and in the development of a closer relationship to solve RTI related problems. It could be seen that the perceptions of KK EMS staff were relatively conformist, reserved within their in-group agreement and respecting authority. The characteristics of collectivist and high power-distance followers may need to be considered in managing EMS in KK Province. Therefore, changes in EMS management may have to be undertaken through subdued interaction and public consensus (Schermerhorn & Bond 1997). Perhaps, an episode of interaction between management and staff could be investigated and compared to practice in the western developed world in order to find how best to manage EMS in the Thai context.

The suggestions presented by the EMS workers were also similar to those in many other countries which have aimed to change social attitudes and behaviour to improve RTI risks (Assum 1997; Henderson 1991; Khorasani-Zavreh et al. 2009b; Sheehan et al. 2008). The areas suggested were associated with an increase in policing, tightening of traffic law enforcement, modification of road environments and improving public education, which could be comprised of public and school education, to attempt to change attitudes and reduce road injury risk at an early age. According to Thai social characteristics, the management needs to initiate closer receptive links and develop effective teamwork by more complete engagement of stakeholders. Any guidelines which may be put forward, based on the suggested solutions from the EMS staff, would be for management to use evidence based information by management, share knowledge and facilitate learning loops within the EMS system with the public (March & Yancey II 2002). In relation to the qualitative findings, it might be necessary to develop additional information infrastructure to be used as evidence to support the perceptions of the EMS staff and stakeholders. This evidence could then be used to

evaluate whether feedback given by staff is useful or not. This would also create a receptive context and involve EMS staff in a consultative process about improvement of patient outcomes.

7.5 Implications for policy, practice and research in EMS context: facilitating change in Khon Kaen Province

This thesis has investigated different aspects of EMS response to road trauma from a public health and social constructionist/interpretivist perspective and identified a number of significant issues. In reviewing how these issues might be addressed from a KK EMS perspective, the following section will outline the implications of this study for policy, practice and future research.

Various studies have outlined how EMS outcome may become worse where there is no proper EM Service available after the emergency event (Dobson 1996 cited in Tipayarangsarit 2005; World Health Organization 2005a). In terms of policy development, the allocation and delivery of EM services can be seen as a system consisting of inputs, process and outcomes. Further studies need to be undertaken to identify and clarify the constraints and influences, particularly regarding EMS infrastructure and the EMS workforce which have been paid less attention. Research that explores the availability of data which can demonstrate factors associated with RTI risk and injury could help understand the condition underlying RTI.

The findings of this study also indicate that current injury surveillance, and to a less degree, the EMS database, provide a perspective that is somewhat similar to the EMS staff comments. In a social context, the participants constructed their views on EMS management based on the local worldview which provides a background and value to the people involved. In documenting insights the EMS staff gave in regard to RTI and EMS management, this research may have generated unique ideas regarding solutions to EMS management of road trauma. Furthermore, surveillance systems, while generating information to aid development of injury prevention programs, could be

of more use (Zeitz 2004). The information can be used in co-operation with public actions and interventions to generate greater public knowledge. This quality information could significantly improve the function of these data in decision-making and public education programs.

While public knowledge about EMS should be promoted, the EMS needs to have a broad network of access to capture those victims who require pre-hospital care. Further planning research is needed which aims to identify the need, demand and use of EMS regarding RTI. The need of EMS for RTI patients could also be further assessed. While characteristics of RTI could be used to describe need and demand, which may stimulate supply of better equipment and training of EMS personnel, the utilization of the emergency room and EMS could also be used to assess supply needs. These three components may need to be made more comparable (Black & Gruen 2005c).

An exploration of RTI and EMS countermeasures provides a useful framework to investigate multi-dimensional aspects of EMS management. The investigation of EMS management within the KK social context has shown that there is a deficit of understanding in EMS personnel regarding road trauma problems across different EMS worker roles. Undertaking research that will further explore and more fully investigate issues raised by this study, such as blood-alcohol testing, helmet use and EMS related activities, can help explore aspects of RTI and EMS knowledge construction, and also be extended to other areas of injury and emergency medical conditions.

The study has helped to identify and understand why road users are not following the road safety rules and regulations. While there have been a number of campaigns and studies that have attempted to improve this situation, there have not been sustained and holistic efforts to improve the current situation. Stakeholders involved have not paid great attention to this problem in the past, while there has been no evidence to indicate the size of the problem.

Support from road traffic engineering and policing is important in implementing road safety campaigns, particularly in primary prevention as well as in supporting individual road users to be more aware of road safety issues. The allocation of funding to improve road defects and police presence needs to be taken into consideration. The identification of these two factors in association with RTI should give priority to environmental conditions to prevent future problems. Furthermore, the task of correcting the inputs associated with road defects and sanctioning laws should also be investigated, as should maintenance of those inputs.

Dubois and Singh (2009) argued that wider perspectives, which focus on how human resources can be differently managed may be useful in the management of health care. In relation to comments of EMS personnel regarding RTI management, the issue could be handled by combining top-down and bottom-up approaches for the road users and injury victims to promote an understanding of primary and secondary injury prevention. Drawing on the body of knowledge evaluated by the Haddon matrix and an outcome-based management approach reveals that management of RTI and KK EMS is bound up with various stakeholders. Greater attention to a system approach associated with RTI and EMS in managing the present situation could help to construct new knowledge of EMS in relation to RTI.

Cultural differences in managing organizations involving a number of staff hierarchies need to be acknowledged and addressed at a number of levels (Hofstede 1997; Hofstede & Hofstede 2005). As discussed, this study demonstrates that the management of EMS response to RTI is tied up with the social context. The most effective way to address and maintain the effectiveness of EMS management is to promote the involvement of authorities such as family and local and government leaders, rather than to start with the general population. An alternative strategy would be to encourage more in-group perceptions. Rather than discriminating against those FRs who may be

unskilled, acknowledging these people, such as allowing them better access to training on prevention and encouraging them in their position as team members, could encourage more positive and homogenous effects. Less out-group imagery and discrimination could help construct new EMS management.

While the observations made in this study provide a better understanding of the trends in RTI and the use of the KK EMS based on how EMS utilization is perceived by KK EMS personnel, a number of questions have been raised that require further investigation. The research questions developed for this study could be replicated in other areas such as in similar rural settings in other Provinces. As demonstrated in this study, experiences affect the understandings of EMS personnel and how they interpret the RTI situation and the response of the EMS system to RTI.

7.6 Limitations of the study

As discussed in chapters 4 and 5, there are a number of limitations inherent in the quantitative component of this thesis. The biggest limitation was not being able to obtain specific detailed cases involving road traffic injury from the EMS database. While specific information in relation to treatment outcomes and EMS utilisation is not presented in detail in this published version, specific information relating to road traffic injuries was not independently presented in the EMS database. Integration of the Trauma Registry data and EMS database could improve the available information, particularly for road traffic injury cases and other issues of interest. Moving beyond the epidemiological approach currently taken towards surveillance data to include road safety, EMS workforce and infrastructure data could be useful for assessment of the performance of EM units.

The limitations of the study include the use of two separate routinely collected data sets which are limited to providing information on injury cases who attended KKRH ER and those who used the EM Services in KK Province. Moreover, these two datasets had an overlapping catchment area and a significant time-lag between time of injury and analysis of data. This meant that any prevention programs which may have reduced injury would not have been evident, nor would any new trends arising in injury levels. Variations and changes in definition of RTI and EMS over time have also occurred.

The data collected from all Thai injury surveillance sentinel sites, including KKRH Trauma and Critical Care Centre (TCC), can be assumed to represent only 27.7% of all fatal and 5.5% of all non-fatal RT injury reported at the national level (Bureau of Non Communicable Disease 2006). This means that the rest (72.3% of fatalities and 94.5% of non-fatalities) occurred outside sentinel site areas. The sentinel site dataset will have a reporting bias to sites collecting the information. The lack of resource availability, such as technical and financial support and human resources of the nearby districts, means that there are data gathering limitations in these districts. To improve injury data availability in non-sentinel sites, a recommendation would be to conduct a death audit and case file audit of injury in district hospitals.

As discussed in Chapter 6, a reflective approach to the use of content and thematic analysis can increase analytic rigour. The reflective nature and flexibility of the thematic analysis shaped the conceptual ideas presented in this thesis. Interpretations from the EMS staff were thematised and analysed for development of emerging themes. However, individuals interviewed for this study were limited to one EMS and one health area and did not include samples in other stakeholder sides such as the enforcement and engineering officers. A comparison with other health areas, for example rural areas and stakeholders, for instance policemen and engineers, would increase the

comprehensiveness of the present study. Further research exploring differences between locations could add more specific detail for the different health areas and the underlying physical and social factors in EMS management of road traffic trauma.

7.7 Contributions of the study

The research undertaken in this study found that while there has been valuable research covering many aspects of road traffic injuries and EM Services such as involvement of alcohol, law enforcement, and EMS performance, this has been the only study conducted to date to specifically examine EMS response to injury following RTIs. For this reason, the study is a valuable source for initiating and supporting future research that may be undertaken to investigate RTIs and EMS responses. From as an early stage in the study process, it was recognized that the available data published in KKRH Trauma Registry and obtained from an EMS database used to manage KK EMS was expected to provide deeper information. However, it provided an evidence-based context and rationale for exploring important aspects of injury specific to the KK situation, reinforcing the importance of road traffic injury and EMS response and presenting detailed evidence for managing the EMS in KK Province.

The study has highlighted the need to rethink current approaches to RTI and EMS response regarding road traffic injury surveillance. For instance, the integration of road traffic injury in-patient data and road trauma injury in the EMS database could assist in understanding EMS performance and capability in each episode of care at a national and local level. In the delivery of EM Services and resources it is important to more fully understand what is needed as well as understanding demand and supply available in a local context. Providing an examination of locality-based information in greater detail would enable decision-making to be driven from an evidence base.

This study has shown the important role inputs, processes and outcomes can play in the management of EMS. This study has demonstrated that there is a requirement to clarify the real need of the population rather than supply to the predicted demand of the EMS. This study also confirms that a more comprehensive understanding of the service users is required to make improvements. The findings strengthen the importance that each process in the episode of EM care has for patient outcomes ranging from activation of EMS units to the transportation of the patient to a health facility.

This research draws attention to the social context that the Thai character and worldview play in determining subtle interactions which will affect changes in health service provision. This study has demonstrated that one of the critical factors influencing EMS and RTI management is the way things are administrated. The study also confirms that powerful leadership or authority remains significantly important in relation to RTI control and EM Service handling. The findings also reinforce the view that trust and a respectful relationship towards leaders is valued by subordinates. Consequently, it is important that good management for EM personnel infrastructure should not be undervalued in efforts to improve performance of the organization.

Some of the major trends identified for injury notifications are indicative of many factors and constraints, including social, economic, cultural and political elements that compound the service of EMS to road traffic victims experienced by EMS staff. These problems impinge on the community and will continue to affect the community until these aspects are addressed by national and local authorities. The experiences relayed by the study participants highlight the Thai social context that influences their views and perceptions of the management of road trauma. Measures that encourage individuals to adapt their risk behaviours to reduce risk will aid the management of EMS and other road safety interventions. Accepting that EMS personnel experiences will have a

range of attitudes, increasing the discourse around EMS and RTI in the KK context could help create more positive and well-defined messages.

One of the contributions of this research is to highlight the value of combining qualitative and quantitative information when investigating factors associated with injury, conducting research, developing policy and undertaking interventions in relation to road traffic injury. The consideration of social aspects, especially sociocultural data, with public health surveillance data could provide better insight into the trends and patterns of RTI and EMS provision. Conducting further studies that show the importance of inequities and the results of interventions would be an important contribution that could be made to the public health agenda.

This study has drawn attention to how the understanding of EMS personnel in regard to EMS management and road trauma shape EMS patient outcomes. The relationship between the perceived RTI and EMS management can influence not only patient outcome but also influence the interactions that occur within the EMS. Ensuring better performance of EMS regarding RTI could increase the decision made by EMS staff to raise problematic issues with their leaders.

The significance of level of care in influencing EM Services, demonstrated in this study, highlights the importance of care level as a marker for affecting provision of care and shaping different experiences. While general demographic data such as gender and age are prominent in the literature, the social values and the worldview of Thais generally have not often been considered in the Thai research context, the effect of these dimensions in relation to management of road trauma by EMS staff may influence actions and interactions of EMS staff and thereby impinge on any strategies to improve functioning of EM Service. Future research that explores the relationship of Thai sociocultural characteristics in relation to health service management and road traffic trauma

would be an important contribution to the public health agenda and could move beyond demographic aspects of the population studied. By extending the notion of social context underpinning decision-making of injury prevention programs in KK, any programs implemented would most likely be more successful, and effectively reduce the burden on the Thai health service of injury-associated cost. It can be implied that the dominant discourses in management present in KK EMS are also integrated into the management practice of the local organisation. Strategies in relation to EMS management of road trauma that are directed towards road users and EMS users will require an understanding of the contexts of Thai rural communities in order to be effective.

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