国士舘大学審査学位論文

「How to Improve Prehospital Patients Outcomes by

Using Smartphone Applications Based on the Nationwide

Patient Transportation Registry in Thailand」

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博士論文

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How to Improve Prehospital Patients Outcomes by Using Smartphone Applications Based on the Nationwide Patient Transportation Registry in Thailand

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CONTENTS

Chapter 1. BACKGROUND

Chapter 1. Background

Section 1: Significance of the problem

Key performance indicators (KPIs) are used to monitor and evaluate critical areas of clinical and support functions that influence patient outcomes. Traditional prehospital emergency care performance monitoring has focused solely on response time metrics[1-2]. In healthcare, these standards should be based on the best current evidence. Crucially, performance indicators need to be specific, measurable, achievable, relevant, and time-phased to precipitate safer, better healthcare delivery for patients[3]. Much of the published evidence on prehospital emergency care performance has focused on survival from out-of-hospital cardiac arrest (OHCA), though this constitutes only 1%-2% of all Emergency Medical Service (EMS) responses[4-5]. EMS organizations have largely focused on response time metrics as indicators of service performance because they are accessible, practical, and amenable to change[6].

The performance of ambulance services and the quality of prehospital care has traditionally been measured using simple indicators, such as response time intervals, based on low-level evidence. The discipline of paramedicine has evolved significantly over the last few decades. Consequently, the validity of utilizing such measures as holistic prehospital care quality indicators (QIs) has been challenged[7]. The most commonly addressed prehospital care quality attributes were appropriateness (47.5%). Health care providers in the EMS system were the paramedics 83.3% and the physician 16.7%[7]. The most OHCA distribution of quality indicators within the clinical framework is 10.8%[7]. The 10 steps to improve cardiac arrest survival are as follows; 1) Establish a cardiac arrest registry, 2) Begin Telephone-CPR with ongoing training and QI, 3) Begin high-performance EMS CPR(HP-CPR) with ongoing training and QI, 4) Begin rapid dispatch, 5) Measure professional resuscitation using the defibrillator recording (and voice if possible), 6) Begin an AED program for first responders, including police officer, guards, and other security personnel, 7) Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to a nearby arrest to provide early CPR and defibrillation, 8) Make CPR and AED training mandatory in schools and the community, 9) Work toward accountability-submit annual reports to the community, and 10) Work toward a culture of excellence[8].

A medical emergency call to access pre-hospital emergency medical services (PEMS) is important for the initial activation of process care and ambulance services. Emergency medical dispatch centers (EMDCs) handle and prioritize emergency calls based on information

from the callers and allocate limited pre-hospital resources accordingly[9-10]. EMD also serves as a pre-arrival instructor of CPR and guides callers in performing first aid through the telephone until the arrival of the ambulance service staff[11-12]. Therefore, EMDs have an important gatekeeper function in the provision of pre-hospital emergency care and potentially hospital admissions[9].

Ambulance services have always been intended for those with life-threatening or serious medical illness or injury[13]. But over time they have been increasingly used for non-urgent and even social reasons. In natural disasters or emergencies, capacity can be so constrained as to contribute to adverse outcomes and preventable deaths[14]. There is an increasing demand for pre-hospital emergency care and ambulance services[15]. This underlines the significance of organizational planning of the EMS including ambulance services and EMDCs and the importance of medical dispatchers' gatekeeper function[16]. Emergency patients' first contact with the system and the result of the first verbal interrogation in a nonvisual environment has not yet been described in detail and modifiable factors in emergency patients' trajectory have rarely been explored[9]. The number of validated indicators is limited, mainly focusing on specific pathologies, but not on system-wide process evaluation[16]. Little is known about the epidemiology and evolution of a European PEMS over more than 10 years. Only limited data on specific medical topics or only some parts of the system were investigated[17-18]. There is however an important medical, policy, and public health interest to analyze the activity and trends of the whole PEMS concept, including the emergency call center, the pre-hospital emergency ambulances, and physicians' response, as well as the admission of the patients into the hospital emergency network[17].

OHCA is a leading cause of global mortality[19]. The incidence rate is 50-60 per 100,000 person-years[20] and is comparable throughout numerous parts of the world[21-22]. In Asia Pacific, the reported OHCA is 8.2% of patients with the return of spontaneous circulation (ROSC) at the scene or care in transport, whereas the OHCA survival rate is 5.4%[23]. Meanwhile, Thailand shows an incidence of OHCA rate of 6,450 per year[24]. The most common location of OHCA is a home residence (61.8%)[25]. The most common etiology of cardiac arrest consists of 54% presumed cardiac etiology[25]. OHCA accounts for 15.8% of compression-only bystander cardiopulmonary resuscitation (BCPR) cases in Bangkok[25]. However, Thailand reported 25.9% ROSC[23]; the outcomes showed that 27.7% of patients survived to admission, and 4.2% survived to discharge[25].

The effect of BCPR resulted in a 31.4% increase in survival[26]. Early BCPR, which is performed before the arrival of ambulance services, is one of the most significant predictors of survival after OHCA[27-28]. Early defibrillation by an automated external defibrillator (AED) and the initiation of BCPR is critical to improving the outcomes after OHCA[29]. Early defibrillations within 3-5 min of collapse can produce a survival rate of as high as 50%-70%[30]. Each minute of delay to defibrillation reduces the probability of survival to hospital discharge by 10.7%[31]. Currently, less than 2% of OHCA patients are equipped with an AED before the ambulance arrives[32]. Using mobile technology to improve communication with the ever-growing number of mobile devices, the United States is rapidly updating its 9-1-1 service by providing better caller location information and enabling the public to transmit text, images, video, and data[33]. Adding a locator system further reduces the response time after a call from a mobile phone[34]. Using such maps, modern smartphones can help bystanders locate and retrieve nearby AEDs swiftly[35]. Recently, a published study demonstrated that the mobile AED map significantly shortened travel distances to find and retrieve AEDs[23]. Telephone-CPR is independently associated with improved survival and functional outcomes after OHCA (11.5%)[36]. A total of 18% of hospital discharge rates increased significantly with the use of a mobile rescuer, and 11% of the patients resuscitated with a mobile rescue experienced a good neurological outcome[37].

Therefore, researchers have been interested in the analysis of the PEMS situation and how the measurement for prehospital emergency care performance monitoring has focused solely on response time and keeping standards of EMS of care to improve emergency patient outcomes in Thailand.

Section 2: Research framework

This study has a research framework that depends on the large data set of emergency calls to request the PEMS system in Thailand. After that, the problems obtained from the analysis were used for the design and development of smartphone applications for BCPR in the prehospital setting. This study has a two-phase variable in the first phase as follows; 1) Independent variable consisting of 25 Criteria base Dispatching (CBD), 2) Dependent variable consisting of the trend of the emergency call, regional and province, emergency priority levels (EPLs), age rang, life-threatening conditions, trauma condition, and 3) Variable of emergency consisting of EPLs on temporal variation. In the second phase of the development of the smartphone application as follows; 1) the independent variable consisting the CPR smartphone

application, 2) the dependent variable consists of the modes of function, 3) The independent variable is the opinion or creativity of creating an application to facilitate the resolution of OHCA witnesses (Figure 1).
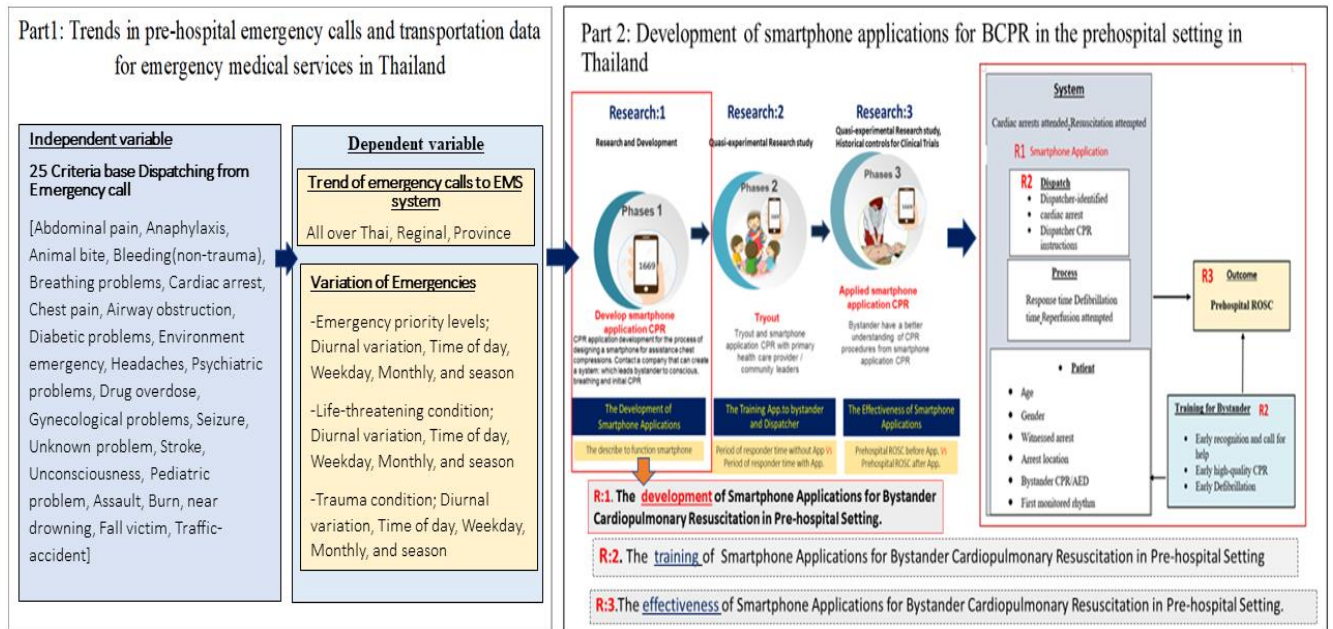
Figure 1 Research framework

Section 3: Research questions

1. What are the trends in pre-hospital emergency calls and EMS transportation data in Thailand?
2. How to the development of smartphone applications for BCPR to increase the ROSC in the pre-hospital setting?

Therefore, this study aimed to describe the trend of pre-hospital emergency calls and EMS transportation data and to search for a method to develop and design a smartphone application for BCPR that is appropriate in the prehospital setting in Thailand. In addition, we reflected on the conclusions from the consensus for the development of smartphone applications.

Chapter 2. OBJECTIVE

Chapter 2. Objective

The study aimed to describe the trend of PEMS calls and EMS transportation data and the development of smartphone applications for BCPR in the prehospital setting in Thailand. Specifically, we investigated the following:

1) To clarify the request for emergency calls to the PEMS situation in Thailand

2) To develop innovation of smartphone applications for the PEMS of Thailand.

3) To reduce response time to early BCPR, AED locates to increase the survival rate of OHCA.

Chapter 3. METHODS

Chapter 3. METHODS

This study was to explore causes for access, emergency priority levels, and temporal variation within the season, weekdays, and time of day for emergency calls. After that focuses on the development of smartphone applications for BCPR in the pre-hospital setting in Thailand. In this research, the researcher used "Mixed Methodology Research" The research methodology presented in the second phase is as followed:

Phase 1: Trends in pre-hospital emergency calls and EMS transportation data in Thailand

In the first phase, this study was on the trends in prehospital emergency calls and EMS transportation data in Thailand. A researcher has performed the following actions.

Section 1: Study design and population

Section 2: Data collection and processing

Section 3: Selection of emergency calls, life-threatening conditions, and trauma-related calls

Section 4: Conflict of interest

Section 5: Derived variables

Section 6: Statistical analysis

Section 1: Study design and population

This study was based on a nationwide cross-sectional study from a database of 25 CBDs by the EMS system of Thailand. The data from a five-year study period (January 1, 2016 to December 31, 2020) were retrospectively analyzed.

Thailand has a total land area of 517,646 km[38] and a total population of 66,558,935 people[39]. It is divided into six regions (Northern, Southern, Eastern, Western, Central, and Northeastern) consisting of 76 provinces and 1 special administrative division that was

Bangkok. The population of 5,666,254 people and a population density of 3,623 in Bangkok (Figure 2).
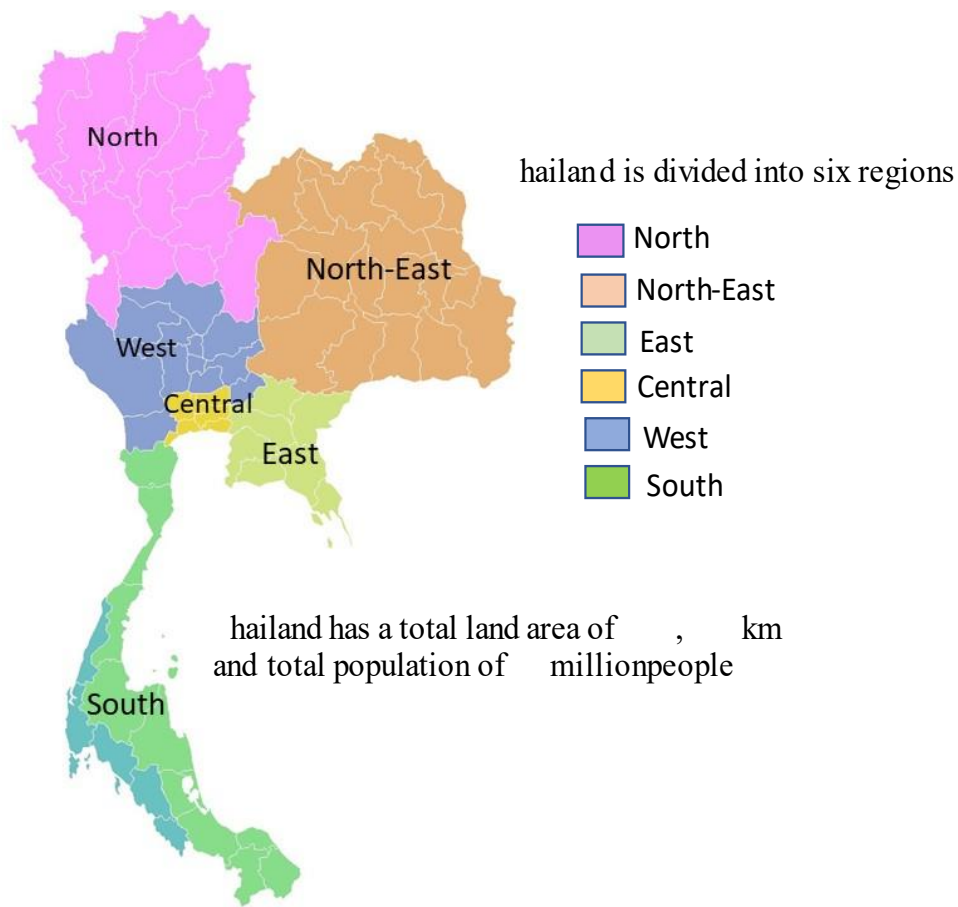
Figure 2 Thailand map and regions

Thailand has six regions as follows: 1) The North has nine provinces as follows: Chiang Roi, Chiang Mai, Mae Hong son, Lampang, Lamphun, Nan, Phayao, Phrae, Uttaradit, 2) The Central has twenty-first provinces as follows: Bangkok, Kamphaeng Phet, Chai Nat, Nakhon Nayok, Nakhon Pathom, Nakhon Sawan, Nonthaburi, Pathum Thani, Phra Nakhon Si Ayutthaya, Phichit, Phitsanulok, Phetchabun, Lopburi, Samut Prakan, Samut Songkhram , Samut Sakhon, Sing Buri, Sukhothai, Suphan Buri, Saraburi, Ang Thong and Uthai Thani, 3) The East has sever provinces as follows: Chanthaburi, Chachoengsao, Chonburi, Trat, Prachinburi, Rayong and Sa Kaeo, 4) The North-East has ninth teen provinces as follows: Khon Kaen, Chaiyaphum, Nakhon Phanom, Nakhon Ratchasima, Bueng Kan, Buriram, Maha Sarakham, Mukdahan, Yasothon, Roi Et, Loei, Sakon Nakhon, Surin, Sisaket, Nong Khai, Nong Bua Lamphu, Udon Thani, Ubon Ratchathani and Amnat Charoen, 5) The West has five provinces as follows: Kanchanaburi, Tak, Prachuap Khiri Khan, Phetchaburi and Ratchaburi,

and 6) The South has fourteen provinces as follows: Krabi, Chumphon, Trang, Nakhon Si Thammarat, Narathiwat , Pattani, Phang Nga, Phatthalung, Phuket, Ranong, Satun, Songkhla, Surat Thani, and Yala (Table 1), and to describe population ratio and population density in Thailand(Table 2).

Table 1 Regions and provinces

North (9)	Central (21)	East (7)	North-East (19)	West (5)	South (14)
Chiang Roi	Bangkok	Chanthaburi	Khon Kaen	Kanchanaburi	Krabi
Chiang Mal	Kamphaeng Phet	Chachoengsao	Chaiyaphum	Tak	Chumphon
Mae Hong son	Chai Nat	Chonburi	Nakhon Phanom	Prachuap Khiri Khan	Trang
Lampang	Nakhon Nayok	Trat	Nakhon Ratchasima	Phetchaburi	Nakhon Si Thammarat
Lamphun	Nakhon Pathom	Prachinburi	Bueng Kan	Ratchaburi	Narathiwat
Nan	Nakhon Sawan	Rayong	Buriram		Pattani
Phayao	Nonthaburi	Sa Kaeo	Maha Sarakham		Phang Nga
Phrae	Pathum Thani		Mukdahan		Phatthalung
Uttaradit	Phra Nakhon Si Ayutthaya		Yasothon		Phuket
	Phichit		Roi Et		Ranong
	Phitsanulok		Loei		Satun
	Phetchabun		Sakon Nakhon		Songkhla
	Lopburi		Surin		Surat Thani
	Samut Prakan		Sisaket		Yala
	Samut Songkhram		Nong Khai		
	Samut Sakhon		Nong Bua Lamphu		
	Sing Buri		Udon Thani		
	Sukhothai		Ubon Ratchathani		
	Suphan Buri		Amnat Charoen		
	Saraburi				
	Ang Thong				
	Uthai Thani				

Table 2 Clarifies the population ratio and population density.

North	Population	Population density	Central	Population	Population density	North-East	Population	Population density
Chiang Roi	1,298,304	113	Bangkok	5,666,264	3,623	Khon Kaen	1,802,872	169
Chiang Mal	1,779,254	79	Kamphaeng Phet	725,867	86	Chaiyaphum	1,137,357	91
Mae Hong son	284,138	23	Chai Nat	326,611	131	Nakhon Phanom	920,030	430
Lampang	738,316	59	Nakhon Nayok	260,751	122	Nakhon Ratchasima	2,648,927	128
Lamphun	405,075	92	Nakhon Pathom	920,030	430	Bueng Kan	424,091	106
Nan	478,227	40	Nakhon Sawan	1,059,887	111	Buriram	1,595,747	159
Phayao	472,356	76	Nonthaburi	1,265,387	1,986	Maha Sarakham	962,665	172
Phrae	441,726	68	Pathum Thani	1,163,604	766	Mukdahan	353,174	87
Uttaradit	453,103	58	Phra Nakhon Si Ayutthaya	820,188	322	Yasothon	537,299	130
			Phichit	536,311	124	Roi Et	1,305,211	166
			Phitsanulok	865,247	82	Loei	642,950	61
			Phetchabun	485,191	77	Sakon Nakhon	1,153,390	121
			Lopburi	755,556	116	Surin	1,396,831	157
			Samut Prakan	1,344,875	1,420	Sisaket	1,472,859	165
			Samut Songkhram	193,305	467	Nong Khai	522,311	160
			Samut Sakhon	584,703	675	Nong Bua Lamphu	512,780	125
			Sing Buri	208,446	255	Udon Thani	1,586,646	143
			Sukhothai	595,072	89	Ubon Ratchathani	1,878,146	120
			Suphan Buri	846,334	156	Amnat Charoen	378,438	115
			Saraburi	645,911	185			
			Ang Thong	279,654	294			
			Uthai Thani	328,618	50			

West	Population	Population density	South	Population	Population density	East	Population	Population density
Kanchanaburi	895,525	46	Krabi	476,739	90	Chanthaburi	537,698	84
Tak	665,620	39	Chumphon	511,304	85	Chachoengsao	720,113	139
Prachuap Khiri Khan	554,116	88	Trang	643,164	136	Chonburi	1,558,301	346
Phetchaburi	485,191	77	Nakhon Si Thammarat	1,561,927	158	Trat	229,958	78
Ratchaburi	873,101	168	Narathiwat	808,020	180	Prachinburi	485,191	77
			Pattani	725,104	367	Rayong	734,753	201
			Phang Nga	268,788	49	Sa Kaeo	566,303	83
			Phatthalung	524,865	135			
			Phuket	416,582	762			
			Ranong	193,370	60			
			Satun	323,586	107			
			Songkhla	1,435,968	186			
			Surat Thani	595,072	89			
			Yala	536,330	119			

In case of an emergency, there is a single emergency number (1669) for the dispatch center where requests for ambulance transportation to the hospital and support from an emergency medical team are forwarded. The dispatch center staff follows a decision-making process based on an emergency medical triage protocol and CBD[40]. This is a validated tool for managing emergency calls for emergency cases. The EMS system in Thailand is a two-tiered ambulance system consisting of the ALS, which is provided by hospital-based ambulances, and basic care, which is provided by the non-public health sector organizations[41].

Section 2: Data collection and processing

The study used electronically registered data from the EMDC in each province concerning requests for an ambulance. During such calls, dispatchers are recorded on the computer base linked to the National Institute for Emergency Medicine (NIEM). The dispatch data contain information following each step of the decision-making process based on the emergency medical triage protocol and 25 CBD in Thailand as follows; abdominal pain anaphylaxis, animal bite, bleeding(non-trauma), breathing problems, cardiac arrest, chest pain, airway obstruction, diabetic problems, environment emergency, headaches, psychiatric problems, drug overdose, gynecological problems, seizure, unknown problem, stroke, unconsciousness, pediatric problem, assault, burn, near drowning, fall victim, and traffic-accident[40].

Section 3: Selection of emergency calls, life-threatening conditions, and trauma-related calls

We included all emergency calls over the five-year study period for our analyses of temporal patterns. These calls are categorized as follows: EPL I (potentially life-threatening), EPL II (acute, but not life-threatening), EPL III (not acute, but transportation and observation in an ambulance are necessary), and EPL IV (advised, recommendation, referral to the general practitioner). We determined five life-threatening conditions that usually caused these emergency calls: dyspnea, unconsciousness, cardiac arrest, stroke, and airway obstruction. Finally, we also included all types of trauma-related calls.

Section 4: Conflict of interest

The study was approved by the Institutional Review Board of Navamindradhiraj University(#COE001/2565). No author has any conflict of interest or financial ties relevant to the study to disclose.

Section 5: Derived variables

Causes and emergency priority levels were extracted from each emergency call, including the type of EPL [I, II, III, and IV], life-threatening conditions, and cause of trauma. For temporal patterns, we determined three seasons: winter (November to February), summer (March to May), and rainy (June to October). For the analysis of the time-of-day variation, we included the following: night (00:00– : 9), morning (0 :00 – : 9), afternoon (2:00 – : 9), and evening (8:00–23: 9) he variables included were the patients' age range (≤20, 21–40, 41–60, 61–80, and ≥81 years). Diurnal pattern variation analysis included the time of day, day of the week, month, season, and year in which emergency calls were made.

Section 6: Statistical analysis

This study was descriptive statistics using a report with frequency distribution and percentage. For analysis of causes and EPLs, life-threatening conditions, and trauma-related causes. We used a JMP PRO 15.00 (SAS Institute Inc.) for calculating the adjusted ratio estimates for the associations between the number of calls and season, day of the week, and time of day during the study period.

Phase 2: Development of smartphone applications for BCPR in the prehospital setting in Thailand

The second phase focuses on the development of smartphone applications for BCPR in the pre-hospital setting in Thailand. A researcher has performed actions that will be illustrated in the following sections;

Section 1: Research Design

Section 2: Research Instruments

2.1 Research Intervention Instrument in Experimental Research

Section 1: Research Design

The method employed in this research is the research and development towards the development of smartphone applications for BCPR in a pre-hospital setting.

Section 2: Research Instruments

2.1 Instrument for Collecting Research Data

It is the process of creating and assessing the quality of research tools. A questionnaire for survey opinions of experts on the development of smartphone applications for bystander cardiopulmonary resuscitation in the pre-hospital setting in Thailand is utilized. The questionnaire utilizes a Likert point scale of 0-5 (respectively for non and very much agree). There are 13 questions and 113 sub-questions in total (as shown in the appendix).

2.2. Assessment of Research Tool

The quantitative research data collection tool was a questionnaire. A rating scale questionnaire requires a two-step quality check: first is a test for validity, also known as the use of the IOC (index of item-objective congruence: IOC finding the consistency index between question and objective), and the second step is to check the reliability.

2.2.1. Questionnaire Design

The study checks validity with the use of a group of people who may be an advisor or qualified persons. There will be an odd number of 19 experts answering each question., and to see coverage on research question issues (Comprehensiveness), and the language content (language) that will validate whether the respondents understand the same way as each other or not. Which one passes, gives a score of 1, does not pass, gives a score of -1, not sure, will give a score of 0, take each item from an expert to find an average of more than 0.5. If not, you can cut off that point. Also called finding an index of consistency between the question and the objective.

The study will create and develop smartphone applications for BCPR in a pre-hospital setting according to the recommendations from the consultant, and bring it to experts in curriculum content, process, language, and assessment check for content quality and accuracy.

The criteria for consideration are:

+1   = Congruent with a clear understanding

0   = Uncertain or not sure whether the item is related to the study,

-1   = Not understood or not congruent or related to this study.

Data analysis, suitability, and consistency of innovation by using the conformity index (IOC) calculated according to the formula.

$$IOC = \frac{\sum R}{N}$$

IOC   = Item-Objective Congruence Index

R   = Point given by expert

$\sum R$ = Total point of each expert

N   = Number of experts

Data collected from expert opinions were used to calculate the IOC using the Index of item objective congruence of experts to calculate the index, then select a consistency index value of 0.80 or more.

2.2.2. The questionnaire focuses on the Likert point scale 5-point for agreement on a Likert scale of 0-5 (respectively for non and very much agree). we created a consensus-based questionnaire with 13 main questions and 113 sub-questions.

Section 3: Research Steps

The method employed in this research is research and development. According to Sugiyono[42], the method of research and development is a kind of research method employed to create and test products. The product of this research is a smartphone application that has been validated by concept experts, media experts, and dispatchers, then integrate with the Delphi technique. Delphi technique is considered desirable to reach a consensus on a field where a lack of agreement or incomplete knowledge is evident. Its application is primarily

based on anonymity, allowing participants to express their opinions freely, and eliminating any possible personal conflict[43], respectively. It is characterized by (i) iteration, which allows participants to reconsider and refine their opinion, (ii) controlled feedback, which provides them with information about the group's perspectives to clarify or change their views and (iii) statistical response, to represent the group's views quantitatively [44].

However, two of the most fundamental issues in the Delphi application are related to the questionnaire design and the expert's panel selection he former is referred to the Likert scale choice and the number of rounds, while the latter to the panel size, its main characteristics, and the response rate.

Theoretically, the Delphi process can be continuously iterated until a consensus is determined to have been achieved. However, point out that three iterations are often sufficient to collect the needed information and to reach a consensus in most cases. The following discussion, however, provides guidelines for up to four iterations to assist those who decide to use the Delphi process as a data collection technique when it is determined that additional iterations beyond three are needed or valuable[45].

Round 1: In the first round, the Delphi process traditionally begins with an open-ended questionnaire. The open-ended questionnaire serves as the cornerstone of soliciting specific information about a content area from the Delphi subjects[45].

Round 2: In the second round, each Delphi participant receives a second questionnaire and is asked to review the items summarized by the investigators based on the information provided in the first round. Accordingly, Delphi panelists may be required to rate or "rank-order items to establish preliminary priorities among items. As a result of round two, areas of disagreement and agreement are identified"[46]. In some cases, Delphi panelists are asked to state the rationale concerning rating priorities among items[45]. In this round, consensus begins forming and the actual outcomes can be presented among the participants' responses[45].

Round 3: In the third round, each Delphi panelist receives a questionnaire that includes the items and ratings summarized by the investigators in the previous round and is asked to revise his/her judgments or "to specify the reasons for remaining outside the consensus"[41]. This round allows Delphi panelists to make further clarifications of both the information and their judgments of the relative importance of the items. However, compared to the previous round, only a slight increase in the degree of consensus can be expected[46].

Round 4: In the fourth and often final round, the list of remaining items, their ratings, minority opinions, and items achieving consensus are distributed to the panelists. This round provides a final opportunity for participants to revise their judgments. It should be remembered that the number of Delphi iterations depends largely on the degree of consensus sought by the investigators and can vary from three to five[46].

Figure 2 shows that the research development method has four main steps: 1) planning, 2) development, 3) evaluation, and 4) Product: Innovative smartphone applications for BCPR to the EMS system in Thailand.

1) Planning

1.1 Identification and assessment of OHCA problems in Bangkok, Thailand

1.2 Review literature related to the application

1.3 Storyboard making

1.4 Concept development

2) Development

2.1 Media defining

2.3 Scheduling

2.3 Creation process

3) Evaluations and refining process of prototypes and final stage application by experts on "usability and usefulness"

This is the stage of creating the initial prototype smartphone application, design, and evaluation (validation by concept experts, media experts, and dispatchers from questionnaires and the meeting)

4) Product: Innovative smartphone applications for BCPR to the EMS system in Thailand (Figure 3).

Section 4: Data collection

4.1 The expert meetings are comprised of three rounds of discussions;

The 1st meeting aims to obtain expert opinions on the necessity of having the smartphone applications for BCPR for the EMS system in Thailand, and obtain comments on the required operating modes of the application.

The 2nd meeting will be conducted with experts from the information technology department in Thailand, Zoll company from Thailand and Asia- Pacific, and the expert from Kokushikan University, Japan.

The 3ʳᵈ meeting will be conducted with experts from the information technology department in Thailand, Allm.Inc, in Japan, and the expert from Kokushikan University, Japan.

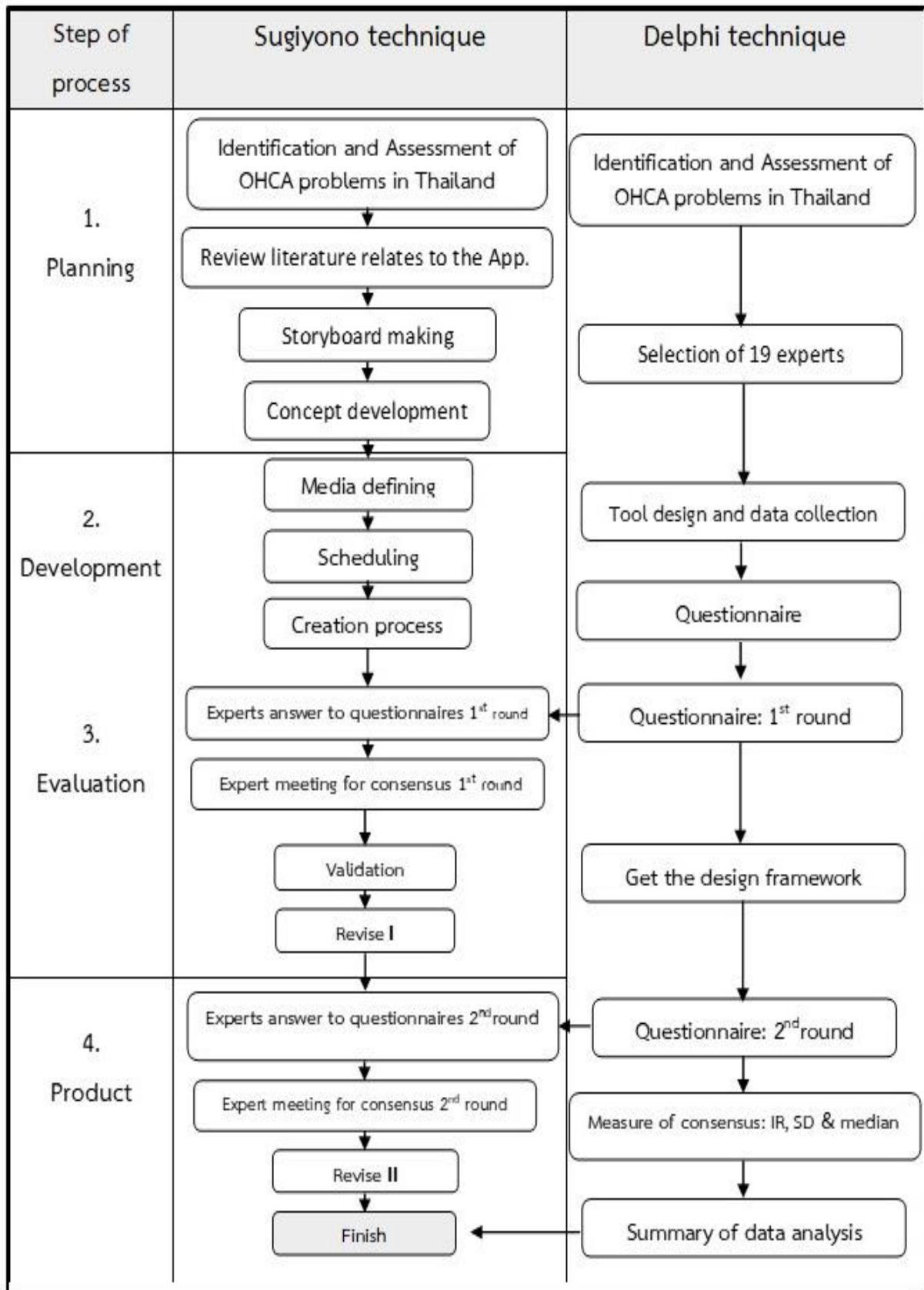| Step of process	Sugiyono technique	Delphi technique
1. Planning	Identification and Assessment of OHCA problems in Thailand Review literature relates to the App. Storyboard making Concept development	Identification and Assessment of OHCA problems in Thailand Selection of 19 experts
2. Development	Media defining Scheduling Creation process	Tool design and data collection Questionnaire
3. Evaluation	Experts answer to questionnaires 1st round Expert meeting for consensus 1st round Validation Revise I	Questionnaire: 1st round Get the design framework
4. Product	Experts answer to questionnaires 2nd round Expert meeting for consensus 2nd round Revise II Finish	Questionnaire: 2nd round Measure of consensus: IR, SD & median Summary of data analysis

Figure 3 Study design

4.2 The questionnaire

The researcher sends questionnaires to experts using Google Forms in a total of 2 rounds. Questionnaire for surveys opinions of experts on the development of smartphone applications for BCPR in the pre-hospital setting in Thailand. The questionnaire focuses on the Likert point scale 5-point for agreement on a Likert scale of 0-5 (respectively for non and very much agree). There is a total of 13 questions and 113 sub-questions. The list of questions included the following: (1) Is the development of smartphone applications in the EMS in Thailand necessary?; (2) What do you think of the emergency call mode of activated emergency?; (3) What do you think of the dispatch center using location data?; (4) What do you think of the registered bystander who finds the location data?; (5) What do you think of the emergency medical response (EMR) use in location data?; (6) What do you think of the application being able to teach CPR for daily life?; (7) What do you think of the scope of first-aid?; (8) What do you think of the application being able to guide bystanders when providing BCPR?; (9) What do you think of the application being able to offer notification about real-time feedback on high-quality CPR for bystanders?; (10) What do you think of how the application gives real-time feedback to BCPR?; (11) What do you think of the application's need to track bystanders to administer care?; (2) What do you think of the application's need to track bystanders to contact?; (13) What do you think of the distance from the application to a bystander? The next step involved sending questionnaires to experts using Google forms in two rounds. The questionnaire focused on the 5-point Likert scale for agreement (0- for "do not agree" to "very much agree") (As shown in appendix B table 4).

Section 5: Data analysis

5.1. The study analyzes the efficiency of the development of smartphone applications for BCPR in the pre-hospital setting in Thailand according to the set criteria, using percentages.

5.2. The study analyzes the results of the development of smartphone applications for BCPR in the pre-hospital setting in Thailand. This is often achieved by ranking items according to their median and percentage scores as decided by group responses on Likert-type scales. The individual can then see where their opinion lies about that of the total group. Median and Inter-quartile range (IR).

Section 6: Statistical methods

The research will analyze the collected data using the following statistics;

6.1 Statistics used to verify tool quality:

Determination of the conformity index between questions with the main issues according to the content validity as follows;

$$IOC = \frac{\sum R}{N}$$

$\sum R$ = Total point of each expert

N   = Number of experts

Data collected from expert opinions will be used to calculate the IOC using the Index of item objective congruence of experts to calculate the index. Then select a consistency index value of 0.8 or more.

6.2 A central tendency (or measure of central tendency) is a central or typical value for a probability distribution. It may also be called a center or location of the distribution. Colloquially, measures of central tendency are often called averages. The most common measures of central tendency are percentages and medians.

6.2.1 Percentages

$$\text{Percentages (\%)} = \frac{\sum R(4+5)x\ 100}{N}$$

$\sum R$ = Total point of each expert

N   = Number of experts

he study will accept the 80% percent of respondents lying in the "highly important" or "strongly agreeing" category

6.2.2 Median Formula

Using the median formula, the middle value of the arranged set of numbers can be calculated. For finding this measure of central tendency, it is necessary to write the components of the group in increasing order. The median formula varies based on the number of observations and whether they are odd or even. The following set of formulas would help in finding the median of the given data.

$$Mdn = \frac{N+1}{2}$$

The median to assess consensus is more than 4

6.3 Level of Dispersion

The interquartile range (IQR), also called the mid spread, middle 50%, or H spread, is a measure of statistical dispersion, being equal to the difference between the 75th and 25th percentiles, or between upper and lower quartiles,

$$IQR = Q3 - Q$$

First quartile Q1 = median of the n smallest values

Third quartile Q3 = median of the n largest values

The second quartile Q2 is the same as the ordinary median

The interquartile range (IR) to assess consensus should be less than the corresponding 1.5 to consistency.

6.4 Check the Precision of the Instrument

Consistency of the content with its intended purpose: The method for checking content validity is an examination of tools that are representing or covering the content. by considering the content analysis or examination table. Experts' consideration for conclusions using the questions with the purpose.

Use the expert's score to find the correspondence index by using the formula [50].

$$IOC = \frac{\sum R}{N}$$

Where IOC is the index of conformity between the questions and the purpose

$\sum R$ = Total point of each expert

N = Number of experts

To set criteria for determining the level of conformity index of the questions obtained from a calculation from a formula that will have a value between 0.00 and 1.00, the details of the criteria are as follows;

1. Have an IOC value of 0.5 or more,

2. Select the exam that can be used, but if IOC values are lower than 0.5, they should be corrected, adjusted, or eliminated (show IOC in appendix table 5). Find the index of content precision from the formula;

$$CVI= \sum \frac{R4,5}{N}$$

When CVI is an index of content validity

It is the number of points that all experts strongly agree with levels 4 and 5.

N= the total number of questionnaires

With the content validity criteria applicable from 0.8 and above (Davis 1992:104)

(Show IOC in appendix table 4)

Section 7: production developing process

7.1 To connect with Allm Co., Ltd. or Allm. Shaping healthcare 3-27-11, Shibuya, Tokyo, Japan. Allm Co., Ltd. has product positioning for personal health records and uses the cloud and Apps to improve business efficiency (Figure 4).

Product positioning

Personal Health Record

Team Cloud

Using the Cloud and Apps to Improve Business Efficiency

MySOS   **Join**   **Team** Kango Kaigo

| pre | in | post |

Support app for life saving and healthcare

Communication app for medical professionals

Solution for total communi healthcare system

✓Basic Personal Information
✓Family Information (Contact Information)
✓Medication Information
✓Medical history
✓Primary physician information
✓Emergency Guidelines

Anytime & Anywhere
✓ Communication app (SNS) for medical professionals only
✓ Linkage with hospital system
✓ Check image information anywhere

✓ Basic User Information
✓ Patient condition
✓ Nursing Treatment Information
✓ Care progress

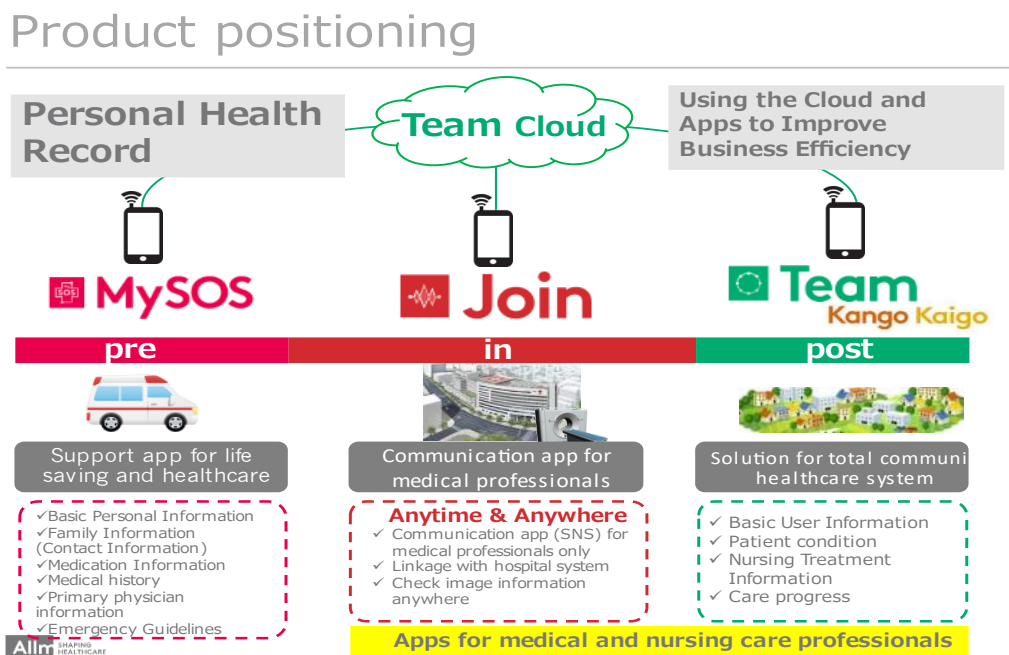**Apps for medical and nursing care professionals**

Figure 4 Product positioning

his smartphone app keeps track of you and your family's health and medical treatments to ensure a smooth response in case you suddenly fall ill. MySOS helps emergency medical services achieve higher survival rates; provides a community self-help platform; reduces the cost of medical treatment; and more.

Figure 5 [MySOS] Support app for life-saving and healthcare (Permission with Allm. company)

Figure 6 Feature of MySOS (Permission with Allm. company)

Basic life support

In an emergency, the app offers instructions for basic first-aid and lifesaving techniques such as chest compressions and the recovery position. An emergency notification text message can be sent to emergency medical services and pre-registered emergency contacts.

Figure 7 Basic life support (Permission with Allm. company)

Medical emergency guides for adults and children

How to react and administer first-aid if someone suddenly falls ill. According to the symptom, we suggest the response method recommended by the degree of urgency of 3 to 5 grades.

Figure 8 Medical emergency guides for adults and children (Permission with Allm. company)

First-aid guide (Editorial supervision by Japanese Red Cross)

The included first-aid guide tells you how to handle medical emergencies such as bone fractures, dislocated joints, and burns. The guidelines are provided by the Japanese Red Cross Society.

Figure 9 First-aid guide (Permission with Allm. company)

AED / Medical facility search

You can search for AED/Medical facilities in the surrounding areas on a map. The various institutions are listed by name with distances from your present location. Tapping the list displays detailed information on AED/ Medical facilities. *Currently only in Japan and Brazil

Figure 10 AED / Medical facility search (Permission with Allm. company)

Emergency calls

Send emergency calls to nearby medical professionals who have MySOS installed and registered emergency contacts such as family members. When an emergency call comes in, a map with the route from their current location to the scene of the emergency shows up. The distance and travel time are also displayed.

Figure 11 Emergency calls (Permission with Allm. company)

Video telephone call

Free and anonymous video telephone calls are available to patients who make emergency calls through MySOS and the recipients of the calls. The recipients can find the exact location of the patient or check the symptoms before they arrive at the patient's location.

Dialing emergency number

You can dial the emergency number and send a rescue request at the same time. *Currently available only in Japan, Taiwan, and Brazil.

Figure 12 Video telephone call (Permission with Allm. company)

My clinical record (medical checkup results)

Your medication history (prescriptions), medical referral letters, case or medical history, examination results, and other information can be easily collected using the camera scanning feature.

You can receive medical checkup results on your smartphone.

After the medical check-up at clinics, you can receive and check the results and medical images such as MRI.
* Registration to the app is required.
* Only available to hospitals and clinics affiliated with MySOS.

Call from the lock screen

MySOS features can be launched by tapping a button even if the smartphone is locked. *Only supported in Android version[65].
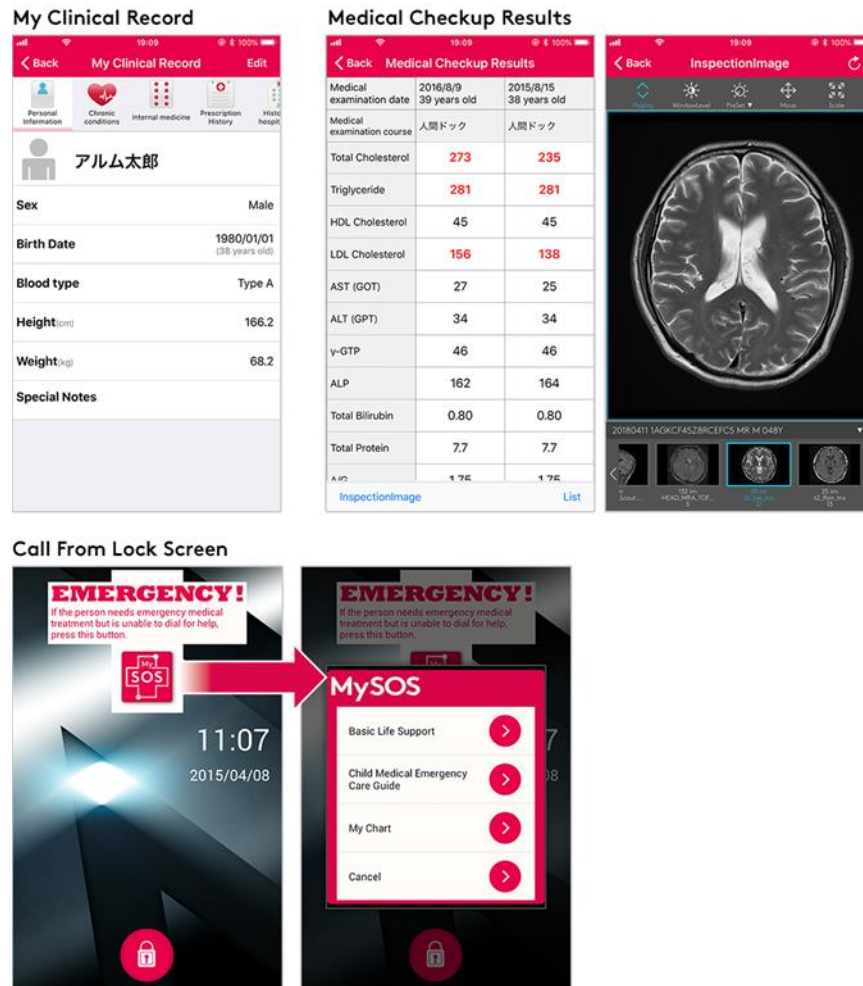
Figure 13 My clinical record (Permission with Allm. company)

7.2 Researcher and Allm. company has conducted with a corporation developer of the Thai version as followed;

This joint development agreement is entered into by and between [Miss. Duangpon Thepmanee] and Allm Inc. ("Allm"). The parties hereby agree as follows:

7.2.1 Joint Development

Miss. Duangpon Thepmanee and Allm will jointly conduct development ("Development") to localize for the market of Thailand "MySOS", which is an application

developed (including any improvements, modifications, adaptations, or localizations that may hereafter be made) by Allm for emergency medical care and health support ("MySOS", and the localized Thai language version thereof created through development is hereinafter referred to as "Localized MySOS")

7.2.2 Responsibilities of each party in development shall be as follows:

(1) Miss. Duangpon Thepmanee: Planning and organizing the entire development, provision of contents, etc. (such as translation of texts used in the application into Thai language, database on AEDs (automated external defibrillator) and medical institutions in Thailand, texts and artwork in the Thai language), and managing development timeline. Miss. Duangpon Thepmanee shall cause Kokushikan University to supervise and review from an academic and medical standpoint the contents to be provided by Miss. Duangpon Thepmanee, and shall ensure the correctness of such contents has been warranted by Kokushikan University.

(2) Allm: Activities of development required for incorporating contents, etc., provided by Miss. Duangpon Thepmanee into MySOS (including programming and other activities)

7.2.3 Scope of development; The scope of development shall be as follows:

(1) Translating MySOS into the Thai language.

(2) Setting Thai health emergency call number (1669) for MySOS's SOS function.

(3) Incorporating Thai AEDs and medical institution information into AED and medical institution search functions in MySOS.

(4) Incorporating the Thai version of MySOS health emergency and first aid guides.

7.2.4 Governing Law

This Agreement shall be governed by, and construed following, the laws of Japan, without reference to its conflict of law rules.

Therefore, I have permission from Allm. company for research of Ph.D. student period in Kokushikan University. They agree with the original animation and the main function. However, the researcher has changed the content of each mode for the Thai version.

Chapter 4. RESULTS

Chapter 4. RESULTS

The results shown in the second phase are as follows: 1) Trends in pre-hospital emergency calls and EMS transportation data, and 2) Development of smartphone applications for BCPR in the prehospital setting in Thailand.

Phase 1: Trends in pre-hospital emergency calls and EMS transportation data in Thailand

This study showed trends in prehospital emergency calls and EMS transportation data in Thailand. The results were presented in the form of figures or tables of interpreting data using percentages, and number by investigating the research objectives as follows:

Section 1: Characteristics of emergency calls

Section 2: Areas with the most frequent emergency calls

Section 3: Causes of EMD contact through emergency calls

Section 4: To clarify by age group of emergency causes and each the province

Section 5: To clarify by a percentage of EPL

Section 6: Temporal variations in emergency calls

Section 7: Temporal variations for life-threatening causes

Section 8: Temporal variations for trauma-related emergency causes

Section 1: Characteristics of emergency calls

In total 8,182,724 emergency calls were registered in the study period, corresponding to an emergency call incidence of 24 calls: 1000 people/ year (population in Thailand 66.5 million in 2019[19)]. Of those, 8,116,969 (99%) had complete data for causes in the provinces and regions. 7,859,726 (96%) contains complete data for analyzing EPL. 2,860,646 (36%) contains complete data for analyzing trauma emergency calls. 4,993,080 (64%) contain complete data for analyzing non-trauma calls and 1,101,352 (22%) contain complete data for analyzing life-threatening non-trauma. This leaves each type of call eligible for analysis of causes, emergency priority level, life-threatening, trauma emergency calls, and temporal variations. The data flowchart is presented in Figure14.
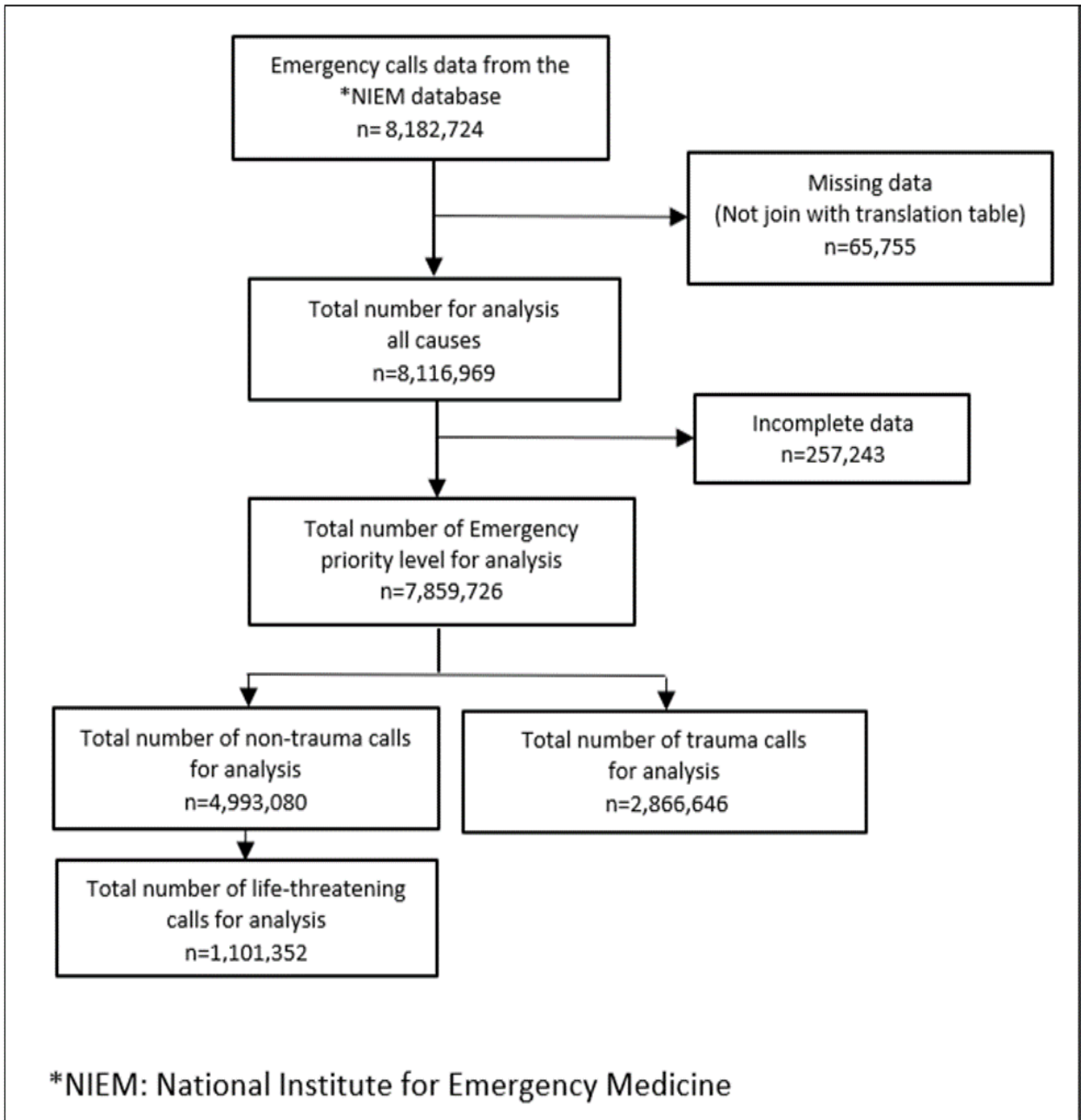
Figure 14 Flow chart for the data collection process

Section 2: Areas with the most frequent emergency calls

Provinces	Population	Population density	Number of call (%)	Ranking
Khon Kaen	1,802,872	169	513,571 (6.15%)	1
Nakhon Ratchasima	2,648,927	128	382,607 (4.58%)	2
Roi Et	1,305,211	166	312,047 (3.73%)	3
Ubon Ratchasima	1,396,831	120	291,973 (3.49%)	4
Mahasakhan	962,665	172	252,258 (3.02%)	5
Surin	1,396,831	157	242,902 (2.9%)	6
Bangkok	5,666.264	3,632	233,156 (2.79%)	7
Chiang Mai	1,779,254	79	233,156 (8%)	8
Udon Thani	1,586,646	1143	213,583 (2.55%)	9
Kalasin	983,418	142	209,137 (2.50%)	10

Table 3 The top 10 provinces with the highest number of emergency patients

The top 10 provinces with the highest number of emergency cases were; Khon Kaen 513,571 (6.15%), Nakhon Ratchasima 382,607 (4.58%), Roi Et 312,047 (3.73%), Ubon Ratchasima 291,973 (3.49%), Mahasakhan 252,258 (3.02%), Surin 242,902 (2.9%), Bangkok 233,156 (2.79%) Chiang Mai 233,156 (8%), Udon Thani 213,583 (2.55%) and Kalasin 209,137 (2.50%), respectively (Table 3), and A map of Thailand shows the top 10 provinces with the highest emergency cases (Figure 15).
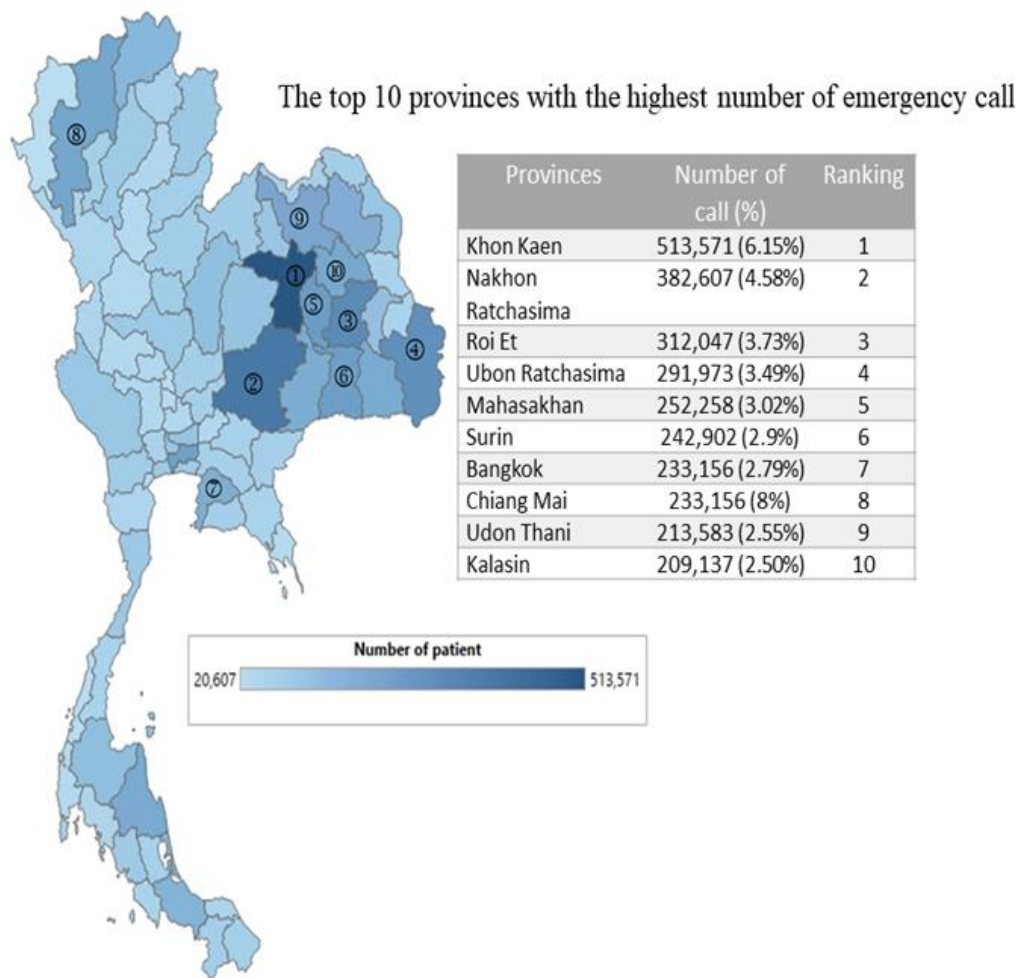
The top 10 provinces with the highest number of emergency call

Provinces	Number of call (%)	Ranking
Khon Kaen	513,571 (6.15%)	1
Nakhon Ratchasima	382,607 (4.58%)	2
Roi Et	312,047 (3.73%)	3
Ubon Ratchasima	291,973 (3.49%)	4
Mahasakhan	252,258 (3.02%)	5
Surin	242,902 (2.9%)	6
Bangkok	233,156 (2.79%)	7
Chiang Mai	233,156 (8%)	8
Udon Thani	213,583 (2.55%)	9
Kalasin	209,137 (2.50%)	10

Figure 15 Areas with the most frequent emergency calls in Thailand

Areas with the least frequent emergency calls

The top 10 provinces with the least number of emergency patients were Mae Hong Son 20,607 (0.24%), Sing Buri 22,643 (0.27%), Ranong 24,507 (0.29%), Trang 26,570 (0.31%), Trad 28,836 (0.34%), Phangnga 33,816 (0.4%), Sukhothai 34,264 (0.41%), Samut Songkhram 38,104 (0.45%), Uthai Thani 39,202 (0.46%), and Kamphaeng Phet 39,310 (0.47%), respectively (Table 4).

Table 4 The top 10 provinces with the least number of emergency patients

Provinces	Population	Population density	Number of calls (%)	Ranking
Mae Hong Son	284,138	23	20,607 (0.24%)	1
Sing Buri	208,446	255	22,643 (0.27%)	2
Ranong	734,753	201	24,507 (0.29%)	3
Trang	643,164	136	26,570 (0.31%)	4
Trad	229,958	78	28,836 (0.34%)	5
Phangnga	5,495	49	33,816 (0.4%)	6
Sukhothai	595,072	89	34,264 (0.41%)	7
Samut Songkhram	193,305	467	38,104 (0.45%)	8
Uthai Thani	328,618	50	39,202 (0.46%)	9
Kamphaeng Phet	725,867	86	39,310 (0.47%)	10

In addition, the table describes the ratio between population and population density in each province, and A map of Thailand shows the top 10 provinces with the least emergency cases (Figure 16).
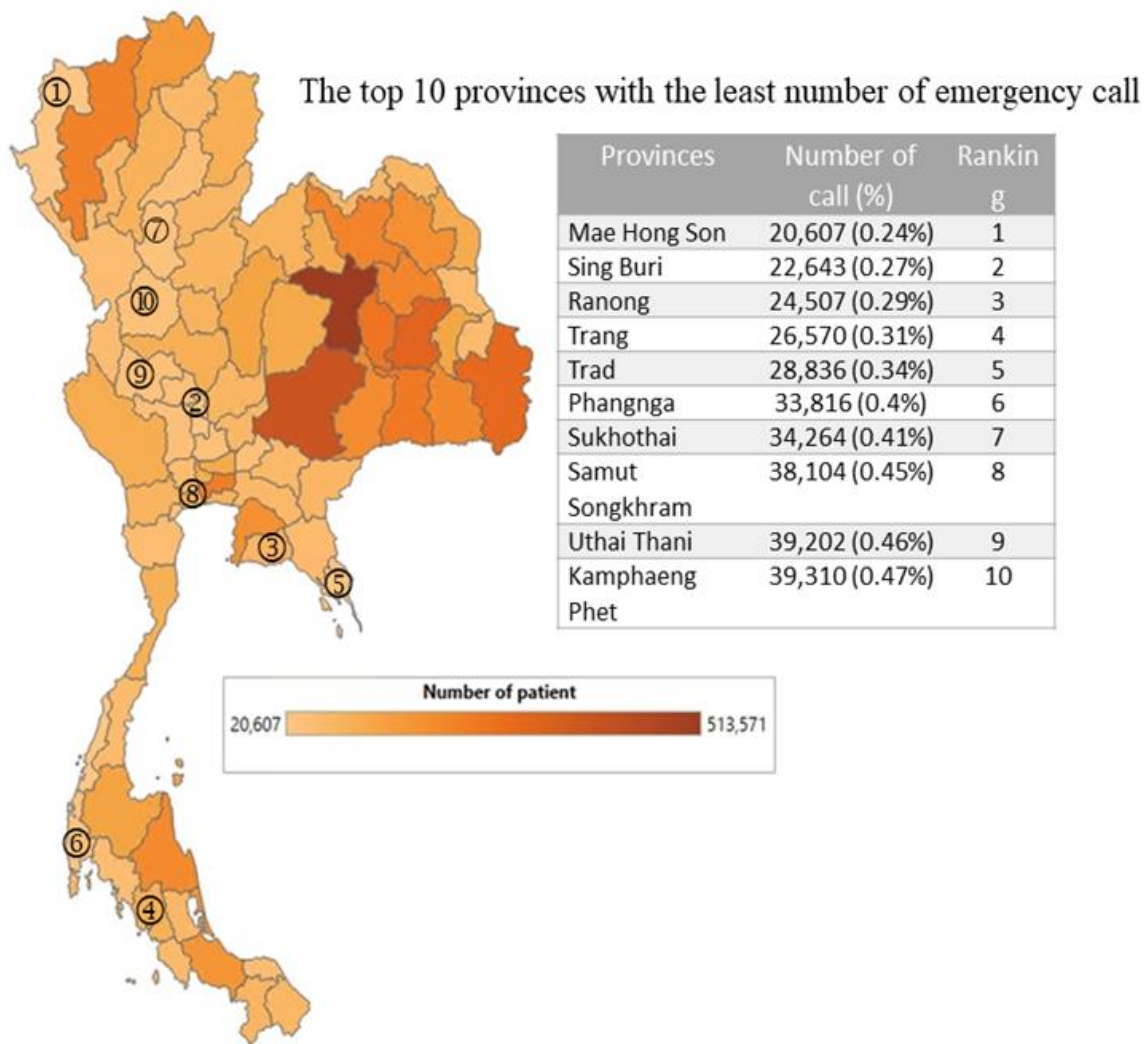
The top 10 provinces with the least number of emergency call

Provinces	Number of call (%)	Ranking
Mae Hong Son	20,607 (0.24%)	1
Sing Buri	22,643 (0.27%)	2
Ranong	24,507 (0.29%)	3
Trang	26,570 (0.31%)	4
Trad	28,836 (0.34%)	5
Phangnga	33,816 (0.4%)	6
Sukhothai	34,264 (0.41%)	7
Samut Songkhram	38,104 (0.45%)	8
Uthai Thani	39,202 (0.46%)	9
Kamphaeng Phet	39,310 (0.47%)	10

Figure 16 Areas with the least frequent emergency calls in Thailand

Number and percentage of regional emergency patients

The regions with the highest and lowest numbers of emergency calls were the Northeast (3,797,799/ 45.5%), Central (1,601,736/ 19.2%), Southern (1,162,897/ 13.9%), Northern (843,660/ 10.1%), Eastern (555,839/ 6.6%) and Western (386,632/ 4.6%) regions, respectively (Figure 17). However, the Northeast has the highest population in Thailand.
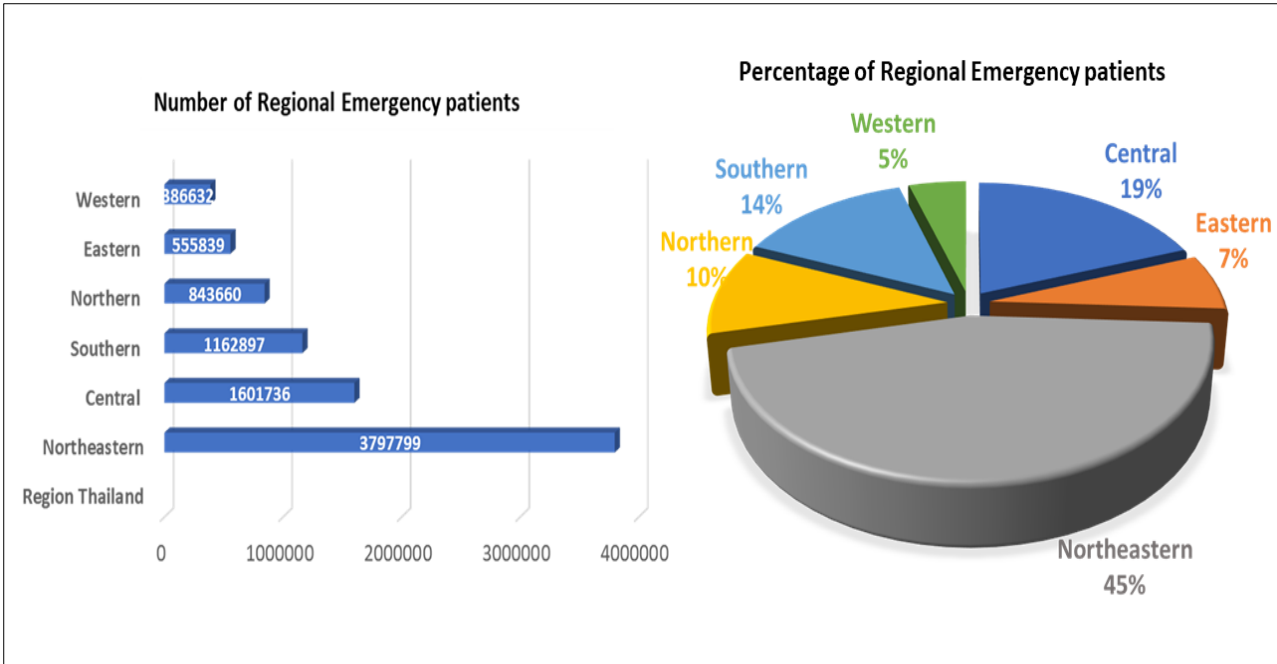
Figure 17 Clarify by number and percentage of regional emergency patients

The annual frequency of emergency calls

The annual frequency of total emergency calls from 2016 to 2020 showed that there were 1,468,054, 1,533,196, 1,656,139, 1,740,925, and 1,718,725 emergency calls, respectively. Our study found an increasing trend in emergency calls every year. Moreover, we found that cardiac arrest increased from 1,052 (8.6%) to 4,699 (42.5%) of total cardiac arrest calls. And the emergency environment increased from 509 (11.6%) to 2,098 (75.73%) total emergency environment calls (Figure 18).
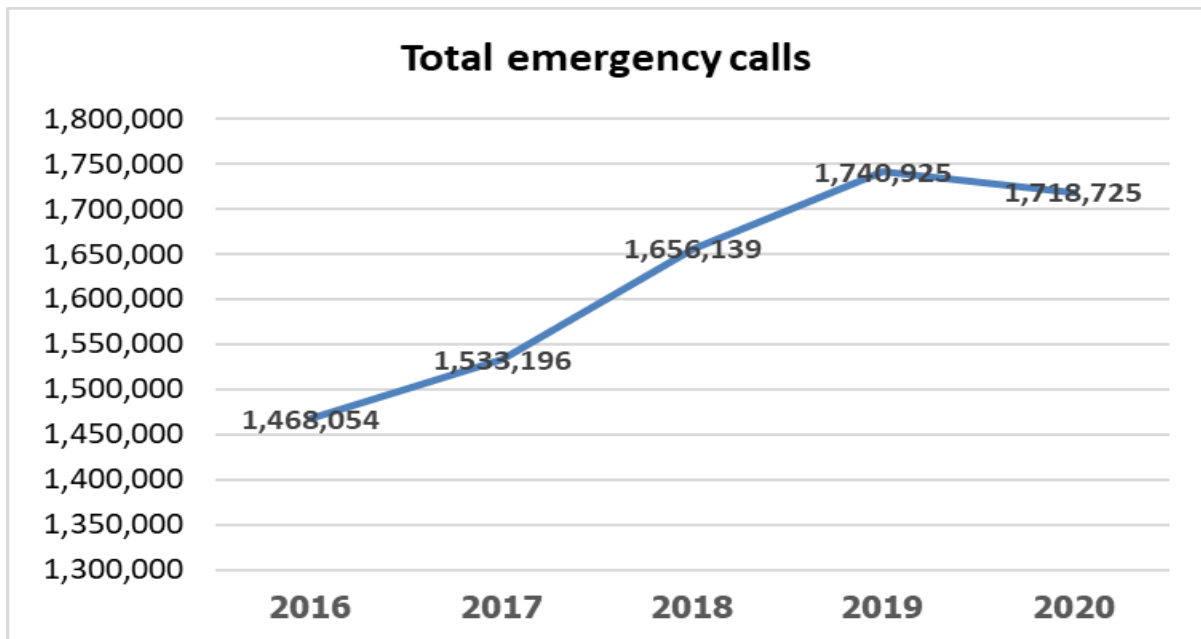

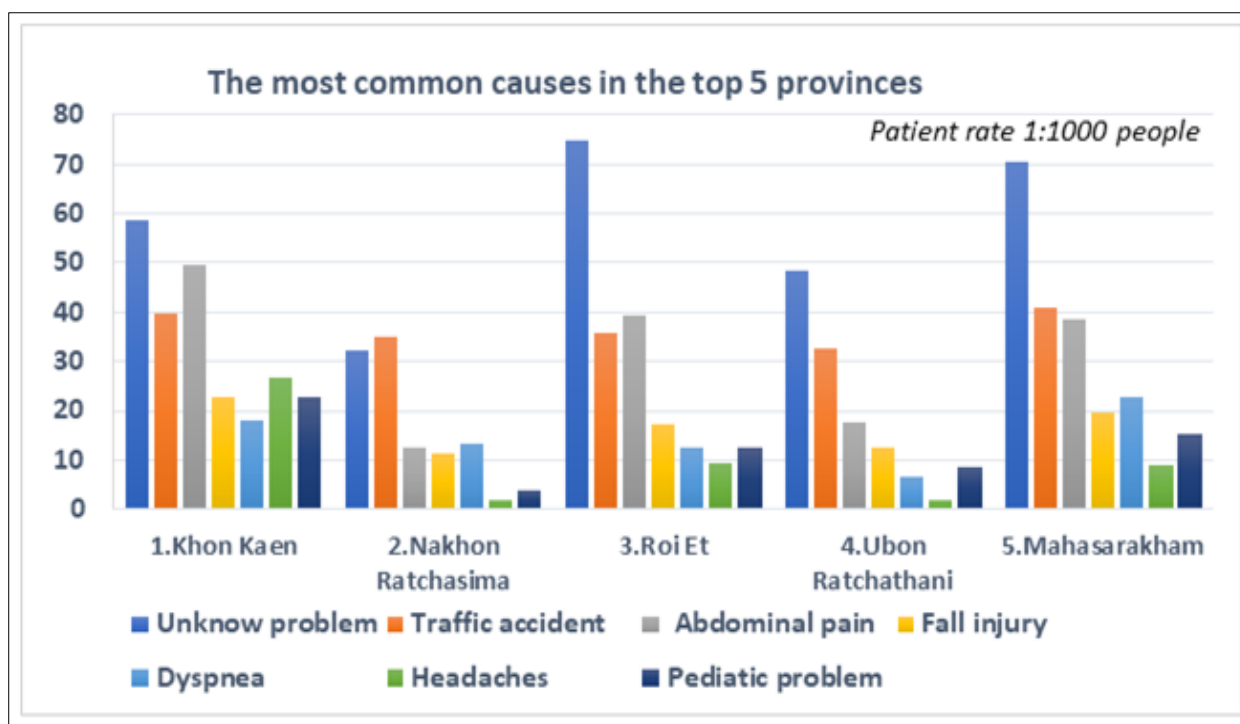**Figure 18** Total emergency calls each year

Figure 19 Clarify by types of most emergency patients in the top 5 provinces

Types of most emergency patients in the top 5 provinces

The patient rates of the most common emergency causes reached a ratio of 1:1,000 for each province. The most common causes of an emergency call in the provinces were "unknown problem" (%) in Roi Et, "traffic accidents" (%) in Mahasarakham, and "abdominal pain" (0%), "fall injury" (23%), "headaches" (2 %), and "pediatric problems" (23%) in Khon Kaen.

The 10 provinces with the most emergencies include as follow; Khon Kaen 513,571 (6.15%), Nakhon Ratchasima 382,607 (4.58%), Roi Et 312,047 (3.73%), Ubon Ratchasima 291,973 (3.49%), Mahasakhan 252,258 (3.02%), Surin 242,902 (2.9%), Bangkok 233,156 (2.79%) Chiang Mai 233,156 (8%) Udon Thani 213,583 (2.55%) and Kalasin 209,137 (2.50%), respectively. While the 5 provinces with the least emergency patient include as follow; Mae Hong Son 20,607 (0.24%), Sing Buri 22,643 (0.27%), Ranong 24,507 (0.29%), Thong 26,570 (0.31%), Trad 28,836 (0.34%). Moreover, we clarified the patient rates of the most common emergency causes by a ratio of 1:1,000 for each province (Figure 19).

Section 3: Causes of EMD contact through emergency calls

The most common recorded causes were categorized as follows: traffic accidents (25.6%); unknown problems (20.4%); abdominal pain (10.6%); fall injury (8%); dyspnea (7.8%); unconsciousness (4.4%); seizure (3.2%), pediatric problems (3.1%), and headache (2.8%); chest pain (2.6%), gynecological problems (2%), diabetic problems (1.8%), and assault (1.6%); and animal bite (0.9%), bleeding (non-trauma, 1.3%), stroke (1.1%), psychiatric problems (1%), anaphylaxis (0.7%), drug overdose (0.4%), burn (0.3%), cardiac arrest (0.14%), airway obstruction (0.12%), near drowning (0.1%), and environment of emergency (0.04%). In addition, male emergency patients accounted for 13% more than females (Figure 20).
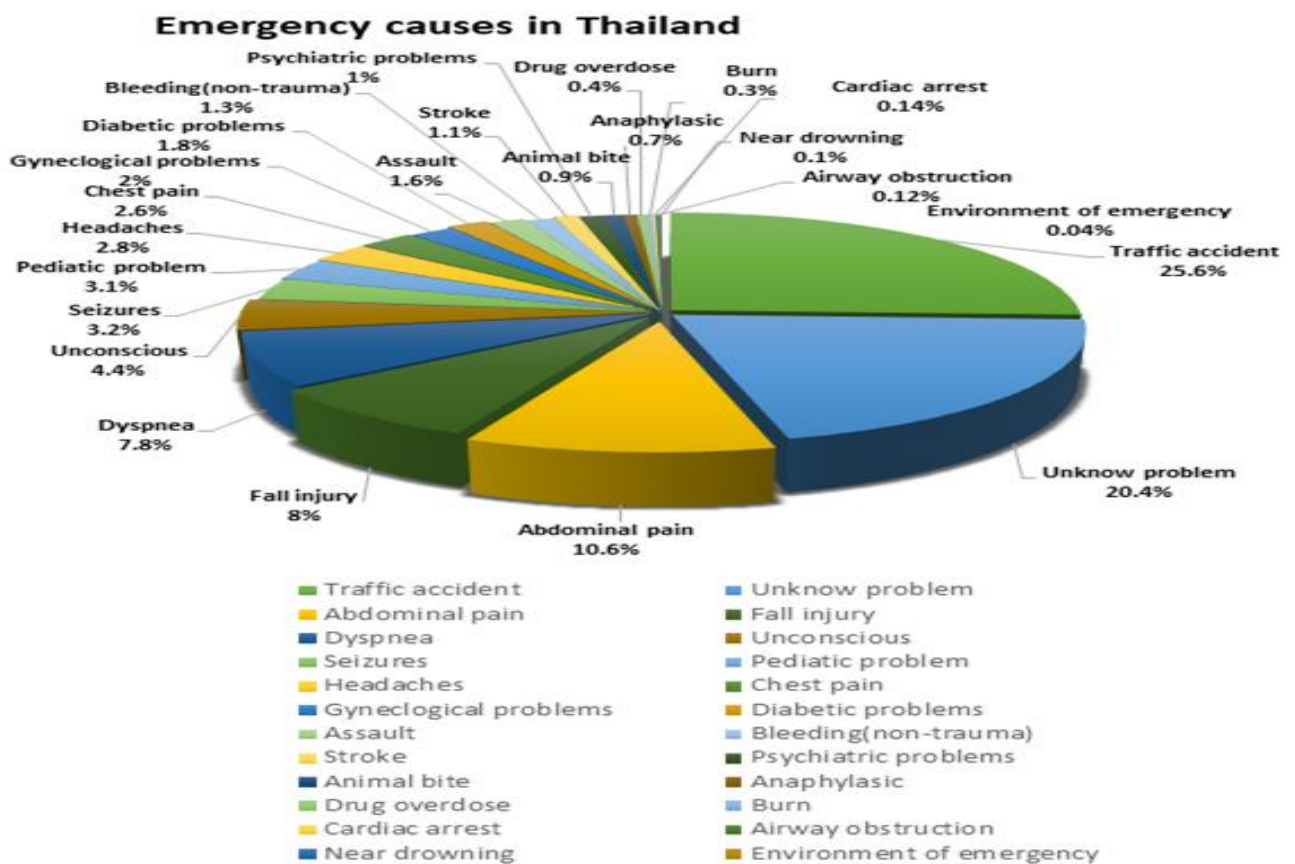
* ***Unknown problems*** *is a combined group of symptom and unclear problem of the emergency patient in the pre-hospital period, including; fever, sick, fatigue, vertigo, and nausea[40].*

Figure 20 Causes of EMS contact through emergency calls

Section 4: To clarify by age group emergency causes and each the province

In terms of incidence of the disease in each age range, nearly 38.1% of near-drowning and (45.8%) of traffic accidents occurred most often among people aged ≤ 20 years; gynecological problems(69.7%), psychiatric (48.6%), assault (44.9%), drug overdose (42.3%), environmental emergency (35.9%), and burn (32.4%) occurred most often among those aged 21–40 years; and bleeding (non-trauma, 38.5%), seizure (37%), animal bites (31.6%), abdominal pain (30.9%), and anaphylactic shock (29.7%) occurred most often among people aged 41–60 years. In addition, diabetic problems (54.1%), stroke (45.4%), dyspnea (41%), unknown problems (40.2%), cardiac arrest (39.8%), headaches (38.3%), chest pain (36.5%), airway obstruction (34%.1), and unconsciousness (35.5%) occurred most often among the 61–80 age group, while dyspnea (15.1%) occurred most often among those aged ≥ 81 years (Figure 21).
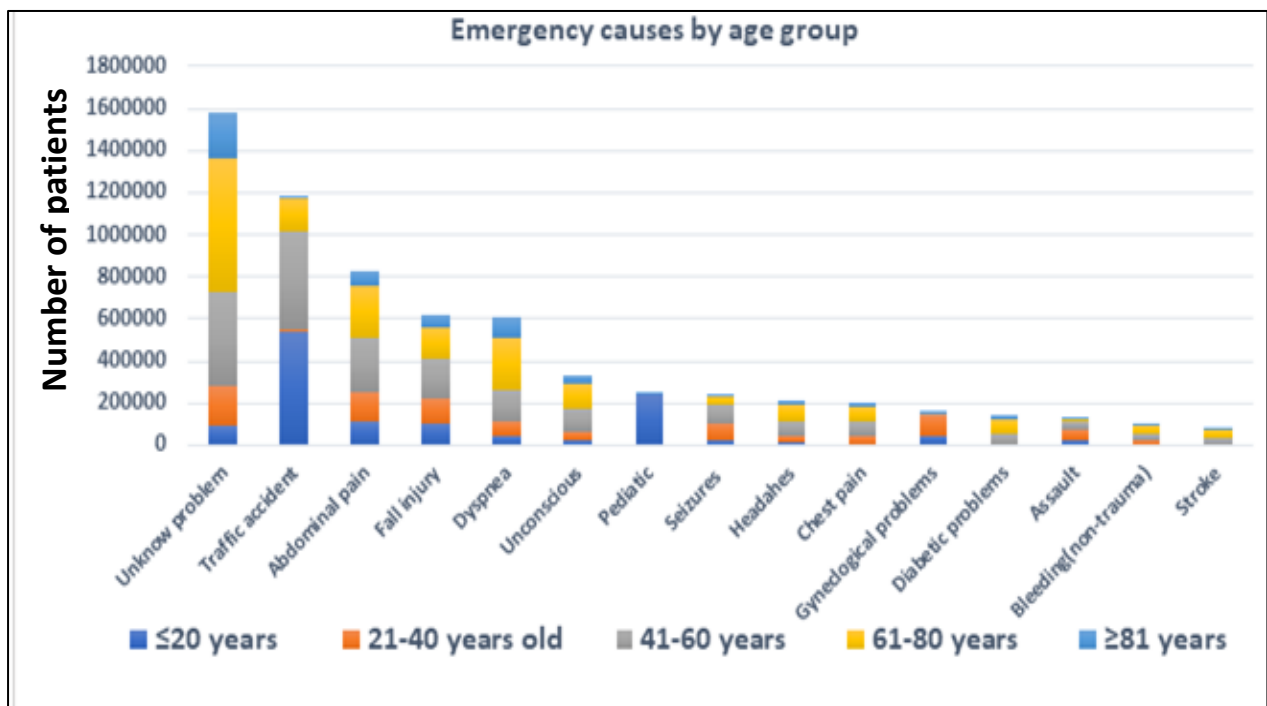

Figure 21 Causes of EMS contact through emergency calls to clarify by age group

Causes of EMS contact through emergency calls to clarify by age group in each the province

In terms of each age range of the province, the province occurred most often emergency calls among people aged ≤20 years; Krabi (16.22%), Narathiwat (15.79%), Bangkok (15%), Satun (14.91%), and Ubon Ratchathani (14.44%), respectively, while Sing Buri (2.7%) lowest numbers of an emergency call. The province occurred most often emergency calls among people aged 21-40 years; Krabi (33.96%), Lamphun (31.51%), Phuket (30.71%), Narathiwat (29.61%), and Mae Hong Son (28.31%), respectively, while Sing Buri (8.35%) lowest numbers of an emergency call. The province occurred most often emergency calls among people aged 41-60 years; Si Sa Ket (32.52%), Bueng Kan (31.94%), Surin (31.32%), Phetchabun (31.19%), Amnat Charoen (31.18%), respectively, while Lampang (20.25%) lowest numbers of an emergency call. The province occurred most often emergency calls among people aged 61-80 years; Sing Buri (43.57%), Ang Thong (40.35%), Phrae (37.35%), Uttaradit (37.23%), and Chai Nat (37.35%), respectively, while Krabi (16.63%) lowest numbers of an emergency call. The province that occurred most often emergency calls among people aged ≥81 years; Lampang (35%), Sing Buri (21.61%), Samut Songkhram (20.45%), Phetchabun (18.56%), and Suphan Buri (16.94%), respectively, while Nong Bua Lamphu (5.94%) lowest numbers of the emergency call, shown percentage (Figure 22) and several ranges in each province (Figure 23).
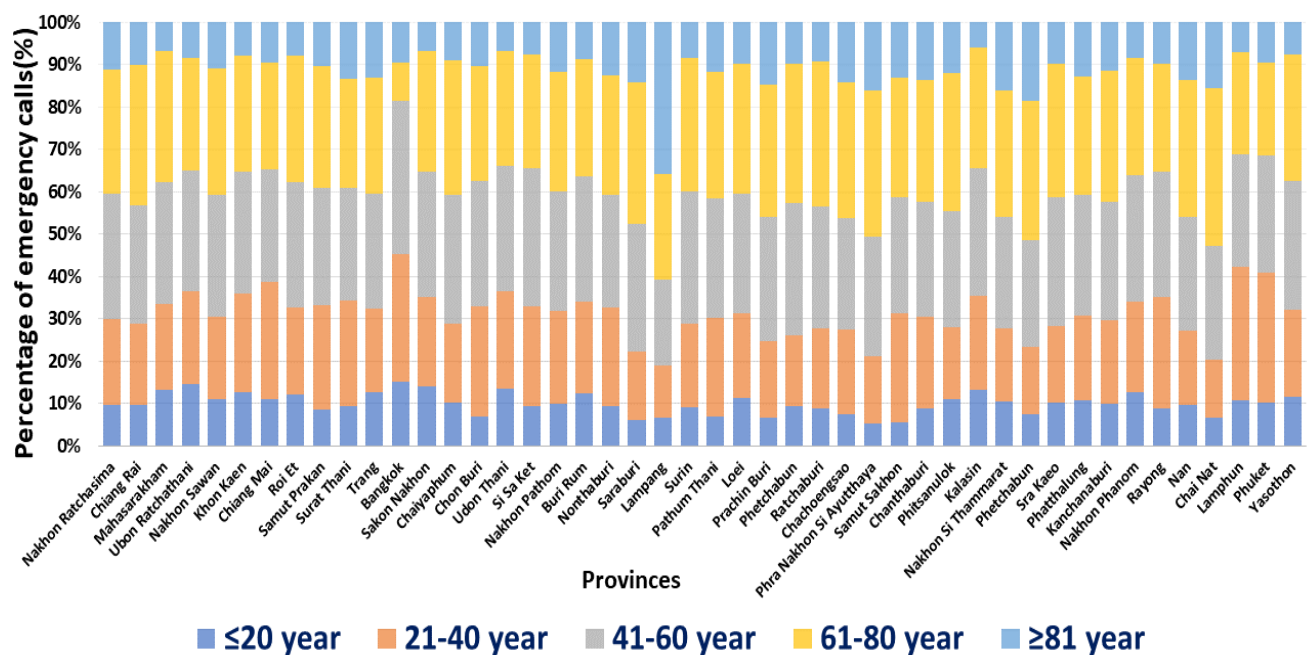

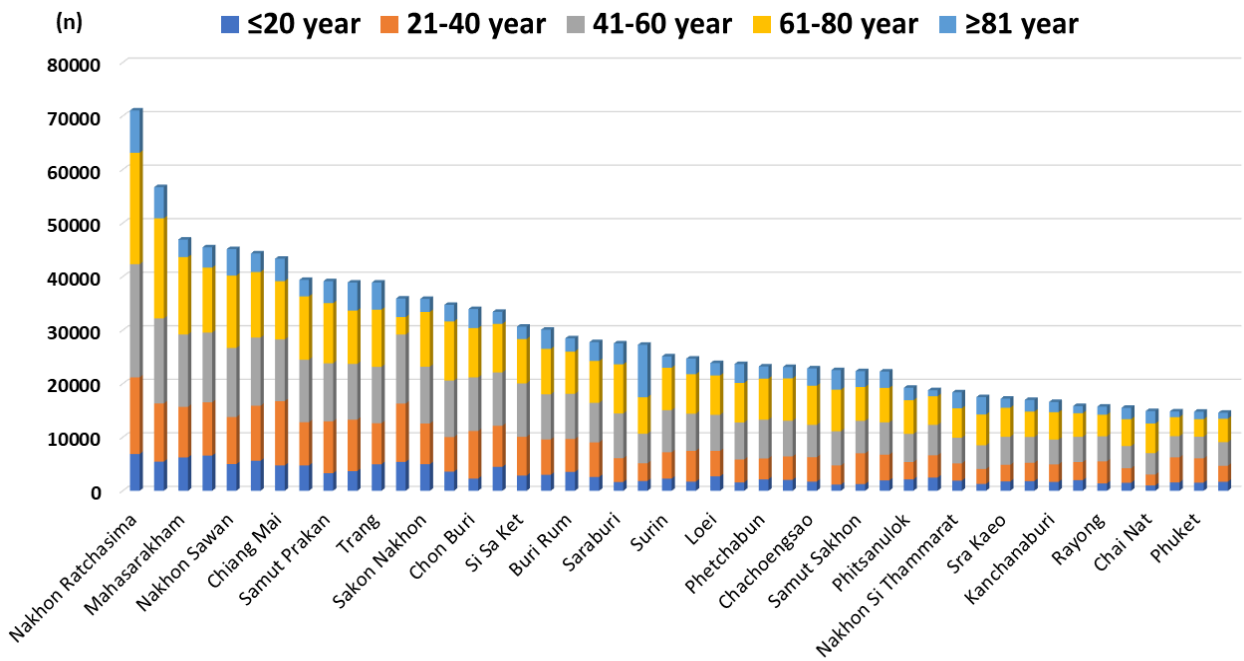**Figure 22** Percentage age of range each province.

Figure 23 Number of age ranges in each province.

Section 5: To clarify by a percentage of EPL

The highest EPLs II were assigned in 70.8% of calls and EPLs I (15.6%). EPL I case involved cardiac arrest (93.9%), near-drowning (66.9%), unconsciousness (53.9%), stroke (52.7%), diabetic problems (51.3%), seizures (44.5%), environment emergency (37.8%), burn (18.3%), dyspnea (29.5%), drug overdose (28.1%), airway obstruction (27.4%), bleeding (non-trauma) (27.2%), chest pain (26.3%), and anaphylaxis (23.6%). While the most common EPL II were abdominal pain (89.9%), headaches (86.5%), psychiatric problems (70.1%), animal bites (78.4%), and unknown problems (76.8%), gynecological problems (77%), traffic accident (77%), bleeding(non-trauma) (72%), anaphylactic (71%), chest pain (69%), drug overdose (68%), and dyspnea (65%). In addition, the most common EPL III was the pediatric problem (40%), assault (38%), and fall injuries (37%). While EPL IV is rarely a case, only (12%) of animal bites (Figure 24).
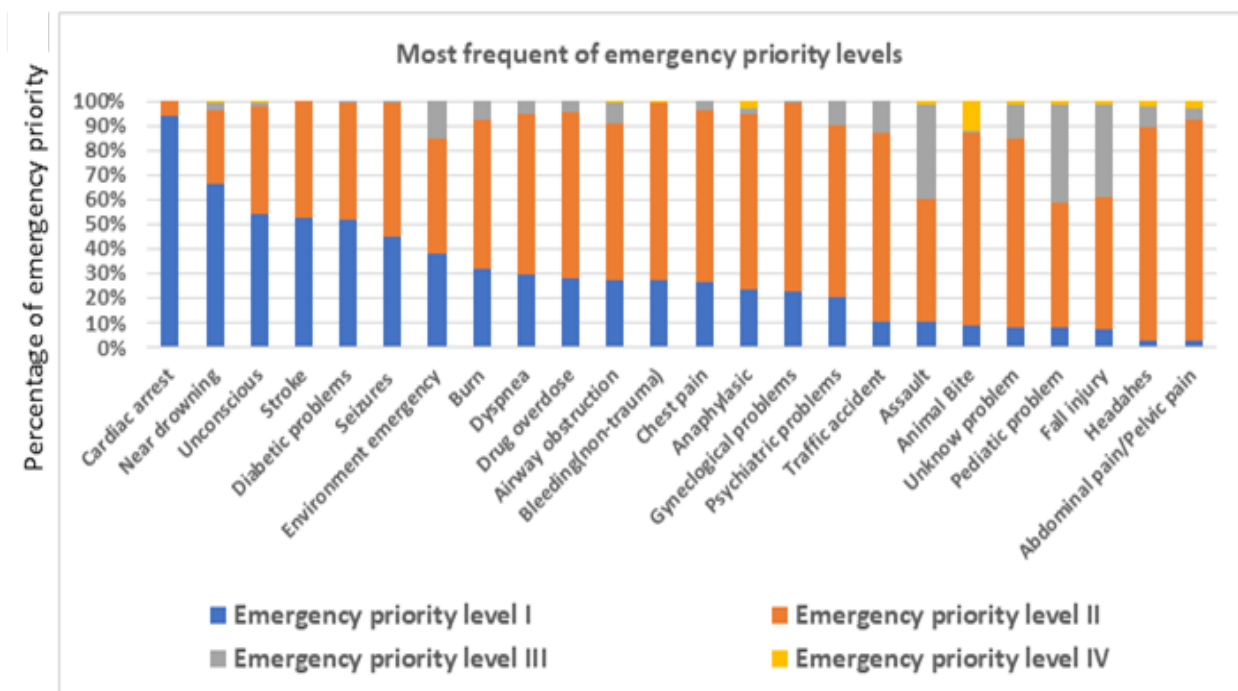
Figure 24 Causes of EMS contact through emergency calls to clarify by a percentage of EPL

Emergency priority level A= red response (potentially life-threatening), Emergency priority level B= yellow response (acute, but not life-threatening), Emergency priority level C= green response (not acute, but transportation and observation in the ambulance in necessary), Emergency priority level D= white response (Advise, recommendation, referral to general practitioner)

Section 6: Temporal variations in emergency calls

Table 5 shows the total numbers and percentages of emergency calls overall and stratified by season, day of the week, and time of day according to EPLs for all calls within the study period. The highest (71%) and lowest number of calls for EPL II cases were in the rainy and summer seasons, respectively. Most of the calls occurred during weekdays (Fridays;14.7%) than on weekends, and the lowest number of emergency calls on Sundays (13.6%). The highest was in the afternoon time (36.55%), and the lowest number was at night (11.56%). EPLs I was (15.6%) of the total number of calls, showing a peak on Friday from weekday variation. In terms of the time of day, the most and least number of calls were made in the afternoon and during nighttime, respectively. EPL III was (12.4%) of the total number of calls, and showed a peak on Friday and Monday, in terms of the time of day, the most and least number of calls were made in the afternoon and nighttime, respectively. EPL IV was 1.1% of the total number of calls.

Table 5 Total number and percentages of emergency call overall and stratified by season, weekday, and time of day according to emergency priority levels

Variable	Emergency priority level[a]				
	I	II	III	IV	Total
Total, n (%)	1,229,425(100)	5,569,278(100)	972,596(100)	88,427(100)	7,859,726(100)
Variable					
Season[b]					
Winter, n (%)	427,157(34.7)	1,886,266(33.9)	326,874(33.6)	29,150(32.9)	2,669,447(34)
Summer, n (%)	292,509(23.8)	1,330,378(23.9)	229,981(23.6)	21,226(24)	1,874,094(23.8)
Rainy, n (%)	509,759(41.5)	2,352,634(42.3)	415,741(42.7)	38,051(43)	3,316,185(42.2)
Weekday					
Monday, n (%)	178,874(14.5)	819,034(14.7)	142,402(14.7)	13,200(14.9)	1,153,510(14.7)
Tuesday, n (%)	176,093(14.3)	799,774(14.4)	138,810(14.3)	12,724(14.4)	1,127,401(14.3)
Wednesday, n (%)	175,664(14.3)	801,745(14.4)	138,724(14.3)	12,753(14.1)	1,128,886(14.4)
Thursday, n (%)	178,643(14.5)	803,743(14.4)	140,304(14.4)	12,996(14.7)	1,135,686(14.4)
Friday, n (%)	179,278(14.6)	820,231(14.7)	143,247(14.7)	12,936(14.6)	1,155,692(14.7)
Saturday, n (%)	170,335(13.9)	770,213(13.8)	135,569(13.9)	12,010(13.6)	1,088,127(13.9)
Sunday, n (%)	170,538(13.9)	754,538(13.5)	133,540(13.7)	11,808(13.4)	1,070,424(13.6)
Time of day[c]					
Night, n (%)	144,031(11.7)	576,381(10.3)	86,151(8.9)	8,266(9.3)	814,829(11.3)
Morning, n (%)	358,279(29.1)	1,646,286(29.6)	283,531(29.2)	27,480(31.1)	2,315,576(32.8)
Afternoon, n (%)	397,878(32.4)	1,822,969(32.7)	326,241(33.5)	27,958(31.6)	2,575,046(36.5)
Evening, n (%)	329,237(26.7)	1,523,642(27.4)	276,673(28.4)	24,723(27.9)	2,154,275(30.5)

[a]*Emergency priority level A= red response (potentially life threatening), Emergency priority level B= yellow response (acute, but not life threatening), Emergency priority level C= green response (not acute, but transportation and observation in ambulance in necessary), Emergency priority level D= white response (Advise, recommendation, referral to general practitioner)*

[b]*Seasons are defined as winter (November to February), summer (March to May) and rainy (June to October)*

[c]*The day is divided into four period: Night (00.00-5.59) morning (06.00-11.59) afternoon (12.00-17.59) and Evening (18:00-23.59)*

Section 7: Temporal variations for life-threatening causes

Figure 25 is a graphical illustration of life-threatening conditions caused by non-trauma cases, which we determined by diurnal variation and time of day. The figure shows different trends for the causes identified. The highest number of calls were made for dyspnea (57%), followed by unconsciousness (33.3%), stroke (7.9%), cardiac arrest (1.09%), and airway obstruction (0.97%). Calls made for dyspnea and unconscious patients occurred in two peaks (10:00 and 19:00–21:00), while calls for stroke peaked in the morning. Calls for life-threatening cases mostly occurred from September to December.
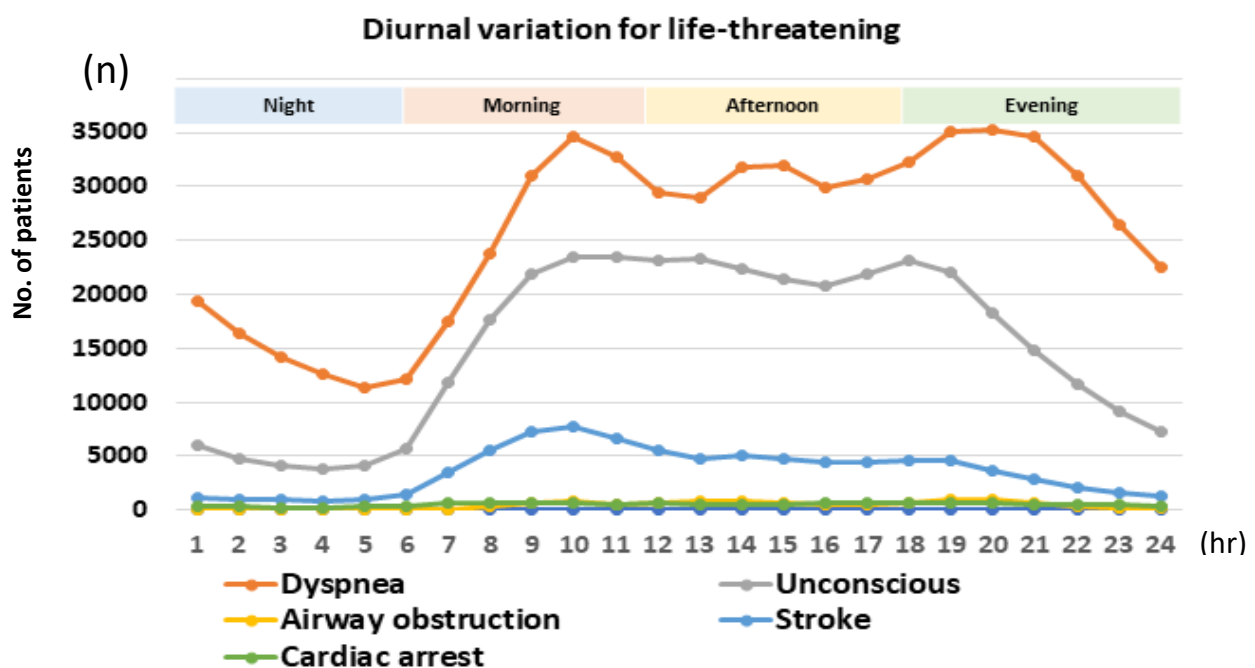
The day is divided into four periods: Night (00.00-5.59) morning (06.00-11.59) afternoon (12.00-17.59) and Evening (18:00-23.59)

Figure 25 Life-threatening causes to clarify diurnal and time of day

Figure 26 is a graphical illustration of life-threatening conditions caused by non-trauma cases, which we determined by year. The figure shows all of the life-threatening conditions trends increasing every year. while calls for cardiac arrest cases increased every year (9% in 2016 vs. 39% in 2020).
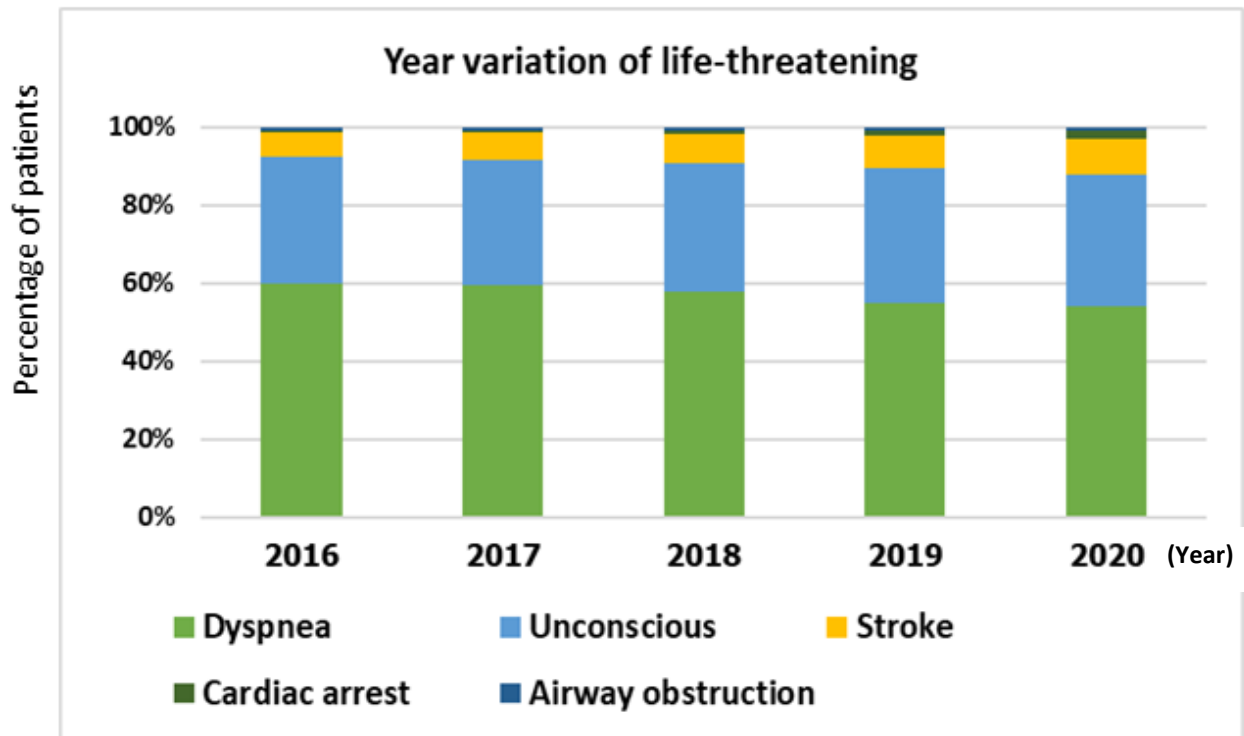
Figure 26 Life-threatening causes to clarify year variation

Section 8: Temporal variations for trauma-related emergency causes

Figure 27 is a graphical illustration presenting the diurnal and monthly variations in emergency calls based on trauma emergency causes. The different types of traumas included traffic accidents, fall injury, assaults, animal bites, and burn. The figure shows the different occurrences of traffic accidents peaking in the afternoon and during the evening (15:00–20:00).
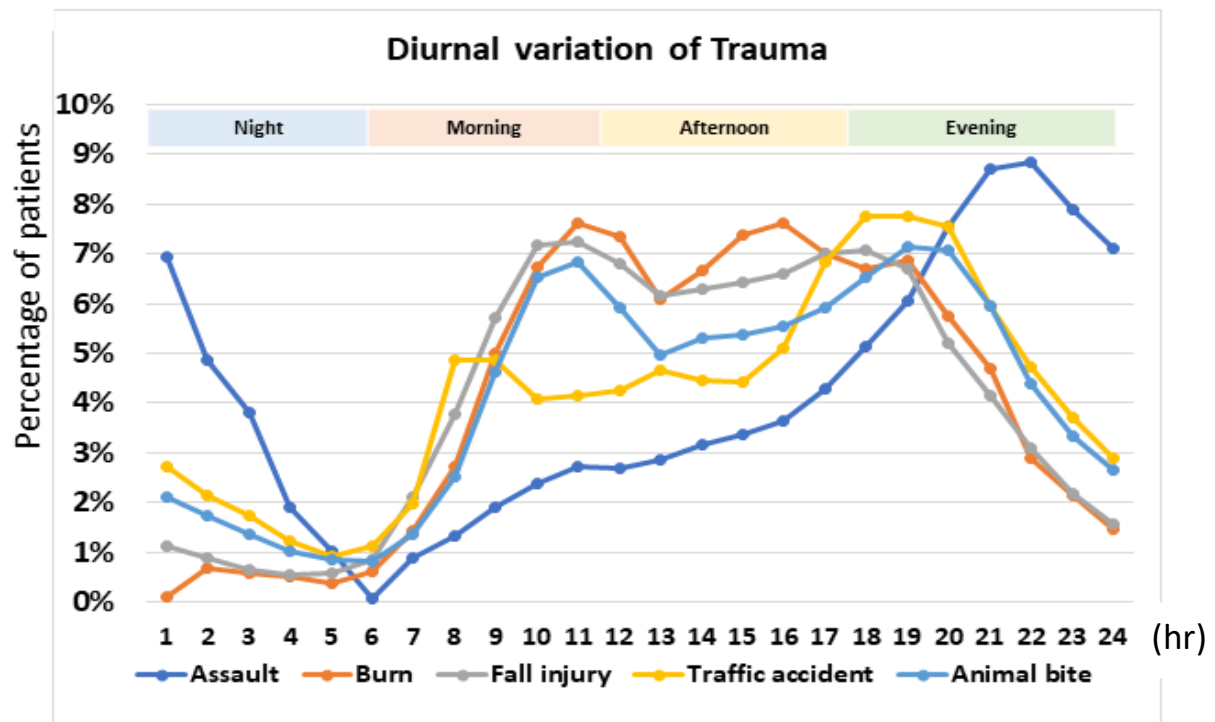
The day is divided into four periods: night (00.00-5.59) morning (06.00-11.59) afternoon (12.00-17.59) and evening (18.00-23.59).

Figure 27 Trauma emergency causes to clarify by diurnal and time of day variation

The number of traffic accident calls was the highest from October to December and was the lowest in March. Calls related to animal bites comprised the majority of all calls made in May and during the rainy season, while assault showed a high percentage in the evening (18:00–24:00). While the number of animal bite calls was the highest in May, on the summer season. The number of fall injury calls was the highest in April, during the summer season (Figure 28).
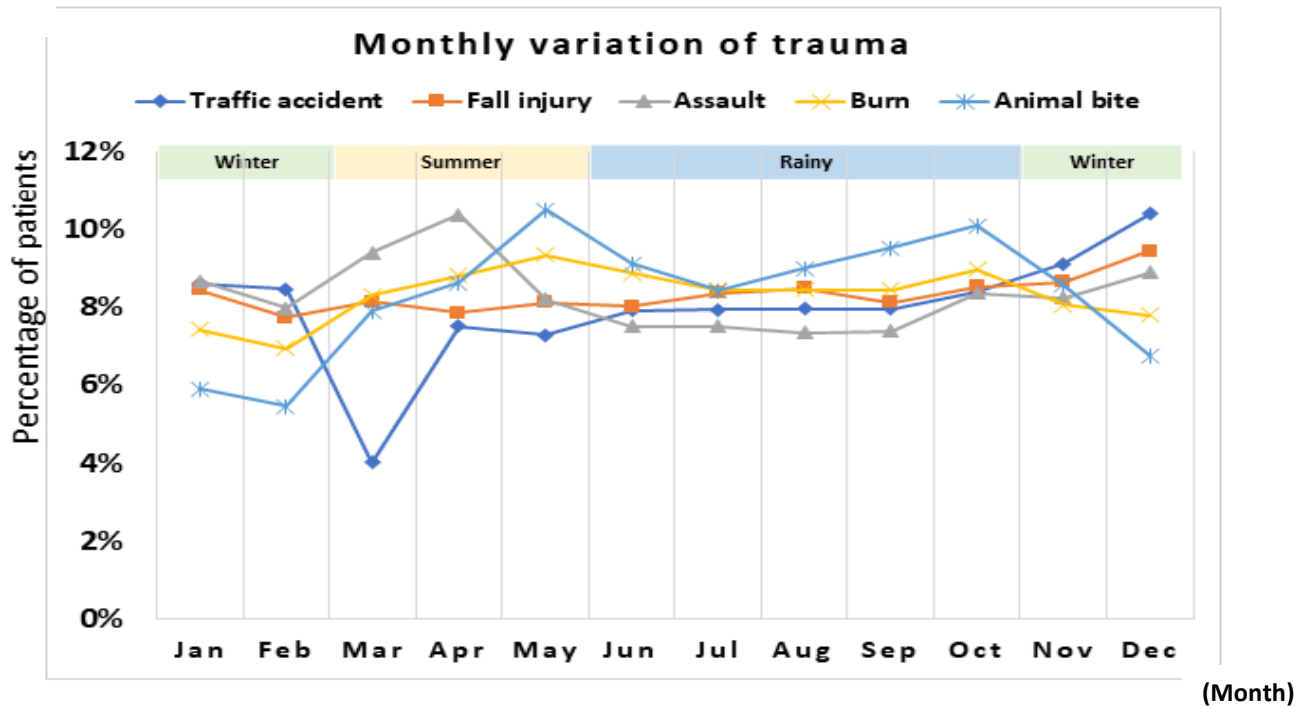
Monthly variation of trauma

*Seasons are defined as winter (November to February), summer (March to May), and rainy (June to October)

Figure 28 Trauma emergency causes to clarify by monthly and seasonal variation

From the trends in pre-hospital emergency calls in Thailand. As a consequence, researchers have awareness regarding OHCA that showed highest in EPL I at 93.9% of total "Cardiac arrest". The application was expected to solve the problem of prolonged recourse in the EMS which affects the mortality rate of OHCA.

Phase 2: Development of smartphone applications for BCPR in the prehospital setting in Thailand

Data analysis and interpretation the analysis of this research study utilize a ready-made computer program to process the data. The operator analyzes and presents the results in the form of an annotated table. Topics of data analysis are sorted into 4 sections as follows:

Section 1: Functions of the smartphone application

Section 2: Scope of the first aid content of the smartphone application

Section 3: Only the feature strongly agrees with the application mode

Section 4: Summary of the function of smartphone applications for bystander cardiopulmonary resuscitation in pre-hospital settings in Thailand

Section 1: Functions of the smartphone application

The 2 rounds of the survey had questionnaire response rates of 94.7% (n = 18) and 84.21% (n = 16). The results obtained from the data showed that 93% of experts strongly agreed that application development is essential for an EMS in hailand; 00% with emergency calls and video calls; 00% with the dispatcher, bystander, and EMR being able to share the location of OHCA, nearby AED, and nearby ambulance; 9 % with the teaching of CPR for daily life by video; 00% with providing a guide for BCPR by hand-only and AED; 88% with pediatric CPR; 00 % with the tracking of real-time feedback to BCPR by voice; 83% with the tracking of bystanders on given care after the case or answering the survey; 88% with contacting bystanders by phone number; 83% with the application being capable of transmitting signals of the OHCA to nearby bystanders within 400 m (able).

Section 2: Scope of the first aid content of the smartphone application

The scope of the consensus regarding the first-aid content of the smartphone application revealed that experts strongly agreed with the scope of the first-aid content for daily life; 9 % non-trauma knowledge, including airway obstruction, breathing problems, cardiac arrest, chest pain/ heart problems, loss of consciousness/ unconscious/ syncope, seizures, or convulsions and stroke; 90% of knowledge on non-trauma practice, including allergies/ stings, airway obstruction, breathing problems, cardiac arrest, unconscious/ syncope, seizures or convulsions, and stroke; 8 % of information on trauma knowledge, including bleeding/ laceration, bone fracture/ dislocation/immobilization, burns, near drowning, fall victim, spinal injury, stabbing/ gunshot victim, and traffic-related injuries; 8 % of data on trauma practice,

including bleeding/ laceration, bone fracture/ dislocation/ immobilization, burns, electrocution, fall victim, head injury, spinal injury, and traffic-related injuries (Table 7).

Table 6 Consensus of the application function

Mode of function (N = 19) *	% of strong agreement		Median		**IR	
	1st round	2nd round	1st round	2nd round	1st round	2nd round
The necessity of smartphone applications in EMS in Thailand	88	93	5	4.5	1.00	1.00
The Emergency call mode of activating emergency rescue						
Emergency number 1669	94	100	5	5	0.0	1.0
Make video calls	94	100	4.5	5	1.0	1.0
Application can call	63	93	5	5	2.0	1.0
The Dispatch center will use the location data						
The OHCA location	100	100	5	5	0.0	0.0
The nearby AED location	100	100	5	5	0.0	0.0
The bystander nearby AED and nearby OHCA location	94	100	5	5	0.0	1.0
The ambulance near the OHCA location	100	93	5	5	0.0	1.0
The registered bystander can find the location data						
The OHCA location	100	100	5	5	0.0	1.0
The AED location	100	100	5	5	0.0	1.0
The EMR will use the location data						
The OHCA location	94	100	5	5	0.0	0.0
The nearby AED location	88	93	5	5	1.0	1.0
The ambulance near the OHCA location	77	93	5	5	1.0	1.0
To teach CPR for daily life						
By picture	83	62	4	4	1.0	2.0
By text	50	12	3.5	3	2.0	1.0
By video	94	93	5	5	0.0	1.0
To guide bystander when he gives bystander CPR						
Hands-only CPR	88	100	5	5	0.0	0.5
Conventional CPR	50	56	3.5	4	2.0	1.0
Pediatric CPR	88	87	5	4.5	1.0	1.0
Infant CPR	72	82	4	4	2.0	0.5
AED	94	100	5	5	0.0	0.0
COVID-19 of personal protective equipment	66	75	5	4	1.0	1.5
To notify real-time feedback of high-quality CPR for bystanders						
Rate of chest compression	100	94	5	5	1.0	0.5
Compression depth	94	94	5	5	1.0	0.5
Recoil of chest compression	94	87	5	5	1.0	1.0
Interruptions in chest compressions	100	94	5	5	1.0	0.5
Notify every 2 min to rotate compressor	88	81	5	5	1.0	1.0
Track real-time feedback to bystander CPR						
By light	50	62	4	4	2.0	2.0
By picture	44	37	3	3	1.0	1.0
By text	11	69	3	3	1.0	1.5
By waveform	55	62	4	4	3.0	1.0
By voice	100	87	5	5	1.0	1.0
Track bystanders on given care						
After the case	83	75	4	4	1.0	1.5
Answer the survey	83	81	4	4	1.0	0.0
Contact bystanders						
By email	72	44	3.5	3	1.0	1.0
By line	61	75	4	4	1.0	1.5
By phone number	88	87	4	4	1.0	1.0
By ID	44	37	3	3	1.0	1.0
The distance from applications to a bystander						
100 m	61	81	4	5	1.0	1.0
200 m	77	75	4	5	1.0	1.0
300 m	66	87	4	5	2.0	1.0
400 m	83	75	4	4	1.0	1.0
500 m	77	69	4	4	1.0	2.0

The 1st response rate to the survey was 94.7% (N = 18)
The 2nd response rate to the survey was 84.21% (N = 16)
**IR=Inter-quartile rang

Table 7 Scope of first-aid for bystander

Scope of first-aid for bystander (N = 19) *	Knowledge						Practice					
	% of expert who agreed		Median		**IR		% of expert who agreed		Median		**IR	
Non-trauma	1st round	2nd round	1st round	2nd round	1st round	2nd round	1st round	2nd round	1st round	2nd round	1st round	2nd round
1. Abdominal pain	44	25	3	3	1.0	0.5	38	25	3	3	2.0	1.0
2. Allergies/Stings	72	81	5	4	2.0	1.0	83	75	5	4	1.0	1.0
3. Airway obstruction	94	93	5	5	1.0	1.0	94	81	5	5	1.0	1.0
4. Back pain	33	33	3	3	2.0	1.0	38	25	3	3	2.0	1.0
5. Breathing problems	94	25	5	5	1.0	1.0	94	81	5	4.5	1.0	1.0
6. Cardiac arrest	94	93	5	5	0.0	0.0	94	81	5	5	0.0	1.0
7. Chest pain/Heart problems	88	93	5	5	1.0	1.0	94	75	4	5	1.0	1.0
8. Covid-19	55	75	4	5	2.0	1.0	72	62	4	4	1.0	1.5
9. Diabetic problems	50	62	3.5	4	2.0	1.5	66	50	4	4	2.0	1.0
10. Drug overdose/Poisonings/Ingestions	61	75	4	4	2.0	1.5	72	62	4	4	2.0	1.0
11. Dyspnea	72	93	4	4	2.0	1.0	72	69	4.5	4	2.0	1.0
12. Headache	50	37	3.5	3	1.0	1.0	55	56	3	3	1.0	2.0
13. Loss of consciousness/Unconscious/ Syncope	94	87	5	5	0.0	1.0	94	69	5	5	1.0	1.0
14. Pregnancy/Gynecological problems	55	50	4	3.5	1.0	1.5	66	44	3.5	4	1.0	1.5
15. Psychiatric/Behavioral problems	44	56	3	4	1.0	1.5	61	50	3.5	4	1.0	1.0
16. Seizures or convulsions	94	87	5	5	1.0	1.0	83	69	5	4	1.0	1.0
17. Stroke	94	93	5	5	0.0	1.0	83	69	5	4	1.0	2.0
Trauma												
1. Animal bite or bee sting	77	69	4	4	1.0	1.0	77	69	4	4.5	1.0	2.0
2. Assault/Violence/Sexual assault	61	62	4	5	1.0	1.0	27	62	4	4	1.0	2.0
3. Bleeding/Laceration	88	81	5	4	1.0	1.0	94	44	5	5	1.0	0.5
4. Broken bone/Dislocation/Immobilization	94	81	5	4	0.0	1.0	88	87	5	5	1.0	1.0
5. Burns	83	81	5	3	1.0	1.0	83	75	5	5	1.0	1.5
6. Cold exposure	61	44	4	4	1.0	1.0	50	37	3.5	3	2.0	1.0
7. Near drowning	88	94	5	4.5	2.0	1.0	55	94	5	5	1.0	1.0
8. Electrocution	83	75	5	4	1.0	1.5	88	81	5	4.5	1.0	1.0
9. Eye injuries	55	55	4	4	1.0	1.0	61	75	4	4	2.0	1.5
10. Fall victim	83	75	4	4.5	2.0	1.0	83	75	4	4	1.0	1.0
11. Head injury	77	75	5	4	1.0	1.0	83	87	4.5	4.5	1.0	1.0
12. Heat exposure	83	75	4	4.5	1.0	2.0	66	81	4	4	2.0	1.0
13. Spinal injury	88	75	5	5	1.0	1.0	83	87	4	5	1.0	1.0
14. Stabbing/Gunshot victim	83	75	5	5	1.0	1.5	72	81	4	4.5	1.0	1.0
15. Traffic-related injuries	77	87	5	4	1.0	1.0	88	87	4	4	1.0	1.0

*The 1st response rate to the survey was 94.7% (N = 18)
*The 2nd response rate to the survey was 84.21% (N = 16)
**IR=Inter-quartile rang

Section 3: Only the feature strongly agrees with the application mode

To confirm that the experts from this study strongly agreed that more than 80% of smartphone applications featured in application development are essential for EMS in Thailand, including the emergency call mode of activated emergency by number, video, and voice, the dispatch center will use the location of the OHCA, AED, bystander, and ambulance. The registered bystander can find the location of OHCA and AED. The EMR can also find the location of OHCA, AED, and ambulance. The application should be capable of teaching CPR for daily life by video, guiding bystanders when they perform manual CPR via hand-only CPR, AED, and pediatric CPR; provide real-time notifications of feedback on high-quality CPR for bystanders regarding chest compression rate, chest compression depth, the recoil of chest compression, and minimize interruptions in chest compression and notifications every 2 min to rotate the compressor by voice. The applications need to track bystanders after care and survey by phone number. In addition, the application should be able to transmit signals of OHCA to nearby bystanders within 400 m and offer the first-aid content for daily life to 9 % of the non-trauma knowledge, 90% of the non-trauma practice, 8 % of the trauma knowledge, and 8 % of the trauma practice (Figure 29).
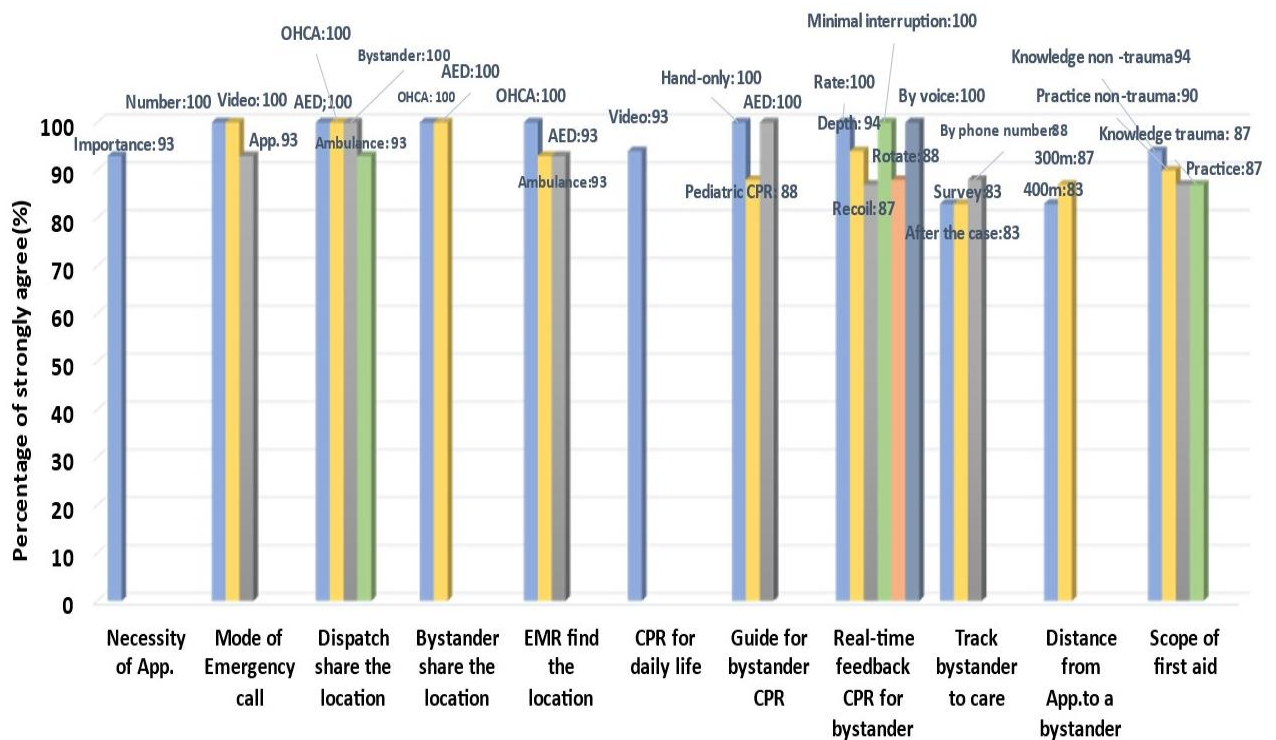

Figure 29 Only the feature strongly agrees with the application mode

Chapter 5. DISCUSSION

Chapter 5. DISCUSSION

This large, population-based, multisite study of 8,116,969 emergency call events had several important findings. First, there was a 21% increase was in the emergency calls of requests to PEMSs between 2016 and 2020 among 77 provinces in Thailand. The overall ratio of requests was 24 calls per 1,000 people for ambulance services, with the highest rate among people aged 41-60 years, and male emergency patients accounted for 13% more than females. Second, the most frequent chief complaints during requests to the PEMSs were mostly regarding traffic accidents, unknown problems, abdominal pain, dyspnea, fall injury, and unconsciousness. Third, the most frequent emergency calls occurred during the rainy season, on Fridays, and in the afternoons. Interestingly, the highest number of emergency calls came from traffic accidents among young people aged ≤20 years, with its occurrence peaking in the evening. Fourth, the most common EPL I cause was cardiac arrest, most common among people aged 61-80 years, peaking in the morning and early evening as defined by the time the emergency number was called. Furthermore, the highest incidence of cardiac arrest was on Mondays, during the winter from October to December. Similarly, other studies have demonstrated a circadian pattern in the incidence of out-of-hospital cardiac arrest (OHCA), with a typical peak in occurrence during the early morning hours and a smaller secondary peak in the early evening. There is also evidence for circadian patterns in the incidence of acute myocardial infarction[47,48].

In accordance with previous studies, these results confirm an increasing rate of PEMS requests and interventions[15]. There was a 39.8% increase in the number of calls to EMDs, with the highest increase observed among patients aged 80-89 years[49]. Most of these calls were made during the day (62% during 7:00-19:00), without any difference according to the day of the week[40]. he most frequent complaint category was an "unclear problem" (9%)[9]. The highest EPLs were assigned in 81% of the calls, and the total number of calls peaked in wintertime (26%), Saturday (16%), and during daytime (39%)[9]. A previous study regarding the demographics of EMS callers found that 55% were women, 50% were in the age range of 70–89 years (with dyspnea, chest pain, and abdominal pain being the most common signs and symptoms), and 13% had a final diagnosis defined as a potentially life-threatening condition[50]. In Osaka, the most frequent symptom was also dyspnea (40.7%)[51].

Our study found that traffic accidents were the most frequent emergency cases, similar to a previous study analysis revealing that 70% of the people injured or killed in traffic crashes are aged 10–39 years.

Notably, men are at four to five times higher risk of death and injury due to traffic crashes than women[52]. Road traffic accidents (RTAs) have emerged as an important public health issue, which needs to be tackled by a multi-disciplinary approach[53]. Human errors contribute significantly to an increasing number of road accidents, with 28% of crashes involving males over 15 years being attributable to alcohol intoxication. Furthermore, drunk driving has been responsible for 70% of road fatalities in Mumbai and Delhi, India[53]. The burden of road traffic injuries mostly affected motorcyclists, men (about 80%), and young people (15-34 years)[54]. The contributing factors of RTA included human errors, environmental factors, and vehicular factors, which were identified as definite causes in 70.7%, 12.4%, and 4.5% of accidents, respectively[55]. RTAs have a decreasing trend in developed countries, whereas a higher number of injuries occurs in developing nations[56]. Meanwhile, EMSs have been designed to rapidly respond to severe or traumatic medical emergencies and provide life-sustaining care [57]. This is a key performance indicator reflecting the time traffic crash victims wait to be rescued and serving as a measurable quantity for evaluating and managing dispatch operations of EMS vehicles[58].

Similar to previous studies, there are temporal differences in the incidence and survival rates of OHCA. There was significant variability in the frequency of OHCA by the hour of the day, with the highest incidence occurring during the daytime, from Friday to Monday, in December. Survival at hospital discharge was lowest for those that occurred overnight (from 23:01 to 7:00; 7.1%) versus daytime (7:01 to 15:00; 10.8%) or evening (15:01 to 23:00; 11.3%) and spring (11.1%)[59], with changes in potential physiological triggers, including blood pressure and heart rate, vascular tone, heart rate variability, blood viscosity, and platelet aggregation[60,61]. In a previous study, the neurologically intact survival at hospital discharge with dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) was 7.0%, while that of bystander-initiated CPR and no BCPR were 7.5% and 4.4%, respectively. At one-month neurologically intact survival with DA-CPR, bystander-initiated CPR, and no BCPR was 3.1%, 5.7%, and 2.5%, respectively[62]. In recent years, numerous studies worldwide have claimed that DA-CPR is associated with a higher probability of survival, including neurologically intact survival[63,64]. Given this information, there is a clear need to identify the immediate precipitants

of trends and temporal variability during the pre-hospital phase, in order to develop preventive strategies and optimize resource planning in an effort to improve emergency patient outcomes. In addition, the health sector should closely coordinate with local authorities to jointly promote health, educate, campaign, and create attitudes to prevent common diseases in each province and region. Hopefully, these steps will help in the development of the EMS system and the public health system in Thailand.

The future model should focus on the development of smartphone applications for BCPR in the prehospital setting in Thailand. The features of the application should consist of eight modes (Thai original language version):

1) Emergency SOS response: The application can make SOS calls to family members registered in advance and neighbors who have MySOS installed.
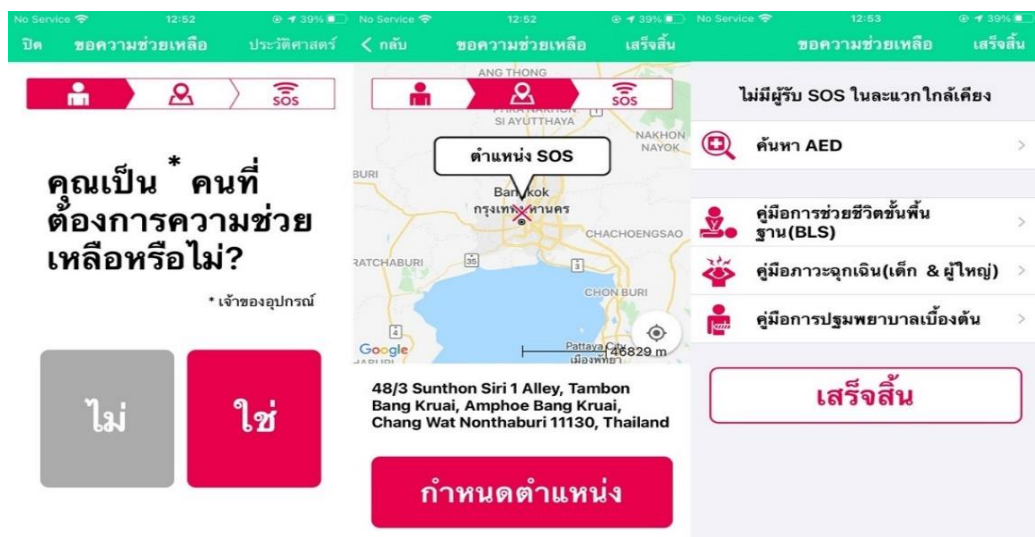

Figure 30 Emergency SOS response

2) Basic Life Support Guide: It will guide bystanders through the flow of basic life support utilizing OHCA. Depending on the situation, this mode can guide practices, such as chest compressions and recovery positions. MySOS can also be used to request help from those who can assist if necessary. In an emergency, the application offers instructions for basic first-aid and life-saving techniques. An emergency notification text message can be sent to the EMS and pre-registered emergency contacts.
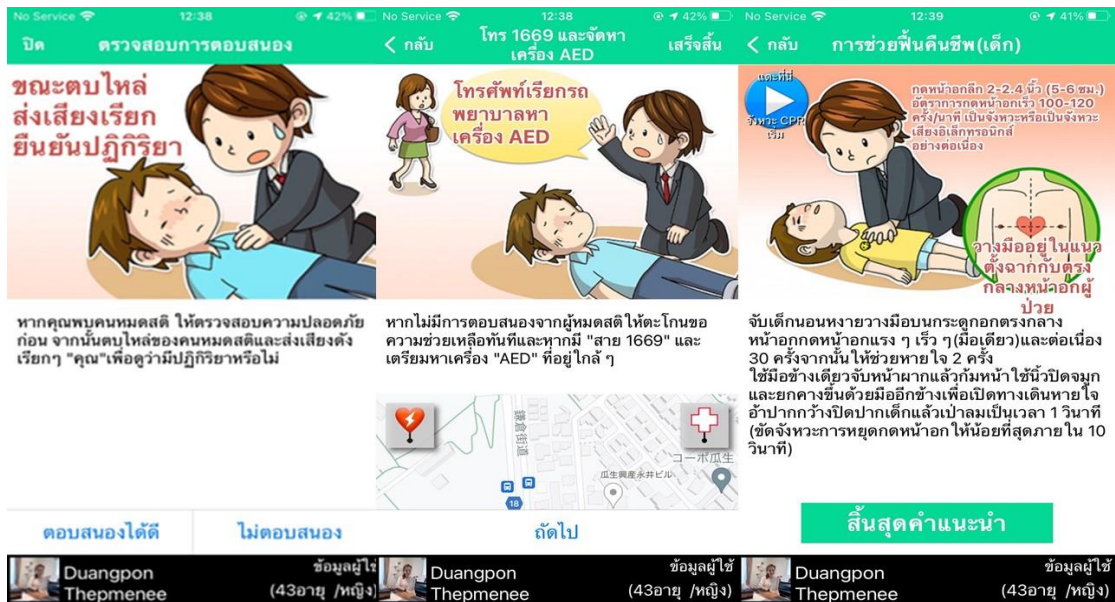
Figure 31 Basic Life Support Guide

3) AED/ Hospital Search: Bystanders can search for nearby AEDs and hospitals on the map. The distance and name of current locations are also listed. The application can be used to verify detailed information by tapping the list.
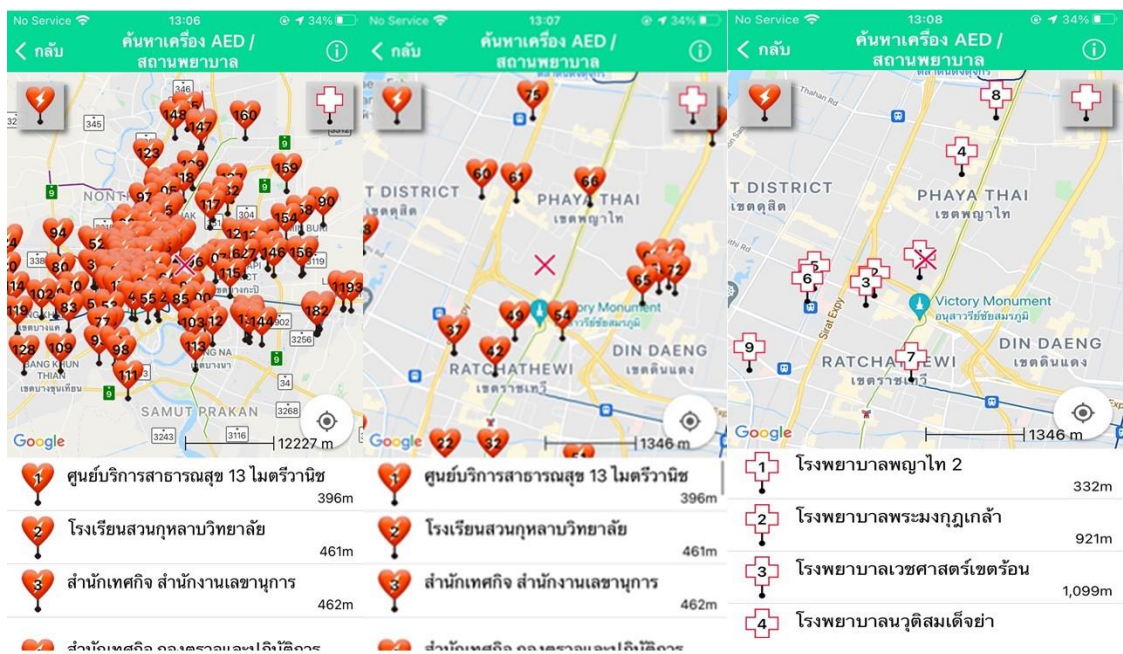

Figure 32 AED/ Hospital Search

4) Adult/ Pediatric Emergency Guide: The application can provide an idea of whether the medical condition or injury requires urgent care, or whether the situation should be monitored first and how to approach it. The recommended criteria for adults have

63

three levels, which consist of emergency, urgent, and non-urgent, and five levels for children, including immediate, emergency, urgent, semi-urgent, and non-urgent levels. All the criteria for this determination depend on the symptoms. The content for the adult emergency guide consists of difficulty breathing, wheezing, asthma attack, palpitations, level of consciousness, convulsions, headache, chest pain, back pain, fever, and stomachache he part for children's emergency guide includes fever, convulsion, head injuries, stomachache, swallowing foreign objects, headache, vomiting, diarrheal, coughing, eye pain, ear pain, bee stings, and hiccups.
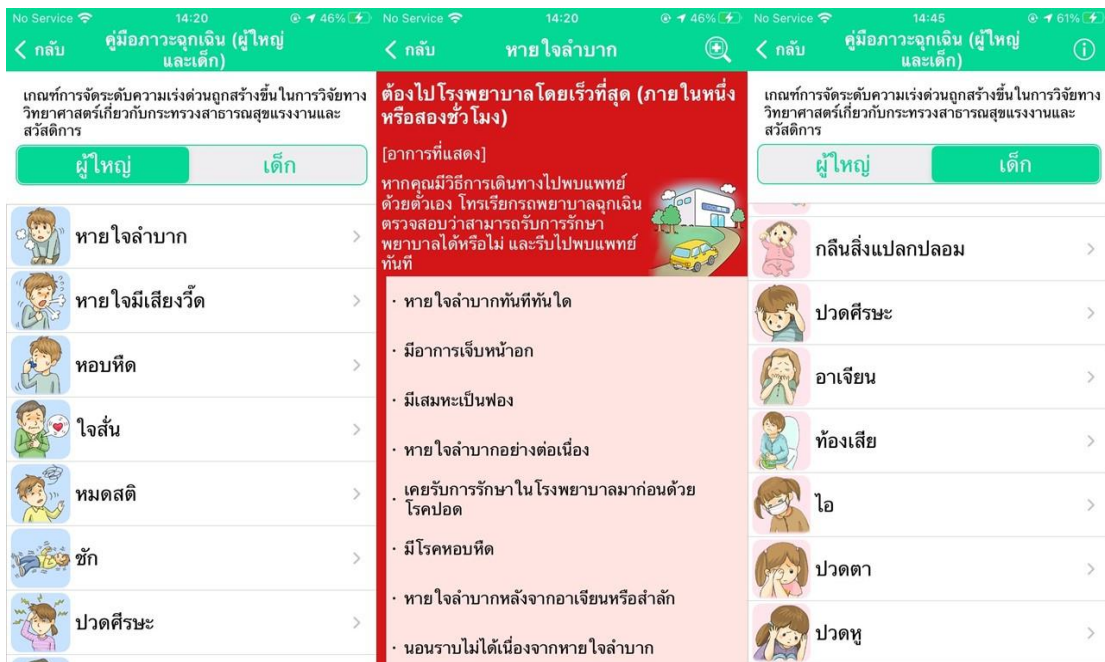
Figure 33 Adult/Pediatric Emergency Guide

5) First-Aid Guide: This guide is based on the international consensus review paper on first-aid science with treatment recommendations published in 2020[30]. It provides treatment methods for sudden cardiac arrest, syncope, seizures or convulsions, heart attack, stroke, anaphylaxis, airway obstruction, heatstroke, laceration/ how to stop bleeding, bandage, fractured bone, head injury, spinal injury, burns, electrocution, near drowning, dog bite, snake bite, and bee sting.

Figure 34 First-Aid Guide

6) Medical Checkup Results: This guide includes the easy management of health examination results. The application can be used to easily manage the results of a medical examination by manually entering it or receiving data from an affiliated medical institution. The application can also be used to check for trends and year-to-year changes and values at a glance.
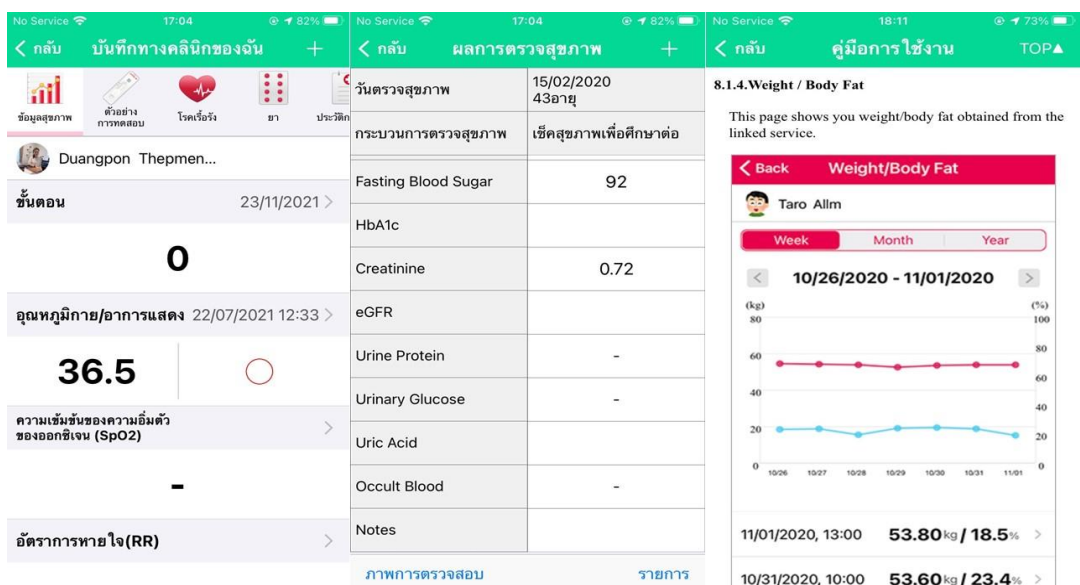

Figure 35 Medical Checkup Results

7)) My Clinical Record: This guide is for the management of medical and health information, including medical (disease, medicine, prescription history, outpatient history, family doctor, and examination images) and health information (the number of steps, blood pressure, and weight) by linking with iOS "Health" and OMRON connect. The application can be used to manage data without manual input, and the settings can be changed anytime from [Setting] - [Health Information Cooperation].

The feature model to the development of smartphone applications. The features of the application should consist of eight modes: 1) Emergency SOS response, 2) Basic Life Support Guide, 3) AED/Hospital Search, 4) Adult/Pediatric Emergency Guide, 5) First-Aid Guide 6) Medical Checkup Results, and 7) My Clinical Record (Figure 36).
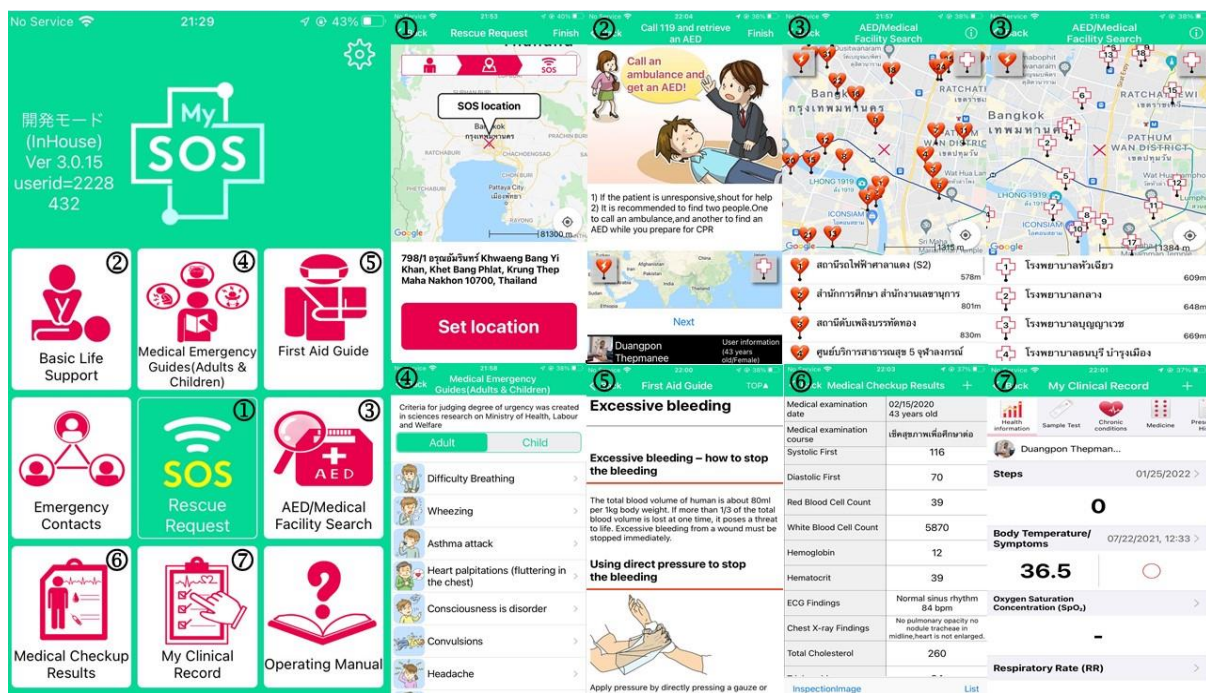
Figure 36 Mode for development of smartphone application

As a consequence, Allm. the corporation has Thailand-modified applications on smartphones and is related to the original MySOS limited. The number of modifications was (InHouse)Ver 3.0.15 user-id =2228432.

Therefore, to improve prehospital patients' outcomes by using smartphone applications based on the nationwide patient transportation registry in Thailand in the future.

Chapter 6. CONCLUSION

Chapter 6. CONCLUSION

Phase 1: Trends in pre-hospital emergency calls and EMS transportation data in Thailand

Section 1: Conclusion

In this large, multidimensional emergency, population-based study, we analyze temporal differences in the incidence of all emergency calls in terms of season, days of the week, and time of the day to reflect the trend of EMS workload on service time and disease occurrence. This study provides fundamental information for the development of strategic treatment planning and the allocation of emergency resources in Thailand. Further, the improvement of supportive dispatch priority tools, education training for EMS workers, and the addition of smartphone application technology to ensure timely access and location, as well as rapid response time in PEMS.

Section 2: Recommendation and future research

Furthermore, Thailand should continue to train EMTs, including PHTLS, ATLS, ACLS, AMLS, and BLS, to help improve their ability to decide on appropriate treatments, strengthen practices, and ensure the efficient allocation of resources to improve the outcomes of emergency patients in Thailand.

Phase 2: Development of Smartphone Applications for BCPR in the Prehospital Setting in Thailand

Section 1: Conclusion

The purpose of this research is to develop modern innovations for the benefit of Thailand's EMS by developing a smartphone application for bystanders in an OHCA incident and increasing the survival rate in a pre-hospital setting.

This study recruited 19 specialists in emergency medical systems representing Thailand and Japan to meet for consensus on the mode of function, and smartphone application development for bystanders of the OHCA, to reach the most useful conclusion for Thailand. From the results of 5 meetings, consensus requests, and responses to 2 questionnaires, it was found that smartphone application development for the audience OHCA is significant to the emergency medical system in Thailand. In particular, regarding real-time communication in the pre-hospital setting system, experts strongly agree on developing the application from

MySOS in Japan which has 5 modes of function SOS, AED/ medical facility search, basic life support, medical emergency guides (adults and children), and first aid guide.

The main conclusion of this study is that the research findings were discussed for the development of smartphone applications for bystander cardiopulmonary resuscitation in the pre-hospital setting in Thailand. The main functions of the application were as follows: 1) emergency response 2) SOS mode 3) movie for daily life and 4) first aid. The modes of operation are consistent with the implementation of MySOS in Japan.

Researchers look forward to the success of the innovative 5 smartphone modes that are consistent with their application in Thailand. This is a well-coordinated system that is effective in Thailand.

Section 2: Recommendation and future research

This study is an ongoing project. In the next study, the researchers plan to bring the MySOS application to Bangkok in, Thailand, for training with dispatchers and bystanders. Then will be promoted to the public known through social media and implementation in EMS as soon as possible.

ACKNOWLEDGEMENTS

Duangpon Thepmanee

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APPENDICES

APPENDICES

Part 1: Future research plan

In the next study, the researchers plan to bring the MySOS application to Bangkok in Thailand, with delegates and bystanders. However, the use of the media must still be promoted to make the public known and used in emergencies.
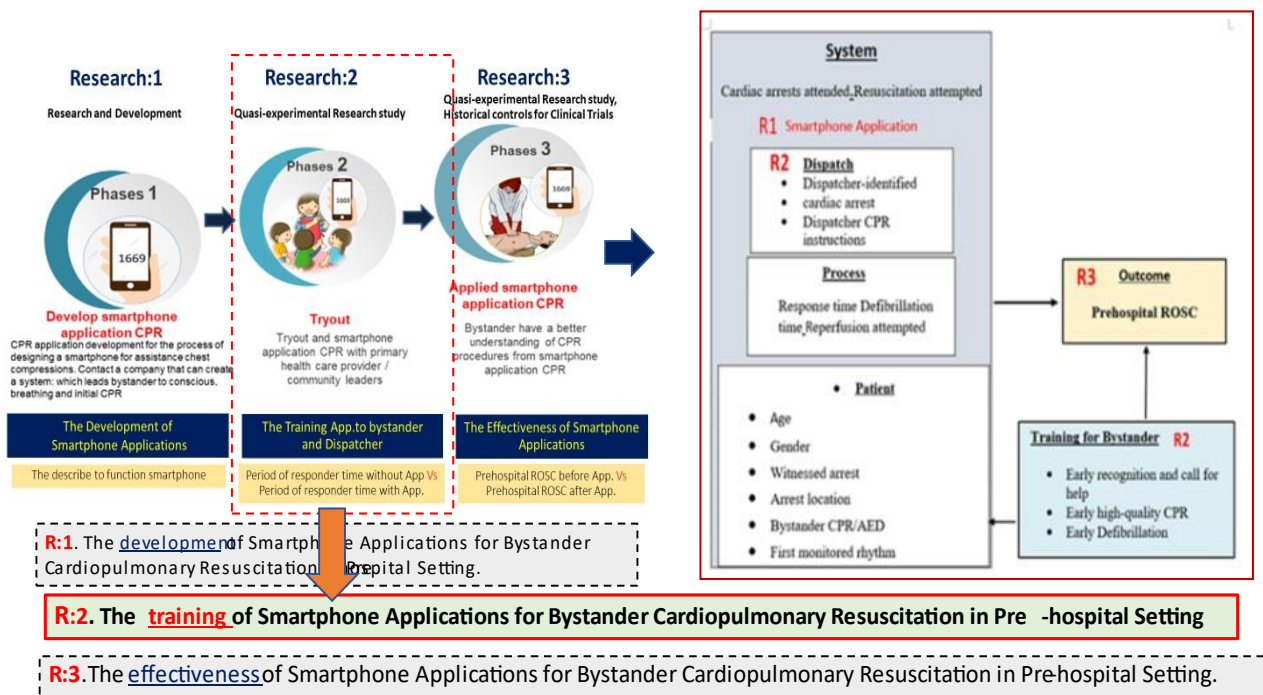
Figure 37 Conceptual framework research plan

Therefore, the researcher is interested in bringing the smartphone application to a pilot study with volunteers and dispatch. This study is part of the 2nd sub-project to bring the applications to disseminate and transfer knowledge to practitioners by experimenting with sample groups. That is the training of smartphone applications for BCPR in a pre-hospital setting in Bangkok.
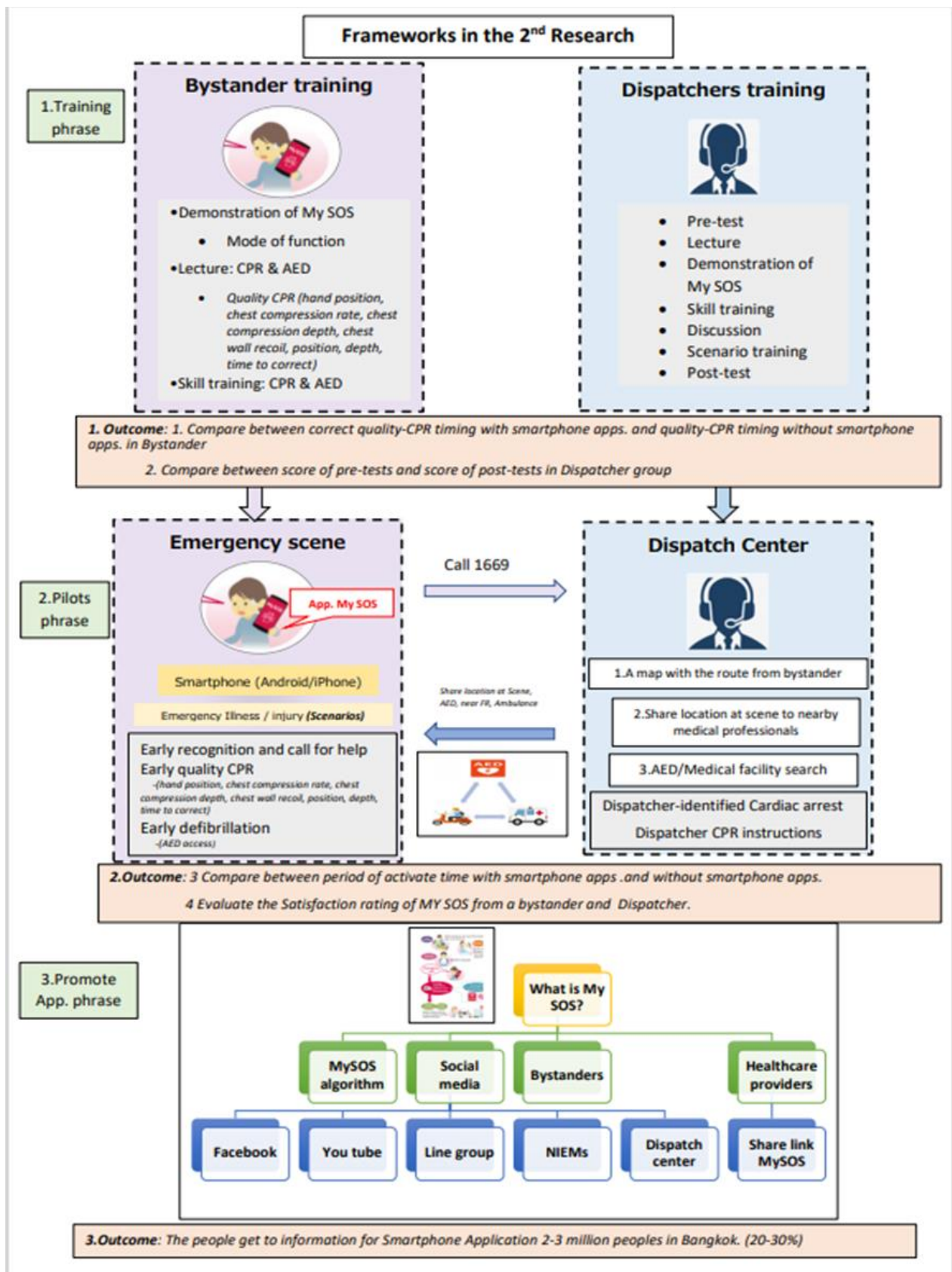
Figure 38 Activity of research plan

Part 2: Supplementary

The supplementary in the phase of development of smartphone applications for BCPR in the prehospital setting in Thailand was as follows:

Appendix A: List of expert's flows

Table 2: List of Participants for the 2nd meeting Application collaborations

Table 3: List of Participants for the 3rd meeting Application collaborations

Appendix B: Tables of the questionnaire

Appendix C: Smartphone function contents

1. First Aid Guide
2. Medical Emergency Guides (Adults)
3. Medical Emergency Guides (Children)
4. Basic Life Support

Appendix A: List of experts flows;

Table 1: List of participants for the 1st meeting application collaborations on July 19, 2020

No	Name	Position	From	Remark
1	Prof. Hideharu Tanaka	Dean & Professor	Kokushikan University	Japan
2	Dr. Takahiro Hara	professors	Kokushikan University	Japan
3.	Flt.Lt. Dr. Atchariya Pangma	Secretary-General of NIEM	National Institute for Emergency Medicine	Thailand
4	Dr. Pornthep Saeheng	Director of Bangkok Dispatch center	Bangkok EMS Center (Erawan center)	Dispatch center
5	Dr. Komchit Chavanasporn	Chief of Emergency Medical Service Operation Group	Bangkok EMS Center (Erawan center)	Dispatch center
6	Mr. Naron Santaweephol.	Registered Nurse, Senior Professional Level	Bangkok EMS Center (Erawan center)	Dispatch center
7	Dr. Jiraporn Srion	Director of Emergency Medical Department	Navamindradhiraj University	Central Thailand
8	Dr. Chirakit Hengrasmee	Professor of Emergency Medical Department	Navamindradhiraj University	Central Thailand
9	Dr. Chunlanee Sangketchon	Director of Paramedic program.	Navamindradhiraj University	Central Thailand
10	Dr. Rossakorn Klaiangthong	professer of Paramedic program.	Navamindradhiraj University	Central Thailand
11	Dr. Patiporn Bunyaphatkun	Director of ENP program Senior Nurse	Vajira Hospital	Central Thailand
12	Dr. Sattha Riyapan	Director of Emergency medicine department	Siriraj Hospital	Central Thailand
13	Dr. Rapeeporn Rojsaengro	Professors of Paramedic	HRH Princess Chulabhorn College of Medical Science	Central Thailand
14	Dr. Narain chotiros	Director of the tertiary accident center	Maharaj Nakorn Chiang Mai Hospital.	*(North region)*
15	Miss. Phatsawan Sairai	Head Nurse of Emergency Medical Service and Referral Center,	Maharaj Nakorn Chiang Mai Hospital.	*(North region)*
16	Dr. Prakit Sarathep	Phang Nga Provincial Health Doctor	*Phang Nga Provincial*	*(Southern region)*
17	Assoc. Prof. Dr. Prasit Wuthisuthimethawee	Professor of Emergency Medical	*Prince of Songkla University*	*(Southern region)*
18	Dr. Ratrawee Pattanaratanamolee	Director of EMS	*Khon Kaen hospital*	*(Northeast)*

No	Name	Position	From	Remark
1	Prof. Hideharu Tanaka	Dean & Professor	Kokushikan University	Japan
2	Dr. Takahiro Hara	professors	Kokushikan University	Japan
19	Dr. Sumana Uthaithammarat	Medical Director of emergency medical service	Chaophyaabhaibhubejhr hospital Prachinburi	*(Eastern region)*

Table 2: List of participants for the 2nd meeting application collaborations

The development of smartphone applications for bystander cardiopulmonary resuscitation in pre-hospital settings in Thailand. On September 23, 2020

No	Name	Position	From	Remark
1	Prof. Hideharu Tanaka	Dean & Professor	Kokushikan University	Japan
2	Dr. Takahiro Hara	professors	Kokushikan University	Japan
3	Miss. Duangpon Thepmanee	Ph.D. (EMS) *Student*	Kokushikan University	Japan
4.	Flt.Lt. Dr. Atchariya Pangma	Director of NIEMs	NIEMs	Thailand
5	Dr. Nattanun Thatphithakkul	-	NECTEC	Thailand
6	Dr. Chatchawarn Hansakunbuntheung	-	NECTEC	Thailand
7	Mr. Prasong Tachapornpong	Digital Division	NIEMs	Thailand
8	MR. khuanchai Muaydee	Application Programmer	NIEMs	Thailand
9	Mr. Phichet Nongchang	Research and Academic Office	NIEMs	Thailand
10	Ms. Porntip Wachiradilok	Research and Academic Office	NIEMs	Thailand
11	Mr. Samak Jaisan	Research and Academic Office	NIEMs	Thailand
12	Ms. Dangfun Promkhum	Office of Strategy	NIEMs	Thailand
13	Mr. Nakhorn Pornnattavuttikul	Country Manager	Zoll	Thailand
14	Mr. Wiwis Jirasiriwatana	Clinical Sales Manager	Zoll	Thailand
15	Miss. Yada Intaravigasit	PAD manager	Zoll	Thailand
16	Miss. Joey Chai	Marketing Manager Public Access	APAC	Malaysia
17	Miss. Maria Oh	Data Engineer	APAC	Singapore

Table 3: List of participants for the 3rd meeting application collaborations

On November 6, 2020 (11.00 AM Thai & 1.00 PM Japan) Via Zoom.

No	Name	Position	From	Remark
1	Dr. Takahiro Hara	Research Associate	Kokushikan University	Japan
2	Miss. Duangpon Thepmanee	Ph.D.EMS Student	Kokushikan University	Japan
3	Mr. Bundit Pheeraphan	Digital Division	NIEMs	Thailand
4.	Mr. Prasong Tachapornpong	Digital Division	NIEMs	Thailand
5	MR. khuanchai Muaydee	Application Programmer	NIEMs	Thailand
6	Ms. Dangfun Promkhum	Office of Strategy	NIEMs	Thailand
7	Mr. Shinagawa	Application Programmer	Dawn. Corp	Japan
8	Mr. Tai	Application Programmer	Dawn. Corp	Japan
9	Mr. Matsunaga	Application Programmer	Dawn. Corp	Japan

*NIEMs: National Institute for Emergency Medicine

Appendix B: Tables of the questionnaire

Table 4: For Expert opinion on the development of smartphone applications for bystander cardiopulmonary resuscitation in a pre-hospital setting.

Please choose the answer and suggestion as follows					
	None necessity	Little necessity	some necessity	Much necessity	Very much necessity
1. The necessity of the development of smartphone applications in the emergency medical system in Thailand.	1	2	3	4	5
(If none and little necessity please suggest more…… ……					

	None agree	Little agree	Some agree	Much agree	Very much agree
2. What do you think about the Emergency call mode of activated emergency as follows?					
1. The application can activate the emergency number 1669 to the Dispatch center.	1	2	3	4	5
2. The application can make video calls to the Dispatch center.	1	2	3	4	5
3. The application can call the bystander.	1	2	3	4	5
(If none and little agree please suggest more…… ……					

	None Agree	Little Agree	Some Agree	Much Agree	Very much Agree
3. What do you think if the Dispatch center will use the location data as follow?					
1. The dispatcher use location data to define the OHCA location.	1	2	3	4	5
2. The dispatcher use location data to define the nearby AED location.	1	2	3	4	5
3. The dispatcher use location data to define the bystander nearby AED and nearby OHCA location.	1	2	3	4	5
4. The dispatcher use location data to define the Ambulance near the OHCA location.	1	2	3	4	5
(If none and little agree please suggest more……… ……					

	None Agree	Little Agree	Some Agree	Much Agree	Very much Agree
4. What do you think if the registered bystander can find the location data as follow? *(The bystander definite who is age 15 years old and older with previous CPR training and registered after CPR training by Niems)*					
1. The OHCA location.	1	2	3	4	5
2. The AED location.	1	2	3	4	5
(If none and little agree please suggest more……… ……					

	None Agree	Little Agree	Some Agree	Much Agree	Very much Agree
5. What do you think if the emergency medical response (EMR) will use the location data as follow? *(Emergency Medical Respond is a prehospital care provider with the basic level of training and certification whose duties include the provision of immediate medical care in the event of an emergency; FRs have basic emergency care equipment, O2 and mask combinations, tools for extrication)*					
1. The emergency medical response use location data to define the OHCA location.	1	2	3	4	5
2. The emergency medical response use location data to define the nearby AED location.	1	2	3	4	5
3. The emergency medical response use location data to define the Ambulance near the OHCA location.	1	2	3	4	5
(If none and little agree please suggest more……… ……					

	None Agree	Little Agree	Some Agree	Much Agree	Very much Agree
6. What do you think about the application that should be able to teach CPR for daily life as follow?					
1. by picture.	1	2	3	4	5
2. by text.	1	2	3	4	5
3. by video.	1	2	3	4	5
(If none and little agree please suggest more……… ……					

	None agree	Little agree	Some agree	Much agree	Very much Agree
7. What do you think about the scope of the first aid as follows? *(Reference from Emergency Medical triage Protocol and Criteria Based Dispatch in Thailand, State of New Jersey Emergency Medical Dispatch Guidecards)*					
7.1 What do you think about the knowledge of non-trauma of the first aid for bystanders as follows?					
1. Abdominal pain	1	2	3	4	5
2. Allergies/ Stings	1	2	3	4	5
3. Airway obstruction	1	2	3	4	5
4. Back pain	1	2	3	4	5
5. Breathing problems	1	2	3	4	5
6. Cardiac arrest	1	2	3	4	5
7. Chest pain/ Heart problems	1	2	3	4	5

	None agree	Little agree	Some agree	Much agree	Very much agree
8. Covid-19	1	2	3	4	5
9. Diabetic problems	1	2	3	4	5
10. Drug overdose/Poisonings/Ingestions	1	2	3	4	5
11. Dyspnea	1	2	3	4	5
12. Headache	1	2	3	4	5
13. Loss of consciousness /Unconscious /Syncope	1	2	3	4	5
14. Pregnancy/ Gynecological Problems	1	2	3	4	5
15. Psychiatric / Behavioral problems	1	2	3	4	5
16. Seizures or convulsions.	1	2	3	4	5
17. Sick person	1	2	3	4	5
18. Stroke	1	2	3	4	5

(If none and little agree please suggest more...
....
....

7.2 What do you think about the practice of non-trauma of the first aid for bystander as follows?	None agree	Little agree	Some agree	Much agree	Very much Agree
1. Abdominal pain	1	2	3	4	5
2. Allergies/ Stings	1	2	3	4	5
3. Airway obstruction	1	2	3	4	5
4. Back pain	1	2	3	4	5
5. Breathing problems	1	2	3	4	5
6. Cardiac arrest	1	2	3	4	5
7. Chest pain/ Heart problems	1	2	3	4	5
8. Covid-19	1	2	3	4	5
9. Diabetic problems	1	2	3	4	5
10. Drug overdose/Poisonings/Ingestions	1	2	3	4	5
11. Dyspnea	1	2	3	4	5
12. Headache	1	2	3	4	5
13. Loss of consciousness /Unconscious /Syncope	1	2	3	4	5
14. Pregnancy/ Gynecological Problems	1	2	3	4	5
15. Psychiatric / Behavioral problems	1	2	3	4	5
16. Seizures or convulsions	1	2	3	4	5
17. Sick person	1	2	3	4	5
18. Stroke	1	2	3	4	5

(If none and little agree please suggest more...
....

7.3 What do you think about the knowledge of trauma of the first aid as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. Animal bite / bee sting	1	2	3	4	5
2. Assault/Domestic violence/ Sexual assault	1	2	3	4	5
2. Bleeding/ Laceration	1	2	3	4	5
3. Broken bone/ Dislocation/Immobilization	1	2	3	4	5
4. Burns	1	2	3	4	5
5. Drowning	1	2	3	4	5
6. Electrocution	1	2	3	4	5
7. Eye problems/Injuries	1	2	3	4	5
8. Fall victim	1	2	3	4	5
9. Head injury	1	2	3	4	5
10. Heat / Cold exposure	1	2	3	4	5
11. Spinal injury	1	2	3	4	5
12. Stabbing / Gunshot victim	1	2	3	4	5
13. Traumatic injury	1	2	3	4	5
14. Vehicular related injuries	1	2	3	4	5

(If none and little agree please suggest more...
....

7.4 What do you think about the practice of trauma of the first aid as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. Animal bite or bee sting	1	2	3	4	5
2. Assault/Domestic violence/ Sexual assault	1	2	3	4	5
2. Bleeding/ Laceration	1	2	3	4	5
3. Broken bone/ Dislocation/Immobilization	1	2	3	4	5
4. Burns	1	2	3	4	5
5. Drowning	1	2	3	4	5
6. Electrocution	1	2	3	4	5
7. Eye problems/Injuries	1	2	3	4	5
8. Fall victim	1	2	3	4	5
9. Head injury	1	2	3	4	5

	None agree	Little agree	Some agree	Much agree	Very much agree
10. Heat / Cold Exposure	1	2	3	4	5
11. Spinal injury	1	2	3	4	5
12. Stabbing / Gunshot victim	1	2	3	4	5
13. Traumatic injury	1	2	3	4	5
14. Vehicular-related injuries	1	2	3	4	5

(If none and little agree please suggest more...
....

8. What do you think about the application that should be able to guide bystander when he gives bystander CPR as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
Hands-only CPR	1	2	3	4	5
2. Conventional CPR	1	2	3	4	5
3. Pediatric CPR	1	2	3	4	5
4. Infant CPR	1	2	3	4	5
5. AED.	1	2	3	4	5
6. COVID-19 of personal protective equipment.	1	2	3	4	5

(If none and little agree please suggest more..
....

9. What do you think about the applications that should be able to notify Real-time feedback on high-quality CPR for bystanders as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. Rate of Chest compression	1	2	3	4	5
2. Compression Depth	1	2	3	4	5
3. The recoil of Chest compression	1	2	3	4	5
4. Interruptions in Chest compressions	1	2	3	4	5
5. Notify every 2 minutes to rotate the compressor	1	2	3	4	5

(If none and little agree please suggest more...
....

10. What do you think about how the applications give real-time feedback to bystander CPR as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. By light	1	2	3	4	5
2. By picture	1	2	3	4	5
3. By text	1	2	3	4	5
4. By waveform	1	2	3	4	5
5. By voice	1	2	3	4	5

(If none and little agree please suggest more...
....

11. What do you think about the applications that need to track bystanders to do care as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. To contact the bystander after the case.	1	2	3	4	5
2. To ask the bystander to answer the survey.	1	2	3	4	5

(If none and little agree please suggest more...
....

12. What do you think about the applications need to track bystanders to contract as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. By email	1	2	3	4	5
2. By line	1	2	3	4	5
3. By Phone number	1	2	3	4	5
4. By ID					
5. By email					

(If none and little agree please suggest more...
....

13. What do you think about the distance from applications to a bystander as follows?	None agree	Little agree	Some agree	Much agree	Very much agree
1. 100 m.	1	2	3	4	5
2. 200 m.	1	2	3	4	5
3. 300 m.	1	2	3	4	5
4. 400 m.	1	2	3	4	5
5. 500 m.	1	2	3	4	5
6. 600 m	1	2	3	4	5
7. 700 m	1	2	3	4	5
8. 800 m	1	2	3	4	5
9. 900 m	1	2	3	4	5
10. 1,000 m	1	2	3	4	5
11. 1,100 m	1	2	3	4	5
12. 1,200 m	1	2	3	4	5
13. 1,300 m	1	2	3	4	5

14. 1,400 m	1	2	3	4	5
15. 1,500 m	1	2	3	4	5
(If none and little agree please suggest more………. ……. ……					

Appendix C: Smartphone function contents

1. First Aid Guide

1. Sudden Cardiac arrest occurs when the heart suddenly and unexpectedly stops pumping. If this happens, blood stops flowing to the brain and other vital organs. Cardiac arrests are caused by certain types of arrhythmias that prevent the heart from pumping blood.

Symptoms: Acute chest pain or unconsciousness.

First aid

1) Assess the safety at the scene.
2) Early recognition of cardiac arrest by waking up to call "Are you ok?" and touching both shoulders 2-3 times. if the victim does not respond then call for help.
3) If the victim is unresponsive and is not breathing or gasping, activated emergency call 1669 and request an automated external defibrillator (AED).
4) Breathing assessment by looking at the chest wall, is it any movement? if no movement must do immediate chest compression.
5) Early high-quality chest compressions until someone helps to arrive by
   - The victim is in a supine position and on a solid surface.
   - Put the heel of your hand on the center of their chest, right between the nipples.
   - Put your other hand on top of that hand.
   - Push down on the heels of your hands, or chest compression to a depth of 5-6 centimeters or 2-2.4 inches at a compression rate of 100-120 times/min.
   - Interrupt or stop chest compressions for less than 10 seconds.

   * In the case of mechanical ventilation, 30 chest compressions alternate with 2 ventilations count as one cycle. Reassessment every 5 minutes.

   **no need to breathe in the absence of a breathing apparatus, chest compressions only for 200 times, or about 2 minutes, and then re-evaluate.

6) An automatic defibrillator in the area.

   6.1) Open the machine and turn it on. Follow the voice prompts and instructions from the machine.

   6.2) Use large-size pads on adults then come back to the phone when the machine tells you to do CPR.

6.3) The AED analyzes the ECG, during which time do not touch the victim. Be warned aloud, "Everyone back down " he machine will take a short time of -10 seconds to analyze. During that time, an analytical signal may be heard.

6.4) The AED detects the ECG that requires a shock. the machine will say shock recommended withdraw from the victim, press the "shock" button, but before the rescuer presses the shock button, make sure No one touched the victim. By shouting out loud, "Everyone back off!!!!" with arms spread out to prevent uninvolved people from entering Look again as a final check that no one is touching the victim. Then press the "shock" button. After pressing the shock button, continue chest compressions immediately. and the unit will evaluate the ECG every 2 minutes. Follow the AED instructions until help arrives.

*** Do not operate AED in/ or around:

- Water, snow, or ice.
- Bathtubs, pools, or Jacuzzis.
- Metal, street ventilation gates.
- Hazardous materials.
- Any type of conductive medium.

| Scene safety | Early recognition | Activation of emergency response | Breathing assessment | Early High-quality CPR | Defibrillation |
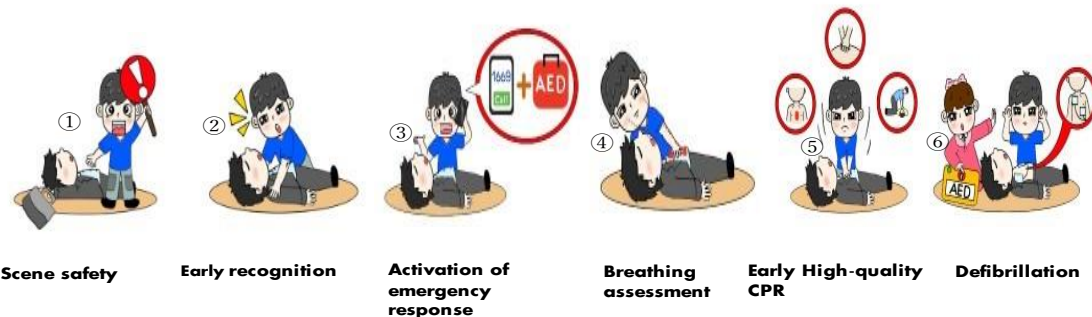
2. Asthma is a long-term inflammatory disease of the airways of the lungs. It is characterized by variable and recurring symptoms, reversible airflow obstruction, and easily triggered bronchospasms.

Symptoms: wheezing, coughing, chest pain, shortness of breath, agitation, and sweating.

Coughing, shortness of breath, agitate and sweating

First aid

1) Help the victim to sit in a comfortable position.

2) Tell the victim to breathe deeply and slowly.

3) Help victims receive bronchodilators.

4) Have the victim inhale 1-2 inhalers every 2 minutes 10 times. If symptoms worsen, call 1669 immediately.

1 Press button of bronchodilator

2 Patient inhale
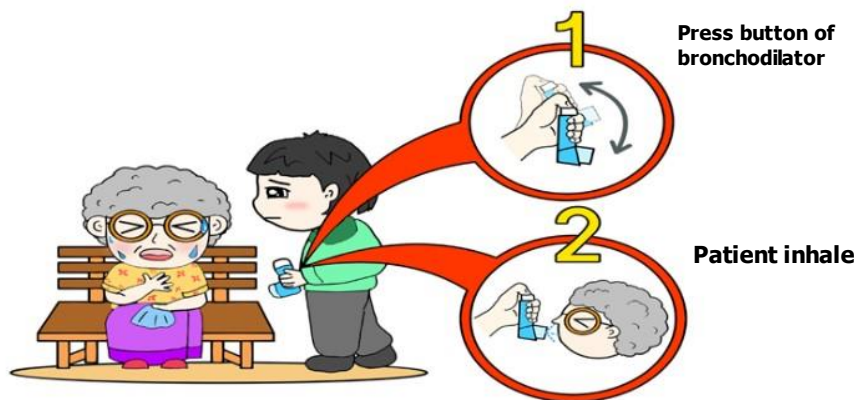
3. Syncope is a sudden loss of consciousness due to reduced blood supply to the brain. Most of which is caused by the heart's immediate decrease in blood supply to the body. Thus, causing him to lose consciousness for a moment.

Causes: pain, emotions, hunger, prolonged stay in stuffy places.

Symptoms: discomfort, palpitations, lightheadedness, dizziness, palm sweating, fainting.

First aid

1) Appropriate air and environment take it indoors in a well-ventilated place.

2) The clothes are loosened.

3) Place the victim's head slightly low and turn the victim's head to one side to prevent obstruction of your airway.

4) Use a moist cloth to wipe your forehead, hands, and feet.

5) Drink sugary water or mineral salts, except in the case of unconsciousness, symptoms do not improve. Immediately call an ambulance 1669.

Air and environment take it indoors   Head slightly low and   use a moist cloth to wipe forehead.   Drink sugary water or mineral salts

4. Seizures or convulsions: Seizures are caused by rapid and uncoordinated electrical firing in the brain. This can cause temporary abnormalities in behaviors, movements (such as alternating stiffening and jerking of the arms and legs), sensations, or a loss of consciousness or altered consciousness level.

Symptoms:

1) Loss of consciousness during the seizure, or between several seizures.

2) Becoming unresponsive.

3) In an absence seizure, the person stops concentrating on their activity and stares off into space, becoming unresponsive until the seizure abruptly ends.

4) Becoming vague, disorientated, or confused.

5) Numbness or tingling sensations.

6) Excess saliva coming from the mouth.

7) Increased heart rate.

8) Hallucinations.

9) Impaired thinking.

10) Eye blinking or eyes rolling upwards.
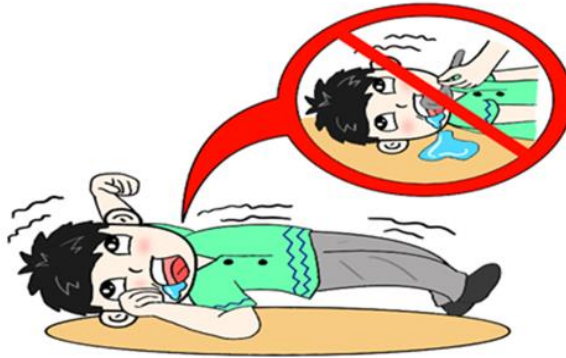
Do not pry or put anything into the patient's mouth during a seizure.

First aid

If you are with someone having a tonic-clonic seizure (where the body stiffens, followed by general muscle jerking), try to:

1) Stay calm and remain with the person.
2) If they have food or fluid in their mouth, roll them onto their side immediately.
3) Keep them safe and protect them from injury.
4) Place something soft under their head and loosen any tight clothing.
5) Reassure the person until they recover.
6) Time the seizure, if you can.
7) Gently roll the person onto their side after the jerking stops.

*Do not put anything into their mouth or restrain or move the person, unless they are in danger. To make a recovery position after the seizure and immediately call an ambulance 1669.

Step to recovery position

5. Heart attack: A heart attack, also called a myocardial infarction, happens when a part of the heart muscle doesn't get enough blood. The more time that passes without treatment to restore blood flow, the greater the damage to the heart muscle. Coronary artery disease (CAD) is the main cause of heart attacks. A less common cause is a severe spasm, or sudden contraction, of a coronary artery that can stop blood flow to the heart muscle.
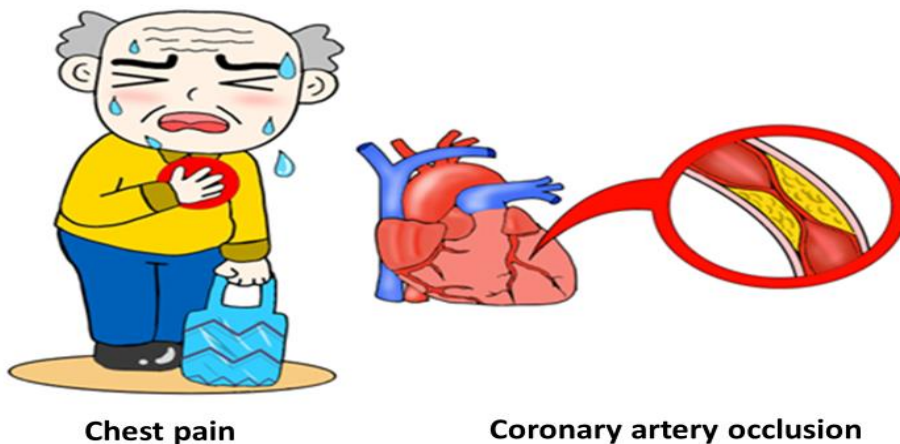
Chest pain   Coronary artery occlusion

Symptom

1) Chest pain or discomfort.
2) Feeling weak, light-headed, or faint.
3) Pain or discomfort in the jaw, neck, or back.
4) Pain or discomfort in one or both arms or shoulders.
5) Shortness of breath.

First aid

1) Call 1669 immediately, if you notice symptoms of a heart attack.
2) Place the victim in a comfortable position. Sit in a chair or lie down.
3) If the victim has Isordil sublingual. Allows the victim to take 1 tablet If it does not improve, 1 more tablet can be taken under the tongue after 5 minutes.
4) If aspirin is available and the victim is feeling well, chewing 1 tablet thoroughly in the mouth will help reduce the risk of heart damage.

6. **Stroke:** A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts (or ruptures). When that happens, part of the brain cannot get the blood (and oxygen) it needs, so it and its brain cells die.
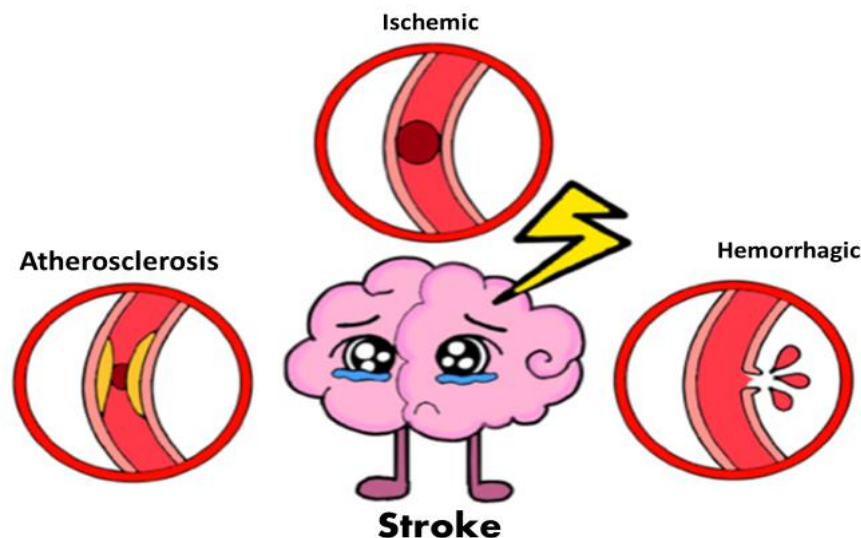
Symptoms: Use the FAST principle.

Facial weakness: Can the person smile? Has their mouth or eye drooped?

Arm weakness: Can the person raise both arms?

Speech: Can the person speak clearly and understand what you say?

Time to call 1669: if you see any of these signs.

Make sure you and your loved ones all know the FAST test.

Act **FAST** and call 1669

| **Facial** weakness | **Arm** weakness | **Speech** problem | **Time** to call 1669 |

Other symptoms of stroke

- Sudden weakness or numbness on one side of the body, including legs, hands, or feet.

- Difficulty finding words or speaking in clear sentences.

- Sudden blurred vision or loss of sight in one or both eyes.

- Sudden memory loss or confusion, dizziness, or a sudden fall.

- A sudden, severe headache.

* May occur with symptoms One eye is blurred or unable to see. blurred vision or iris-like symptoms sudden severe headache, dizziness, or loss of balance.

First aid

• Call 1669 immediately as the vascular disease requires immediate treatment to reduce disability and death.

7. **Anaphylactic:** a condition in which there is a severe immune response to some stimulants causing symptoms in various systems throughout the body.

Mild to moderate allergic reactions.

- Swelling of the lips, face, and eyes.
- Skin rash
- Numbness around the mouth

Symptoms of an acute, severe allergic reaction

- Difficulty breathing/ noise, difficulty speaking, and/or hoarseness
- Swollen tongue, dizziness, or fainting

- Swelling/ tightness in the throat, pale skin, and pale fetus
- Wheezing when breathing or coughing

Angioedema   **Lie down with feet elevated**

First aid

1) Call 1669 immediately if you suspect that the victim has symptoms of acute anaphylaxis.
2) Place the victim in a comfortable position.
3) Victims with difficulty breathing but consciousness should support to sit on the chair.
4) If you have a like unconscious, you should lie down position on the floor and raise your legs.

8. **Airway obstruction:** is a life-threatening medical emergency. The airway may be partially or completely occluded. Partial obstruction of the airway can lead to progressive hypoxia, hypercapnia, and respiratory and cardiac arrest. If the airway is completely obstructed, permanent brain injury or death will occur within 3-5 minutes secondary to hypoxia. Foreign bodies obstructing the airway are most common in children such as buttons, coins, nuts, and candy, stuck in the throat. In adults, such as large pieces of food stuck to the throat.

Foreign body obstruction
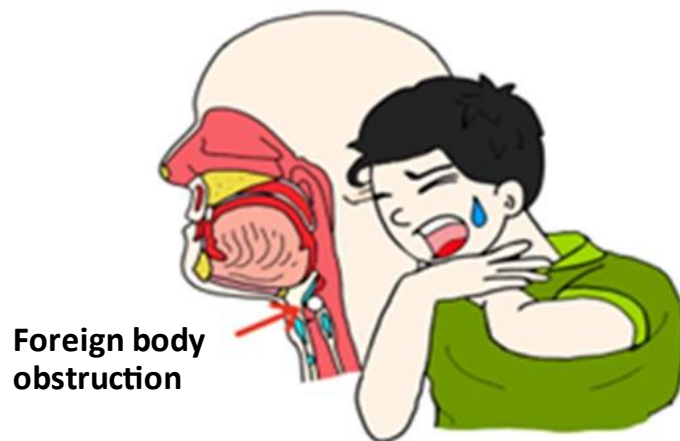
Symptoms: cough, speechlessness or crying, difficulty breathing, facial and mouth cyanotic.

First aid

Infant: Aged 1 month to 1 year,

1) Sit with the infant in your lap, do not use this technique if the victim is not responsive.

2) Avoid pressure on the infant's throat, and support the infant's head and neck

3) With your forearm resting on your thing, rest the infant face down on your forearm; his head should be lower than his chest.

4) Deliver ba ck blows between the infant's shoulder blades.

5) Turn the infant face up on your other forearm with his head lower than his chest.

6) Using 2 fingers of your free hand, deliver 5 chest thrusts over the bottom half of the breastbone. If the infant becomes unconscious or pulseless at any moment, start CPR. Obstruction relieved?

7) Call 1669 immediately.

Back blows   **Chest thrusts**

Choking in Adults and Children

Degree of obstruction

Mild Obstruction: Breathing but may also be wheezing, coughing, and making noise.

Severe obstruction: Clutching the neck (the universal sign of choking, weak or no cough, unable to make noise or talk; may make high-pitched noise, little or no breathing, appears cyanotic (blue around lips and fingertips)

Children: 1-8 years of age.

Mild Obstruction

1) Stay with the person, try to keep them calm.

2) Encourage them to cough.

3) Call 1669/EMS if the person seems to be getting worse.

Severe obstruction

1) Use abdominal thrusts to attempt to remove the obstruction.

   Abdominal Thrusts, do the following:

   - Stand behind the responsive person. Wrap your arms around them under their ribcage.

   - Put the side of your fist above the person's navel in the middle of their belly Do not press on the lower part of the sternum.

   - With your other hand, hold the first fist and press forcefully into the person's abdomen and up toward their chest.

   - Continue performing these thrusts until the obstruction is relieved or until the person becomes unresponsive.

2) Call 1669/EMS

3) Begin BLS if the person becomes unresponsive.

Back blows   **Abdominal thrusts**

Abdominal thrusts

9. **Heatstroke:** Heat stroke or heatstroke, also known as sunstroke, is a severe heat illness that results in a body temperature greater than 40.0 °C (104.0 °F), along with red skin, headache, dizziness, and confusion. Sweating is generally present exertional heatstroke, but not in classic heatstroke. The start of heat stroke can be sudden or gradual. Heatstroke is a life-threatening condition due to the potential for multi-organ dysfunction, with typical complications including seizures, rhabdomyolysis, or kidney failure.

Heatstroke

Symptoms:

Behavioral changes, confusion, delirium, dizziness, weakness, agitation, combativeness, slurred speech, nausea, and vomiting.

First Aid:

1) Call 1669 immediately.

2) Rapid mechanical cooling along with standard resuscitation measures.

3) Aggressive ice-water immersion remains the gold standard for life-threatening heat stroke. (Immersion should be avoided for an unconscious person)

4) Cooling method

- A cloth dampened with cold water to wipe the body and head. together. with the use of a cooling fan to lower body temperature to lower down as quickly as possible.

- if the victim is conscious soak your hands or feet in cold water. 10-17 degrees Celsius for about 15-30 minutes.

- An ice pack was placed on the forehead and palm.

- Soak in cold water temperature of 1 - 26 degrees Celsius.

- Use the principle of reducing body temperature through conduction, evaporation, convection, or radiation. 39 degrees Celsius.

Turn on the fan, and Ice pack placed on forehead, palm

10. Laceration/stop bleeding: The total human blood volume is approximately 80 ml per kg of body weight if more than 1/3 of the total blood volume is lost at one time, it poses a threat to life. Excessive bleeding from the wound must be stopped immediately.

Types of external hemorrhage

1) Arterial Bleeding: Blood spurts out of the wound, bright red, pulsating with a strong pulse. If the blood pressure is lowered, the ejection of blood will be less.

2) Vein hemorrhage: The blood flows through the veins, is dark in color, more bleeding, but easier to stop the bleeding.

3) Capillary hemorrhage: Bleeding from the wound, dark red, often stops on its own.
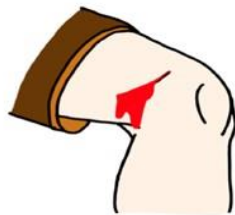
Capillary hemorrhage   **Vein hemorrhage**   **Arterial Bleeding**

First aid

1) Apply pressure by directly pressing a gauze or handkerchief on the wound for a while.

2) This method is the most basic and certain in stopping the bleeding.

3) Tightly wrapping a bandage offers the same effect in stopping the bleeding.

4) Apply direct pressure first, then consult a physician.

5) Call 1669 with the size and location of the wound and the amount of blood lost.

**To prevent transmission of blood-borne pathogens, it is recommended that plastic bags and gloves be used.

| Direct pressure | Bandage pressure | Raised part of wound |

In front of the ear: While supporting the opposite side of the head with one hand, apply pressure with a thump to the pulsing area just at the front of the ear.

Direct pressure

Underarm: Apply pressure with your thumb from the depression in the armpit to the humerus.

Direct pressure

Groin: Apply pressure with the palm of a head on the groin area (base or thigh). Lock the elbow and apply whole body weight.

Direct pressure

Nosebleed: The majority of nosebleeds occur as the result of damage to the capillaries in the nasal mucous membrane near the entrance of the nostril by either an external injury (scratching or bumping) or changes in blood or air pressure.

First aid

1) Sit down, lightly tilt the head down, and apply strong pressure on the nose. This will be sufficient for the majority of cases.
2) Cool the area between the forehead to the nose, loosen the tie, and let the victim sit quietly.
3) Stuff the nostril with small pieces of gauze, and pinch the nose.
4) Do not blow the nose immediately after the bleeding subsides.
5) If these steps do not work, consult a physician for the possibility of a deeper injury.

* If the head is tilted back, warm blood may drip down to the throat, which may cause discomfort. Also, swallowing blood may elicit a sick feeling. Therefore, do not tilt the head backward.

** If the nosebleed occurs as a result of a head contusion, do not waste time trying to stop the bleeding first. Instead, immediately call 119 while administering treatment.

Position for stop nose bleeding

Bandage

Protective gauze (wound cover)

Before bandaging the wound, place a protective gauze prepared to a suitable thickness and size. Protective gauze is effective in stopping bleeding, absorbing blood and other secretions, maintaining cleanliness (preventing infection), and reducing pain by resting the wound.

Bandage

The bandage is administered to stabilize the protective gauze on the wound and the splint and to suspend a hand or an arm. it can also be used to stop bleeding by wrapping tightly with it. Many types of bandages are commercially available including, rolled gauze bandages, elastic bandagesม adhesive bandages, triangular bandages, and tubular stretch bandages. Any of these can be used, as long as it meets the needs. For example, to stabilize a protective gauze on the face, head, or joints, elastic bandages or appropriately cut hosiery may be useful.

Triangular bandage

A triangular bandage can be used based on the size of the wound, and it is suitable for bandaging a large wound area or joints and suspending the hands and arms. If you are familiar

with the proper use of a triangular bandage, it is possible to substitute it with a scarf, a wrap, or a sheet.

Sample use of triangular bandage

1. Ear (cheek or chin)

Fold the triangular bandage to an appropriate width, and place its center on the protective gauze. Bring one end toward the chin and the other end toward the top of the head.

Cross the sides just above the opposite ear. Then, bring one end toward the forehead and the other toward the back of the head to avoid the wound, and make a knot.
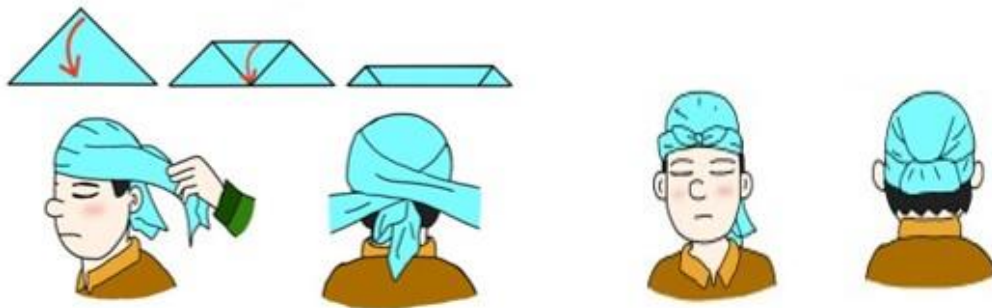
Triangle bandage around the head

2. **Knee**

Fold the triangular bandage just wide enough to cover the knee, wrap the bandage over the protective gauze, and let the end a cross in the back.

Bring one end around the bottom of the knee, and the other around the top of the knee. Tie the ends on the outside of the leg, toward the top of the knee.

Triangle bandage around the knee

3. Arm sling

Place the apex at the elbow of the affected arm and place one end on the opposite shoulder. fold the other end toward the shoulder of the affected arm, and tie it with the other end. Either tie the apex to close or fold it over and pin it.

Triangle bandage for Arm sling

11. Bone fracture

There are many kinds of bone fractures. There are closed and open fractures, complete fractures, where the bone is completely separated, and incomplete fractures, where separated, and incomplete fractures, where the bone is cracked. If there is a slightest suspicion of a bone fracture, administer treatments as such.

Type of fracture

Open fracture   Close fracture
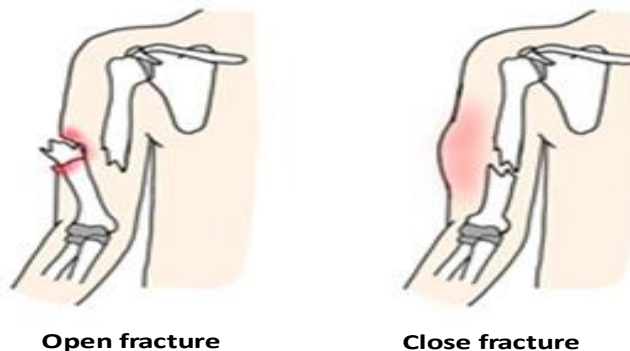
- *Closed fracture:* In a close fracture, no damage is observed on the skin around the fractured part, or the fractured part is not directly connected to the superficial damage.

First aid

1) Keep the entire body, including the injured part, still.
2) Stabilized affected area (to allow for the monitoring of the periphery of the broken limb, remove gloves, socks, and shoes).
3) If the broken part is bent, stabilize it in that position. Forcibly correcting it to a normal position may lead to the sharp ends of the broken bone causing damage to the nerves and blood vessels.
4) After stabilization, place the victim in a comfortable position. Raise the injured part, if possible, in order to the nerves and blood vessels.
5) Wrap the victim's body with a blanket to maintain temperature

- *Open fracture*

The fractured part is directly connected to the wound on the surface of the body. In addition to the external injury, the sharp ends of the broken bone could have penetrated through the skin. Alternatively, It could be a secondary injury from inappropriate handling.

The open fracture could be dangerous because: "damages to the nerves, blood vessels, and muscle are severe," "an excessive amount of blood is lost," and "the fractured part can easily be contaminated, increasing the risk of infection " These factors could prolong recovery, lead to suppuration, and make it difficult to move joints. Subsequently, amputation may be inevitable.

First aid

    1) Same treatment as closed fracture, with the following key points to keep in mind.

    2) Stop the bleeding, and treat the open wound before stabilizing.

    3) Do not try to retune the broken ends to their original position.

    4) Articles of clothing restricting the wound area should be removed, or cut to widen the wound.

Fingers splint

Leg splint

12. Head injury: Head injuries are damage to the scalp, skull, or brain caused by trauma When it affects the brain, they're called a traumatic brain injury (TBI). This may cause a change in the level of consciousness. It depends on the severity of the injury.

Direct pressure

Close wound

Sign and Symptom

    1) Loss of consciousness for a short time. There may be repeated bruises on the head, dizziness/ nausea, vomiting, memory loss at the time of the incident or before the incident, mild headache, and confusion.

2) Severely injured, there is a history of an object hitting the head/ falling head on the ground, decreased response, bleeding from nose and ears, pupils are not equal.

3) If a Battle sign or Racoon eye, see a fractured skull or a depressed skull fracture If there is blood or cerebrospinal fluid (CSF) coming out of the ear or nose, this is a symptom of a "cracked skull base "

First aid

1) If there is a bleeding wound wrap the wound with a clean cloth or gauze or gauze to stop the bleeding. make the injured person lie down.

2) If the victim is unconscious or confused, drowsy, have vomiting, Call 1669 immediately.

3) If the victim is conscious reduce pain and swelling by applying cold compresses to the injured.

13. Spinal injury: mechanisms of injury such as falls from a height, traffic accidents, hanging, jumping, or any kind of accident that causes the victim to be unconscious.

Mechanism of spinal injury(fall)

Symptoms: Pain in the neck, back, arms, and legs, numbness, or weakness, shortness of breath, and difficulty breathing.

First aid

1) Restrictions do not move the victim because they may cause more injuries.

2) Manual in-line of the cervical spine.

3) Call 1669 immediately.

Manual inline and spinal immobilization

14. Burns

he re are many causes of burns in a home "wider" and "deeper" the burn area, the more dangerous it is. A child is in critical condition if he sustains burns in 10-15% of his body.

First aid

1) Immediately cool with cold water or tap water until the pain subsides.
2) Do not remove clothing, apply cold water over the clothes.
3) Do not burst blisters, cover them with a sterilized or clean cloth and cool.

- Cooling a large affected area could dangerously lower the victim's body temperature. Particularly be mindful of children and the elderly.

- Do not apply any ointment, oil, or sanitizer (it could cause an infection or interfere with a physician's examination)

- Burns over a large area or on the face and hands require special treatment. In these cases, call 1669 for a transfer to an appropriately equipped medical facility.

Cool water and Tap water   **Cover clean cloth**

15. Electrocution is the wrong use of electrical appliances. Using defective electrical appliances or it may be caused by the child's ignorance.

First aid

1) Do not touch the victim with bare hands. Also be careful of touching the conductors that may bring electricity to the rescuer, such as wet areas.

2) Immediately cut off the electricity in the area of the accident, except for the high-voltage. Should notify the electric utility to cut off the power safely.

3) Call 1669 immediately.

Do not direct contact with the victim

16. Near drowning is the term for survival after suffocation caused by submersion in water or another fluid. Some experts exclude from this definition cases of temporary survival that end in death within 24 hours, which they prefer to classify as drownings.

Sign and symptom

Some victims are alert but agitated, while others are comatose. Breathing may have

stopped, or the victim may be gasping for breath. Bluish skin (cyanosis), coughing, and (material expelled from the respiratory tract by coughing) are often observed in rapid breathing (tachypnea), a rapid heart rate (tachycardia), and a low-grade fever   are common   during   the   first   few   hours   after   rescue. Conscious victims may appear confused, lethargic, or irritable.

First aid

From the ground

1) Using either a convenient item or with bare hands, extend the arms and pull the victim toward the land by lying flat on your stomach.

2) If the victim is unreachable, use your shirt, belt, or a board, stick or rope found close by to pull.

Using rescue equipment:

1) How to use a ring/buoy: quickly gather the rope in a ring shape. Firmly step on the end of the rope.
2) Toss the rope using an underhand throw to land behind the victim. When the victim has securely grabbed on, slowly pull the rope.
3) Call 1669 immediately.

Using rescue equipment

17. Dog bite:

When bitten by sharp teeth, a deep wound and laceration develop. These are cases where children are bitten to death. When bitten by a dog, the risk of contracting rabies immediately comes to mind. Currently in Thai, however, there is no rabies. Yet, there is a potential for contraction through animals that were infected with rabies while traveling or

flying in an airplane from countries with rabies. The rabies virus can be transmitted through cats, foxes, wolves, and skunks, as well as dogs.

Dog bite

First aid

1). Immediately seek a physician since there is a risk for infection.

2). If the owner of the dog is unknown, report the characteristics of the dog to the public health center and have them take it (the dog will be observed in quarantine for 2 weeks. If it is infected with rabies, it will fall ill and die).

*If you have been bitten in a country with rabies, receive a vaccination at a medical establishment as soon as possible.
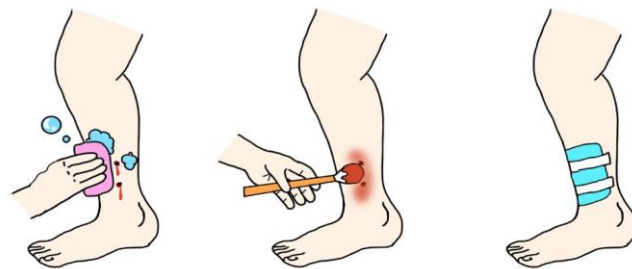
Clean by soap and water

18. **Snakebite:** Snake bites should always be taken seriously. Though some are dry bites, which aren't as dangerous and will likely cause some swelling, others are venomous bites, which, if not treated carefully and quickly, can result in death. Always seek immediate medical attention if you've been bitten by a snake, as it could be a matter of life and death. There are 3 types of venomous snakes in Thailand.

Fang mark   Non-fang mark

- **Neurotoxins:** cause paralysis or other damage to the nervous system. causing drooping eyelids, unable to open eyes, stiff jaws, slurred speech, unable to swallow saliva, chest pain, shortness of breath, and fatigue Paralysis and death include; Cobra, King cobra, Malayan krait, and Banded krait.

Cobra   King cobra   Malayan krait   Banded krait

- **Hemorrhagic:** Disrupts the blood vessels. There was blood oozing along the blood-stained fangs beneath the skin of his head. scurvy nose bleeds vomiting and bloody stools include; Russel's viper, the green-pit viper-tailed, and the Malayan viper.
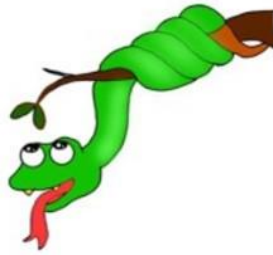
Russel's viper   Green pit viper   Malayan viper

- **Myotoxins:** Break down muscles, the symptoms are similar to that of a nervous venomous snake. muscle pain especially at the hips and shoulders acute renal failure which was the leading cause of death including sea snakes
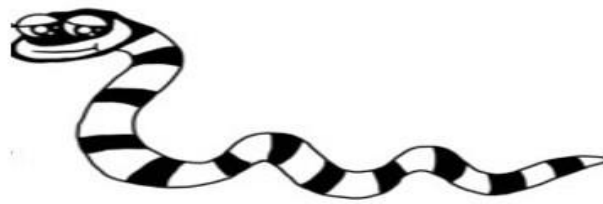
Sea snakes

Symptoms of a snake bite

1) Bite marks on your skin. These can be puncturing wounds or smaller, less recognizable marks.
2) Sharp, throbbing, burning pain around the bite that you may not feel for a little while after the bite. You may also feel pain up whichever limb was affected, such as in the groin for a bite on the leg or the armpit for a bite on the arm. But not everyone feels pain. For example, a bite from a coral snake can be almost painless at first, but still deadly.
3) Redness, swelling, and tissue damage, or destruction, in the area of the bite.
4) Abnormal blood clotting and bleeding. Severe bleeding can lead to a hemorrhage or kidney failure.
5) Low blood pressure, a faster heart rate, and a weaker pulse.
6) Nausea and vomiting, diarrhea, anxiety, headaches, dizziness, and blurred vision.

7) Difficulty breathing, or in serious cases, complete loss of breath.

8) Increased production of saliva and sweat.

9) Weakness in your muscles and numbness in the face or limbs.

First aid

1) Remove any jewelry or watches, as these could cut into the skin if swelling occurs.

2) Keep the area of the bite below the heart to slow the spread of venom through the bloodstream.

3) Remain still and calm. If you can, roll over to your side and rest in the recovery position. Moving around a lot will cause the venom to spread faster through the body.

4) Cover the bite with a clean, dry bandage. Try to use a pressure immobilization bandage if you can. This type of bandage should be tightly wrapped around the bite. he n, wrap another bandage around the entire limb, so that it's immobilized

5) Call 1669 immediately.

Clean by soap and water fang mark and immobilization

Scorpions, spiders, and centipedes bite: There will be a pain, swelling, and red heat. In severe cases, kidney failure may occur.

Scorpions   Spiders   Centipedes

First aid

1. Wash the wound with clean water and soap or smear the wound with ammonia.
2. Compress with cold water.
3. If the pain is severe, you can take painkillers.
4. If symptoms are severe, immediately take them to the hospital.

Clean by soap and water   Cold pad

*In case of severe allergic reactions such as swelling of the face, trouble breathing, tightness in the chest, lightheadedness, dizziness nausea, vomiting, shock, or unconscious, call 1669

Bee bite

Bees, wasps, and hornets bite

A bee sting is a wound and pain caused by the stinger of a male bee puncturing skin. Bee stings differ from insect bites, with the venom of stinging insects having considerable chemical variation. The reaction of a person to a bee sting may vary according to the bee species. While bee stinger venom is slightly acidic and causes only mild pain in most people, allergic reactions may occur in people with allergies to venom components.

First aid

1. The stinger should be removed as quickly as possible without regard to the method.
2. Apply a cold compress.
3. If the pain is severe, you can take analgesics or painkillers.
4. If there is a severe allergic reaction, call 1669 immediately.
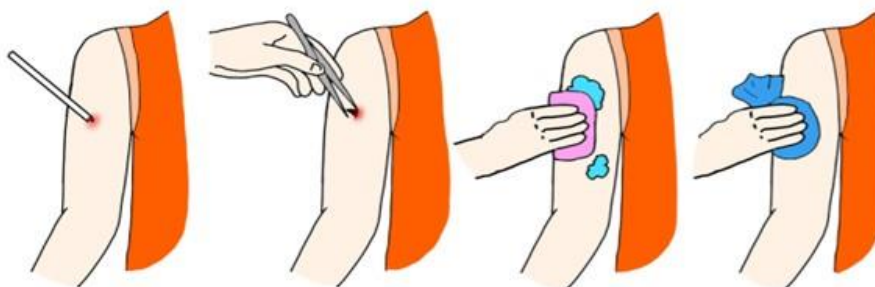
Remove stinger   Clean by soap and water   Cold pad

2. Medical Emergency Guides (Adults)

Adult	**Emergency** *Medical examination as soon as possible to (with an hour or two from now)*	**Urgent** *Visits within a few hours (within 6 hours)*	**Non-Urgent** *It may not consult*
1. Difficulty Breathing	• Suddenly became difficult to breathe. • Having chest pain. • Having phlegm that is often watery • Continuously experiencing breathing difficulty. • Was hospitalized before due to lung disease. • Have asthma. • Became difficult to breathe after vomiting or choking. • Cannot take a deep breath.	• Recently had a physical injury • Recently gave birth to a child or currently pregnant with one (or possibly so) • Have some kind of allergy • Having nasty phlegm • Have a fever <u style="color:red">Raise the level of urgency</u> Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	• Feeling numbness in the fingers and/or face. • Experiencing a lot of stress lately • Having a stuffy nose. <u style="color:red">Raise the level of urgency</u> Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk
2. Wheezing	• Cannot lie down due to breathing difficulty. • Having chest pain. • Suddenly became difficult to breathe. • May have inhaled something • Having phlegm that is often watery.	• Have an asthma • Having nasty phlegm • Have some kind of allergy. • Have a heart lung or kind of disease • Experienced a similar symptom before. <u style="color:red">Raise the level of urgency</u> Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	• None of the above applies. • <u style="color:red">Raise the level of urgency</u> Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk
3. Asthma attack	• Cannot lie down due to breathing difficulty • Have difficulty breathing even when taking medication • Cannot walk	• Having a little bit of a cold. • Currently taking an asthma medication • The symptom appeared after vomiting or choking • Was hospitalized before due to asthma	• None of the above applies.

Adult	Emergency *Medical examination as soon as possible to (with an hour or two from now)*	Urgent *Visits within a few hours (within 6 hours)*	Non-Urgent *It may not consult*
		• Was admitted to an ICU before • The medication that has been recently prescribed is not working • Having nasty phlegm	
4. Palpitations	• Experiencing heart palpitations (fluttering in the chest) for more than 30 minutes • Having difficulty breathing • Feeling pressure in the chest • Feeling unpleasant (pent-up) sensations in the chest. Having a sense of discomfort in the chest. • Having chest pain for more than 30 minutes • Experiencing a cold sweat at the moment • Experiencing pain in the jaw, arm, etc. • The amount of urine is less than usual. It is also thicker than usual. • Experiencing dry lips. • Feeling dizziness. • Having heartburn. • Having a very fast or slow pulse.	• Having a headache • Have a thyroid disease • Have a heart disease • Often experiencing this kind of symptom • Vomiting and/or having diarrhea • The rhythm of the pulse is unusual (skipped a beat, etc.) • Gained weight. Became bloated. • Currently pregnant (females only) • Raise the level of urgency • Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	• Have been treated for an irregular pulse • Recently took a cold medication, diuretic, diet pill, or heart failure medication. • Have recently been treated for asthma • Experiencing sleeplessness • Experiencing an increased level of stress • Took a large amount of medication • Have a fever • Have exercised in the last 30 minutes • Tired at the moment Raise the level of urgency Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk
5. Level of Consciousness	• Consciousness suddenly became disturbed • Cannot speak well • Cannot follow instruction • Exhibiting unusual behaviors • The arm and leg on either the left or right side cannot be moved or controlled at will. • Bleeding • Experiencing a severe headache • Vomiting • Have a fever • Had a spams • Took a large amount of medication • Had a large amount of alcohol • Have diabetes	• The condition has been improving • Was previously diagnosed as an alcoholic • The amount of urine is less than usual. It is also thicker than usual. • Experiencing dry lips. • Feeling thirst quite often • Felt dizzy • Although lost consciousness for a period of time, the condition is back to normal now. • Had been bedridden before admission	-

Adult	Emergency *Medical examination as soon as possible to (with an hour or two from now)*	Urgent *Visits within a few hours (within 6 hours)*	Non-Urgent *It may not consult*
	• Have a bad liver. The white of the eye is ocher. • Having an irregular pulse.	• Have cognitive impairment. Raise the level of urgency Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	
6. Convulsions	• Still having a convulsion now. • Does not provide any answer after begin called. • Recently injured the head and/or face. • Have hit the head, Bleeding from the head, but the tongue. • Does not engage in conversation with others. • Having an odd behavior, exhibiting restlessness. • Have a fever • Cannot move the arm(s) and /or leg(s) • Experiencing a headache • Had a spasm for the first time in life.	• No- anti-spasm medication is available • Experienced a convulsion before. Raise the level of urgency Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	
7. Headache	• Feel like vomiting or have vomited. • Experiencing a severe and unusual headache. • Experiencing the kind of headache that resembles getting hit in the head hard. • Experiencing a splitting headache like never felt before. • The pain is becoming increasingly intense. • Feeling numbness in the arm(s) and leg(s) and cannot control them at will. • There is a floating sensation in the body. Feeling dizzy • The eyesight has grown dim. Things look strange. • Cannot move the body.	• Have a fever. • Exhibiting the symptoms of a cold such as chill, runny nose, coughing, etc. • The symptoms persist even after taking medication. • Saw a doctor before to treat a headache (migraine, tension headache, cluster headache, etc.) • Still experiencing a headache. • Experiencing the same kind of headache as usual. • Have hit my head.	• Have run out of the medication that is usually taken.

Adult	Emergency *Medical examination as soon as possible to (with an hour or two from now)*	Urgent *Visits within a few hours (within 6 hours)*	Non-Urgent *It may not consult*
	• Having an odd behavior. The eyes are not focused. Feeling hazy. • Having a spasm or had a spasm. • Does not provide any answer after being called.		
8. Chest pain	• Having a tightening sensation in the chest. Feeling pressure in the chest. Having pent-up sensations in the chest. Experiencing a splitting pain in the chest. • The pain has been spreading to the neck, jaw, shoulders, back, and arms. Etc. • Feeling like vomiting or having vomited. • Having chest pain even when staying still. • Experiencing fluttering in the chest. There is an irregularity in the pulse. • The chest pain cannot be relieved with medications such as nitroglycerin, frandol tape, etc. • Was sitting down for a long time. Was it the same posture continuously. The pain started after returning from a travel. • Had a heart disease before. This is not the type returning from a travel • Had been on the pill(contraceptive) • Exhibiting symptoms in the feet/legs such as pain, swelling, belatedness, redness, heat, etc. • The ankle(s) suddenly become swollen. • Have spit phlegm that contained blood. • Was previously injured, pregnant, gave birth to a child, or underwent an operation.	• Chest pain can be caused by deep breathing or coughing • Have a fever. • Coughing. Yellowish or greenish phlegm comes out. • Recently had an injury and it hurts when moving body. • It hurts when pushed in a painful spot. • It is clear where the painful spot is. • Raise the level of urgency • Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Currently pregnant • Cannot walk • Have diabetes • Have a chronic renal failure • Smoker or used to smoke cigarettes. • Have high blood pressure.	• None of the above applies. • Raise the level of urgency • Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Currently pregnant • Cannot walk • Have diabetes • Have a chronic renal failure • Smoker or used to smoke cigarettes. • Have high blood pressure

Adult	Emergency *Medical examination as soon as possible to (with an hour or two from now)*	Urgent *Visits within a few hours (within 6 hours)*	Non-Urgent *It may not consult*
	• Was diagnosed with a blood disease before. • Bleeding does not stop easily.		
9. Back pain	• Suddenly started having back pain which has been getting worse. • Also having chest pain. • Suddenly the legs/feet became numb. Experiencing dullness in the legs/feet. Cannot move the legs/feet. • The painful spot changes • It is a splitting pain. • The color of the urine was red. Hurts greatly when urinating. • Cannot hold urination and/or defection until going to a toilet. • Feel like vomiting or have vomited. Having a fever.	• Was sitting for a long time. Was in the same posture continuously. The pain started after returning from a travel. • The medication being used is not working • Have cancer and/or diabetes. • Lost weight recently. • Have difficulty urinating. It is hard to urinate even in a toilet. • Go to the toilet quite frequently. Hurts to urinate. • Experiencing pain from the hip/waist area down through the legs. • Have difficulty walking • Recently had an injury or accident. •Raise the level of urgency • Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Currently pregnant • Cannot walk • Have high blood pressure.	• Have chronic back pain. Had a back operation before. Have kidney disease. • Experiencing pain in an area other than the back. Can still move the body but it still hurts. • Have a fever. •Raise the level of urgency • Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Currently pregnant • Cannot walk • Have high blood pressure.
10. Fever	• Cannot get up. • Having a severe headache. Vomiting. • Was in a hot place. Exercised hard and the body temperature has gone up to 30 C or above afterward. • Experiencing a headache and haziness. or exhibiting odd reactions.	• There is dryness in the skin and/or lips. • Feeling quite thirsty. • The amount of urine decreased. The color of urine became thicker. • Experiencing vertigo and/or dizziness. • Have pain in the back and/or the rib area. • Was in a hot place. Did hard exercise. • Having a headache.	• None of the above applies • Raise the level of urgency Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk

Adult	**Emergency** *Medical examination as soon as possible to (with an hour or two from now)*	**Urgent** *Visits within a few hours (within 6 hours)*	**Non-Urgent** *It may not consult*
		• Having difficulty swallowing. Having sore throat. • Having yellowish and greenish phlegm. • Having a body temperature of 40 C or above, and the medication being used is not working. • Have stomachache. • Feel like vomiting. Have vomited. • Have a heart or liver disease. Have diabetes. Currently taking steroid medication. Have cancer. Being treated for infectious disease. • Have a fever for the past three days or longer. • Have diarrhea. • There is redness all over the body. Red rashes are present over the body. • Hurts to urinate. • Have pain in the ear(s) • Recently underwent an operation. • (Females only) have pain in the vagina(genitalia). Experiencing a larger amount of vaginal discharge, a larger amount of vaginal discharge than usual. • (Females only) Currently pregnant or gave birth to a child recently. • Raise the level of urgency Increase the degree of urgency in the case of the following apply: • 65 years old or above. • Cannot walk	

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Adult	Emergency *Medical examination as soon as possible to (with an hour or two from now)*	Urgent *Visits within a few hours (within 6 hours)*	Non-Urgent *It may not consult*

11. Stomachache	• Suddenly started having pain. or experiencing strong pain continuously.
	• Also, have pain in the chest and/ or back on top of a stomachache.
	• Blood is present in the vomit.
	• Blood is present in or around the excrement.
	• (Males only) Swelling in the scrotum.
		• Pain is becoming increasingly intense.
		• Continuously experiencing pain that intensifies sometimes and decreases at other times.
		• Have vomited or feel like vomiting.
		• Have a fever (38C or higher).
		• Have diarrhea.
		• Feel dizziness.
		• Experiencing constipation.
		• Have stiffness in the top area of the thigh(s).
		• Have a mild stomachache and recently had stomach surgery.
		• Have a mild stomachache and recently had injured the stomach or significant force applied to the stomach.
		• There is bleeding from the genitalia.
		• Have mild pain in the waist and/or back.
		• (Females only) Currently pregnant.
		• (Females only) Currently menstruating.
		•Raise the level of urgency
		  Increase the degree of urgency in the case of the following apply:
		  • 65 years old or above.
		    • Cannot walk
			• Often experience similar stomachache. Or often have similar pain.
			• Experiencing a sense of discomfort or stomach tension(distension) instead of describing it as pain.
			• Feel unpleasantness rather than pain.
			Raise the level of urgency
			  Increase the degree of urgency in the case of the following apply:
			• 65 years old or above.
			• Cannot walk

3. Medical Emergency Guides (Children)

Children	**Immediately** *Activated call 1669 and early CPR*	**Emergency** *Activated call 1669*	**Urgent** *Activated call 1669 By 1 hours*	**Simi-urgent** *You may see a doctor the next day if it doesn't improve.*	**Non-urgent** *It is not necessary to see a doctor and continue to observe the symptoms.*
1. Fever over 38 C	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Under 3 months • Lethargic • Look blank and listless • Wrong face color • Struggles to stay awake • Unusual behavior	• No passing urine for half a day • Slack skin and dry lips • Running a fever over 40 degrees • Vomits and complains a headache→ Refer to Headache	• Takes fluids • Drinks milk fine • No difficulty eating • Passes urine • Giggles when rocked • Rashes all over the body • Vomiting, diarrhea, stomach pain→ Refer to Stomachache	• Active • Spirited • Smiles • No alarming symptoms other than the high fever
2. Convulsion	• Not breathing • Purple lips. • Unresponsive to voice • No pulse • Prolonged convulsions • The convulsions stopped but the child is unconscious	• Wrong face color • Recurring convulsions	• Under 6 months • Drowsy all day • No passing urine for half a day • Asymmetric spasms • Not feverish but convulsions occur (below 38 c) • Wrong movements in the hands and legs after the convulsions. • First convulsion experienced • Vomits and complains a headache→ Refer to Headache • Head injuries→Refer to Head injuries	• The convulsions has stopped • Fully conscious • Right face color	• Not sure if event is a convulsion

Children	Immediately *Activated call 1669 and early CPR*	Emergency *Activated call 1669*	Urgent *Activated call 1669* *By 1 hours*	Simi-urgent *You may see a doctor the next day if it doesn't improve.*	Non-urgent *It is not necessary to see a doctor and continue to observe the symptoms.*
3. Head injuries	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Vomiting occurs more than 3 times • The bleeding won't stop • Confused • Wrong face color • Cannot walk straight	• The bleeding stopped but the wound is open • Changes in behavior • The swelling feels tender to the touch • Not fully conscious • Pain in the neck	• Bump • Vomited once or twice • Conscious • The bleeding has stopped • Walks straight	• Took a hard blow but seems fine • Cute and scrapes • Might have been hit in the head • Reddened skin • Sleeps soundly
4. Stomach ache	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Took a blow to the stomach • Vomits repeatedly→ • Refer to Vomiting • Blood in the vomit • Lethargic • Bloodstained stool • Cannot walk (or move) • Curled up in pain • No passing urine for half a day	• Vomited more than three times • Pain when touched on the stomach • Swollen abdomen • Pain when walking • Passes watery stool repeatedly • Throws up when given fluids • No smile • High fever (over 38C) • Cries hard intermittently (When not seems fine)	• Vomited once or twice • Diarrhea • No passing stool for a few days • Giggles when rocked • Takes fluids • Passes urine • Not feverish	• Vomited but seems fine • Improved after passing stool
5. Swallowed foreign objects	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Prolonged coughing • Wrong face color • (Possibly) swallowed a battery • Complains a chest pain • Swallowed chemicals	• Cough starts suddenly and then stops • Ate a cigarette (shorter than 2 cm) • Swallowed a sharp object	• Seems fine • Drinks water • Swallowed a coin • Ate a toy or plastic	• Ate a cigarette and spat it out • Not sure what the child has ingested

Children	Immediately *Activated call 1669 and early CPR*	Emergency *Activated call 1669*	Urgent *Activated call 1669* *By 1 hours*	Simi-urgent *You may see a doctor the next day if it doesn't improve.*	Non-urgent *It is not necessary to see a doctor and continue to observe the symptoms.*
		such as detergents • Refuses to drink water • Drank from ashtray • Ate a cigarette (longer than 2 cm)			
6. headache	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Confused • Convulsions • Wrong face color • Struggles to walk	• Vomiting occurs more than 3 times • High fever (over 38C) • Severe headache • Drowsy all day • External head injuries→Refer to Head injuries • Listless • Changes in behavior	• No head injuries • Stuffy nose • Active • No difficulty walking • Mild headache	
7. Vomiting	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Under 3 months • Lethargic • Looks blank and drowsy • Blood in the stool • High fever and headache→ Refer to Headache • Produces streaks of blood in the vomit (like coffee grounds)	• No passing urine for half a day • Throw up when given fluids • Refuses to take fluids • Vomits repeatedly • Passes watery stool repeatedly • Slack hard intermittently (When not, seems fine) • Severe stomachache	• Active • Not irritable • Takes fluids • Passes urine • Diarrhea • Slight fever	• Recovered after vomiting two times • Gags ang spits out
8. Diarrheal	• Not breathing • Purple lips.	• Lethargic • Drowsy	• Under 3 months	• Smiles • Not feverish • Takes fluids	• Watery stool once or twice • Spirited

Children	Immediately *Activated call 1669 and early CPR*	Emergency *Activated call 1669*	Urgent *Activated call 1669* *By 1 hours*	Simi-urgent *You may see a doctor the next day if it doesn't improve.*	Non-urgent *It is not necessary to see a doctor and continue to observe the symptoms.*
	• Unresponsive to voice • No pulse	• Blood in the stool	• No passing urine for half a day • Sunken eyes • Vomits repeatedly→ Refer to Vomiting • Refuses to take fluids • High fever (over 38 C)	• No vomiting • Passes urine • There was blood when you wiped the child's bottom • Slight blood in the stool (streaks of blood)	
9. Coughing	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Difficulty breathing • Wrong face color • Trouble lying down • Struggles to speak • Acute cough starts suddenly	• The cough prevents the child from sleeping • Listless • Labored breathing • Has been diagnosed with asthma • No trouble lying down • No passing urine for half a day • High fever (over 38 C) • Coughs like a barking dog • Raspy voice	• Right face color • Pink lips • Coughs but sleeps fine • Active • Runny nose	-
10. Eye pain	-	• Difficulty opening eyes • External eye injuries (hit by a hard ball) • Cannot see because of swollen eyes • Severe pain • Bleeding • Has been stung in the eye	• Increase light sensitivity • Injuries to the eyeball • Took a blow to the eye • Low vision or cannot confirm the vision • ingestion of chemical(acid)	• No difficulty opening eyes • Pain when touched in the eyelids • No light sensitivity problems • Eye mucus • No low vision problems • Ingestion of chemicals (small amount of acid) • Pain in the eyelids	-

Children	Immediately *Activated call 1669 and early CPR*	Emergency *Activated call 1669*	Urgent *Activated call 1669* *By 1 hours*	Simi-urgent *You may see a doctor the next day if it doesn't improve.*	Non-urgent *It is not necessary to see a doctor and continue to observe the symptoms.*
		• Ingestion of chemicals(alkali)		• Has been hit in the eyelids	
11. Ear pain	-	• Pain behind ears • Dizziness(wobbly) • Struggles to walk • Different from the usual walk	• Too painful to sleep • Bug ingestion • Put a button battery in the mouth • Ingestion of adhesives • High fever (over 38 C) • Complains a headache	• Active • Complains of pain but sleeps fine • Complains after cleaning ears • Slightly bleeds after cleaning ears • Ear discharge • Pain when chewing • Pain in the area between the ear and jaw	-
12. Bee Stings	• Not breathing • Purple lips. • Unresponsive to voice • No pulse	• Breaks out in rashes all over the body • Wheezing • Coughing • Wrong face color • Different from usual breathing • Labored breathing	• Acute pain • Multiple stings	• Mild swelling • Mild pain • Itchiness	
13. Hiccup	-	-	-	• Persistent hiccups • If there're symptoms other than hiccups, see items specific to those symptoms	• Hiccups will go away naturally • Monitor the child carefully

4. Basic Life Support

1. **Check for responsiveness**

   When you spot a person in distress, make sure the scene is safe. Tap the shoulder and shout to check for responsiveness.

   1.1) When you spot an individual in distress, ensure your surroundings and the scene is safe. Your safety is first.

   1.2) To check for responsiveness, tap the individual's shoulders and shout "Are you okay?"

   Responsive or Unresponsive

2. **Activate emergency call for help and request AED**

   2.1) If the patient is unresponsive, shout for help

   2.2) It is recommended to fine two people. One to call an ambulance and another to find an AED while you prepare for CPR.

3. Check for breathing

> 3.1) Look to see if the chest and abdomen rise and fall for at least 5 seconds (no more than 10 seconds).
>
> 3.2) If the individual is not breathing or has abnormal breathing (e.g., gasping) the individual is in cardiac arrest. * Irregular gasping sounds are a sign of cardiac arrest.

4. Early chest compression while waiting for help to arrive.

> 4.1) Lay the patient on his/her back on a hard, level surface.
>
> 4.2)   Hand position: On the lower haft of the sternum in adults (chest compression is performed between the nipples).
>
> 4.3) Chest compression to a depth of 5-6 centimeters or 2-2.4 inches at a compression rate of 100-120 times/minute.
>
> 4.4) Minimal interruptions in chest compressions: interrupt compressions < 10 seconds.
>
> 4.5) Rotate compression every 2 minutes, or sooner if fatigued.

In the absence of a breathing apparatus, 30 chest compressions alternating with 2 ventilations count as one cycle. Reassessment every 5 minutes.

* In the case of mechanical ventilation, 30 chest compressions alternate with 2 ventilations count as one cycle. Reassessment every 5 minutes.

* No need to breathe in the absence of a breathing apparatus do chest compressions only 200 times, or about 2 minutes, and then re-evaluate.

5. When the AED arrives

5.1) Turn on the device. Press the power button and there will be a sound telling you what to do next. Follow the instructions immediately.

5.2) Place the conductive pads on the patient's chest. Check the patient's chest for complete dryness. If found to be wet or not completely dry, use a towel to dry the patient's chest first. then peel off the plastic sheet

5.3) The AED analyzes the ECG, during which time do not touch the patient. Be warned aloud, "Everyone back down " he machine will take a short time of 5-10 seconds to analyze. During that time, an analytical signal may be heard.

5.4) The AED detects the ECG that requires a shock. the machine will say Shock recommended Withdraw from the patient, press the "shock" button, but before the rescuer presses the shock button, make sure No one touched the patient. By shouting out loud, "Everyone back off!!!!" with arms spread out to prevent uninvolved people from entering. Look again as a final check that no one is touching the patient. Then press the "shock" button. After pressing the shock

button, continue chest compressions immediately. and the unit will evaluate the ECG every 2 minutes. Follow the AED instructions until help arrives.