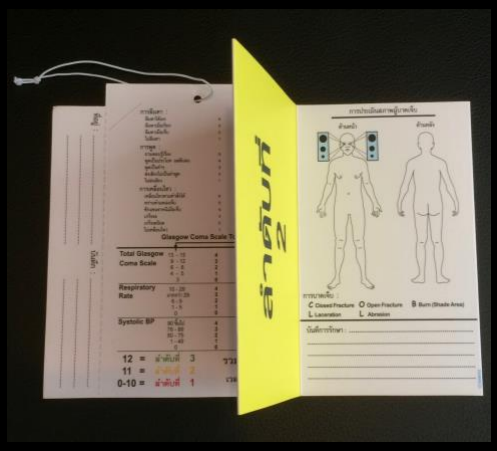

UNIVERSITY OF GOTHENBURG

Hospital preparedness for major incidents and disasters in Thailand

Evaluating hospital preparedness and focusing on medical products and technology, service delivery and participation in Phuket and Phang Nga

Emilie Laurell

Degree Project in Medicine

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THE SAHLGRENSKA ACADEMY

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Gothenburg, Sweden 2018

Supervisors:
Amir Khorram-Manesh,
Unit of Security and Preparedness at Region Västra Götaland, Sweden

Prasit Wuthisuthimethawee,
Faculty of Medicine, Prince of Songkla University, Thailand

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Emilie Laurell, Degree Project, Programme in Medicine, University of Gothenburg, Sweden

Abstract

Background: A hospital should be safe and prepared to deliver health care during any disaster. One way to assess hospital preparedness is to use the World Health Organization's *Hospital Safety Index*. Nevertheless, the tool is comprehensive and hence time and resource consuming. A new, universal self-assessment tool has been developed in Thailand. It is less comprehensive and aims to be used for strategic planning by the Ministry of Public Health. However, it has not been tested before. The aim of this study is to analyze the preparedness level in Phuket and Phang Nga regarding three modules of the tool: *medical products and technology*, *service delivery* and *participation*.

Method: The tool was distributed to all 13 hospitals in Phuket and Phang Nga provinces. The number of Yes-answers in 60 items was summarized, converted into percentage and separated into three levels of preparedness; insufficient 0-59%, sufficient 60-79% and good 80-100%. The preparedness level was calculated for the three modules separately and as a total sum. The mean was compared between four hospital levels and between the two provinces. Furthermore, 14 key items were tested for correlation to preparedness percentage.

Results: With a response rate of 85%, 36% of the hospitals had good preparedness level, 45% sufficient and 18% insufficient. The module with highest preparedness level was *service delivery* and the lowest was *participation*. No significant differences between hospital levels nor provinces were seen. No significant correlation between key items and preparedness percentage was found.

Discussion and conclusion: Although this study revealed needs for further improvements, most of hospitals had good or sufficient preparedness with this tool. Our results are in concordance with previous studies and could hence reflect the state of preparedness in investigated hospitals. There is however a need for further studies with larger samples.

Key words: Hospital preparedness, hospital assessment, hospital safety index, Thailand

Introduction

Disasters are inevitable and causes damage and disturbances in society. Prehospital and hospital health care are provided to the citizens to lessen the damaging effects. It is therefore important to keep a hospital structurally and functionally safe during a disaster. This study assesses the hospital preparedness for disasters and major incidents in Thailand. Before introducing the topic of the study, an introduction to the field of disaster medicine and hospital preparedness is needed.

Disasters and major incidents

Disasters are the results of a hazard, but not all hazards lead to disaster. *Hazard* is a potential threat or danger. A hazard could either be natural, man-made or mixed. Natural hazards origin from nature, e.g. earthquakes, flooding and epidemics. Man-made hazards are intentionally or unintentionally caused by human and include conflicts, famines, industrial accidents and displacement [1, 2]. If a hazard is actualized it could generate functional and structural damage [3]. Structural damage is physical damages to buildings, infrastructure, humans and/or the environment. Functional damage is when essential functions cannot be carried out [3]. Needs occur because of structural and/or functional damage, and are the difference between available and required resources. If the needs could be met by rearranging resources, e.g. with the use of reserve supplies and called-in personnel, the situation is defined as a *major incident (MI) or major emergency* [3, 4]. If rearrangements are not enough to meet the needs and outside assistance is required, it is then defined as a *disaster*. The assistance could be locally, nationally or internationally provided [3, 4].

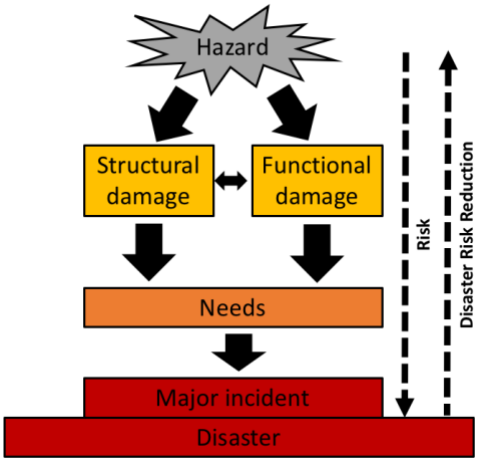

Figure 1. From hazard to disaster. *Illustration by Emilie Laurell, inspired by the Conceptual Framework by Prof. M.L. Birnbaum.*

Risk is the probability to get harmed by a hazard [5]. Risk reduction includes all actions that hinder a hazard from developing into a disaster; by preventing, reducing and managing risk [3]. The risk for structural damage inside the hospital could be reduced by e.g. flood-proof buildings. Hospitals are also vulnerable to structural damage outside the hospitals since their dependence on supply chains of medical products and machines, personnel transport and food delivery to the hospital [6]. The most frequent threat to hospitals during disasters is a loss in function [7]. Functional damage could be reduced by building capacity to respond independently of outside circumstances [3, 8]. Response capacity is the ability to meet the needs. Further, the capacity to response and recover from a disaster is called *hospital preparedness* [3, 8]. Consequently, a proper preparedness could be the difference between a MI and a disaster at the hospital.

Hospital response

There are four different phases in hospitals´ response to a MI or disaster; alert, receiving, treatment and recovery [2]. When a disaster occurs, hospitals will be notified by external communication and the *alert phase* is initiated and the disaster plan is activated. The disaster plan assists the disaster management and should be adjusted to an all-hazard concept, meaning that it should be applicable irrespective of the type of hazard [2]. The coordination and command center is also initiated during this phase. The center has the general overview of the disaster and coordinate communication to regional and national agencies, e.g. the provincial director or the police [2]. The center has, beyond responsibility for external communication, also mandate to administer the hospital response, manage media, internal information and supporting systems [2].

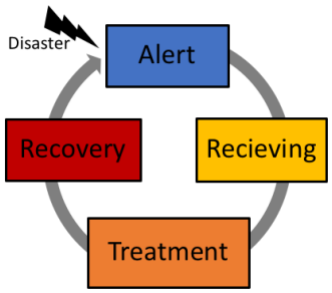

Figure 2. The phases of hospital response. *Illustration by Emilie Laurell, inspired by the disaster management cycle.*

The *receiving phase* is when patients arrive to the hospital. As mentioned before, the hospital should have capacity to receive a large patient influx. This is usually a problem of concern since many hospitals operate near to full capacity due to cost efficacy and have hence limited surge capacity [6]. Surge capacity is the ability to meet the need for medical care during a high demand [9]. The outcome of the disaster is dependent on the surge capacity [10]. Other processes of the receiving phase could be the use of a decontamination zone. In case of biological or chemical hazards, patients should be decontaminated (e.g. change clothes and shower) before entering the hospital entrance to keep the personnel safe [2]. For safety, the personnel could also use personal protective equipment (PPE). The patients are then triaged. Triage decides in which order affected patients are treated and transported, and it could be visualized with a color-coded triage tag fastened to the patient. (See front page, lower left picture) [9, 11].

The following phase is *treatment*. To supply a proper diagnosis and treatment, functional equipment is needed. Laboratory equipment and radiology are some instruments used to diagnose. Supporting systems (e.g. water, IT and electricity) are required to clean wounds, retrieve information about the patients and to operate the technical devices. Medicines such as antibiotics, pharmacologic treatment of myocardial infarcts and adrenaline are fundamental for adequate treatment [12]. After receiving proper diagnosis and treatment, patients are transported within the hospital or evacuated to other locations for further care [2].

The recovery phase includes all efforts needed to get to normalcy, and to review and evaluate the disaster management, to see if improvements could be made for future MI/disaster preparedness [2].

Evaluating hospital preparedness and safety

The main issue during disasters is the imbalance between needs and resources, which demands optimal use and relocation of available resources [3]. There are some key factors that facilitate a proper health care delivery during a large influx of patients: medical equipment should be operational and protected from damage; personnel should be safe and able to deliver health care; additionally, supporting systems should not be disrupted [7]. These factors are some examples of items evaluated when assessing hospital preparedness. Today, several tools exist, but there is no consensus of what should be included, or how to evaluate hospital preparedness [13-15]. *Hospital Safety Index* is an international and widely used self-assessment tool of the hospitals' preparedness, developed by the World Health Organization (WHO) and Pan American Health Organization (PAHO). Globally, 3,500 facilities have been assessed 2008-2014 [7]. If the assessment tool is carried out to a greater area, comparison between hospitals could be made. Additionally, if hospitals are repeatedly assessed, improvements could be monitored [7, 16, 17]. A negative aspect of the *Hospital Safety Index* is that it is time-consuming, consisting of 176 pages and 209 items [7]. Furthermore, the evaluation should be conducted in multidisciplinary teams consisting of an engineer, architect, specialist in supporting systems (e.g. water, IT and electricity), health care personnel and specialist in emergency and disaster management, hence the evaluation also consume personnel resources [7]. Moreover, the target group of *Hospital Safety Index* is tertiary hospitals [7]. There is thus a need for developing new assessment tools. Such attempt has been made in other countries, but not in Thailand, until now. [16, 17].

Thai health care context

Thailand has during the last 40 years developed from a low-income country to an upper-middle-income country [18, 19]. In 2014, the total expenditure on health was around 4 % of GDP [20]. The Thai health care insurance system is originally based upon employment and/or

voluntary insurance. Unemployed and poor citizens are covered by a national program, which ensures health care free of charge [21]. Despite good availability to health care, one inequality is the accessibility in urban and rural areas. There is a higher distribution of doctors, nurses and hospital beds in urban areas compared to the rural areas, especially low concentration in the north and northeast region [21, 22]. This is in contrast with a large portion of the population, 52 %, who are living in rural areas [23]. Another inequality is between private and governmental health care. The public-sector accounts for 80 % of hospitals, but has only 50 % of the doctors in Thailand [11, 22]. Thai hospitals are organized in primary, secondary and tertiary care. Hospitals with inpatient departments are further categorized on capacity into four levels: Fundamental (F), Middle (M), Standard (S) and Advanced (A)/University (U) [11]. The distribution of public hospitals is as follows;

1. Primary care has in total 10,174 facilities. This level only treats outpatients [11].
2. Secondary care contains 774 facilities that are ranging from hospitals with only outpatients, to *Fundamental hospitals* (*F*), with 10 to 120 beds and *Middle hospitals* (*M*), with more than 120 beds [11].
3. Tertiary care accounts for 116 facilities and includes *Middle hospitals* with larger capacity *"Provincial hospitals"* (*M*), with 150-300 beds, *Standard hospitals* (*S)* have 300-500 beds and *Advanced/University hospitals* (*A/U)* have more than 500 beds [11].

The need of hospital preparedness assessment in Thailand

Thai Hospital Assessment Instruction and Evaluation Tool for Mass Casualty Incident and Disaster Preparedness ("*THAI-MDP*") is a newly developed tool to assess hospital preparedness. The importance of having proper hospital preparedness in Thailand is due to their exposure of hazard and disasters in the country. Floods are the most frequent natural disasters. During the last 20 years (1997-2017) Thailand has encountered 57 floods that

caused 2,373 deaths [24]. Earthquakes and tsunamis are rare in Thailand and have occurred 3 times in the same period, with 8,347 deaths, whereas 8,345 from the tsunami 2004 [24]. Amongst the man-made disasters, major transport accidents are the most frequent with 38 events and 863 deaths1997-2017, including 5 accidents in air with 226 deaths [24].

One objective of developing a new assessment tool in Thailand was to ease the process for the evaluator by reducing the number of items and pages. Another objective was to make it feasible to the Thai context, both regarding hospital levels and to facilitate strategic planning by the Ministry of Public Health (MoPH). Adjusting THAI-MDP to address all levels of hospitals is important due to the high number of hospitals in secondary level in Thailand, whereas the *Hospital Safety Index* has been developed for the tertiary level [7]. All hospital levels have been addressed by adjusting the number of items in the checklist. Level F hospitals have 96 items, M hospitals 101 items, S hospitals 122 items and A(U) hospitals have 126 items. With further items added successively, the demands increase for every hospital level. Strategic planning has been facilitated by adapting the *Six Building Blocks Plus*. The THAI-MDP has been developed by a research group using a systematic review approach. 76 research papers or practice guidelines were used to select key elements. The elements were subcategorized into seven modules according to *Six Building Blocks Plus* [25], see *Table 1*. These building blocks are a WHO health system framework adapted by the MoPH, defining seven core components in the Thai health care system [25]. Firstly, *leadership and governance* involves policy framework, management, decision making and oversight of the health care. Secondly, *financing* is health funding that ensures that people can use needed services. The third component, *workforce* is the personnel delivering health care. Number four, *information system* facilitates the delivery of reliable health care and information [25]. The fifth block, *medical products and technology* includes essential products and technical devices required to assure safe, efficient and good-quality health care [25]. Regarding disaster

preparedness, the evaluated items will for example be: logistic planning for transport of personnel and equipment; stockpiling of medical products and machines; and the existence of reservoirs to supporting functions (water, electricity, oil and medical gas). The sixth block, *service delivery* involves personnel delivering and patients receiving health care, with effectively used resources [25]. The items in the assessment tool includes: protocols for announcing and canceling a disaster plan; the existence of disaster triage; and a zoning system. Zoning is locating patients according to the outcome of the triage (see front page, upper left picture). The last building block, *participation*, involves all external partnership and collaborations with outside actors [25]. Evaluated items are for example: the ability to request assistance when the capacity at the hospital is not enough; evaluation of disaster training; legal contracts and available cooperation with external agencies such as fire fighters, police or distributers of medical products and machines. To analyze all modules/building blocks in depth, the assessment tool was divided into two pilot studies. This study evaluates module 5-7.

This pilot study was the first implementation of THAI-MDP, preceding a future national implementation. Thailand is divided into six regions: north, northeast, central, west, east and south. The regions are further subdivided into 76 provinces [26]. This study was conducted in Phang Nga and Phuket provinces in the southern region. The reason to conduct the study in these provinces are their recent exposure to natural disasters. During the tsunami 2004 they were two of the worst affected provinces, with 5,880 dead or missing victims in Phang Nga and 887 in Phuket. This equals 70%, respectively 11% of all dead or missing in Thailand during the tsunami [27].

This was the first assessment of the tool, but the THAI-MDP has been validated 2016-2017 with: expert consultation from National Institute of Emergency Medicine, Department of

Disaster Prevention and Mitigation and WHO Thailand; a public hearing; tool modification; a pilot feasibility test with 41 hospitals; and a stakeholder meeting with inputs. To ease participation and enhance a broad distribution in the country, the tool has been designed as a self-assessment tool. The template has been developed in English in order to be evaluated by international readership and then translated and used in Thai at the hospitals.

Aim and research question

The aim of this study is to analyze the preparedness for disasters and major incidents using the new assessment tool *Thai Hospital Assessment Instruction and Evaluation Tool for Mass Casualty Incident and Disaster Preparedness (THAI-MDP)*. The research questions are; What is the level of preparedness at hospitals in Phuket and Phang-Nga provinces regarding *medical products and technology*, *service delivery* and *participation*? Secondly, could any difference be seen between different hospital levels (fundamental, middle, standard and advanced) or between the two provinces? Thirdly, could the assessment tool be further reduced by finding key items that correlates to good preparedness level?

Methods

The THAI-MDP is divided into four parts. The first part is *Basic information* about the hospital. The second part is *Preparedness checklist*, with the answering alternatives Yes/Not known/No. The evaluator will be asked to complement with additional information to certain items. This study includes module 5-7 in THAI-MDP and the number of items in this study is therefore: 45 for level F hospitals, 48 for level M, 59 for level S and 60 for level A/U. The item distribution for level F hospitals is shown in *Table 1*. The third section, *Suggestions* for improvements have not been analyzed in this study. The fourth part, *General and Surge Capacity* corresponds to item 4.1 from the *Preparedness Checklist* and represents a form with where the number of beds and equipment in the hospital should be listed. This part has only been used to verify the information in part one. The total amount of pages is 11. The complete assessment tool could be found in *Appendix 1*.

Table 1. Components of the assessment tool.

Part (number of items)	Module (number of items)
1. Basic Information (8)	
2. Preparedness Checklist (96)	
	1. Governance (20)
	2. Financing (9)
	3. Health Workforce (7)
	4. Information System (15)
	5. Medical Products and Technology (18)
	6. Service Delivery (20)
	7. Participation (7)
3. Suggestions (7)	
4. General and Surge Capacity (4)	

The number of items presented in this table is adjusted for fundamental (F) hospitals. Module 5, 6 and 7 are evaluated in this study and thus marked with a box.

Data collection

The assessment tool was distributed to all private and public hospitals in the Phang Nga (n=9) and Phuket (n=4) province in March-April 2018. The tool was distributed to the evaluator at all hospitals in Phang Nga during a collective meeting, where a Thai tool developer and

researcher explained the appliance of the assessment tool and aim of this study. The assessment tool was individually distributed and explained to the evaluators at the Phuket hospitals by the same Thai researcher. Contact information to the researcher was given to all evaluators for potential questions. The evaluator should be the person responsible for emergency, mass casualty incident or disaster management at each hospital. All data was collected by the Thai researcher and stored in a research safe at the Prince of Songkla University. Data was translated to English and sent to the Swedish researcher. The Thai researcher is one of the tool THAI-MDP developer and also supervisor of this study. He is associate professor in Emergency Medicine and have attended the Disaster Medicine Fellowship program at Harvard Medical School. He is also a member of the ASEAN (Association of Southeast Asian Nations) project group for strengthening the ASEAN Regional Capacity on disaster Health management (ARCH Project). All translations of the tool were made by the Thai researcher.

Data analysis

Firstly, descriptive statistic of the preparedness checklist was calculated. To assess the preparedness, all Yes-answers in each module of the *Preparedness checklist* has been summarized and divided by the total number of items in each module, hence creating a preparedness percentage. The total number of items is according to self-reported hospital level in part 1. All items, aimed for all hospital levels (F, M, S, A), have been analyzed. Missing values were considered as Not known/No. When a standard value is present for one item, it is quantified in the fourth column of the THAI-MDP. The standard value is according to national guidelines. The evaluators were asked to answer No if the standard was not achieved. If this has not been done properly by the evaluator, it has been changed by the author of this study. The preparedness percentage has

Table 2. Preparedness percentage and level.

Preparedness percentage	Preparedness level
0 - 59 %	Insufficient
60 - 79 %	Sufficient
80 - 100 %	Good

been subjectively categorized into to three levels by the Thai researcher according to *Table 2*. Secondly, the mean of the preparedness percentage has been compared between provinces and between hospital levels, to investigate if any differences could be found between F, M, S or A(U) hospitals, respectively between Phang Nga and Phuket. Thirdly, 14 key items have been selected and tested for correlation to the total preparedness percentage of module 5-7, to determine if any of the key items could predict good preparedness. Correlation equals that hospitals with high preparedness percentage have answered yes and hospitals with low preparedness have answered no. Five key items are from module 5, six key items from module 6 and three key items from module 7, all marked in *Appendix 1*. The key items have been selected through discussion with the Thai researcher.

Data was analyzed using Microsoft Excel (Microsoft Corporation) and SPSS Statistics 24 (IBM). When comparing the means of preparedness percentage between different provinces, respectively hospital levels, analysis of variance (ANOVA) was used. Spearman's correlation coefficient was used to correlate key items and preparedness percentage. The level of significance was 0.05.

Ethics

This study has been ethically approved by the Faculty of Medicine, Prince of Songkla University, Thailand the 16th February 2017. REC number: 59-328-20-1. As it could be seen as confidential information [7], participating hospital names are not mentioned in this study. No information about patients was registered.

Results

Out of 13 distributed assessment tools 11 were returned, resulting in a response rate of 85% in total, 75% for Phuket and 89% for Phang Nga province. The characteristics of the hospitals is shown in *Table 3*. From the meetings it was known that all evaluators were emergency nurses or nurses. Their current position varied from practitioner to managing levels.

Table 3. Characteristics of participating hospitals.

Hosp-ital	Province (P=Private affiliation)	Cap-ability	Patients receiving emergency service / year	Number of workforce		Reserve capability within 12h	Level of trauma center (1-5)
				Doctors	Nurses		
PN1	Phang Nga	F	< 25,000	5	-	No	4
PN2	Phang Nga	F	< 25,000	2	11	No	4
PN3	Phang Nga	F	< 25,000	5	38	Yes	4
PN4	Phang Nga	F	< 25,000	2	11	No	4
PN5	Phang Nga	F	< 25,000	2	24	Yes	5
PN6	Phang Nga	F	25,001-50,000	6	10	No	4
PN7	Phang Nga	M	-	-	-	Yes	-
PN8	Phang Nga	S	25,001-50,000	32	204	No	-
PU1	Phuket	M	-	13	79	No	4
PU2	Phuket (P)	S	< 25,000	112	271	No	2
PU3	Phuket	A (U)	50,001-75,000	148	629	Yes	2

PN= Phang Nga. PU= Phuket. P=Private hospital, all unmarked are governmental. F=Fundamental, M=Middle, S=Standard and A(U)= Advanced(University) capability. - = missing data. Reserve capability is defined as the ability to increase the capacity of beds with 20 %. Regarding trauma center level 1-5, 1 is a hospital prepared for any kind of trauma, including neuro and thoracic surgery and 5 is a center providing initial evaluation and treatment [28].

Preparedness

The result of the preparedness checklist for module 5-7 is illustrated in *Figure 3.* The mean was 68% and standard deviation 24. 36% (n=4) of the hospitals had good preparedness, 45% (n=5) sufficient and 18% (n=2) insufficient preparedness level. When analyzing each module separately, number 5, *medical products and technology*, had a slightly higher mean with 69%, but lower occurrence of good preparedness level with 27% (n=3), 55% (n=6) had sufficient and 18% (n=2) insufficient level, see *Figure 4*. The standard deviation was 18.

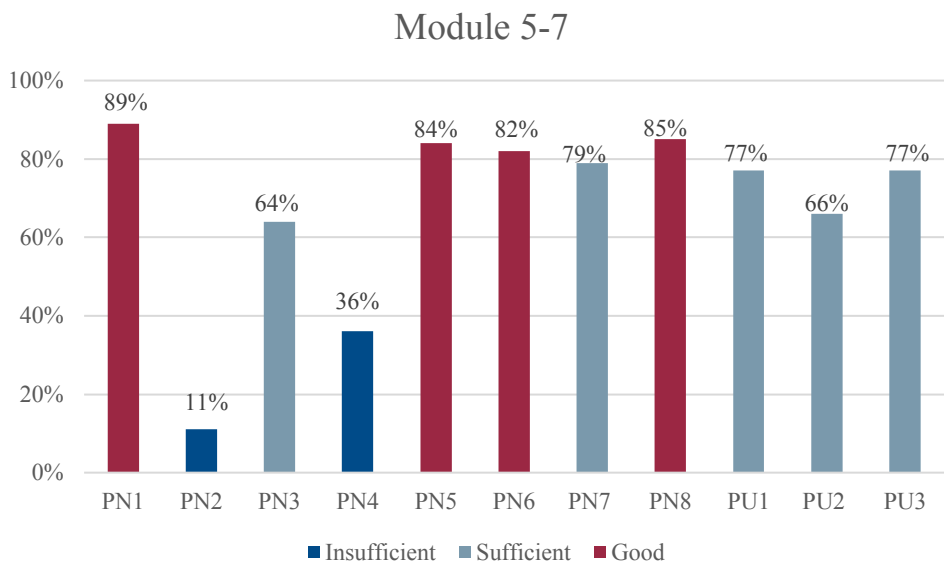

Figure 3. Preparedness level in module 5-7. *PN=Phang Nga province. PU=Phuket.*

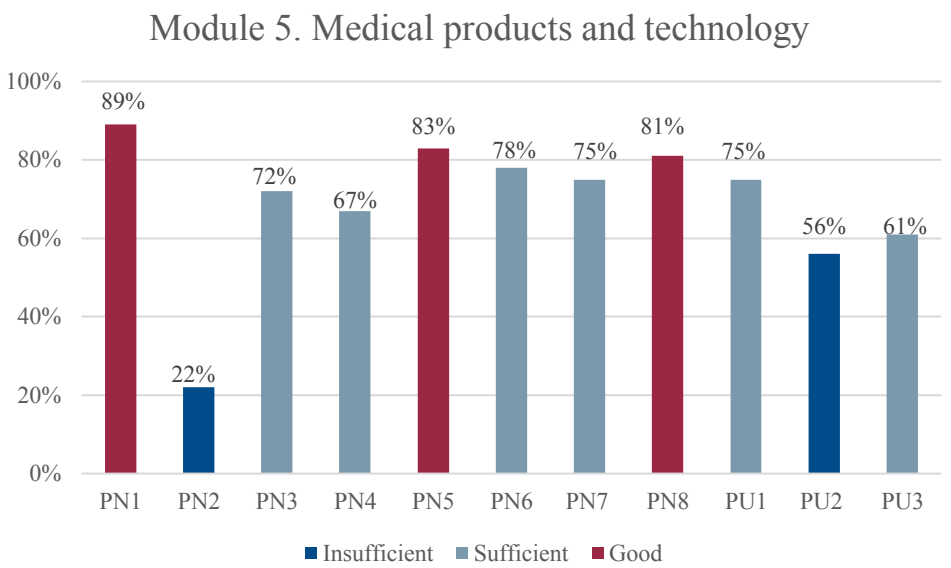

Figure 4. Preparedness level in module 5. *PN=Phang Nga province. PU=Phuket.*

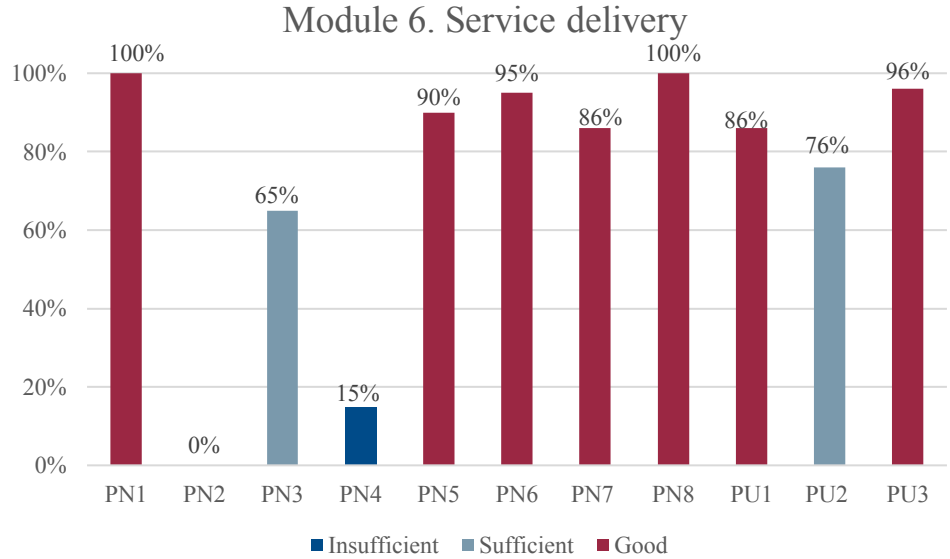

Figure 5. Preparedness level in module 6. *PN=Phang Nga province. PU=Phuket.*

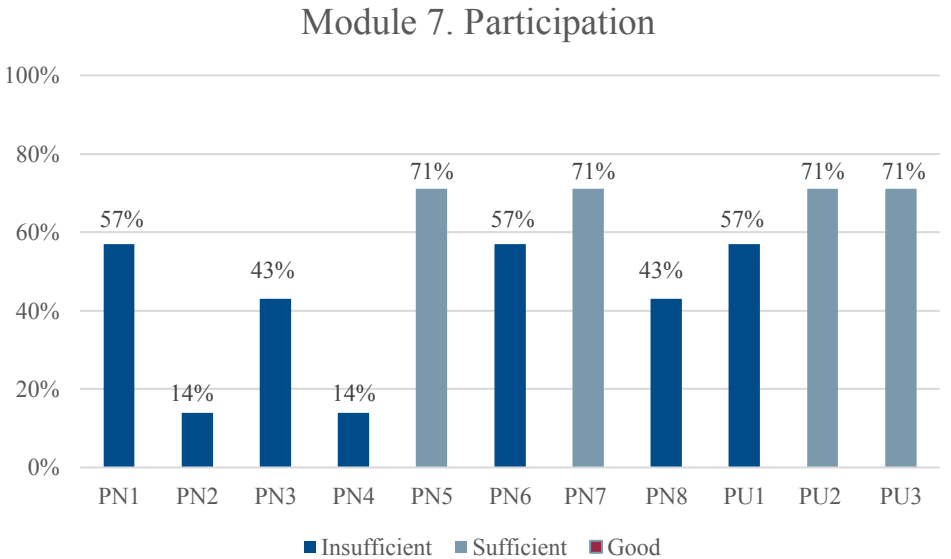

Figure 6. Preparedness level in module 7. *PN= Phang Nga province, PU=Phuket.*

Service delivery was the module with highest preparedness levels with a mean of 73% and standard deviation of 34. Seven hospitals (64%) had good preparedness, two (18%) sufficient and two (18%) insufficient level, see *Figure 5.* The lowest mean was found in module 7, *participation*, with 51% and a standard deviation of 21. No hospital had good preparedness, 36 % (n=4) had sufficient and 64% (n=7) insufficient level in this module, see *Figure 6.*

Mean comparsions

No significant mean differences between hospital levels were found, either when the preparedness percentage was calculated in total for module 5-7 or individually for each module, see *Table 4.*

Table 4. Comparison of group means between hospital levels.

Level of hospital	Total 5-7	5. Medical prod. & tech.	6. Service delivery	7. Participation
Fundamental (n= 6)	61%	69%	61%	42%
Middle (n=2)	78%	75%	86%	64%
Standard (n=2)	76%	69%	88%	57%
Advanced (n=1)	77%	61%	69%	71%
Analysis of variance (sig.)	0.840	0.942	0.785	0.868

Neither was a significant difference between the provincial means found. Irrespectively of comparisons made with preparedness percentage as a total for module 5-7 or by each module separately, see *Table 5.* All hospitals in Phuket had sufficient preparedness. In Phang Nga, two had insufficient, three sufficient and three good preparedness level.

Table 5. Comparison of group means between provinces.

Province	Total 5-7	5. Medical prod. & tech.	6. Service delivery	7. Participation
Phang Nga (n=8)	66%	71%	69%	46%
Phuket (n=3)	73%	64%	86%	66%
Analysis of variance (sig.)	0.728	0.600	0.773	0.775

Key items

No key items had a significant correlation to the total preparedness percentage of module 4-7.

The result of four key items and five items of interest for the discussion are presented in *Table 6.* Key items not mentioned in the discussion have not been listed.

Table 6. Key items and items of interest.

Item (KI = Key item)	Hospital level	Preparedness (%)	Sig.
5. Medical products and technology			
5.1 Logistic planning	F	91%	
5.2.1 Stockpile: medicines (KI)	F	82%	0.099
5.2.5 Stockpile: Personal protective equipment = PPE	F	91%	
5.10 Electricity generator and reserved capacity (Minimum standard: 4 hours) (KI)	F	91%	0.116
5.11 Water reservation system (Minimum standard: 4 days) (KI)	F	55%	0.765
5. 17 Waste management	F	73%	
6. Service delivery			
6.9 Dead body management and reserved location	F	72%	
6.17 Psychological care	S, A	100%	
7. Participation			
7.4 Coordination with the manufacturer/distributor/supplier (KI)	F	27%	0.571

KI= Key Item. F= Fundamental hospital (n=11). S, A= Standard and Advanced hospital (n=3).

Discussion

One major finding is that nine out of 11 hospitals in Phuket and Phang Nga had good or sufficient preparedness level, with a group mean of 68% for all modules. The results in this study are based on a response rate of 85%. No information has been obtained why two hospitals chose not to participate. If it was due to insufficient preparedness level, the mean would have been lowered and the share of hospitals with insufficient level would have increased. Nevertheless, most hospitals would still be at good or sufficient preparedness level.

The module with highest preparedness was *service delivery* with seven hospitals at good preparedness level. This module had also the greatest disparity with a standard deviation of 34. One hospital (PN2) had 0% in this module and another hospital (PN4) 15%. Thus, despite good preparedness at group level in Phuket and Phang Nga, two hospitals in Phang Nga have high demand for improvements regarding *service delivery*. At group level, the need for improvements were especially high in the *participation* module, with a mean of 51% and seven hospitals with insufficient preparedness level.

No hospital scored 100% in all modules. The findings of this study tell us that improvements are still needed at all Phuket and Phang Nga hospitals. Hospital PN2 had insufficient result through all three modules, whether it was due to thoroughgoing bad preparedness or difficulties to fill out the template is not known.

The result of pilot study has no intentions to be generalized and describe the preparedness level in Thailand. One should be reminded that the Phuket and Phang Nga provinces were seriously affected by the tsunami and this could have increased the disaster awareness and preparedness compared to other regions in Thailand.

Comparing the result with previous studies

Preparedness level

Thailand has experienced an increase in the number of disasters and major incidents, but a decrease in mortality and morbidity amongst causalities. This can be explained by an improved disaster management in recent years [29]. Besides, the Association of Southeast Asian Nations (ASEAN) reports the Thai preparedness for emergency response to be well equipped and contain necessary facilities [11]. This is in concordance with the result in this study.

Since this assessment tool has applied a new approach to divide the modules, the score of the modules could not be compared with previous studies. Hence, the comparisons have been made one by one item. The preparedness in Phang Nga and Phuket was evaluated in the aftermath of the tsunami 2004. One problem during the tsunami was the ability to manage large influx of patients [30]. A fundamental hospital in Phang Nga received almost 1,000 patients to the emergency department the first day of the disaster [31]. At the time, Thai hospitals were in general not prepared for disasters [30]. This study indicates that the problem is still evident, and improvements are needed, since only 4 of 11 hospitals (36%) had reserved capability within 12 hours.

Furthermore, handling and identification of the large amount of dead bodies was a complex issue during the tsunami, partly due to lack of coffins and storage, and partly a psychological burden for the healthcare staff, with burn-outs and depressions [31]. Using THAI-MDP, 72% of participating hospitals had dead body management and reserved location (module 6). This item is not coherent with previous studies. On the other hand, improvements have been made after the tsunami [10, 11], and this could have been a prioritized area. Another possible explanation is that our method does not require a quantifying of how many bodies that could be managed. Thus, a hospital could have a positive result in our study but would still not be

able to handle the numerous dead bodies as during the tsunami 2004. Regarding the psychological support, 100% of level A and S hospitals have psychological care aimed for their patients (module 6). Psychological support for the personnel has not been assessed with this tool.

During the flooding 2011 in central Thailand, road network disruptions led to problems with supply chains and transport of personnel and equipment to hospitals [32]. This led to decreased response capacity and the hospitals had difficulties to provide medical care for the victims [32]. In this pilot study logistic planning of personnel and equipment (module 5) was found in 91% of hospitals. This result is not coherent with the post-disaster evaluation. On the other hand, the Thai flood preparedness has gradually improved after 2011 [32, 33]. Before and 6 months after the flood, the hospital preparedness in the affected area had increased their stockpiling of personal protective equipment (PPE) from 19% to 83% of participating hospitals [33]. The planning of waste management had increased from 16% to 80% [33]. In this pilot study 91% of participating hospital had stockpiling of PPE (module 5) and 73% had waste management (module 5). Both these results are coherent with the post-flooding evaluations.

A study of the Thai evacuation during the flooding concluded that the preparedness level at all assessed hospitals could be improved [10]. One hospital had delayed or nonexistent deliveries of dialysis fluids, pacemakers and surgical devices during the flooding 2011, despite having valid contracts with the suppliers [10]. In this study, 27% of participating hospitals had existent coordination with the manufacturer/distributor/supplier (module 7). Hence, this item has a need of improvement in many of the participating hospitals. It should though be noted that a contract is not a guarantee to keep a hospital functional during a disaster. A strength during the evacuation had been the supply of medications [10]. Stockpiling of medicines was

also a strong item in this study, evident in 82% of participating hospitals (module 5). Water reservation system (module 5) was evident in 55% of participating hospitals. In the evacuation study, one hospital had to buy water on the black market due to shortage of drinking water [10]. The result of THAI-MDP suggests that water supply is a risk in many hospitals and that those hospitals are in need of improvements.

Mean comparsions

In this pilot study, the sample size was too small to detect any statistical significant difference between hospital sizes or provinces. Requesting a difference of minimum 10 percentage points, with the standard deviation of 24, as found in this study, all groups should have 91 participating hospitals to obtain a power of 80 % with 5 % level of significance [34]. To detect a mean difference of minimum 20 percentage points, the sample size should contain 23 hospitals. A national implementation would attain these sample sizes when comparing hospital sizes. Provincial comparisons will probably not be possible, and could be substituted by regional comparisons.

Previous studies in Iran and Sweden, using an adjusted version of the *Hospital Safety Index,* have indicated that hospital affiliation, size and function do not affect level of preparedness [14, 17]. On the other hand, the largest Iranian study with 421 participating hospitals with the same adjusted tool found significant differences between e.g. military, private and oil company affiliated hospitals. They also found differences between hospital sizes [16]. This indicates the need for further comparisons between hospital levels when implementing the tool in a larger study group. A national implementation would also be of interests to see if the southern region, as well as flooding prone regions, have better preparedness due to their recent exposure of disasters.

Key items

Different studies emphasize different items and functions as important to keep a hospital functional during a disaster or MI [10, 28, 35]. With a higher number of participating hospitals, all items could be tested for correlation, and the findings could be compared with the literature. Such comparisons would eliminate the subjective selection of key items used in this study. Furthermore, this study could not correlate any items with preparedness level and has hence no suggestions of how to reduce number of items in the assessment tool. A larger sample size could also further investigate this research question.

Limitations

One Iranian study discussed self-assessment as a strength, as it could function as self-learning process [16]. On the other hand, self-assessment may be subject to bias by the evaluator [16, 36]. The THAI-MDP is conducted by only one evaluator with no prior training. Additionally, with little explanations of the items, the risk for different interpretations and answers by different evaluators increase. The aim of this pilot study was to compare the frequency of Yes-answers between the hospitals. Numerous Not known-answers could imply a poor assessment made by the evaluator. Calculating the frequency of Not known-answer could hence indicate a poor quality of answer made by the evaluator. This have not analyzed in this study and could be considered as a limitation. Improvements that could facilitate the same interpretations could be a post-evaluation meeting with table-top discussion for all evaluators. Another improvement could be to use grades instead of Yes/Not known/No as answering alternatives. This would require clearer descriptions of what should be included to acquire a certain grade. Grading would also better define the result. For example, an electric generator could be in the basement and hence be more vulnerable for flooding [10]. Using a grade, the location and not merely the existence of a power generator, would influence the total score. Moreover, a qualitative follow-up study could investigate evaluator's bias.

Another difference is the presentation of the result. The *Hospital Safety Index* has three levels: C with 0-35% of max points, B with 36-65% and A with 66-100% [7]. The limits for insufficient/sufficient/good preparedness level of the THAI-MDP have been subjectively set by the Thai researcher, and could not be directly compared with other tools. Despite, the subjectively preparedness level limits, the majority of hospitals in this study would have fulfilled 60-90% of the items in this tool.

Compared to the *Hospital Safety Index,* other methods of calculation and sub categorization into modules are used. In the *Hospitals Safety Index*, three modules are summarized and calculated to an index: structural safety, non-structural safety and emergency and disaster management. If the hospital location is an earthquake and cyclone prone area, structural safety is weighted higher with 50% of the total sum. If not, all three modules count for 33.3% each [7]. The modules of the THAI-MDP have not been weighted. Consequently, the module with highest number of items has the greatest impact to the total preparedness level. For example, at F level hospitals, *participation* with its seven items has lesser effect of the total sum than *service delivery* with its 20 items. In this study, the low result in *participation* did not affect the total preparedness percentage notably, due to better result in the other two modules. When a disaster occurs, a good *service delivery* could supposedly not compensate a non-functional collaboration with authorities, suppliers and other actors.

Another limitation to this study, is the absence of an item concerning psychological support for the personnel. The personnel's mental well-being affects their capacity to response and recovery during an MI/disaster [10, 31], and should therefore be included in an assessment of disaster preparedness. Two studies assessing hospital preparedness during the flooding 2011 also emphasized the need for psychological support to the personnel [10, 33].

Finally, using a standardized assessment tool, such as the THAI-MDP or the *Hospital Safety Index*, all hospitals will be evaluated using the same criteria, independently of any differences in patient groups at the hospitals. The needs could differ between different patient groups [37] and this is not taken into account in the THAI-MDP. On the other hand, a standardized assessment tool enables comparisons between hospitals, and since the aim is a future national implementation, it is desirable to evaluate all hospitals using the same criteria.

Further studies

Since only 2 of 76 provinces have been invited to participate in this pilot study, the result should not be used to draw conclusion about the general preparedness level in Thailand. To investigate that, wider implementation is needed. To obtain an accurate overview of the preparedness further studies should also analyze the THAI-MDP as a unit, and not only analyzing three modules, as in this pilot study.

Further studies could compare the preparedness level between regions, especially the poorer, rural regions. Since the tool is adjusted to be used for strategic planning, identifying special areas of interests would be useful to know whether targeted interventions are needed. Particularly the poor population should be investigated, due to their higher vulnerability during disasters [2].

Whether this result could represent the ability to deliver health care during a MI/disaster will not be fully clear until MI/disasters have affected the hospitals. To get a hint of it, further studies could correlate the preparedness level form the THAI-MDP with the outcome of disaster exercises and/or table-top drills.

Conclusion and implications

Most of the items in this study are coherent with previous findings. This suggests that the results of the THAI-MDP could be reliable. The result of this pilot study indicates needs for further improvements, but also a general good or sufficient preparedness level in two modules. The low number of participating hospitals made it difficult to draw any statistical conclusions about differences between hospital levels or provinces.

The THAI-MDP is easy to use regarding the number of pages and items. On the other hand, less information on every item leads to uncertainty and different interpretations by the evaluators. The self-assessment method could be a matter of bias, but also positive with quick distribution and the possibility of self-learning. The assessment tool, could according to this study, be used in all hospital levels. When implementing this tool at national level, the results will be easy to use for planning since every module corresponds to an area of responsibility within the MoPH.

Further studies and improvements have been suggested in this study. Since the aim of hospital preparedness is to maintain a hospital functionality during a MI/disaster, it is of a high interest and importance to compare the results from the preparedness checklist with the outcome of disaster trainings and/or drills.

Acknowledgements

I wish to thank my supervisors for strains beyond data collection and handling report writing. Despite initial problems, Dr. Khorram-Manesh and Dr. Wuthisuthimethawee overcame these difficulties and managed to rearrange the research area. Dr Wuthisuthimethawee has also, beyond great supervision, arranged NIEM and hospital visits and invited me to observe a regional collaboration drill with the ASEAN member states in Vietnam. The visits have not been a part of this study, but have been useful to get an in-depth understanding of Thai hospitals and regional preparedness, since I had not been in contact with the Thai medical system, or the ASEAN collaboration before.

I would also send a special thanks to the following doctors, nurses and other personnel whom invited me to their hospitals and to NIEM. You gave me plenty of inspiration and information about hospital preparedness, thank you!

National Institute of Emergency Medicine (NIEM), Bangkok: Secretary General Dr Achariya Pangma, Karun Sriwatanaburapa, Sun, Pornthida Yamapayonta, Nawanan Aintharak.

Ramathibodi hospital, Bangkok: Dr Phatthranit Phattharapornjaroen

Vajira hospital, Bangkok: Dr Gawin Tiyawat and Dr Chirakit Hengrasmee

Phang Nga hospital: The manager of the emergency department

Vachira Phuket hospital: Dr Chanida Khemngern and Dr Lersak Leenanithikul

Patong hospital, Phuket: Ms Hathairat Rangsansarit, Ms Saowanee Jitkua and Ms Wimonrat Khocharoen.

Sjukhusens katastrofberedskap i Phuket och Phang Nga
Utvärdering av katastrofberedskap med fokus på: medicinska produkter och teknik, sjukvårdsservice, samt samarbeten med andra aktörer.

Populärvetenskaplig sammanfattning

När en katastrof eller allvarlig händelse drabbar ett samhälle måste sjukhusen ha beredskap för att hantera den aktuella situationen. Även om ett sjukhus inte är fysiskt skadat eller ligger i den direkta närheten av händelsen så leder många katastrofer till konsekvenser för sjukvården, ofta i form av ett ökat patientflöde till sjukhusen. För att kunna agera effektivt och bibehålla god kvalitet på sjukvården krävs omorganisering, ledning och koordinering av de tillgängliga resurserna för att möta patienternas ökade behov.

Det finns olika metoder för att utvärdera sjukhusens beredskap. En ny thailändsk enkät har utvecklats och delats ut till sjukhus i provinserna Phuket och Phang Nga. Sjukhusen har fått besvara 96-126 Ja/Vet ej/Nej-frågor som anses vara relevanta för att kunna leverera sjukvård under en katastrof. Frågorna av uppdelade i sju moduler och antalet frågor berodde på sjukhusen storlek. Antalet Ja-svar summerades och omvandlades till procent, därefter grupperades resultaten i tre grupper: 0-59% Ja-svar räknades som otillräcklig beredskap, 60-79% som tillräcklig och 80-100% som god beredskap. Denna delstudie har utvärderat enkätresultaten i tre av sju moduler: *medicinska produkter och teknik, sjukvårdsservice*, samt *samarbeten med andra aktörer.*

Majoriteten av de 11 undersökta sjukhusen hade god eller tillräcklig beredskap. Resultaten visade inga generella skillnader mellan sjukhusstorlek eller mellan provinserna. Däremot framträdde skillnader mellan sjukhusen och mellan de olika modulerna. Totalt sett hade fyra sjukhus god, fem tillräcklig och två sjukhus otillräcklig beredskap. I kategorin *medicinska produkter och tekniker* hade tre sjukhus god, sex tillräcklig och två otillräcklig beredskap. Nio av sjukhusen hade ett lager med mediciner. Däremot var det bara sex som hade

vattenreservoarer som höll i minst fyra dagar. Den högsta beredskapen fanns i kategorin *sjukvårdsservice,* med sju sjukhus med god, två med tillräcklig och två med otillräcklig beredskap. En fråga som vållade bekymmer under tsunamin 2004 var hanteringen av döda kroppar. I denna studie hade åtta av de tillfrågade sjukhusen hade förvaringsplatser. Modulen *samarbeten med andra aktörer* hade sämst resultat: sju sjukhus hade otillräcklig beredskap, fyra tillräcklig och inga sjukhus hade god beredskap. Frågorna gällde avtal och koordination mellan polis, räddningstjänst, hälsomyndigheter och andra samarbetspartners. 27% av sjukhusen hade samarbeten med leverantörer och distributörer av t.ex. medicinska produkter.

Studiens resultat överensstämmer med tidigare genomförda studier. Slutsatsen är att flera sjukhus har tillräcklig eller god beredskap i två av modulerna, samt att samtliga sjukhus är i behov av förbättringar. Ett av sjukhusen är i behov av stora insatser i alla moduler. Det finns behov av att utvärdera sjukhusens beredskap i hela Thailand, samt uppföljning av redan undersökta sjukhus för att följa förändringar över tid. Vidare studier krävs för att erhålla en förståelse om enkäten representerar sjukvårdens förmåga att möta patienters behov vid en katastrof.

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Appendix

1. Thai Hospital Assessment Instruction and Evaluation Tool for Mass Casualty Incident and Disaster Preparedness (THAI-MDP)

All unmarked items are aimed to all levels of hospitals. With higher level of hospital, further items are added successively. This is marked with a bracket of the hospital level (M, S and/or A) after intended item. Thus, level F is solitary unmarked items and contains 96 items. Level M counts for 101 items, S 122 and A 126. When a standard value is present for one item, it is quantified in the fourth column of the THAI-MDP. The standard value is according to national guidelines. The key items aimed to test correlation to preparedness percentage has been marked in red.

Thai Hospital Assessment Instruction and Evaluation Tool For Mass Casualty Incident and Disaster Preparedness

Version 1.0

Forewords

Community preparation for an emergency, such as mass casualty incident, disaster, etc., is an important factor in reducing the impact or damage in terms of infrastructure, health, and economy. Hospital is a part of the community and it is important in providing healthcare services in case of disaster from responding to recovering phase. However, whether a hospital will be able to respond effectively to the disaster depends on the preparation of the hospitals for mass casualty incident and disaster. If any hospital is well prepared, it will not be affected or slightly affected by the incidence. In addition, the hospital will be able to provide the healthcare service to the victims more effectively.

The research team hopes that this evaluation tools will be widely applicable in all levels of hospitals for assessing the mass casualty incident and disaster preparation. The hospital will, therefore, experience no or little impact of the disasters and can assist the victims in the most effective way.

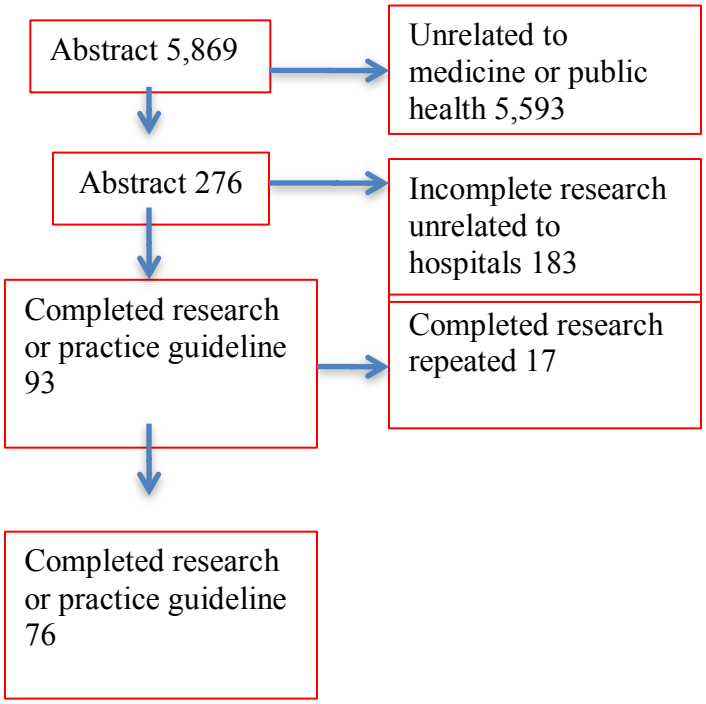
Research team

Framework

The hospital assessment instruction and evaluation tool for mass casualty incident and disaster preparedness are created to continuously improve the hospital operation and ensure that it is well prepared to reduce the impact of the disaster. Also, the hospital will be able to assist the victims in the most effective way.

This hospital evaluation tool is created using the systematic review approach. The data is screened from other research papers from various research databases both locally and internationally. This also includes the practice of agencies with expertise in disaster. The researcher has selected the key factors for conducting self-evaluation of a hospital, which are divided according to the World Health Organization Six Building Blocks and health system framework. The feedbacks from practitioners and experts from various organizations both locally and internationally are also considered to set the evaluation standard.

Procedures and Findings



Thai's Hospitals Assessment and Evaluation Tool for Mass Casualty Incident and Disaster Preparedness

The survey is divided into four sections - basic information, preparation, suggestions, and hospital capacity

Part I Basic Information

Basic information	Evaluation					
1. Location of hospital (region/district)	Middle District……	Northern District……	Southern District.....	Eastern District ……	Western District ……...	North Eastern District……
2. Hospital Capability	F	M	S	A (U)		
3. No. of patients receiving emergency services/year	<25,000	25,000-50,000	50,001-75,000	75,001-100,000	>100,000	
4. Number of workforce						
4.1 Medical team	Doctor ……	Nurse	EMT	Pharmacist	Other ……	
4.2 Supporting team	Engineer ……	Nutritionist ……	Dressing ……	Security /Traffic ……	Finance ……	Information ……
5. Hospital agency	Ministry of Health	Ministry of Education	Military/ Police	Local admin/ foundation	Private	Other ……
6. Hospital Accreditiation, Joint Commission International Accreditation	Accredited	Under document review	Reaccredited	No accreditation		
7. Reserve capability (within 12 hours)	Yes	No	Don't know			
8. Level of trauma center	1	2	3	4	5	
9. Capability for taking care patients with fire wound (S, A)	Yes	None				
10. Helicopter parking (A)	Permanent	Temporary	None			

Part 2 Preparedness checklist

Preparedness	Evaluation			
1. Governance	**if the answer is 'No', please add a suggestion*			
1.1 Mass casualty incident committee	Yes Name……	Not know	No	
1.2 Mass Casualty Incident or Emergency Management (S, A)	Yes Name…….	Not know	No	
1.3 Official policy and strategy	Yes	Not know	No	
1.4 Risk factor analysis and prioritization	Yes e.g……	Not know	No	1……...2……. 3……4……5….....
1.5 Mass Casualty Incident Planning				
1.5.1 Mass casualty incident plan of the hospital	Yes Year……	Not know	No	
1.5.2 Level of plan (e.g. 1, 2, 3)	Yes.....Level	Not know	No	
1.5.3 Sub-plan according to HVA				
1.5.3.1 Mass casualty incident	Yes	Not know	No	
1.5.3.2 Chemical substance (S, A)	Yes	Not know	No	
1.5.3.3 Epidemics	Yes	Not know	No	
1.5.3.4 Radioactive substance(A)	Yes	Not know	No	
1.5.3.5 Fire	Yes	Not know	No	
1.5.3.6 Computer failure	Yes	Not know	No	
1.5.3.7 Flood	Yes	Not know	No	
1.5.3.8 Earthquake	Yes	Not know	No	
1.5.3.9 Terrorists/bombing	Yes	Not know	No	
1.5.3.10 Emergency room malfunction	Yes	Not know	No	
1.5.4 Plans with external organization	Yes Year ……	Not know	No	
1.5.5 Evacuation/Relocation planning for patients/ staff	Yes	Not know	No	
1.5.6 Recovery plan	Yes	Not know	No	
1.6 MCI or Disaster exercise				
1.6.1 Theory exercise	Yes…..times/ year	Not know	No	Twice a year
1.6.2 Simulation exercise	Yes…..times/ year	Not know	No	Once a year
1.6.3 Exercise with external organizations	Yes…..times/ year	Not know	No	
1.6.4 Evaluation/After action review	Yes	Not know	No	
1.7 Management system (HICS)	Yes	Insufficient	No	

Preparedness	Evaluation			
2. Financing				
2.1 Budget management				
2.1.1 Victims medical fees	Yes	Not know	No	
2.1.2 Aiding team (S, A)	Yes	Not know	No	
2.1.3 Donation	Yes	Not know	No	
2.1.4 Medical products reimbursement	Yes	Not know		
2.2 Training				
2.2.1 Incident command system	Yes …../ year .....% per staff	Not know	No	50% of the management team
2.2.2 Mass Casualty Incident and Disaster management (S, A)	Yes …. /year .....% per staff	Not know	No	
2.3 Exercise/Drill preparation	Yes	Not know	No	
2.4 Community education	Yes	Not know	No	
2.5 Recovery budget management	Yes	Not know	No	
2.6 Compensation from injury from the operation for healthcare provider	Yes	Not know	No	
2.7 Staff operation cost	Yes	Not know	No	
3. Health workforce				
3.1 Hospital teams				
3.1.1 Emergency management team	Yes	Not know	No	
3.1.2 Patient care team	Yes	Not know	No	
3.1.3 Coordinator	Yes	Not know	No	
3.1.4 Supporting team (electricity, water, gas, etc)	Yes	Not know	No	
3.1.5 Emergency management expert (S, A)	Yes	Not know	No	
3.1.6 Special teams				
3.1.6.1 Chemical (HazMat)	Yes	Not know	No	
3.1.6.2 Epidemics	Yes	Not know	No	
3.1.6.3 Radioactive substances (A)	Yes	Not know	No	
3.1.7 Operation evaluation team	Yes	I Not know	No	
3.1.8 Data recording team	Yes	Not know	No	
3.1.9 Security team	Yes	Not know	No	
3.1.10 Translator (S, A)	Yes	Not know	No	
3.1.11 Sign language team (S, A)	Yes	Not know	No	
3.2 Assissting emergency responding team (S, A)	Yes .....Team	Not know	No	
Preparedness	**Evaluation**			
4. Information system				
4.1 Hospital capability	appendix	Not know		

4.2 Staff callback system	Yes	Not know	No	
4.3 Guideline	Yes	Not know	No	
4.4 Victim data collection	Yes	Not know	No	
4.5 Emergency alert system	Yes	Not know	No	
4.6 Hospital map	Yes	Not know	No	
4.7 Disaster incidents data within 5 year	Yes ……times	Not know	No	
4.8 Staff contact list	Yes	Not know	No	
4.9 Internal informing and communication protocol	Yes	Not know	No	
4.10 Internal departments information and contacts	Yes	Not know	No	
4.11 External organization and contacts	Yes	Not know	No	
4.12 Staff roles/responsibility	Yes	Not know	No	
4.13 Communication/Public relation plan (internal, external, relatives, reporters, etc.)	Yes	Not know	No	
4.14 Hospital infrastructure data	Yes	Not know	No	
4.15 Reserved location for providing treatments	Yes	Not know	No	
4.16 Manual data backup system (S, A)	Yes	Not know	No	
4.17 Communication for vulnerability personnel	Yes	Not know	No	
5. Medical products and technology				
5.1 Logistics planning	Yes	Not know	No	
5.2 Stockpile				
5.2.1 Medicines	Yes…..…day	Not know	No	
5.2.2 Blood (M, S, A)	Yes…..…unit	Not know	No	
5.2.3 Vaccines (TT, TAT, Measles)	Yes..…peopl e	Not know	No	
5.2.4 Antidotes (S, A) *	Yes	Not know	No	
5.2.5 Personal protective equipment	Yes	Not know	No	
5.2.6 Portable x-rays machines (M, S, A)	Yes……mac hines	Not know	No	
5.2.7 Portable Ultrasound machine	Yes……mac hines	Not know	No	
5.2.8 Ventilator	Yes……mac hines	Not know	No	
5.3 Preset equipment/labs	Yes	Not know	No	
5.4 Food and Nutrition	Yes…….peo ple ……... day	Not know	No	

5.5 Emergency operation center Commanding (EOC)	Yes	Not know	No	
5.6 Communication center	Yes	Not know	No	
5.7 Materials for evidence investigation and inspection	Yes	Not know	No	
5.8 Public relation center	Yes	Not know	No	
5.9 Oil reservation	Yes.....day	Not know	No	(4 days)
5.10 Electricity generator and reserved electricity	Yes .....day	Not know	No	(4 hrs)
5.11 Water reservation system	Yes .....day	Not know	No	(4 days)
5.12 Gas reservation system	Yes .....day	Not know	No	(4 days)
5.13 Sterilization system	Yes	Not know	No	(4 days)
5.14 Field hospital installation (S, A)	Yes	Not know	No	
5.15 Location and special equipements				
5.15.1 Chemical cleansing room (S, A) *	Yes Stretcher…… people Walk…...people	Not know	No	
5.15.2 Negative pressure room(S, A)	Yes	Not know	No	
5.15.3 Radiation exposure quarantine (A)	Yes	Not know	No	
5.16 Chemical protection uniform (S*, A)	Yes Level ... No……..	Not know	No	
5.17 Waste management	Yes	Not know	No	
5.18 Medical equipments for children and infants (S, A)	Yes Appendix	Not know	No	
5.19 Communication device for disabled (eye, ears) (S, A)	Yes	Not know	No	
6. Service delivery				
6.1 Plan announcement protocol	Yes	Not know	No	
6.2 Plan cancellation protocol	Yes	Not know	No	
6.3 Disaster triage				
6.3.1 Adult	Yes Specify …….	Not know	No	
6.3.2 Children	Yes Specify …….	Not know	No	
6.4 Zoning	Yes	Not know	No	

6.5 Cancellation of non-emergency surgery protocol (S, A)	Yes	Not know	No	
6.6 Evaluation and monitoring of hospital damage and need assessment	Yes	Not know	No	
6.7 Safety and asset managment	Yes	Not know	No	
6.8 Rehabilitation(S, A)	Yes	Not know	No	
6.9 Dead body management and reserved location	Yes	Not know	No	
6.10 Forensic investigation(S, A)	Yes	Not know	No	
6.11 Volunteer management	Yes	Not know	No	
6.12 Temporary shelter	Yes	Not know	No	
6.13 Medical records/follow up	Yes	Not know	No	
6.14 Internal coordination procedure	Yes	Not know	No	
6.15 External coordination procedure	Yes	Not know	No	
6.16 Emergency medical services	Yes level…… teams …….	Not know	No	
6.17 Psychological care (S, A)	Yes	Not know	No	
6.18 Public relation	Yes	Not know	No	
6.19 Evacuation	Yes	Not know	No	
6.20 Hemodialysis (M, S, A)	Yes	Not know	No	
6.21 Recovery	Yes	Not know	No	
6.22 Victims follow up protocol	Yes	Not know	No	
6.23 Operation evaluation	Yes	Not know	No	
6.24 Health and disease prevention education	Yes	Not know	No	
7. Participation				
7.1 Coordination and operation guideline for requesting assistance	Yes	Not know	No	
7.2 Training with external agencies	Yes …….. per year	Not know	No	
7.3 Memorandum of Cooperation with external agencies	Yes	Not know	No	
7.4 Coordination with the manufacturer/distributor/supplier	Yes	Not know	No	
7.5 Cooperation with the legal department or police.	Yes	Not know	No	
7.6 Coordination within the Department of Public Health.	Yes	Not know	No	
7.7 Coordination outside the Department of Public Health	Yes	Not know	No	

Part 3 Suggestions

3.1 Governance

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3.2 Financing and Budgeting

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3.3 Health Workforce

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3.4 Information System

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3.5 Pharmaceuticals, Medical Supplies, and Technology

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3.6 Service Delivery

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3.7 Cooperation with external agencies

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Evaluator
(Responsible for Mass Accidents) Date of Evaluation

Appendix

Information on general capability and reserved capability of the hospital

	Normal Capacity (Bed)	Reserved capacity (within 12 hours)	Heart rate monitoring device	Ventilators	Negative Pressure Room
Hospital					
Emergency room	Red …. Yellow ... Green …. Black	Red …. Yellow ... Green …. Black			
Observation room[S, A]					
Trauma ward[S, A]					
Surgical ward[M, S, A]					
Orthoperdict ward[S, A]					
Medicine ward [M, S, A]					
Obs-Gyn ward [M, S, A]					
Delivery room					
Pediatric ward [S, A]					
Newborn ward[S, A]					
Psychiatric ward [A]					
Surgical ICU [S, A]					
Medicine ICU[S, A]					
PICU[S, A]					
NICU[A]					
Burnt unit/ward[A]					
Operating room [M, S, A]					
Hemodialysis[M, S, A]					
Medical equipments center (if available)					

* Adapted from Disaster management preparation and responsiveness assessment for hospitals National Institutes of Emergency Medicines and Hospital Disaster Preparedness Self-Assessment Tool, American College of Emergency Physician