

# A Study of Distinctive Models for Pre-hospital EMS in Thailand: Knowledge Capture

R. Sinthavalai, N. Memongkol, N. Patthanaprechawong, J. Viriyanantavong, and C. Choosuk

**Abstract**—In Thailand, the practice of pre-hospital Emergency Medical Service (EMS) in each area reveals the different growth rates and effectiveness of the practices. Those can be found as the diverse quality and quantity. To shorten the learning curve prior to speed-up the practices in other areas, story telling and lessons learnt from the effective practices are valued as meaningful knowledge. To this paper, it was to ascertain the factors, lessons learnt and best practices that have impact as contributing to the success of pre-hospital EMS system. Those were formulized as model prior to speedup the practice in other areas. To develop the model, Malcolm Baldrige National Quality Award (MBNQA), which is widely recognized as a framework for organizational quality assessment and improvement, was chosen as the discussion framework. Remarkably, this study was based on the consideration of knowledge capture; however it was not to complete the loop of knowledge activities. Nevertheless, it was to highlight the recognition of knowledge capture, which is the initiation of knowledge management.

**Keywords**—Emergency Medical Service, Modeling, MBNQA, Thailand.

## I. INTRODUCTION

SINCE 2001, a government unit, namely Narenthorn, under the Ministry of Public Health was founded to develop and control the practice of Emergency Medical Service (EMS) in Thailand in response to growing need from the public for pre-hospital professional care, mainly, for road traffic injuries. The ultimate goal of Narenthorn is to contribute a sustainable and effective pre-hospital EMS in Thailand by setting up the system covering all areas in the country and involving local stakeholders (public sectors, private sectors, and local administrative organizations) to provide community based health management. In 2008, Emergency Medical Institute of Thailand operated under the Ministry of Public Health was found prior to formally sustain the growth of pre-hospital EMS and inherit the responsibility from Narenthorn.

Most of current stages of pre-hospital EMS (briefly classified as province) are in the infancy stage. Exceptionally,

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one area, which has been set up the service since 1994, has been recognized by the WHO. However, the rest of provinces started to recognize the importance of developing a pre-hospital care recently and the practice varies greatly. Those can be found as the diverse quality and quantity. No formal pre-hospital system exists. To shorten the development of the system, lessons learnt from best practices are concerned. Therefore, to this paper, the focus was to analyze the cases of pre-hospital EMS in effective areas and to ascertain the factors and their practices. Those can contribute the development of model for guiding other areas to establish or improve the performance of the practices.

To model the practice, MBNQA was chosen to be the modeling framework since it represents wisely for what are key elements in the organization. Besides, it is a remarkably accepted model for organizational quality assessment and improvement. It has been used by thousands of business, healthcare and educational organizations [1]. Consequently, MBNQA is customized to the content of pre-hospital EMS and then, becomes the framework of discussion.

## II. RESEARCH BACKGROUND

### A. Emergency Medical Service (EMS)

EMS should be concerned as the system linked between pre-hospital care and care at the hospital. However, all components must work together. Pre-hospital care is defined as “the care provided in the community (at home, school, work or recreation area) until the patient arrives at a formal health-care facility capable of providing definitive care” [2]. The service covers accidents and emergency. Six key processes in pre-hospital EMS as presented in Fig. 1.

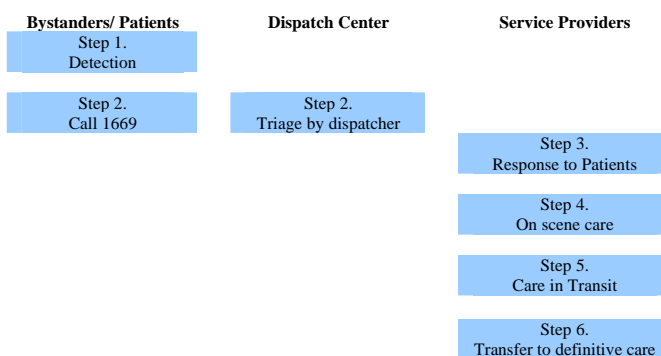


Fig. 1 Pre-hospital EMS processes

Most of the pre-hospital care systems in any countries are composed of these three levels; First Responder (FR), Basic Life Support (BLS) and Advanced Life Support (ALS), ranked by low-to-high ability of operations [3]. Each level varies due to the ability of personnel, medical equipment and transportation. In Thailand, all service providers have to register to Emergency Medical Institute of Thailand. Fig.2 presents the service providers (units) as cumulative from 2003-2007.

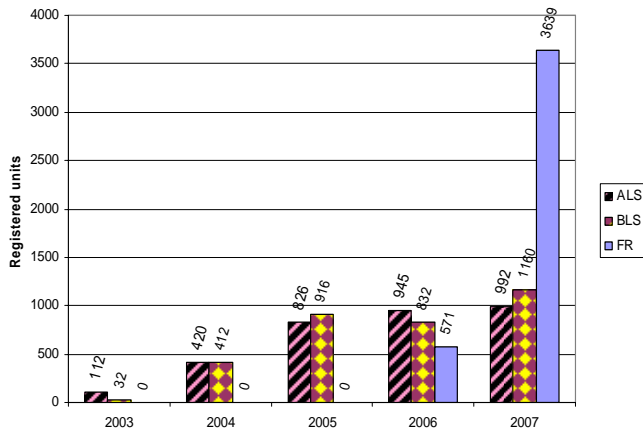


Fig. 2 Service Providers in Thailand

### B. Knowledge Management

Knowledge Management (KM) focuses on the processes of locating, organizing, transferring, using and creating information, knowledge and expertise within an organization [4]. It has become a significant issue since organizations have increasingly regarded the management of knowledge as the way to add competitive value to products and services [5]. KM is a broad and multi-dimensional aspect; it covers most aspects in an organization [5]. Different people propose different KM approaches: for example, some are focused solely on technologies; others consider it as a management philosophy [6]. Some are the integration of technology and community of sharing [7]. Whatever various definitions and approaches are proposed, reference [8] stated that the critical issue is to find useful knowledge, create it, bottle it and pass it around.

A number of papers attempt to classify the activities in the KM or knowledge chain. For example, reference [9] suggested four phases: knowledge construction, dissemination, use and embodiment; reference [7] referred to a process of knowledge as knowledge creation, validation, presentation, distribution and application. The approaches to classifying activities in the knowledge chain may vary in terms of name and type of categories. However, most of the approaches are based on similar core activities: (1) *knowledge capture and codification* (2) *knowledge sharing* (3) *knowledge utilization* (4) *knowledge development and creation*. In this paper, when referring to knowledge activities or knowledge chain, these activities will be used as standard knowledge activities.

### C. Modeling

To this research, the team attempts to develop the model for guiding other areas how to develop or improve their pre-hospital EMS. Thus, there are some constraints to design the model. The key constraints are (1) providing the big picture for all element or success factors in EMS practice and (2) understandable and recognized model. Subsequently, the team worked hard to find the appropriate model and The Malcolm Baldrige National Quality Award (MBNQA) was conclusively chosen.

MBNQA was promoted by the National Institute of Standards and Technology (NIST) under the US Department of Commerce in 1987. MBNQA framework comprises most of the basic tenets of Total Quality Management (TQM) [10]. Therefore, it has been in use particularly in the business, education, health care and nonprofit [1], [10].

Focusing on the objectives of launching the award, there are to promote recognition of quality achievements and to raise awareness of the importance of technique of quality improvement [11]. These benefits could be pinpointed in the companies applying for the award. Besides, MBNQA can be seen as framework that any organizations, even any do not focus ultimately for the award. The framework provides a systematic perspective as self-assessment and as tool to improve overall performance [10].

MBNQA has become a 'role model' in developing a national quality award for many other countries [10]. For example, Australia Business Excellence Award, Singapore Quality Award, Japan Quality Award, European Quality Award and Thailand Quality Award. In Thailand, other sectors also employ MBNQA as framework for awarding; for example Public Sector Management Quality Award (PMQA), State Enterprise Performance Appraisal (SEPA), Primary Care Accreditation (PCA) and Hospital and Healthcare Organization Standards 2006 for the 60<sup>th</sup> Anniversary Celebration of His Majesty's Accession to the Throne June 2006.

Seven categories make up the framework, as presented in Fig. 3 [12]. Top of the framework, *Organizational Profile* is a snapshot of the organization for the way the organization operates. It is to examine the service offerings, organization environment, relationships and strategic challenges and advantages.

Category 1, *Leadership* is to examine how senior executives guide the organization and how the organization addresses its responsibilities to the public. Category 2, *Strategic Planning* is to examine how the organization set strategic directions and how it determines key action plans. Category 3, *Customer and Market focus* is to examine how the organization determines requirements and expectations of customers and markets; builds relationships with customers; and acquires satisfies, and retains customers. As these three categories are grouped together, this is to emphasize the importance of a leadership focus on strategy and customers. Senior leaders should set the organizational direction and project the future opportunities for the organization.



Fig. 3 MBNQA framework

Category 4, *Measurement, Analysis and Knowledge Management* is to examine the management, effective use, analysis, and improvement of data and information to support key organization processes. This category is critical to the effective management of the organization since it leads the organization to a fact-based and knowledge-driven system.

Category 5, *Workforce Focus* is to examine how the organization enables its workforce to develop its full potential and how the workforce is aligned with the organization’s objectives. Category 6, *Process Management* is to examine aspects of how key production/ delivery and support processes are designed, managed, and improved. Category 7, *Results* are to examine the organization’s performance and improvement in its key business areas; customer satisfaction, financial and marketplace performance, human resources, supplier and partner performance, operational performance, and governance and social responsibility. These three categories are placed together to represent the result triad.

III. RESEARCH METHODOLOGY

The overall research methodology can be concluded as Fig. 4. The criteria framework of MBNQA was adopted to be the discussion framework for this research. However, this is not to apply for the award. All weights assigned to the criteria set were ignored.

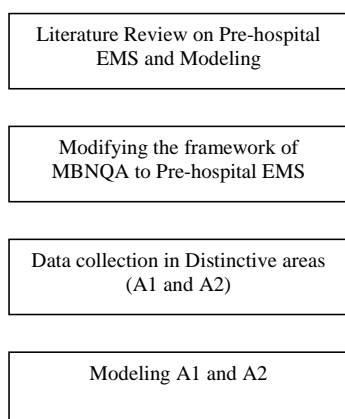


Fig. 4 Research Methodology

In the stage of data collection, in-depth interview to key stakeholders; dispatch centre and service providers (provincial administrative organizations, sub-district administrative organizations, hospital, etc.) was chosen as the main method for gathering the data.

The selection of best practices was based on one of the key performance indicators (KPIs) of EMS practice (governed by Narenthorn) in 2007, “*proportion of hospitalized emergency patients covered by pre-hospital care*”. This resulted in 2 selected areas namely A1 and A2 since both are top-two areas. Table I proposes the data of A1 and A2.

TABLE I  
DISTINCTIVE AREAS; A1 AND A2

Area	Population	Percentage of Hospitalized emergency patients covered by pre-hospital care
A1	1.744 million	61.012
A2	1.768 million	53.458

Pre-hospital care in A1 was established since 1994 and later on became a WHO training centre for trauma care. A2 set up pre-hospital care since 2004 with extraordinary growth in volume of services. The provincial administrative organization together with provincial health office took an initiative to setup pre-hospital care providers covering the whole province within just 1 year. Both provinces are located in the Northeast of Thailand. Focusing on the operations, Table II provides the detail of both areas. It would be pointed that A1 emphasizes the service as FR level; while A2 focuses on BLS service level.

TABLE II  
A1 AND A2 OPERATIONS IN 2007

Area	Service Providers			Total
	ALS	BLS	FR	
A1	2,785	18,191	16,764	37,742
A2	5,383	51,514	49	56,946

IV. RESEARCH OUTCOMES

A. *Pre-Hospital EMS Model*

As been mentioned, MBNQA framework provides a systematic perspective that any organizations can use as self-assessment and as tool to improve overall performance. This research focuses MBNQA as a framework to ascertain the pre-hospital EMS practice in this study.

Subsequently, it is interesting to consider how to define the categories of MBNQA best suited to the content of pre-hospital EMS. Remarkably, the main consideration of this model is in the provincial scale and the key contributors are all stakeholders (administrative organizations, service providers, patients and other supporters) Table III summarizes the definition of categories contributed to the model designed.

TABLE III  
DEFINITIONS OF CATEGORIES IN THE MODEL DESIGNED

Categories	Definition to Pre-hospital EMS
<b>Organizational Profile</b>	
P.1 Organizational Description	Focus on the service offerings and actors in the EMS system (administrative organizations, service providers, patients and other supporters)
P.2 Organizational Situation	Focus on the competitive position- relatively to the growth of provincial service (compared internally) and to other provincial services (compared externally), challenges and advantages
<b>1 Leadership</b>	
1.1 Leadership	Focus on the ways leadership set and communicate the vision, values and mission prior to create the sustainable service with its responsibilities to the patient and social
1.2 Societal Responsibilities	Focus on assuring the ethical behavior and fulfilling societal responsibilities, the contributions to community health
<b>2 Strategy Planning</b>	
2.1 Strategy Development	Focus on the processes of strategic planning and the outcome as strategic objectives and goals and also timetable for accomplishing them.
2.2 Strategy Deployment	Focus on how to set and update the action plans, including allocating finance, human resources and measurement to track the achievement of action plan
<b>3 Customer Focus</b>	
3.1 Customer Engagement	Focus on how to identify the requirements and expectation of patients and stakeholders prior to design the service, make the service easy to access and contribute the customer engagement
3.2 Voice of the Customer	Focus on how to listen to patients and stakeholders for the feedback and how to manage their complaints
<b>4 Measurement, Analysis, and Knowledge Management</b>	
4.1 Measurement, Analysis, and Improvement of Organizational Performance	Focus on how to measure, analyze, review and improve the service performance through the use of data and information
4.2 Management of Information, Knowledge, and Information Technology	Focus on ensuring the quality and availability of needed data, information, software, and hardware and also contribute to knowledge assets.
<b>5 Workforce Focus</b>	
5.1 Workforce Engagement	Focus on how to engage, manage, and reward workforce to achieve high performance. This includes the learning and development system
5.2 Workforce Environment	Focus on how to maintain the safety, secure, and supportive work climate
<b>6 Process Management</b>	
6.1 Work Systems	Focus on how to design the work systems and determine its key processes
6.2 Work Process	Focus on how to manage key processes that lead to service success and sustainability. This includes identifying process measures, preventing errors and improving the processes.

TABLE III  
DEFINITIONS OF CATEGORIES IN THE MODEL DESIGNED (CONTINUE)

Categories	Definition to Pre-hospital EMS
<b>7 Results</b>	
7.1 Health Care Outcomes	Focus on service results in levels and trends of key measures or indicators
7.2 Customer-Focused Outcomes	Focus on customer satisfactions as current levels and trends
7.3 Financial Outcomes	Focus on financial performance in levels and trends of key measures or indicators
7.4 Workforce-focused Outcomes	Focus on workforce engagement and satisfaction as current levels and trends
7.5 Process-effectiveness Outcomes	Focus on operational performance in levels and trends of key measures or indicators
7.6 Leadership Outcomes	Focus on accomplishment of organizational strategy and action plan and the contribution to community health

### B. Knowledge Capture for the Distinctive Practices

Table IV summarized the content of practices in two distinctive areas and some of lessons learnt. Some of the issues were relatively compared and some were pinpointed for further ascertainment if interested.

TABLE IV  
MODELING CONTENT AND LESSONS LEARNT

Modeling Content	Lessons Learnt/ Best Practice
<b>P: Organizational Profile</b>	
<ul style="list-style-type: none"> <li>The practical leaders in A1 is Trauma and Critical Care Center in the main provincial hospital; where as the leader in A2 is the provincial health office</li> </ul>	<ul style="list-style-type: none"> <li>Advantages/ Disadvantages for those issues</li> </ul>
<ul style="list-style-type: none"> <li>The community service providers (sub-district administrative organizations) in A1 are regularly registered as FR; whereas those in A2 are mostly registered as BLS. Those are based on the leader's vision. In A1, the leaders believe that FR can provide sufficient basic first-aid and the service focuses on 'run and scoop'. In A2, the leaders consider that knowledge and skills as FR are insufficient.</li> </ul>	<ul style="list-style-type: none"> <li>Advantages/ Disadvantages for those issues</li> </ul>
<ul style="list-style-type: none"> <li>The involvement of community to setup the service providers in A1 is claimed as bottom-up approach. In A2, the leaders support equipments and transportations, and then request communities to setup team. The initiation could be claimed as top-down approach</li> </ul>	<ul style="list-style-type: none"> <li>Advantages/ Disadvantages for those issues</li> </ul>
<ul style="list-style-type: none"> <li>Based on one of the KPIs in EMS (Table I), A1 and A2 were ranked as top-two in the countries. However, A2 was formally setup the service system in 2004 and the growth rate was recognized as rapidly high.</li> </ul>	<ul style="list-style-type: none"> <li>The rapid growth in A2</li> </ul>
<b>1: Leadership</b>	
<ul style="list-style-type: none"> <li>The leader team in A1 was formally setup and they contribute practically to the service system. The provincial vision is setup and revised regularly prior to the circumstance. The value and norm are formulized gradually since the system was initiated and those are communicated through the practice of the leaders and any activities of the workforces. In A2, no provincial vision is specifically setup.</li> </ul>	<ul style="list-style-type: none"> <li>Leadership commitment in A1</li> </ul>

TABLE IV  
MODELING CONTENT AND LESSONS LEARNT (CONTINUE)

Modeling Content	Lessons Learnt/ Best Practice
<ul style="list-style-type: none"> <li>The leader in A1 and A2 are good in motivating other actors to involve in the service system. A1 could be highlighted for motivating the sub-district administrative organizations to setup the service providers. In A2, the attempt was to setup the facilities (transportation and equipment) prior to initiate the system; thus leader worked hard to involve partners e.g. provincial administrative organization supporting for transportation</li> </ul>	<ul style="list-style-type: none"> <li>Motivating actors in the service system</li> </ul>
<b>2: Strategy Planning</b>	
<ul style="list-style-type: none"> <li>A1 has formally processes in strategic planning and deployment. The objectives and action plans are regularly formulized. The consideration is not only the service but also the research on service improvement.</li> </ul>	<ul style="list-style-type: none"> <li>Strategic planning process and deployment in A1</li> </ul>
<b>3. Customer Focus</b>	
<ul style="list-style-type: none"> <li>A1 sets '80% of customer satisfaction' as one of provincial KPIs and then the formal process for gathering satisfaction is regularly performed. The result and any customer complaints are fed back to service providers and analyzed for further improvement via the monthly meeting (all actors involved)</li> </ul>	<ul style="list-style-type: none"> <li>The process of gathering customer satisfaction</li> <li>Monthly meeting</li> </ul>
<b>4. Measurement, Analysis, and Knowledge Management</b>	
<ul style="list-style-type: none"> <li>Every Month, both A1 and A2 have to report KPIs set by Emergency Medical Institute of Thailand. Additionally, A1 set up further thirteen monthly KPIs and the data collection program, which are employed in 7 nearby provinces.</li> </ul>	<ul style="list-style-type: none"> <li>KPI set in A1</li> </ul>
<ul style="list-style-type: none"> <li>A1 regularly review the set of KPIs in the monthly meeting prior to provide the feedback and consider for improvement. Leaders of A2 review the KPIs quarterly in their meeting</li> </ul>	<ul style="list-style-type: none"> <li>Monthly meeting in A1</li> </ul>
<ul style="list-style-type: none"> <li>A1 could be claimed as research center for Thailand EMS. Many researches have been performed and contributed to setup and improve the EMS system in Thailand</li> </ul>	<ul style="list-style-type: none"> <li>Research center in A1</li> </ul>
<b>5. Workforce Focus</b>	
<ul style="list-style-type: none"> <li>Learning and development system in A1 and A2 are constrained by regulation of Emergency Medical Institute of Thailand.</li> </ul>	
<ul style="list-style-type: none"> <li>A1 provides the open communication and recognition to the service providers via monthly meeting. Service providers can feedback any obstacles or represent their best practices.</li> </ul>	<ul style="list-style-type: none"> <li>Recognition and two-way communication in A1</li> </ul>
<ul style="list-style-type: none"> <li>A2 setup the grant for workforce insurance</li> </ul>	<ul style="list-style-type: none"> <li>Workforce insurance in A2</li> </ul>
<b>6. Process Management</b>	
<ul style="list-style-type: none"> <li>Work system and key processes in EMS service are defined by Emergency Medical Institute of Thailand. However, to involve any partners and to setup roles and responsibilities, those may vary by province. Similarly, the management in key processes is diversely.</li> </ul>	
<ul style="list-style-type: none"> <li>Call center is situated in the main provincial hospital for A1 and in the provincial health office for A2.</li> </ul>	<ul style="list-style-type: none"> <li>Advantages/ Disadvantages for those issues</li> </ul>
<ul style="list-style-type: none"> <li>A1 is highlighted for the pilot setting for service provider. From the pilot, A1 could ascertain factors to manage and maintain the service providers.</li> </ul>	<ul style="list-style-type: none"> <li>Pilot setting the service providers</li> </ul>

TABLE IV  
MODELING CONTENT AND LESSONS LEARNT (CONTINUE)

Modeling Content	Lessons Learnt/ Best Practice
<ul style="list-style-type: none"> <li>The strong focus on expanding service providers covering whole province in A2 results in the initiation concerned as top-down approach</li> </ul>	<ul style="list-style-type: none"> <li>Top-Down mechanism in A2</li> </ul>
<ul style="list-style-type: none"> <li>With the long development of EMS in A1, most of service providers (as sub-district administrative organizations) decided by themselves to start up their services whenever they need. This is claimed as bottom-up approach</li> </ul>	<ul style="list-style-type: none"> <li>Bottom-up mechanism in A1</li> </ul>
<ul style="list-style-type: none"> <li>With the focus on research and performance measurement in A1, the attempt to improve process performance is performed regularly</li> </ul>	<ul style="list-style-type: none"> <li>Process improvement in A1</li> </ul>
<b>7. Results</b>	
<ul style="list-style-type: none"> <li>Both A1 and A2 measure their service performance through KPIs set by Emergency Medical Institute of Thailand. However, the customer-focused outcome, financial outcome and workforce outcome are not considered in those KPIs. In the set of further KPIs in A1, customer satisfaction is considered.</li> </ul>	<ul style="list-style-type: none"> <li>KPIs set in A1</li> </ul>
<ul style="list-style-type: none"> <li>The completed process of PDCA (Plan-Do-Check-Act) in A1 should be highlighted. The well-plan is formulized by the leaders (P), and then the service is performed (D). Set of KPIs measures the performance (C). Feedback are regularly reviewed and communicated to all actors via the monthly meeting. Finally they are involved in proposing the improvement (A).</li> </ul>	<ul style="list-style-type: none"> <li>PDCA in A1</li> </ul>
<ul style="list-style-type: none"> <li>Additionally, the availability of practice guidelines and other technical papers produced by A1 team is strong evidence of explicit knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>Process of Knowledge capture in A1</li> </ul>

As can be seen, the similarities and differences in both cases are beneficial. Those result in different approaches to establish and step-up the practices.

## V. DISCUSSION AND CONCLUSION

There are two ultimate goals for this research. *Firstly, it is to capture the knowledge of practice from the pre-hospital EMS system in two distinct areas.* It is necessary to remark that the focal point of this research is a big picture of EMS system situated in each area; it is not the knowledge in practice of EMS personnel.

Story telling and lessons learnt from the effective practices are valued as meaningful knowledge for shortening the learning curve in some other areas and speeding up their EMS systems. Thus, the systematic knowledge capture for an effective reuse of knowledge is considered. In particular, no formal pattern of the practice exists and the core knowledge of EMS practice is mostly tacit. Within this research, even it is not to complete the whole process of knowledge management; nevertheless starting by capturing the best practices and lessons learnt is an attempt to provoke the knowledge management.

*The second goal of this research is to formulize and prototype the model for pre-hospital EMS practice.* The study was working hard to compare and contrast several models and

finally, MBNQA was chosen. The framework of the MBNQA can represent not only the overall picture of elements in pre-hospital EMS, but also the connection of those elements. It could be claimed as to sustain the model of practice. In the future, if any areas of practices are highlighted for the success, the modeling framework can enable to ascertain the elements of those practices. Respectively, new knowledge of best practice and lessons learnt are captured and shared.

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