The outcome of emergency patient transported by Public air ambulance service in Thailand

Flight Lieutenant Atchariya Pangma

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health Program in Public Health
College of Public Health Sciences
Chulalongkorn University
Academic Year 2016

ผลลัพธ์ของผู้ป่วยฉุกเฉินที่ได้รับการเคลื่อนย้ายโดยบริการอากาศยานพยาบาลสาธารณะของประเทศไทย

เรืออากาศเอกอัจฉริยะ แพงมา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
สาขาวิชาสาธารณสุขศาสตร์
วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2559

Thesis Title	The outcome of emergency patient transported by Public air ambulance service in Thailand
By	Flight Lieutenant Atchariya Pangma
Field of Study	Public Health
Thesis Advisor	Professor Surasak Taneepanichskul

Accepted by the College of Public Health Sciences, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the College of Public Health Sciences

(Professor Sathirakorn Pongpanich)

THESIS COMMITTEE

.....Chairman

(Associate Professor Ratana Somrongthong)

.....Thesis Advisor

(Professor Surasak Taneepanichskul)

.....Examiner

(Nanta Auamkul)

อัจฉริยะ แพงมา : ผลลัพธ์ของผู้ป่วยฉุกเฉินที่ได้รับการเคลื่อนย้ายโดยบริการอากาศยานพยาบาลสาธารณะของประเทศไทย (The outcome of emergency patient transported by Public air ambulance service in Thailand) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ศ. นพ.สุรศักดิ์ ฐานีพานิชสกุล, 92 หน้า.

บทคัดย่อ

พื้นหลัง: ในประเทศไทยระบบบริการแพทย์ฉุกฉินในพื้นที่ชนบทและห่างไกลยังขาดแคลนอยู่มาก โอกาสในการเข้าถึงบริการของผู้ป่วยฉุกเฉินยังมีน้อย บริการอากาศยานพยาบาลสาธารณะของประเทศไทยได้เกิดขึ้นจากแนวนโยบายของสถาบันการแพทย์ฉุกเฉินแห่งชาติในการเพิ่มโอกาสการเข้าถึงบริการให้กับผู้ป่วยฉุกเฉินที่มีความจำเป็นเร่งด่วนในการเคลื่อนย้ายจากพื้นที่ห่างไกลไปยังหน่วยบริการขั้นสูงกว่าด้วยอากาศยาน อย่างไรก็ตามยังพบว่ายังขาดการศึกษาถึงลักษณะการบริการและงานวิจัยนี้ได้จัดทำขึ้นเพื่อศึกษาลักษณะและผลลัพธ์ของการบริการอากาศยานพยาบาลสาธารณะของประเทศไทย

วิธีวิจัย: วิจัยนี้ได้ศึกษาผลลัพธ์ของการบริการอากาศยานพยาบาลสาธารณะของประเทศไทยเชิงพรรณาโดยวิธีผสม ผู้ป่วยทุกรายได้รับการคัดเลือกเข้าสู่การวิจัยจากข้อมูลทุติยภูมิของ สพฉ.(N=205) ข้อมูลปฐมภูมิมาจากการสัมภาษณ์บุคลากรที่เกี่ยวข้องกับระบบนี้โดยมาจาก สพฉ.(N=3),ศูนย์1669 ระดับพื้นที่ (N=1) แพทย์อำนวยการบิน (N=3) ทีมลำเลียงทางอากาศ (N=6).Mean, Median, SD.ใช้สำหรับข้อมูลเชิงบรรยายและ Fisher's Exact test ใช้ในการทดสอบปัจจัยที่เกี่ยวข้องกับผลลัพธ์หลังการเคลื่อนย้าย 1 และ 3 วัน

ผลการศึกษา: พบว่าจาก 205 ครั้งของการร้องขอใช้บริการอากาศยานพยาบาลสาธารณะของประเทศไทย มีผู้ป่วย 184 รายได้รับการเคลื่อนย้าย อีก 33 รายไม่ได้รับการเคลื่อนย้ายเนื่องจากขาดอากาศยาน สภาพอากาศ และผู้ป่วยเสียชีวิตก่อนเคลื่อนย้าย. จากลักษณะของบริการอากาศยานพยาบาลสาธารณะของไทยและปัจจัยเกี่ยวข้องกับผลลัพธ์หลังการเคลื่อนย้ายผู้ป่วย 1 และ 3 วันพบว่า เพศ อายุ กลุ่มโรค ระดับความรุนแรง ทีมแพทย์ ระยะเวลาตอบสนอง และระยะเวลาเดินทางไม่เป็นปัจจัยเกี่ยวข้องกับผลลัพธ์ 1 วันหลังเคลื่อนย้าย นอกจากนี้ยังพบว่าเพศ อายุ กลุ่มโรค ทีมแพทย์ ระยะเวลาตอบสนอง และระยะเวลาเดินทางไม่เป็นปัจจัยเกี่ยวข้องกับผลลัพธ์ 3 วันหลังเคลื่อนย้าย แต่ระดับความรุนแรงเป็นปัจจัยเกี่ยวข้องกับผลลัพธ์ 3 วันหลังการเคลื่อนย้ายที่ระดับสถิติ .05 (p=.033)

บทสรุป: ประเทศไทยมีการพัฒนานโยบายการบริการอากาศยานพยาบาลสาธารณะที่ได้รับการยอมรับจากสาธารณะ ระดับความรุนแรงของผู้ป่วยก่อนการเคลื่อนย้ายเป็นปัจจัยเกี่ยวข้องกับผลลัพธ์ของผู้ป่วย 3 วันหลังเคลื่อนย้าย การศึกษาเพิ่มเติมมีความจำเป็นและสำคัญต่อการช่วยเพิ่มผลลัพธ์ที่ดียิ่งขึ้นและเป็นประโยชน์ต่อการพัฒนาระบบบริการอากาศยานพยาบาลสาธารณะ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....

ปีการศึกษา 2559 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

5778834053 : MAJOR PUBLIC HEALTH
KEYWORDS: AIR AMBULANCE SERVICE / AEROMEDICAL TRANSPORT / EMERGENCY MEDICAL SERVICE / THAI SKY DOCTOR SERVICE / THAILAND

ATCHARIYA PANGMA: The outcome of emergency patient transported by Public air ambulance service in Thailand. ADVISOR: PROF. DR.SURASAK TANEEPANICHSKUL, 92 pp.

Abstract

Background: Public EMS in Thailand was established for many years ago with ground transportation. Aeromedical transport was started for military mission and Private air ambulance service was established for private insurance and pay service. Thai sky doctor service was start since 2010 by initiative idea of former Secretary-General NIEM, Dr.chatree charoenchiwakul and his team. Collaboration under MOU is tools for development of this project. More than 1 million EMS case per year were transported by ground ambulance but only 205 missions were request for pubic air ambulance service in Thailand.

Methods: A Descriptive Cross Sectional study using Mixed method was used to study the outcome of emergency patient transported by Public air ambulance service (Thai sky doctor service) in Thailand. Purposive selective for quantitative data use secondary data of all patient record from NIEM (N= 205) Qualitative data use primary data from staff who associated with Thai sky doctor service system ; National 1669 Dispatch center (N=3) ,Regional 1669 Dispatch center (N=1), Flight medical director (N=3) , Flight medical team (N=6). Percentage, Mean, median, SD were used for descriptive data and Fisher's Exact test were used for explore the factors associated with 1 day and 3 days outcome.

Results: The results showed that 205 missions were request for pubic air ambulance service in Thailand. 184 cases were transported and 33 cases were not transport due to lack of aircraft, weather condition and patients was dead before transport. There were identified characteristic of Thai sky doctor service and factors associated with 1 and 3 day outcome post air transportation. Gender, age, disease group, patient severity, medical team, response time and transport time were not associated with 1day outcome. Gender, age, disease group, medical team, response time and transport time were not associated with 3 days outcome. While patient severity was significant difference associated with 3 days outcome at the .05 statistical level (p = .033).

Conclusion: Thailand has developing public air ambulance service policy with good public concern. Patient severity before air transport are associated with delayed 3 days outcome. Further study may need to improve patient outcome and support public air ambulance service development.

Field of Study: Public Health Student's Signature .....

Academic Year: 2016 Advisor's Signature .....

ACKNOWLEDGEMENTS

I am grateful for everyone who has been there to support throughout my journey towards the finished thesis. I am indebted to and grateful for the following persons and would like to express my highest thanks to Prof. Surasak Taneepanichskul,MD ,Assoc. Prof. Ratana Somrongthong, Ph.D., Nanta Auamkul,MD. for offering through and excellent feedback on an earlier version of this thesis. I would also like to thank Ms.Tharathorn Benjaroon, Mrs.Jirawadee Thepkasetkul, Ms.Suchada wonsawat and all CPHS academic staff who support me anytime. I also would like to express my deepest thanks to Dr.Chatree Chareonchiwakul , (Former Secretary General of NIEM) , Ms. Nayada Puakhum,(The Thai sky doctor Project manager), all sky doctor related organization and related person who initiate and support to have this system for emergency patient in Thailand.

CONTENTS

Page

Page

CHAPTER 1

INTRODUCTION

1.1 Background & Rational

In Thailand, There are more than 4 millions of emergency patients per year. In the past, all are they come to hospital by family, witness and almost all transported by car. Emergency Medical service system in Thailand has been established more than 50 year ago but official establishment was in 2008 by Emergency Medical Acts BE.2551. The emergency medical call center is Narenthorn center and use emergency phone number 1669 for free public access. The number of emergency patient that utilized EMS system are increasing year by year and there have 1.2 million cases in 2013.

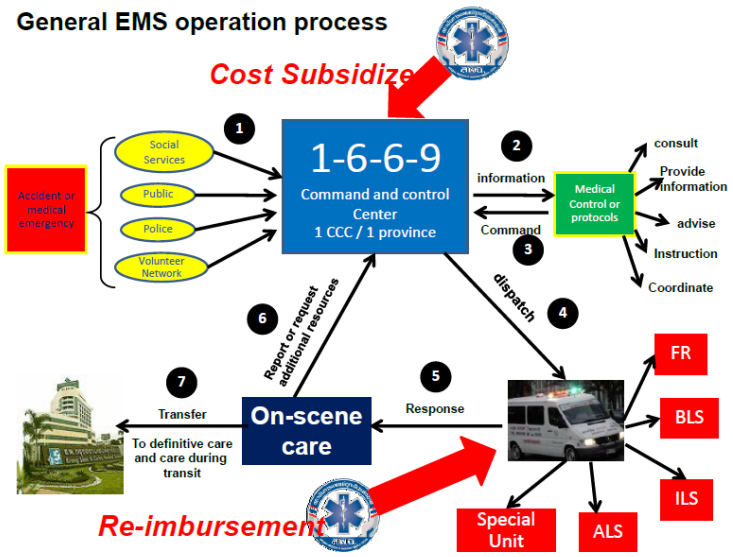


Figure 1 Emergency medical service operation in Thailand

(From National Institute for Emergency Medicine, Thailand)

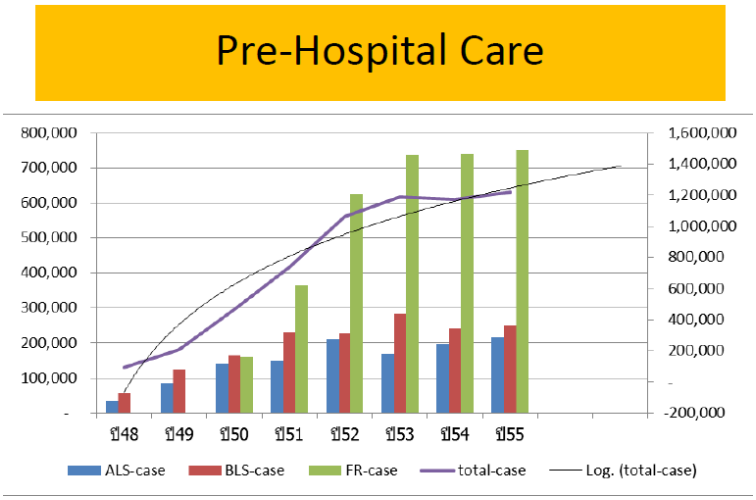


Figure 2 Number of emergency case from year 2007 to 2013[1]

(From National Institute for Emergency Medicine, Thailand)

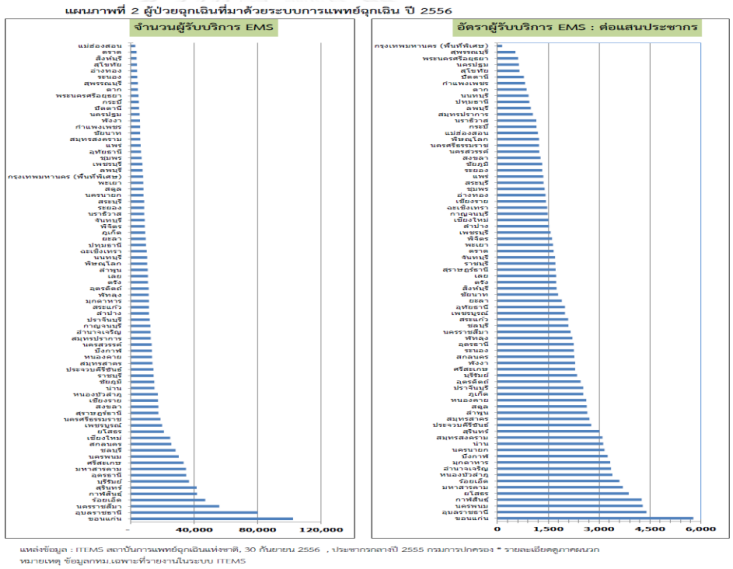


Figure 3 Number of emergency case by provincial of Thailand year 2013[1]

(From National Institute for Emergency Medicine, Thailand)

In remote area of Thailand , there are insufficiency of EMS service and emergency patients are less accessibility to public EMS. When they need to transfer to higher facility it may take longer time more than the golden period of specific disease such as acute ischemic stroke that need to be reach medication within 4.5 hrs. if those emergency patients live in remote area such as Maehongson Province,

northern of Thailand will cause fatality and morbidity because limitation of specialist and medical facility .

The policy that initiate by National Institute for Emergency Medicine to improve accessibility of emergency patient who need to transfer by aeromedical service in rural and remote area of Thailand. This need was come from problem stream and requested from Mae Hong Son provincial public health office.

Aeromedical Transport service in Thailand has been started by military mission more than 60 years. The civil aeromedical transport service in Thailand were operated recently by Public and Private organization that included hospital base service provider and none hospital base provider.

Private air ambulance service were operated by private hospitals and assistance companies, those are paid service. Bangkok hospital (BDMS) is one of the first hospital in Thailand who serve private patients and serve patients those covered by insurance. Many private hospitals also setup this service for their patients too. The BDMS Sky ICU is a name of the first dedicated Helicopter Emergency Medical service (HEMS) in Thailand that started for private service since 2007. This service operated by Bangkok Helicopter services company, Bangkok Hospital under name of Bangkok Dusit Medical Service (Public company), BDMS.

Public air ambulance service or name as “Thai Sky Doctor Service” has been established under the initiative idea of Dr.Chatree Chareonchevakul, The first Secretary- General of National Institute for Emergency Medicine.[2] His idea come from The Her Royal Princess Sirinthorn words when she give advise to high official

level of government about helicopter medical service after senior doctor who had cardiac arrest during follow The HR Princess activity at Khonkean Province. This patient was survived and returned to normal life after emergency medical team resuscitate and transport him by police helicopter to Khonkean Provincial Hospital for advance care within an hour. The Princess said how it could be use this kind of helicopter emergency medical service for Thai citizen when they got severe illness.

Aeromedical collaboration policy is a policy of choice that initiated by Dr.Chatree , The collaboration made by National Institute for Emergency Medicine (NIEM) through Ministry of Public Health (MOPH), National Health Security Office (NSHO), Ministry of Defense (MOD) included Royal Thai Army(RTA), Royal Thai Air force(RTAF), Royal Thai Navy (RTN), Royal Thai police(RTP), Ministry of Agriculture (MOA) , Ministry of National Resource and Environment (MONRE), Bangkok Dusit Medical services Company(BDMS) and Kan air has been developed from NIEM initiative.[2] The purpose of public air ambulance service (Thai sky doctor Service, TSDS) initially use for transport emergency patients from rural and remote area of Thailand to higher medical facilities.

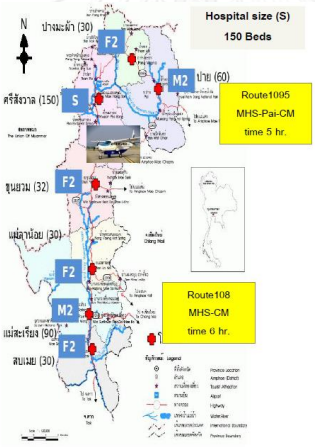
Value of collaboration[3]

Collaboration means the importance, worth, or usefulness of action of working with someone to produce something.[4] The value of collaboration is work together of multi aeromedical transport service agencies for better life of emergency patients in rural area of Thailand.

Figure 5 The Picture of Aeromedical collaboration

There are so many rural or remote area of Thailand that may need air ambulance service but Meahongson , Northern region of Thailand was the first area selected for this policy implementation.

MaeHongson Province is located at Northern part of Thailand, on the north-western border. Mae Hongson is the most mountainous province in Thailand and occupies 13,814 square kilometers (5,334 square miles). The province is subdivided in seven districts and total populations are 248,178 by year 2014. The transportation from Chiangmai to Maehongson take time 5-6 hours by car with more than 1,800 curved along the route. The alternative choice of travel is an hour by airplane. Many of severe illness patients are death before or during transportation to higher facility in Chiangmai Province or another region.



specialist	No.
Gen. Sx	2
Ortho	2
Anes.	1
Radio.	0
Medicine	2
Ped	3
OB-GYN	3
Opthalmo.	2
Intern GP	10

Figure Map of Thailand , Mae Hong Son Province

Thai Sky doctor service Policy Implementation in Thailand.

Mae Hong Son province was the selected area to be the first implementation. The process of implementation will be follow;

1) Negotiate visit and meeting all aircraft provider , finance agency and medical care provider. NIEM is an initiative organization to invite, facilitate and negotiate with these agencies join the collaboration project.

2) Make MOU with all national level agencies.

Ministry of Public Health (MOPH), National Institute for Emergency Medicine (NIEM) ,National Health Security office (NHSO), Ministry of Defense (RTA,RTAF,RTN,RTP) , Ministry of Finance ,BDMS, Kan Air, etc.

3) Meeting with operation level of all agencies

After MOU done, NIEM set meeting with all agencies to make national protocols and Operational procedure guideline, financial system.

4) meeting with local operator

When national level agencies were established MOU it need to clarify about operational process to local aircraft operator, medical team and all participants

5) Prepare 1669 communication center

Operational process for aeromedical transport service need to activate by 1669 Provincial communication center and Narenthorn National communication center (NIEM).

6) Prepare Medical team,

Medical team at provincial area also trained before mission start. NIEM make collaboration with Institute of Aviation Medicine of Royal Thai Air force (IAMRTAF) set up training course for medical team and NIEM make actual drill at provincial area. The first Basic aeromedical evacuation course (BAME) was started at Institute of Aviation Medicine, RTAF in 2010 and NIEM first actual drill training at Mae Hong Son province was set up in August 2010.

7) Prepare medical equipment onboard :

There are some special equipment for patient care onboard such as transport ventilator, transport monitors which are need to prepare for this service. Medical team also need to train for these equipment.

8) Launch the service

When all concerned part of service were ready, the first service has been started at Mae Hong Son province in October, 2010 and after that many cases has been transport by public air ambulance service.

9) Monitor and evaluation

After launch the service, NIEM was monitor and evaluate the policy.

Since Thai Sky Doctor Service project has been launch in 2010 until 31 Dec. 2015. There were 205 requests and 217 patients were involved. Research gap was there has very few study about Public air ambulance service in Thailand. The first study by Tadadej J. is Model and policy recommendation for Thailand's Aeromedical service.[5] Result of the study found that within the Emergency Medical Act of B.E. 2551(2008), NIEM is the main driving organization formulated aero medical emergency policy for civilian via air medical patient transferring plan or Sky Doctor Project by means of assembled parts outsourced materialization such as aircrafts, flight personnel and medical supplies from collaborators, established by memorandum of understanding (MOU) intend to provide medical airlift participation. It is considered as the distinguish usable Assembly Parts Model; moreover, researcher gathered the essential problems from utilization and consideration introduce the aero emergency medical policy recommendation to NIEM so that all levels can access to the healthcare increasingly, equitably, efficiently and sustainably. After the Thai Sky doctor service implemented there is no more study about provision of this

service. This study intent to study characteristic and outcome of Public air ambulance service (Thai sky Doctor service) in Thailand. Mae Hong Son province and nearby provincial in Northern region of Thailand are the first and most active area of this service. Many regions in rural or remote area of Thailand also developing to start Thai Sky Doctor Service in their region but still has limit number of patient transport.

1.2 Research Questions

1) What is the characteristic of Public air ambulance service in Thailand (Thai sky doctor service) ?

2) What are the 1 day and 3 days outcome of emergency patients that transported by Public air ambulance service (Thai sky doctor service) in Thailand ?

3) What are the factors associated with 1 day and 3 days outcome?

1.3 **Hypothesis :**

1.3.1 Gender, age, disease group, patient condition before transport, medical team, response time, transport time associated with immediate 1 day post air transport outcome.

1.3.2 Gender, age, disease group, patient condition before transport, medical team, response time, transport time associated with delayed 3 days post air transport outcome.

1.4 Research Objectives

1.4.1 General Objectives

To describe outcome of emergency patient transported by Public air ambulance service (Thai sky doctor service) in Thailand

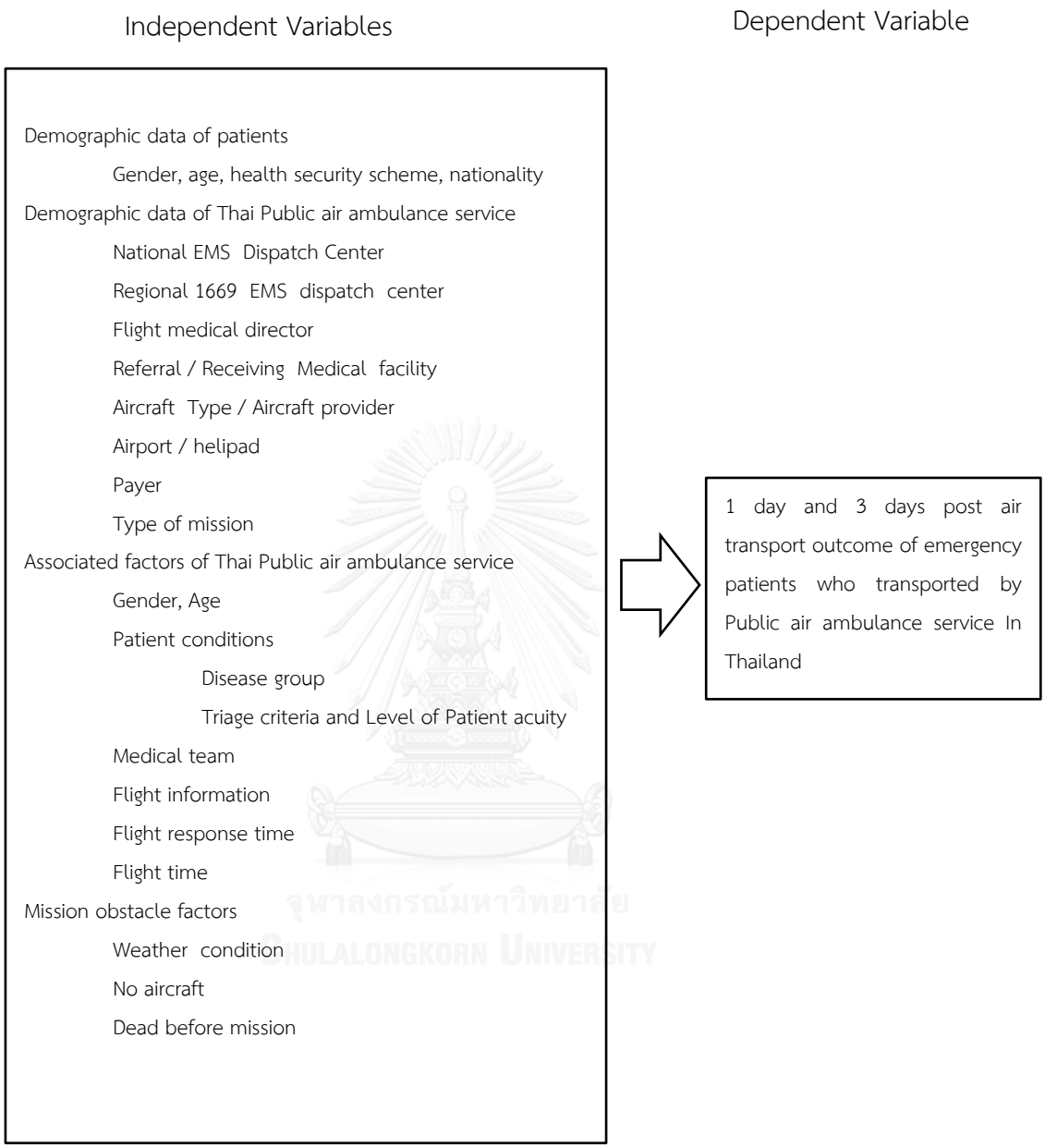
1.4.2 Specific Objectives :

1) To describe general characteristics of Public air ambulance service (Thai sky doctor service)

2) To describe immediate 1 day and delayed 3 days post air transport outcome of emergency patients transported by Public air ambulance service (Thai sky doctor service) in Thailand.

3) To identify the factors associated with 1 day and 3 day outcome.

1.5 Conceptual Framework



1.6 Operational Definitions

Emergency Medical service (EMS)

Emergency medical service is a part of health service. Modern EMS is considered to have started with Jean Dominique Larrey, Napoleon's chief physician, who organized a system to treat and transport injured French soldiers. Emergency medical service are developing in many difference regions of the world follow the concept of modern EMS.

National Institute for Emergency Medicine (NIEM)

The National Institute for Emergency Medicine (NIEM) is a Thai government organization. NIEM was established by the Emergency Medical Act of B.E. 2551 (2008). Its roles and responsibilities are to administrate, manage and develop emergency medicine in Thailand under The Emergency Medical Committee (EMC) policies.

Emergency Medical Committee (EMC)

Emergency Medical Committee (EMC) is a group of people who assigned by The national Emergency Act of B.E.2551 (2008) to regulate EMS system in Thailand. The Minister of MOPH is a chairman of EMC. Member of EMC are from Permanent Secretary General of MOPH, Permanent Secretary General of MOF, Secretary General of NHSO, Secretary General of Social Security Office, Representative of Medical council, Representative of Nursing and Midwifery Council, Representative of Public hospital, Representative of Private hospital, Representative of None Government organization, Representative of local organization, and Experts.

Thai sky doctor service system (TSDS)

Thai sky doctor service system (TSDS) is Public air ambulance service in Thailand that initiate from idea of the Former Secretary General of NIEM. TSDS was work under MOU between multi agencies from Aircraft providers, Medical team and

equipment from hospital base, Referral hospital and ground support and funded by Emergency Medical Service (EMS) Fund and National Health Service (NHS) fund.

Aeromedical Mission

Aeromedical Mission is mission of patients transported by airplane can divide in to 2 categories as :

Primary Mission is mission transported by Helicopter from scene or Prehospital situation to Hospital. This mission may call Helicopter Emergency Medical Service (HEMS)

Secondary Mission is mission of patients transported by fixed wing airplane or Helicopter from hospital to hospital. This mission may call interfacility transfer

Aircraft provider

In this study means aircraft provider that made collaboration with Thai Sky Doctor Service System included RTA, RTN, RTAF, RTN, RTP, MOA, MONRE, BDMS, KAN.

EMS Dispatch Center

EMS dispatch center in Thailand has 1 National level for air ambulance dispatch center and 80 provincial or regional dispatch center for ground and air ambulance dispatch.

Criteria Based Dispatch (CBD)

Thailand EMS use Criteria Based Dispatch to identify 25 groups of symptoms and each group can be triage patient condition or severity of patient by phone call before assign proper medical facilities to the patients.

Triage and Level of patient acuity

Triage and level of patient acuity scale are evaluation tools for evaluate patient condition before treatment and transportation. Currently 5 levels of

triage and patient acuity are more accepted to categorized how serious of patient condition.

Thai sky doctor service dispatch criteria

Dispatch criteria for Thai Public air ambulance service are for patients who triage as resuscitative and emergent level.

Outcome

In this study, outcome means result of patient condition (Admit, Dead and Discharge) after transported by Public air ambulance at 1 and 3 days. 1 day outcome represent immediate outcome post air transportation, 3 days outcome represent delayed outcome post air transportation. Regarding to this study is retrospective study from NIEM secondary data, researcher want to observe the outcome from NIEM data record.

Flight information

Response time mean time from first recognition of request to time was aircraft arrived the patient.

Transport time mean response time plus flight time per one way.

Health region

In Thailand, MOPH design health region into 13 regions from 77 provinces,

Health region 1 included 8 provinces; Chiangmai, Chiangrai, Nan, Payao, Phrae, Maehongson, Lampang, Lampun

Health region 2 included 5 provinces; Pitsanulok, Tak, Petchabun, Sukhotai,Utharadis

Health region 3 included 5 provinces; Nakornsawan, Kampeangpetch, Chainat, Pichit,Uthaitani

Health region 4 included 8 provinces; Nonthaburi, Nakornnayok, Pathumtani, Ayutaya, Lopburi, Saraburi, Singhaburi, Angthong

Health region 5 included 8 provinces; Ratchaburi, Kanchanaburi, Nakornpathom, Petchburi, Prachuabkirikan,Samutsongkram, Samutsakorn, Supanburi

Health region 6 included 8 provinces; Chonburi, Chantaburi, Chacheangsoa, Trad, Prachinburi, Rayong, Sakeaw, Samutprakan

Health region 7 included 4 provinces; Khonkean, Kalasin, Mahasarakam, Roiet

Health region 8 included 7 provinces; Udorntani, Nakornpanom, Beungkan, Loei, Sakonnakorn, Nongkai, Nongbualampu

Health region 9 included 4 provinces; Nakornratchasima, Chaiyapum, Buriram, Surin

Health region 10 included 5 provinces; Ubonratchatani, Srisaket, Yasothorn, Amnatchareon, Mukdahan

Health region 11 included 7 provinces; Surattani, Krabi, Chumporn, Pangnga,Phuket, Ranong, Nakornsithammarat

Health region 12 included 7 provinces; Songkla,Trang, Narathiwas, Pattani, Patalung,Yala, Satun

Health region 13 included; Bangkok Metropolitan

CHAPTER 2
LITERATURE REVIEW

2.1 Policy Making Model

There are so many models that can be used for policies making. Kingdon's model is one of the theory that explained agenda setting for aeromedical service policy in Thailand. This policy is an innovation policy from initiative idea of Dr.Chatree Chareonchivakul, the former Secretary-General of National Institute of Emergency Medicine (NIEM) and his team. The policy started since 2010.

For policy making model, Kingdon's multiple streams model (modification of Cohen, March,and Olsen's garbage can model of organizational choice) is a popular theoretical perspective used to explain the dynamic and complex agenda-setting process. Indeed, Kingdon's model has been used to guide policy research across a wide range of policy domains and institutional settings and has shown promise in explaining educational agenda setting in the U.S. and other countries. Kingdon's model of policy making is based on a metaphor of three process streams: problems, policies, and processes. The streams primarily develop and operate independently, but they can become coupled at critical junctures, a circumstance that dramatically enhances the likelihood of an issue being placed on the government's decision agenda.[6]

The problem stream involves the process of problem recognition. According to Kingdon, societal conditions capture the government's attention and are deemed problems by way of systematic indicators, dramatic focusing events, or negative feedback from existing policies. Indicators assess the magnitude of the condition. When conditions are bad enough or circumstances have changed significantly, policy decision makers see the condition as a problem. Crises or disasters, popularization of powerful symbols, or the personal experiences of government officials are focusing

events that capture the attention of the policy makers. Finally, the feedback that officials receive from constituents or program evaluators can bring issues to the attention of the government.

Operating concurrently, the political stream also explains the relative prominence of issues on official agenda. Like the problem stream, there are primarily three mechanisms in the political stream: swings of national mood, the balance of organized political forces, and events within government itself. A swing of national mood reflects the political climate or the presence of a broad social movement. Policy decision makers' sense of the national mood can lead to the promotion or downgrading of an issue's prominence on the policy agenda. Government decision makers' perception of the level of support, or opposition from organized political forces, can also influence the relative prominence of an issue. Lastly, the political stream is characterized by events within the government such as turnover in key personnel or shifts in the jurisdictional boundaries, changes that can facilitate or hinder the prominence of a policy issue. While both the problem and political streams concern agenda setting, the policy stream addresses alternative specification: the generation and specification of policy solutions to problems by members of the policy community. Policy communities include policy actors inside and outside of the government who interact with each other, exchange ideas, and formulate and reformulate policy alternatives. Individuals who actively invest resources to advocate particular proposals or prominence of an idea are policy entrepreneurs. As policy entrepreneurs build acceptance for their proposals, they soften up both the policy community and larger publics (and improve the receptiveness to their ideas) by introducing bills, making speeches, amending proposals, and issuing studies and reports. Kingdon conceptualizes each of the three streams as following its own rules and dynamics. Yet at critical moments a policy window briefly opens in the problem or political streams, and policy entrepreneurs couple their solutions to the problem

or take advantage of the political climate and bring about the convergence of all three streams, which brings an issue to the top of agenda for authoritative action by governmental officials.

The application of Kingdon's multiple stream model for agenda setting is to use aeromedical service for improve accessibility of emergency patient in remote area of Thailand.

2.2 Emergency Medical Service (EMS)

Emergency medical service is a part of health service. Modern EMS is considered to have started with Jean Dominique Larrey, Napoleon's chief physician, who organized a system to treat and transport injured French soldiers. Emergency medical service are developing in many difference regions of the world follow the concept of modern EMS.

2.2.1 In USA [7], During the Civil War, the Union Army developed an organized system to evacuate soldiers from the field. Lessons learned during the Civil War were applied as civilian EMS systems formed during the late 1800s. By 1960, a patchwork of unregulated systems had developed, with services sometimes being provided by hospitals, fire departments, volunteer groups, or undertakers. Physicians staffed some ambulances, while others had minimally trained or untrained personnel. Despite the major expansion in health care facilities and the emphasis on medical specialization after The 2nd World War, the EMS system had not received much attention or innovation.

Despite the lack of uniform federal legislation, regulations, or standards, and despite the absence of legislation, regulations and standards in most states and cities, EMS was developing and providing care to patients. Most advances had occurred through interest by local physicians, hospitals, firefighters, government officials, or entrepreneurs. The result was a disorganized system of variable and sometimes poor quality care. In 1960, only 6 states had standard courses for

rescuers, only 4 states regulated ambulance design specifications, and fewer than half of all EMS personnel had received even minimal training (e.g., American Red Cross first aid). A survey of 900 cities in 1965 found that only 23% regulated EMS service, and only 8% reported advanced EMS medical training, such as the American Red Cross advanced first aid course. During 1965 and 1966, a convergence of political and medical actions focused the national interest on motor vehicle crashes.

In 1965, President Johnson, continuing Kennedy's interest in motor vehicle crashes, created the President's Commission on Highway Safety. The Commission's report identified the great public health burden of motor vehicle crashes and stated that a coordinated national highway safety program should be a major priority. In particular, the Commission felt that the timeliness and adequacy of care of the injured patient were critical. President Johnson announced his intention to discuss highway safety in his State of the Union address and transportation message in 1966. Simultaneously, a report released in 1966 by the National Academy of Sciences–National Research Council was extremely critical of the emergency care system.

This comprehensive report, titled "Accidental Death and Disability: The Neglected Disease of Modern Society," documented the absence of quality emergency care. Some EMS-related inadequacies included: (1) no treatment protocols; (2) few trained medical personnel; (3) inefficient transportation; (4) lack of modern communications and equipment; (5) the abdication of responsibility by political authorities; and (6) the lack of research evaluating prehospital care.[8]

The recommendations of both reports were incorporated into the Highway Safety Act of 1966. The law established the cabinet-level Department of Transportation to accelerate highway traffic safety programs and improve EMS. The Act specifically provided for federal involvement to improve EMS plans, ambulance specifications, equipment standards, communications, educational requirements, staffing, and other aspects of caring for medical emergencies. Additionally, the Act

allowed for penalties in the event of states' failure to follow the provisions regarding EMS. The legislation reflected some of the prevalent themes of the 1960s, which had also been seen in the Regional Medical Programs (RMP).

First, the Department of Transportation was to accomplish its EMS goals primarily through a combination of demonstration projects and matching grants. This allowed different regions to experiment with different types of EMS systems. It also made it unnecessary to create categorical federal programs that would expand the federal government and require continual funding. Second, the EMS system being developed was to be technologically advanced, with significant attention to using new technology, such as radio communication and telemetry, that would allow EMS to operate over large regions. Technologically intensive medical equipment, promoted by medical leaders, would soon follow.

Finally, the EMS system was supposed to improve the transportation of patients to specialty medical centers, providing advanced care to all patients in a region and supporting the regionalization of health care encouraged by the Regional Medical Programs (RMP). The assignment of EMS responsibility to the Department of Transportation, as opposed to the Department of Health, Education, and Welfare, reflected the view that EMS was primarily a transportation service and not a medical service. For example, during the Highway Safety Act deliberations, the need for EMS was framed as a need to "concentrate on improvement in methods of communication and transportation as well as the need for improved equipment and trained personnel." Medical equipment and staff were secondary to communications and transport. Additionally, in the 1969 Highway Safety Program manual from the Department of Transportation, the only emergency care described was first aid as taught in the American Red Cross program "First Aid on the Highways," despite the existence of more advanced prehospital treatments. Although the government viewed EMS as a transportation service, medical and community leaders had begun

to alter their view of the EMS system. Medical advances of the 1960s, combined with innovative EMS programs to deploy advanced medical technologies throughout the community, convinced people that the EMS system could provide medical services.

Additionally, the return of military trained medics from Vietnam, with both prehospital training and experience, provided a cadre of individuals able to apply the skills they had mastered to civilian EMS systems. The 1960s were a time of rapid improvement in emergency care. During that decade, the importance of cardiopulmonary resuscitation, defibrillation, cardioversion, and new pharmaceutical therapies was demonstrated. The American Heart Association and the American Red Cross accepted these techniques and began to train health care providers, although EMS providers were initially excluded. Advances in trauma care also occurred, Including the development of specialty trauma centers, such as the University of Maryland's Shock Trauma Center. Techniques that had reduced the mortality of injured soldiers reaching medical facilities began to be applied to civilian trauma patients. As a result, physicians and politicians began to treat traumatic deaths as an abnormality, not an inevitable event. In fact, R. Adams Cowley, a leader in trauma and critical care, estimated that a quality emergency health system could cut the accident death rate by 50%. Many of these newest technologies were being applied by EMS with immediate, quantifiable benefits. Of particular note was the development of the mobile cardiac care unit by Pantridge in Ireland. The initial results of this program showed that, of 10 cardiac arrest patients, all had ventricular fibrillation, all were resuscitated, and 5 were discharged home. These outcomes had never been achieved previously (and have never been achieved since).34 Similar models were created in the United States. In Columbus, Ohio, a physician based "Heart mobile" was created. In 1968, the Seattle Fire Department received a grant from the Washington/Alaska RMP to develop a mobile coronary care unit, "Medic 1." Despite the lack of a standardized national curriculum, this program trained

“paramedics” to intubate, place intravenous lines, and identify cardiac rhythms. It showed that paramedics could treat cardiac arrest and the importance of getting a health care provider to the patient as quickly as possible, usually within minutes. These successful programs reinforced the need for a technologically advanced EMS system that could provide care within minutes. During the 1960s, public health once again began to receive significant interest. There had been interest in improving public health during the 1930s and 1940s, as shown by comments in the Committee on the Costs of Medical Care report, the development of the New Deal programs, the passage of the Social Security Act of 1935, and wartime health measures. However, that interest had waned during the 1950s, when health department budgets were reduced and individuals advocating public health services ran the risk of being attacked as a “Communist.” During the late 1950s,1960s, and early 1970s, the confluence of conditions, including social activism and actions by leaders such as William Haddon, Jr; Ralph Nader; Robert Kennedy; and Daniel Patrick Moynihan, led to the increase in public health interest, legislation, and funding. This new interest followed a more medical model, in many ways paralleling infection control. Rather than the traditional behavioral intervention model, public health interventions for injury control began to include identifying causative agents, mitigating the agents and the activity of the agents, and improving emergency, definitive, and rehabilitative care.

2.2.2 In ASEAN

From International perspective**,** In ASEAN socio-cultural community blueprint[9] address that

1. The ASEAN Leaders adopted the Declaration of ASEAN Concord II (Bali Concord II) in Bali, Indonesia on 7 October 2003 to establish an ASEAN Community by 2020. The ASEAN Community shall be established comprising three pillars, namely political and security community, economic community, and socio-cultural

community that are closely intertwined and mutually reinforcing for the purpose of ensuring durable peace, stability, and shared prosperity in the region.

2. At the 12th ASEAN Summit on 13th January 2007 in Cebu, the Philippines the Leaders, affirming their strong commitment to accelerate the establishment of the ASEAN Community by 2015, signed the Cebu Declaration on the Acceleration of an ASEAN Community by 2015.

3. The 13th ASEAN Summit held in Singapore on 20th November 2007, agreed to develop an ASCC Blueprint to ensure that concrete actions are undertaken to promote the establishment of an ASEAN Socio-Cultural Community (ASCC).

4. The primary goal of the ASCC is to contribute to realising an ASEAN Community that is people-centered and socially responsible with a view to achieving enduring solidarity and unity among the nations and peoples of ASEAN by forging a common identity and building a caring and sharing society which is inclusive and harmonious where the well-being, livelihood, and welfare of the peoples are enhanced.

5. The ASCC will address the region's aspiration to lift the quality of life of its peoples through cooperative activities that are people-oriented and environmentally friendly geared towards the promotion of sustainable development. The ASCC shall contribute to building a strong foundation for greater understanding, good neighborliness, and a shared sense of responsibility.

6. The ASCC is characterized by a culture of regional resilience, adherence to agreed principles, spirit of cooperation, collective responsibility, to promote human and social development, respect for fundamental freedoms, gender equality, the promotion and protection of human rights and the promotion of social justice.

7. The ASCC shall respect the different cultures, languages, and religions of the peoples of ASEAN emphasis their common values in the spirit of unity in diversity and adapt them to present realities, opportunities and challenges.

8. The ASCC will also focus on the social dimension of Narrowing the Development Gap (NDG) towards bridging the development gap among Member States.

9. Based on the above, the ASCC envisages the following characteristics: (a) Human Development; (b) Social Welfare and Protection; (c) Social Justice and Rights; (d) Ensuring Environmental Sustainability (e) Building the ASEAN Identity; and (f) Narrowing the Development Gap.

In Blueprint Chapter B.4 said Access to healthcare and promotion of healthy lifestyles *Strategic objective are* Ensure access to adequate and affordable healthcare, medical services and medicine, and promote healthy lifestyles for the peoples of ASEAN. And B.7 said Building disaster-resilient nations and safer communities *Strategic objective are* Strengthen effective mechanisms and capabilities to prevent and reduce disaster losses in lives, and in social, economic, and environmental assets of ASEAN Member States and to jointly respond to disaster emergencies through concerted national efforts and intensified regional and international cooperation.

2.2.3 In Thailand

Thailand Emergency Medical Service (EMS) was set up on the 6th of April 1893 by "The Red Unalom Society of Siam", now being the Thai Red Cross Society, in response to the many casualties suffered during a French-Siamese territorial dispute on the left bank of the Mekong river. The service was set up to help relieve the suffering of those injured. The service was not originally intended for civilians and was only implemented in times of war.

In 1989 the Department of Medical Services allocated a budget for the Ministry of Public Health to build the EMS building at Rajavithi Hospital. The building

was designated as the EMS center for training and administration in Thailand. In 1994 Vajira Hospital, BMA began providing emergency ambulances services under the acronym SMART (Surgico-Medical Ambulance and Rescue Team).

Thailand emergency medical care developed further in 1993 when the Japan International Cooperation Agency (JICA) provided technical assistance to the Ministry of Public Health in order to establish the Trauma Center at Khonkean hospital.

In 1995 The Ministry of Public Health launched nationwide emergency medical care service with the "Narenthorn Emergency Medical Center" at Rajavithi Hospital as its predominant practitioner. Other practitioners in the emergency medical care network included the Nopparat Rajathanee and Lerdsin Hospitals.

In 1996, along with the establishment of Public Health Education and EMT training curriculum for the Public Health Certificate, the Office of Emergency Medical Systems was established under jurisdiction of the Permanent Secretary for Public Health. Since the office's establishment, the Emergency Medical System has continued to expand nationally.

"The National Institute for Emergency Medicine" (NIEM) was established as a result of the Emergency Medical Act of B.E. 2551 (2008). Its duties are to administrate, manage and develop emergency medicine in Thailand. The service has gained considerable recognition.[1]

Figure 6 Logo of National Institute for Emergency Medicine

NIEM structural and Functional

The structure of the Emergency Medical System Mechanism, approved by the Emergency Medical Committee on 28 October B.E. 2553 (2012) is divided into 3 following levels:

1). Structure of mechanism operation and treatment of emergency medicine at central level or national level.

2). Structure of mechanism operation and treatment of emergency medicine at regional level or provincial level.

3). Structure of mechanism operation and treatment of emergency medicine at local level.

The structure has been set up in order to operate emergency medicine most efficiently

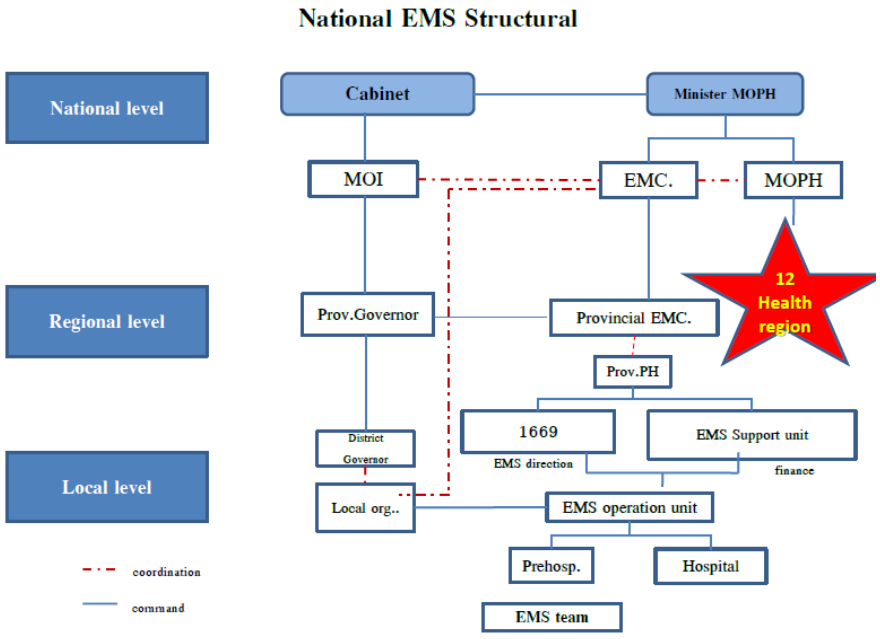


Figure 7 National EMS structure

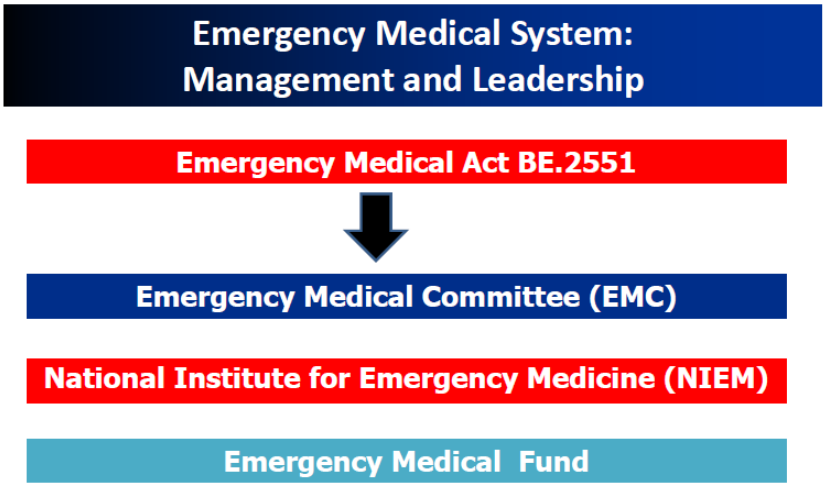


Figure 8 Structure of EMS system Management

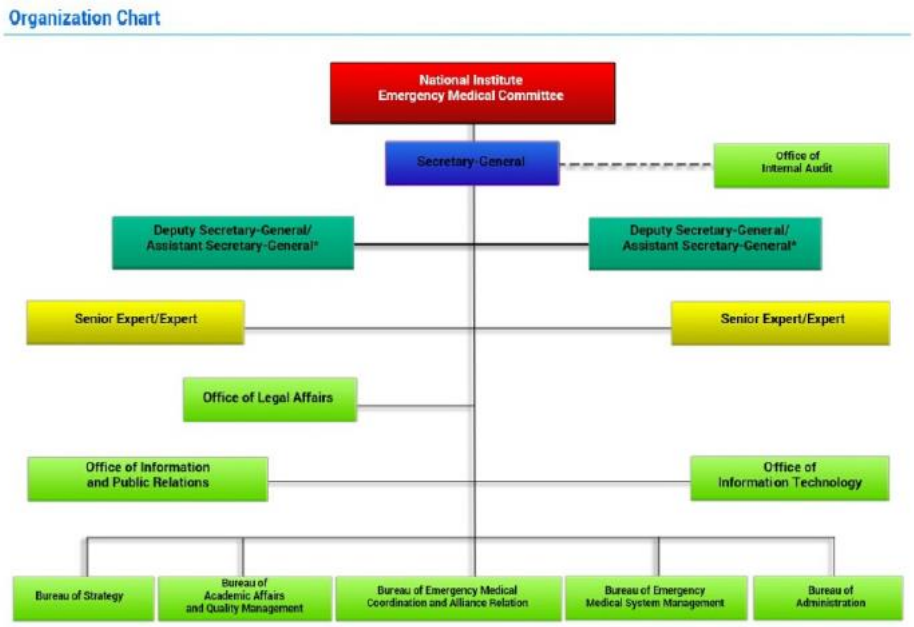


Figure 9 NIEM organization structure

NIEM SWOT Analysis

1). Internal factor

Strengths: NIEM is a government organization which is separated from the Ministry of Public Health, authorized by law, the Emergency Medical Acts is to enforce, encourage and support the protection of the emergency patients. There is also a clear support from the federal budget, funded through the Emergency medical

fund. Although there is not much but it's enough to drive the emergency medical service to people. NIEM is a small organization with administrative hierarchy is not too long to have the flexibility to manage compared with other government agencies.

Weakness: NIEM is a new organization; there is no clear pattern of administration. The directions of the management or policies were based upon the Board of Emergency Medical committee. They have selection process to recruit people to drive the organization, which the minister of public health, as president, followed by the Secretary General of NIEM. A management organization will last for up to four years, thus making the policy may not be powered up in time. Moreover, as NIEM based on the board of management that potential to change frequently, so this may compromise the continuity of operations.

2). External factor

Opportunity : Laws have the authority to NIEM for many missions that will lead to the development of the country's emergency medical system in coordination with the competent agencies, both government and the local organization, private sector for both profit and non-profit. Associations both domestic and international have brought the opportunity to join together in the development of emergency patient care effectively. There is also the opportunity to earn money from their work, which seems to be driven to strengthen the organization's capacity.

Treat: Uncertainty on the politics, cabinet changes frequently, and the board of Emergency medical committee and Secretary General are changed depend on the politics situation. Thus, the direction of change in the society may compromise the continuity of development of NIEM at some point. In addition, if people work in this small organization were selected from an ineffective selection

process, then it could be many people performing the work resulted in in-efficiency easily.

2.3 Aviation and Aeromedical service

"When the needs of injured or ill patients exceed what local clinics and hospitals can provide, urgent evacuation by air to the nearest well-equipped medical facility becomes the key to preserving function and saving lives" Peter G. Teichman, M.D.et.al. [10]

2.3.1 History of Aviation

Since December 17, 1903 the first flight was started by The Wright Brother's Flyer**.** At that moment was the period of neo airplanes and engines developed for many purposes in order to deliver people, goods, armed forces, and weapons from one place to another. Then, by the 20th century's, the advanced air transportation were based on the initial flight by the brothers from Ohio, United Stated.

In fact, the aeromedical services in vary country initially were introduced during war and afterward. Therefore, the early introduced aeromedical flights were done by "balloon" to transfer the patients from urban area of Paris in 1870 when there was the Franco-Prussian War.

Moreover, the most early recorded of evacuated patients by airplane were wounded cases, refers to Serbian patients were transported in an unmodified engine of French fighter plane which took place in 1916, the time of the 1st World War. Soon after a year past, a military man whose ankle had been shot in the Camel Corps in Turkey was flown over to the hospital setting within 45 minutes otherwise 3 days by ground. Whereas in the 1920's throughout the year, airplanes of the military were objective to the missions in the USA for disaster relief, and along the time, the British air ambulance service where a hundred miles distance of an airfield close to London was run by the RAF.

In addition, by the year 1933, United Kingdom established the 1st civilian air ambulance service to serve those Scottish Isles. Therefore, this service of transporting people from the remote islands in the Scotland to mainland is still functions today by the offspring.

In 1942, while 2nd World War was running, the flight evacuation training was begun for the particular purpose of medical assignment, thus the 1st steadfast aeromedical unit was achieved, called "the 38th Medical Air Ambulance Squadron". So far, it was mentioned that "there were using transport aircraft such as the Douglas C-47 Skytrain and the C-54 Skymaster, over a million sick and wounded soldiers were airlifted to the United States during the last three years of the war".

"The rotary wing aircraft" was of particular significance in the development as its capability to manage in confined or narrowed spaces.

In actual fact, in January, 1945, Well documented that "the search and rescue (SAR) and casualty evacuation (casevac) role in Myanmar" was the origin first unit used a helicopter throughout the later stages of the 2nd World War.

However, it was clearly described that "the Vietnam War was the definitive showcase for demonstrating the efficacy of helicopter medical transport in improving care for the injured". The name coded as "Operation Dust off", and using devoted "squadrons of Bell UH-1 Iroquois ('Huey')" aircraft. Initially, "casevac helicopters" were assigned for rapidly removed of injured weapons from near to the point of wound. "Scoop and run" was named to the ideal concept of rapid evacuation for those casualties to nearby medical facility for definite care. It involves in lower mortality rate of wounded care compared to the previous wars.

In Australia by year 1945, "the Victorian, South Australian, and New South Wales sections of the Flying Doctor Service (FDS) jointly funded an experiment of a flying nurse based at Broken Hill". In description, the FDS was the 1st "aeromedical organization" to teach and hire flight nurses. In 1955, it was granted the Royal as a

prefix to formulate name as “The Royal Flying Doctor Service of Australia”, and was value recognized since then as remains as a part of vital of the Australian.[11, 12]

From the situation during the “Korean and Vietnam wars”, the completeness and success of the military approach to help those in needs of medical care were covered by the media as television, news thus immediately brought much attention of the aeromedical to the public to realize the important used of helicopter in practical of medical role. Well, it was clear that the helicopter has ability to move the injured from remote or difficult reaching area to the nearest medical facility is being well known, but it is important to stated that the very first of all of “the world’s civilian helicopter air ambulance services” was the “Swiss Air Rescue Association (known as REGA)”. In 1952, REGA using a “piston powered helicopter” for utmost in medical use. A latter development was the use of helicopters in the rapid evacuate mission of the sick and injured in urban areas.

Additionally, in Belgium was found as the one of the very first countries to realize the significance of using helicopter in medical aspects as air ambulance in 1963, also military helicopters were used. Nevertheless, similar lessons were faced by year 1965 in the USA as “the Helicopter Emergency Lifesaving Patrol (HELP) project” was established in Philadelphia.

Interesting was highlighted while European country as the “Federal Republic of Germany” was being suited to be the first place that provided the service known as ADAC nationwide in 1970, the “United States Departments of Defense and Transportation” introduced a pilot program called “Military Assistance to Safety and Traffic (MAST)”, which first implemented at Houston in Texas, “its *raison d’être* was to provide air medical transportation to rural traffic”. Also in Europe, the “battlefield casualty evacuation” was a good used as lesson learned.

In France, the “Service d’Aide Médicale Urgente (SAMU)” was launched in the 1960s by French anesthesiologists, based upon the awareness of the rate of

prehospital mortality in those patients who had multiple injuries. Moreover, the Emergency medical systems in Switzerland and Germany were funded by its governance to study in the determinant of the feasible of combining helicopters of military and civilian networks together, to be covered all particulate risk areas including all highways.

Last but not the least, In the 1980s the United Kingdom had developed the 1st paramedic crewed urban/coastal EMS helicopter in Cornwall. Soon after, the "Helicopter Emergency Medical Service (HEMS)" was based in London. It takes both a paramedic and physician on their every single flight. Though, "The Automobile Association (AA)" has supported a new charity – the "National Association of Air Ambulance Services (NAAS)" – with an objective to assist the local charities to upgrade or promote the systems, although the combination with a "rolling program" to provide helicopters for the areas had not yet been covered.[13]

2.3.2 In Asia, The most advanced helicopter emergency service (HEMS) system was established in Japan since August 1999. The name of HEMS system is Doctor-Heli system. In August 1999, the Doctor-Heli Investigation Committee started with the support of the secretariat function from the Internal Affairs Office of the Japanese Cabinet. In October of that same year, a trial operation of helicopter emergency medical services (HEMS) was started at two hospitals, Okayama and Kanagawa Prefectures, respectively. In June 2000, the Doctor-Heli Investigation Committee concluded its work, and, in April 2001, the first Doctor-Heli operation officially started from the two trial operations. A fully dedicated and medically equipped helicopter now stands by at an emergency medical care center on a daily basis.[14] The initial phase of air medical services, by a helicopter nick named ''Doctor Heli,'' are available in Hokkaido, Nagano, Chiba, Kanagawa, Shizuoka, Aichi, Wakayama, Okayama and Fukuoka.[15] Now, in 2015 Japan have 45 Doctor-Heli programs and save life of more than 7,000 emergency patients per year.[16]

In Thailand, The first flight has been established by since 1913 and flight doctor service was established in same year. But all mission for military purpose only. Royal Thai Air Force (RTAF) by Institute of Aviation Medicine use airplane to transport patients from Korean War in 1951 and Vietnam War in 1967.[17] Royal Thai Army (RTA), Royal Thai Navy (RTN) and Royal Thai police (RTP) were also use airplane accompany with doctors and nurses for transport injured patients from war to proper hospital too.

2.3.3 Public Air ambulance service in Thailand

In Thailand Public health system, There are more than 4 millions of emergency patients per year. All are they come to hospital by family, witness and almost all transported by car. Emergency Medical service system in Thailand has been established more than 50 year ago but official establishment was in 2008 by Emergency Medical Acts BE.2551.[18] The emergency medical call center is Narenthorn center and use emergency phone number 1669 for free public access.[19] The number of emergency patient that utilized EMS system are increasing year by year and there have 1.2 million cases in 2013.[1] Civil Aeromedical Service in Thailand were operated by Public and Private aeromedical service that included Hospital base and None hospital base provider. Private aeromedical service were operated by private hospitals and assistance companies, those are paid service. Public air ambulance service or name as “Thai Sky doctor service(TSDS) ” has been established from initiation idea of Dr.Chatree Chareonchivakul, the Former Secretary General of NIEM in 2010 under the collaboration between National Institute for Emergency Medicine (NIEM) ,Ministry of Public Health (MOPH), National Health Security Office (NSHO), Ministry of Defense (RTA, RTAF, RTN), Royal Thai police, Ministry of Agriculture , Ministry of National Resource and Environment, Bangkok Dusit Medical services Company and Kan air. The purpose of public air ambulance service (

Thai sky doctor service) initially use for transport emergency patients from rural and remote area of Thailand to higher medical facilities.[2]

2.3.4 Factor associated with aeromedical service

In any part of the world there have many factors associated with aeromedical service. The first things have to concern are patient condition or the criteria for decision maker, cost and benefits.[20] As in many regions of the world have states' policy that promote to have this service for their citizen. In USA, Helicopter emergency medical service integrated dispatch with ground emergency medical service by 911center. Many countries in Europe also utilized helicopter emergency medical service for public and private health service too. They also integrated with ground medical emergency response in their local public emergency response center and integrated with European emergency number 112. In addition, in Japan also has the Doctor-Heli system which integrated with ground EMS by 119center. Aircraft use for aeromedical service are airplane (Fixed wing) and Helicopter (Rotor wing) depending on geographic, rural or remote area were cost- effectiveness. The medical team are also important part of operation, some country has flight doctor, flight nurse and flight paramedic depending on local medical law. All related concerns about aviation such as flight law, airport facilities, avionics, pilots and flight coordinators will be part of mission to success too. Financial concerned about cost and effectiveness are also important role of mission possibility.

In Australia, factor associated with aeromedical service initiated from Flynn's Mantle of Safety as word "Medicine and the experimental technologies of aviation and communications were fused into an innovative solution known as Flynn's Mantle of Safety. The cornerstone of Flynn's plan was the Royal Flying Doctor Service (RFDS). With the pedal radio, sick and injured people could radio for help, and the Flying Doctors could reach them in hours instead of days. The idea was revolutionary, and in recognition of Flynn's tremendous foresight, his portrait now

adorns Australia's $20 note." [12] from this initiation leads to current aeromedical service in Australia.

Lastly, in Thailand, there is the National Institute for Emergency Medicine as national policy level, which promotes and provides financial support for public air ambulance service. Therefore, the factors associated with aeromedical service in Thailand are Emergency medical dispatch center (1669) which work under medical oversight of Medical director who will make decision , Flight doctors and nurses ,aircraft provider, airport operator and Ground facilities, patient condition and referral hospital also part of this service.

Tadadej J. [5] has been study that component of public air ambulance service in Thailand consist of 7 parts are 1).Aircraft 2).Medical personnel 3).medical equipment 4).Law and regulations 5).Ability to pay for service 6).Budget 7).support policy. Pangma A.[2]mention that work flow of public air ambulance service or Thai sky doctor service system consist of 1).requester by doctor or nurses who are primary care team for sick or injured patients 2). Regional 1669 dispatch center which get request from primary care team 3). Regional medical director who make decision for air ambulance service 4).provincial public health office who give primary authorization to use public air ambulance service 5).aircraft provider under MOU who provide proper aircraft for patient transport 6). National1669 dispatch center (NIEM) who coordinate with aircraft provider and give final authorization to use public air ambulance service 7).Medical team with equipment who escort the patient by aircraft 8).Receiving hospital who receive the patient and provide ground ambulance 9). Airport (if use airplane) which involve for airport service 10).Fund supporter (NIEM, NHSO) which support budgets for emergency patient under preauthorization criteria. Some situation that could make mission not success such as not available aircraft, bad weather condition and other reason may found. For flight safety reason this service may not operate if not meet safety criteria.[21]

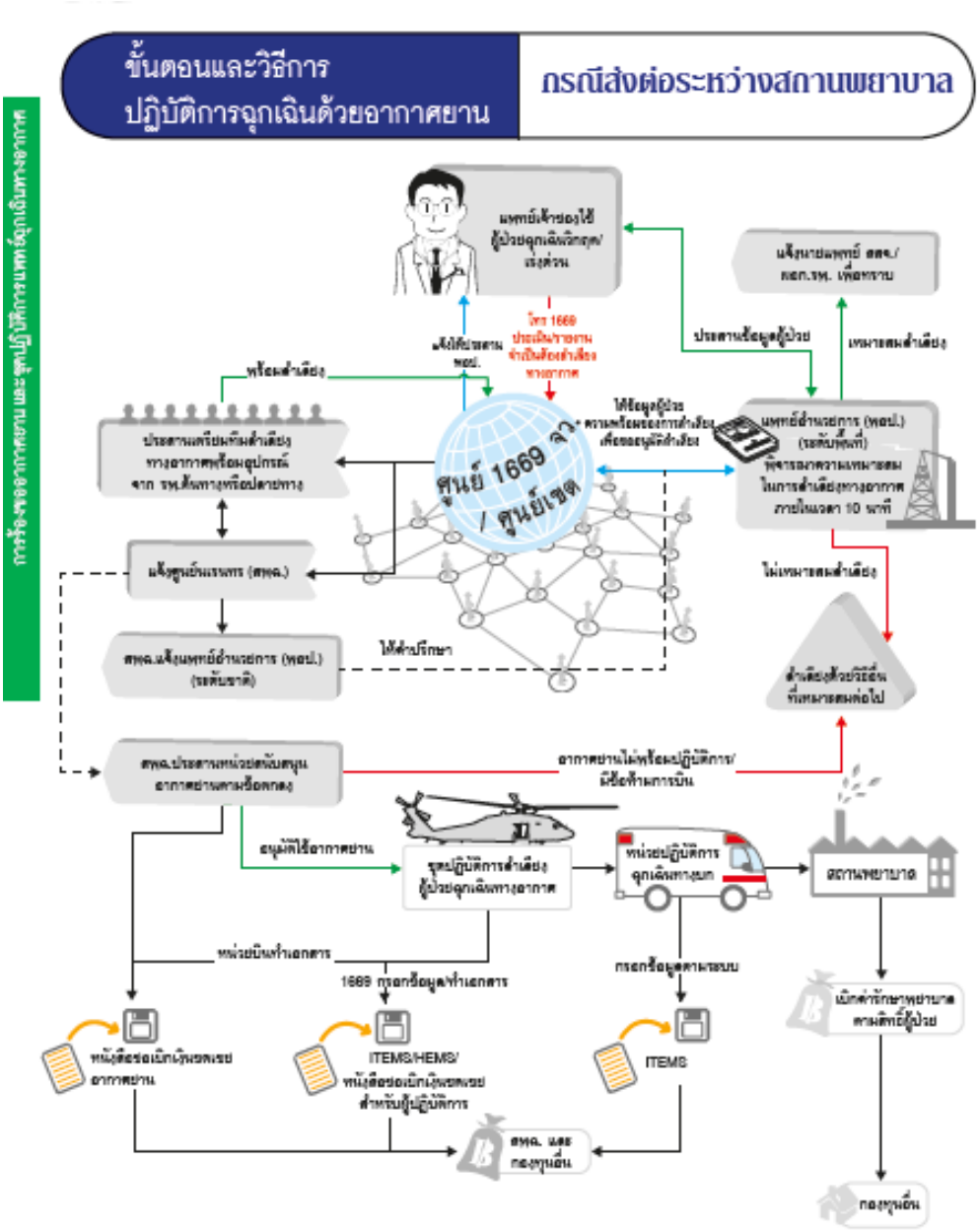


Figure 10 Thai Sky Doctor Service workflow (From NIEM)[2]

2.4 Triage and Patient Acuity scale for Emergency Patient condition evaluation

Triage and Patient acuity scale are evaluation tools for evaluate patient condition before treatment and transportation.

2.4.1 Triage

Patient triage is utilized for initial assessment of patient condition. It can be used for multiple casualties and individual case. There are different methods of triage by phone or scene or emergency room. Criteria Base Dispatch (CBD) is one of phone triage in the world that can assess patient condition by phone call before deliver proper medical care to patient such as ambulance or just give advises or instruction to patient or bystanders. At the scene, in case of multiple casualties from major accident or disaster could be use method of triage as triage sieve and triage sort or START and SAVE to identify level of severity of each casualty and give proper care for them. At the emergency room in hospital, there are many methods to evaluate individual patient before give treatment in overcrowded emergency room. Currently in many developed country accepted 5 level of patient triage scale such as Canadian Triage Acuity scale (CTAS), Emergency Severity Index (ESI) [22]. Emergency room Triage levels are level 1 or resuscitative, Level 2 or emergent, Level 3 or urgent, level 4 or less urgent, level 5 or none urgent.

2.4.2 Patient acuity

Patient acuity scale is a tool for patient evaluation that evaluated by doctors, nurses and medical personnel before transport the patients. National Highway Traffic Safety Administration (USA) make a guideline for patient evaluation that can give proper medical care and proper transport in different 5 levels of acuity and could improve patient safety. From NHTSA, USA guideline [23]

Level 1 Unstable —

Any patient who cannot be stabilized at the transferring facility,
who is deteriorating or likely to deteriorate, such as patients
who require invasive monitoring, balloon pump,
who are post-resuscitation, or who have sustained multiple trauma
(critical care or available crew with time considerations).

Level 2 Stable with high risk of deterioration –

Patients requiring advanced airway but secured, intubated, on ventilator, patients on multiple vasoactive medication drips (advanced care +), patients whose condition has been initially stabilized, but has likelihood of deterioration, based on assessment or knowledge of provider regarding specific illness/injury.

Level 3 Stable with medium risk of deterioration —

3-lead EKG monitoring, basic cardiac medications, e.g., heparin or nitroglycerine

(advanced care +).

Level 4 Stable with low risk of deterioration —

Running IV, some IV medications including pain medications,

pulse oximetry, increased need for assessment and interpretation skills

(advanced care).

Level 5 Stable with no risk for deterioration —

Oxygen, monitoring of vital signs, saline lock,

(basic emergency medical care).

The patient condition which meet triage criteria as resuscitative or Emergent level and level of patient acuity as Unstable or Stable high risk under medical director opinions are accepted for public air ambulance service usage that approved by NIEM in Thailand.

CHAPTER 3

METHODOLOGY

3.1 Research design

Cross sectional Descriptive study

3.2 Study Area

Thailand

3.3 Study Population

Patients record which were transported by Public air ambulance service (Thai sky doctor service) and representative person who associated with public air ambulance service in Thailand during 2010-2015

3.4 Sample and sample size

All patient records which were transported by Public air ambulance service (Thai sky doctor service) in Thailand during 2010-2015 from NIEM (N= 205)

Interview data from staff who associated with Thai sky doctor service system included National 1669 Dispatch center (N=3), Regional 1669 Dispatch center (N=1), Flight medical director (N=3) and Flight medical team (N=6) to support data analysis only.

3.5 Sampling Technique

Purposive selective for all patient records those were transported by Public air ambulance service (Thai sky doctor service) in Thailand during 2010-2015 and

Purposive selective from representative persons who associated with public air ambulance service in Thailand.

3.6 Eligible criteria

Criteria for data collection

Inclusion criteria:

Patient Recorded during year 2010-2015

Exclusion criteria:

Patient record that not permitted to reveal data

Not complete Patient record

Mission during disaster because of lack of complete data

Criteria for interview data

Inclusion criteria

Medical staff who had work for EMS more than 5 years

Medical staff who had work for Thai sky doctor service more than 1 year

Exclusion criteria

Medical staff who not informed consent

3.7 Measurement Tools.

Tape recorder / computer/

Patient data record

3.8 Data collection

Data were collected from NIEM by researcher with permission and interviewed data collection by interview the representative persons from associated agencies by external interviewer. Topics of interview are “What were their roles in Public air ambulance service?” and “What are facilitating factors or obstacle factors for Public air ambulance service?” The location for interview depend on participant convenient. Time for interview will take 1-3 hrs. in each group and 1-2 hrs. for personal interview.

This study will start with secondary data collection and will do interview data collection later. To avoid conflict of interest between researcher who had run this project and participants, the researcher has been resign from NIEM and this study design to have another interviewer for interview data.

All tape records will be deleted when finished this study, some pictures and data record will keep with participant permission for 2 years.

3.9 Data analysis

Descriptive statistics:

Percentages, mean, median and standard deviation.

Inferential statistics:

Chi square test, If more than 20% of the cells have expected frequencies less than 5 this study will use Fisher's exact test.

3.10 Ethical Consideration

The data will use for the study purpose only. Primary and secondary data record will use under permission from organization and ethical committee prior to the study.

3.11. Limitation

Public Air ambulance service (Thai Sky doctor service) is a new medical service of Thailand that few patients can access by selective criteria. This service were also high cost, high value and limit in rural or remote area. Completion of data records are also limit for study.

3.12 Expected Benefit and Application

This study may help to know current characteristic and provision and its factor associated of Public air ambulance service in Thailand. It could be a primary data to study more in the future.

3.13 Administration and Time Schedule

Product/Activities	Time Frame (month)									
	Sep 2015	Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Sep 2016	Oct 2016	Nov 2016
Research Proposal										
Research Interest Topics Setting	X									
Literature reviews		X	X							
Research design; Conceptual framework and Methodology setting				X						
Revision of Study Tools/Questionnaires					X	X				
Research Proposal present							X			
Research Proposal Submit To Ethical committee								X		
Data Collection								X		
Contracting to Collaborators (NIEM, provincial health offices, provincial/community								X		
Field Trips for Data collection and Interviews								X		
Data Entry								X		
Data Analysis									X	
Draft Report Writing									x	
Report Submission										X

3.14 Budget requirement

Total expense plan 50,000 THB

Chapter 4

Research Results

The research results of research topic “The outcome of emergency patient transported by Public air ambulance service in Thailand” will divide in to 3 parts.

4.1 The characteristic of Public air ambulance service in Thailand (Thai sky doctor service)

4.1.1 Demographic data of Thai Public air ambulance service

4.1.2 The Facilitating factors and obstacle factors for Thai Public air ambulance service.

4.2 The 1 day and 3 days outcome of emergency patients that transported by Thai Public air ambulance service (Thai sky doctor service) in Thailand.

4.3 The factors associated with 1 day and 3 days outcome.

Secondary data were collected from NIEM aeromedical transport patient record during 2010-2015. After excluded some data, 205 requested mission were purposive selective to this study. 172 missions (184 patients) were transport and 33 missions (33 patients) were not transport. Primary data was collected from participants who working for Thai Sky doctor service more than 1 year. In depth and focused group interview were perform with informed consent.

Table 1 demographic data of patients

Data	n(%)
Mission	
Request with transport	172(83.9)
Request with no transport	33(16.1)
Patients	
Transport	184(84.8)
No transport	33(15.2)
Transport mission	
Single patient	163(94.8)
Multiple patients	9(5.2)

From secondary data collection, since 2010-2015. 205 requests for service were included to this study. 172 requests were transported (83.9%) 33 requests were not transport (16.1%) .

172 transport mission, 163 flights (94.8%) has been transport single patient in each flight, 9 flights transport multiple patient (5.2%) some flight transport 2 cases but only 1 flight transport more than 2 cases.

Total patients number in both group are 217 cases, 184 cases were transported (84.8%) 33 cases were not transport (15.2%).

Table 2 number of patient in each year

Year	Request with transport n(%)	Request with no transport n(%)	Total n(%)
2010	13(7.1)	1(3.0)	14(6.5)
2011	45(24.5)	9(27.3)	54(24.9)
2012	31(16.8)	8(24.2)	39(18.0)
2013	32(17.4)	2(6.1)	34(15.7)
2014	30(16.3)	6(18.2)	36(16.6)
2015	33(17.9)	7(21.2)	40(18.4)
Total	184(100.0)	33(100.0)	217(100.0)
Mean	29	5	34

From 2010, total requested for air transport 14 cases can perform transport 13 cases and not transport 1 case. Trend of number of request for service is increase. Mean of request number is 34 cases per year, mean of successful request 29 cases per year and mean of unsuccessful request is 5 cases per year.

4.1 The characteristic of Public air ambulance service in Thailand (Thai sky doctor service)

4.1.1 Demographic data of Thai Public air ambulance service

Table 3 Demographic data of patients transport and not transport mission

Variable mission	Transport mission n(%)	Not transport n(%)
Gender		
Male	124(67.4)	18(54.5)
Female	60(32.6)	15(45.5)
Age group		
≤1 month	9(4.9)	3(9.1)
2 mo.-1year	4(2.2)	1(3.0)
2-14 years	7(3.8)	2(6.1)
15-59 years	107(58.2)	16(48.5)
≥60 years	50(27.2)	8(24.2)
Unknown	7 (3.8)	3(9.1)
Nationality		
Thai	167(89.3)	32(97.0)
None Thai	17(9.1)	1(3.0)
Health insurance		
Gov	35(19.0)	4(12.1)
SSS	6(3.3)	0(0.0)
UC	98(53.3)	7(21.2)
Other	23(12.5)	20(60.0)
None	22(12.0)	2(6.1)

From demographic data, 124 (67.4%) male and 60(32.6%) female were transported, Age group 15-59y is most frequent transport(n=107, 60.5%).Age ≥60y is second most frequent (n=50, 28.2%). Pediatric patients are less frequent, age ≤1 mo.(n=9,5.1%), 2mo.-1y(n=4,2.3%), 2y-14y(n=7, 4.0%) accordingly. There were 7 missing data in age group due to incomplete data. Thai nationality is most frequent transported (n=167, 89.3%) and none Thai is less transported(n=17, 9.1%). For health insurance for hospital expense found that UC is most frequent transported (n=98, 53%), SSS is least frequent (n=6, 3.3%).

Table 4 Demographic data of Patient condition in transport and not transport mission

Variable	Transport mission	Not transport
mission	n(%)	n(%)
Disease group		
Neonate-Ped	2(1.1)	0(0.0)
Newborn	9(4.9)	2(6.1)
OB	8(4.3)	0(0.0)
STEMI	37(20.1)	6(18.2)
Stroke	21(11.4)	7(21.2)
Trauma	63(34.2)	6(18.2)
Other	44(23.9)	12(36.4)
Triage or Acuity		
Level 1	55(29.9)	5(15.2)
Level 2	106(57.6)	25(75.8)
Level 3	23(12.5)	3(9.1)

From table 4 found that The most frequent disease group of transported patient is Trauma (n=63, 34%) , other group included respiratory, cardiac or sepsis is second most frequent (n=44,23.9%), STEMI (n=37,20.1%), Stroke (n=21, 11.4%), Obstetric emergency and Newborn group almost same number(n=8, 4.3% and n=9, 4.9%), Neonate-Pediatric group is least transported (n=2, 1.1%). Patient condition group by triage and acuity shown that Level 2 or Emergent is most frequent for transported (n=106, 57.9%), Level 1 or Resuscitative and Level 3 or urgent are less frequent (n=55, 29.9% and 23, 12.5%).

Table 5 Variables in transport mission

Variable	Transport mission n(%)
National EMS Dispatch Center	184(100.0)
Regional 1669 EMS Dispatch Center	184(100.0)
Flight medical director	184(100.0)
Landing area	
Airport	70(38.0)
helipad	114(62.0)
Medical team	
Doctor with nurses	62(71.3)
Nurses	25(28.7)
Aircraft provider	
RTA	57(31.0)
RTN	13(7.1)
RTAF	1(0.5)
RTP	30(16.3)
MOA	9(4.9)
MONRE	3(1.6)
BDMS	16(8.7)
KAN	55(29.9)
Type of aircraft	
Rotor wing (RW)	114(62.0)
Fixed wing (FW)	70(38.0)
Type of mission	
Primary mission	17(9.2)
Secondary mission	167(90.8)
Payer	
EMS fund	86(46.7)
NHS fund	98(53.3)

From table 5, All of transported patients are associated with National EMS dispatch center (n=184, 100.0%), Regional 1669 EMS dispatch center (n=184, 100.0%) and Flight medical director (n=184, 100.0%) accordingly. Aircraft provider who support public air ambulance service under MOU between NIEM and multiagency was found that the most frequent transport aircraft of state aircraft is RTA (n=57, 31.0%). Another state aircraft that use for transport are RTP (n=30, 16.3%), RTN (n=13, 7.1%), MOA (n=9, 4.9%), MONRE (n=3, 1.6%) respectively. KAN is most frequent of private aircraft provider (n=55, 29.9%), BDMS is the least frequent (n=16, 8.7%). Aircraft type is more transport by Rotor wing (n=114, 62.0%). Fixed wing is also use but lesser than RW (n=70, 38.0%). Secondary mission (n=167, 90.8%) is more frequent than primary mission (n=17, 9.2%) in Thailand. Medical team for public air ambulance service is operated by 2 level of care team, Doctor with nurses (n=62, 71.3%) and Nurses (n=25, 28.7%). There were some missing data of medical team from secondary data collection. Health insurance that cover expense of public air ambulance service are EMS fund (n=86, 46.7%) and NHS fund (n=98, 53.3%)

Table 6 Aircraft type in transport mission in each year

Year	Rotor wing(RW) n(%)	Fixed wing (FW) n(%)	Total n(%)
2010	13(11.4)	0(0.0)	13(7.1)
2011	25(21.9)	20(28.6)	45(24.5)
2012	17(14.9)	14(20.0)	31(16.8)
2013	14(12.3)	18(25.7)	32(17.4)
2014	21(18.4)	9(12.9)	30(16.3)
2015	24(21.1)	9(12.9)	33(17.9)
Total	114(100.0)	70(100.0)	184(100.0)
Mean	19	10	29

From table 6 shown that Rotor wing transport (Mean is 19) is much more than Fixed wing transport (Mean is 10).

Table 7 Health region of origin referring medical facility and destination receiving medical facility in transport mission

Health region	origin n(%)	destination n(%)
1	116(63.0)	115(62.5)
2	14(7.6)	12(6.5)
3	3(1.6)	0(0.0)
4	1(0.5)	0(0.0)
5	12(6.5)	12(6.5)
6	3(1.6)	2(1.1)
7	1(0.5)	1(0.5)
8	3(1.6)	0(0.0)
9	6(3.3)	3(1.6)
10	1(0.5)	0(0.0)
11	15(8.2)	4(2.2)
12	8(4.3)	11(6.0)
13	1(0.5)	24(13.0)
Total	184(100.0)	184(100.0)

Many health regions requested for transport their patients by air ambulance service. Health region 1 is the most frequent referring for air transport (n=116, 63.0%) and also the most frequent destination of receiving medical facility from air transportation (n=115, 62.5%).

Table 8 Variables in not transport mission

Variable	Not Transport mission n(%)
Mission obstacle	
Weather condition	4(12.1)
Not ready aircraft	14(42.4)
Dead before transport	5(15.2)
Other	10(30.3)
Total	33(100.0)

From table 8, 33 cases were not transport for few reason, not ready aircraft is the most frequent (n=14, 42.4%). Dead before transport (n=5, 15.2%) and weather condition (n=4, 12.1%) are also reasons for not transport. Other reason is not completed data (n=10, 30.3%).

4.1.2 The Facilitating factors and obstacle factors of Thai Public air ambulance service.

This study would like to study more about facilitating and obstacle factors of Thai Public air ambulance service by interview the representative persons from associated agencies. Topics of interview are “what were their roles in Public air ambulance service?” And “what are facilitating factors or obstacle factors for Public air ambulance service?” External interviewer was performed interview in this study from staff who associated with Thai sky doctor service system ; National 1669 Dispatch center (N=3) ,Regional 1669 Dispatch center (N=1), Flight medical director (N=3) , Flight medical team (N=6). The purpose of this interview data is being study for support quantitative data analysis only.

This study interview 3 persons from NIEM as national level who work for public air ambulance service from beginning since 2010. 1 person work as Thai sky doctor project manager, 2 persons work at National 1669 dispatch center. At regional level this study interview 1 person from regional 1669 dispatch center, 3 flight directors, 6 flight medical team. This interview perform in to 3 groups at difference time and location. All of the interviewers have been work for Thai sky doctor service more than 1 year.

Interviewed data from National level and regional level found that factors facilitating to Thai sky doctor service are below;

A. Facilitating factors for successful mission at National level are;

I. Strong policy support

At the national level, the precipitating factor for successful mission are strong policy and strong support from high official level of collaboration agencies. MOU is very strong key point for this project in the beginning but when time change some agency are not fully support because they are not know about reason to do this project and some agency has been change their policy. By the way, Almost all

of MOU agencies continue their support with some limitation such as aircraft may not ready to support at all time.

II. Quick communication

Route of quick communication between NIEM and aircraft provider was also one of important factor that could make mission successful. In some mission may have delay communication that could make patient condition worsen and mission was cancel.

III. Financial support

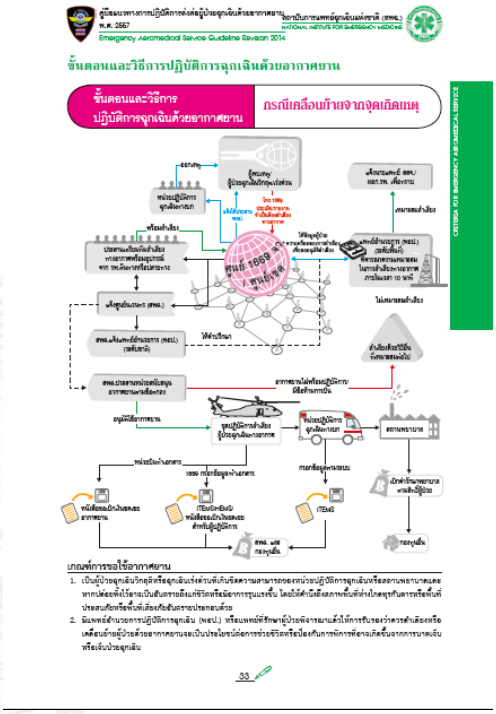
Financial support from EMS fund, NHS fund and financial regulation are important to make this service successful and sustain. In the past, no have financial support very few mission could do but limit only for military mission or high official level of government officer. For public use of air ambulance service are not possible.

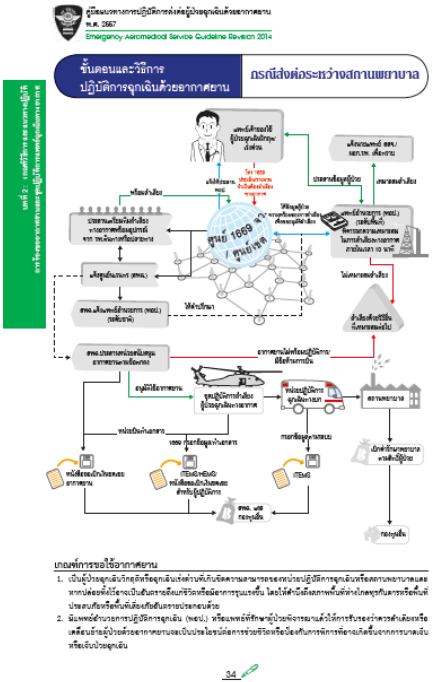
IV. National medical director

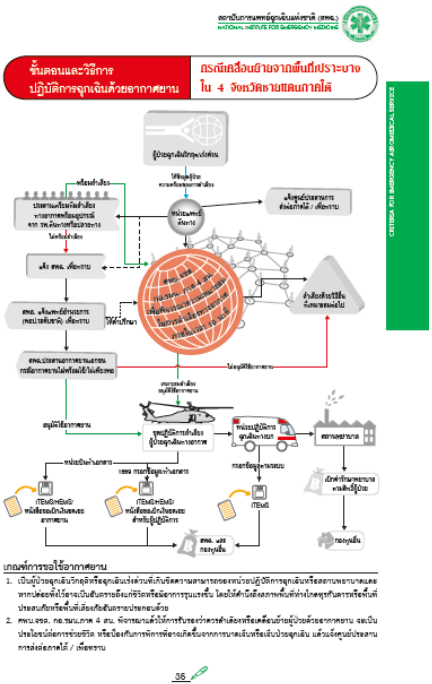
Major role of National medical director have to control medical direction of Thai sky doctor service. Thai Sky doctor service system need 2 persons to give authorize before transport. National medical director will get all information from national and regional 1669 dispatch center to consider how about patient condition. If meet criteria, National medical director will allow to use this service. From beginning period of Thai sky doctor service NIEM set 5 persons who could authorize this service but NIEM has been change to 2 persons (1 from national 1 from regional) because of it take too long time to get all authorization in quick response. In 2014 NIEM start to have pilot area in Health region 1 by use decision maker only 1 regional medical director to improve response time but in another Health region National medical director will take action because of no have dedicated regional medical director.

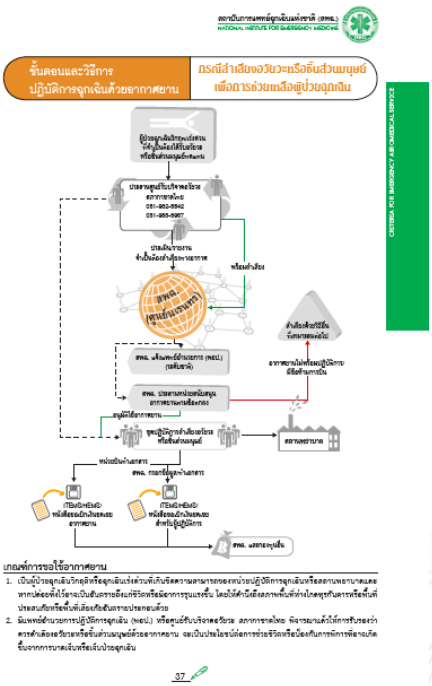
V. Clear guideline for public air ambulance service

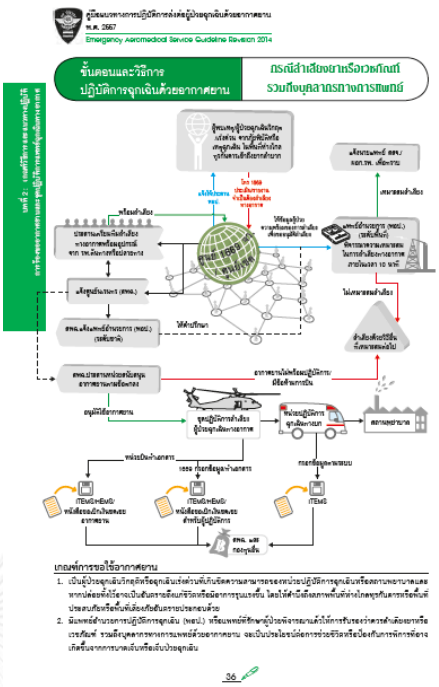
From Emergency Aeromedical service guideline revision 2014, NIEM give clear guideline to all participating team. This guideline included 5 protocols of public air ambulance service and related patient transport clinical guideline.











There are 5 aeromedical protocols with criteria for dispatch are resuscitative and emergent of patient severity has been approved by NIEM included for 1) prehospital primary mission, 2) secondary (interfacility) mission, 3) public air transport in 3 border province of southern Thailand (vulnerable area of terrorist), 4)Medical logistic for disaster response,5) medical logistic for organ harvest. All criteria will support by EMS fund under medical director authorization.

VI. Regional 1669 dispatch center know to use service

Regional 1669 dispatch center knowledge is also one of facilitating factor In health region 1, 5, 11, 12 are the active of this service because of they know how about this service and how to use this service properly. NIEM has been trained about this service to all regional 1669 dispatch center but some of them could learn from their service under supervision of NIEM and experts. Health region 1 is the most active for Thai sky doctor service.

B. Facilitating factors for successful mission at the Regional level are;

I. Got support from high official level

II. Quick and efficiently communication and coordination of coordinators

III. Referral doctor and medical team request to use service

IV. Patient and family know this service properly

V. Time to request, request at day time could easier to success than request at night time.

VI. Referral hospital could assess patient condition and prepare patients properly.

VII. Regional medical director could make decision properly, in Health region 1 has Dedicated regional medical director 24/7 that could make successful and properly.

VIII. Flight medical team was trained by experts

IX. Airport and helipad is ready and safety

X. Pre transport checklist; flight plan, equipment, contact person, etc.

XI. NIEM made MOU with all agencies/ EMS fund support for transport and long term support/ training support/ equipment support/ guideline

XII. Collaboration with regional aircraft provider

XIII. Aircraft readiness

XIV. Coordination between multi agencies for quick response

XV. Communication assisted application; Line application bring to communication tool for quick communication in short time

C. Obstacle factors for unsuccessful mission at National level found that;

I. Lack of National medical director

In case of National medical director has been change or resign or lack of knowledge to make decision. This service may continue with uncertain decision making. That may obstacle the result of mission.

II. Regional 1669 dispatch center not know this service clearly

Many regional 1669 dispatch center are not clear of knowledge or less experienced for this service could make process too long and make failed mission

III. Benefit for medical team were not clear

Many of medical team refused to fly because of lack of benefit support them. This project was start from volunteer medical team without benefit. NIEM try to raise fund to support medical team but it take slow process.

IV. Inflight safety concern

Many of medical team concern about their safety because of military aircraft are very old and potential to have aircraft accident. Some of them fly only private aircraft such as Kan air.

V. Aircraft agencies could not support or delay support

Thai sky doctor service system start from MOU collaboration between NIEM, NHSO, MOPH and air craft provider from Government and private agencies. Aircraft agencies will support only they are available. Some organization they could not support or could support but not in time for response to critical patients. This topic is very important for Thai sky doctor service.

VI. Lack of long term financial support

From national perspective, they said if no have financial support to facilitate this service from NIEM or national level agencies could make mission improper or failure.

VII. Complication of mission

There are some conflict of decision making between NIEM and other agencies. This topic could make poor collaboration in the future

D. Obstacle factors for unsuccessful mission at Regional level are;

I. Not available aircraft and not ready aircraft

II. Bad weather condition or night mission may not possible to operate

III. Delayed response to authorization from National medical director

IV. Patient condition change during mission may change mode of transport or cancel
V. Patient condition is not fit to fly; too serious to fly or not meet criteria of service
VI. Less number of medical team; some case fly with only nurses, not available doctor
VII. Less support training in some region that make not available medical team
VIII. IT support is not good enough
IX. Patient safety concern; lack of doctor; lack of equipment
X. Benefit concern for medical team; delayed process

E. Facilitating factors for successful mission from opinions of Regional medical team
   I. Patient information from referral hospital could make clear for Air transport consideration
   II. Good coordination and quick response between flight coordinator , flight medical team, referral and receiving hospital , aircraft provider, NIEM
   III. Aircraft readiness; availability, maintenance ready; pilot and flight crew
   IV. National, regional, provincial and organization policy support to have air ambulance service mission
   V. Review case and continuous quality improvement
   VI. Collaboration network between medical multi agencies; NIEM, university, MOPH
   VII. National Air operation networking ;NIEM, MOPH, NHSO, provincial public health office ,Airport authority, aircraft provider
   VIII. Volunteer mind of medical team
   IX. Medical team training and support
   X. Need from health system in rural area
   XI. Financial support for operation, training, medical equipment

XII. Experts opinion from domestic and international to support operation
XIII. Line application to support communication
XIV. NIEM support system manager
XV. Resident Doctor training program facilitate to have this service
XVI. Multi aircraft provider in one region; they could make availability of aircraft in region
XVII. Airport or helipad not too far from referral and receiving hospital could make good response time.
XVIII. Regional 1669 dispatch center could work effectively

In Health region 1 has Chiangmai university Trauma center support coordination.

F. Obstacle factors for unsuccessful mission from opinions of Regional medical team are;
   I. Limit of flight medical team, flight medical coordinator could make service unavailability.
   II. In flight Safety concern
   III. Thai sky doctor service is new service model in Thailand. This system is not strong enough in beginning period. Uncertain policy of high official level in region could change their support, depending on personal.
   IV. Lack of dedicate air ambulance in their region
   V. Benefit payment process for medical team is too slow, less motivation.
   VI. IT is not support this service properly.
   VII. Poor data collection
   VIII. Limit financial support to develop this service
   IX. Unclear of functional system in their region; they are working in mix team from different organization
   X. Unclear of public knowledge about this service could make miss understand of service

XI. Complication of service were family need and expectation could abuse the service

XII. When mission is operating, on duty medical staff who is working at hospital will take action for long flight time could increase work load to another staff at hospital due to limit number of medical staff.

XIII. Post flight sickness such as motion sickness, perforate ear drum

XIV. This service is high cost which could have negative feeling to another patient who was unable to use this service.

XV. Controversial idea to use or not use this service; some of them think that overuse of this service could make less develop of rural area.

4.2 1 day and 3 days outcome of emergency patients transported by Public air ambulance service in Thailand

Table 9 1 day and 3 days outcome of emergency patients transported

	Admit n(%)	Dead n(%)	D/C n(%)	Total n(%)
1 day outcome	182(98.9)	2(1.1)	0(0)	184(100.0)
3 day outcome	157(85.3)	17(9.2)	10(5.4)	184(100.0)

1 day and 3 days outcome of emergency patients transported by Public air ambulance service in Thailand found that majority of 1 day outcome were admit (98.9%) and 1.1% were dead but 3 days outcome were admit (85.3%) followed by Dead (9.2%), and D/C (5.4%).

4.3 Identify the factors associated with 1 day and 3 day outcome

To Identify the factors associated with 1 day and 3 day outcome of this study. Chi-Square was applied to test the hypothesis between dependent and independent variables.And if found more than 20% of the cells have expected frequencies less than 5 which did not meet the criteria then Fisher's exact test was applied instead. Please see below results of factors associated with 1 day and 3 day outcome,

4.3.1 The association between gender and 1 day outcome of emergency transported patients

Table 10 Fisher's Exact Test to find association between gender and 1 day outcome of emergency transported patients (*n*=184)

Gender	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
Male	122 (66.3)	2 (1.1)	124 (67.4)	1.000
Female	60 (32.6)	0 (0.0)	60 (32.6)	
Total	182 (98.9)	2 (1.1)	184 100.0)	

In this study found that a total number of patients N=184, 67.4% and 29.7% are male and female respectively.

The results indicated that there was no statistically significant between gender and 1 day outcome of emergency transported patients and it could be implied that there is no different in transportation between male and female. Furthermore, 98.9% and 1.1% were admitted to the hospital and death respectively.

4.3.2 The association between age and 1 day outcome of emergency transported patients

Table 11 Fisher's Exact Test to find association between age and 1 day outcome of emergency transported patients. (n=177)

Age	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
≤1 month	9	0	9	.292
	(5.1)	(0.0)	(5.1)	
2-12 months	4	0	4	
	(2.3)	(0.0)	(2.3)	
2-14 years	7	0	7	
	(4.0)	(0.0)	(4.0)	
15-59 years	107	0	107	
	(60.5)	(0.0)	(60.5)	
≥60 years	48	2	50	
	(27.1)	(1.1)	(28.2)	
Total	175	2	177	
	(98.9)	(1.1)	(100.0)	

In table 11 the association between age and 1 day outcome of emergency transported patients found that a total number of 1 day outcome emergency patients, majority age are 60.5%, 28.2% and 5.1% are majority of the patients' age 15-59 years old, more than 60 years old and less than 1 month old respectively. Additionally we could observed that there was no statistically significant between age and 1 day outcome of emergency patients transport which indicated that there is no difference in transportation among age groups.

4.3.3 The association between disease groups and 1 day outcome of emergency patients.

Table 12 Fisher's Exact Test to find association between disease groups and 1 day outcome of emergency transported patients. (n=184)

Disease group	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
Neonate-Ped	2	0	2	.406
	(1.1)	(0.0)	(1.1)	
Newborn	9	0	9	
	(4.9)	(0.0)	(4.9)	
OB	8	0	8	
	(4.3)	(0.0)	(4.3)	
STEMI	37	0	37	
	(20.1)	(0.0)	(20.1)	
Stroke	21	0	21	
	(11.4)	(0.0)	(11.4)	
Trauma	63	0	63	
	(34.2)	(0.0)	(34.2)	
Other	42	2	44	
	(22.8)	(1.1)	(23.9)	
Total	182	2	184	
	(98.9)	(1.1)	(100.0)	

This table illustrated the association between disease groups and 1 day outcome of emergency patients' transportation where there was no statistically significance. It could be implied that all disease groups will not cause any different in transportation. Majority showed 34.2% and 23.9% are Trauma, Other, and STEMI respectively.

4.3.4 The association between severity of patients' condition prior to transport and 1 day outcome of emergency transported patients.

Table 13 Fisher's Exact Test to find association between severity of patients' condition prior to transport and 1 day outcome of emergency patients. (n=184)

Patient severity	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
Level 1	55	0	55	.654
	(29.9)	(0.0)	(29.9)	
Level 2	104	2	106	
	(56.5)	(1.1)	57.6)	
Level 3	23	0	23	
	(12.5)	(0.0)	(12.5)	
Total	182	2	184	
	(98.9)	1.1)	(100.0)	

In this study we could observed that the association between severity of patients' condition prior to transport and 1 day outcome emergency transported patients were not statistically significant and could be implied that 1 day outcome emergency patients' transportation were same in every severity of the patients' condition. In addition, 57.6%, 29.9% and 12.5% were Emergency, Resuscitation and Urgent respectively.

4.3.5 The association between medical transport team and 1 day outcome of emergency transported patients.

Table 14 Fisher's Exact Test to find association between Doctor with nurses, Nurses and 1 day outcome of emergency transported patients. (n=87)

Medical team	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
Doctor with nurses	60	2	62	1.000
	(63.0)	(4.1)	(71.3)	
Nurses	25	0	25	
	(28.7)	(0.0)	(28.7)	
Total	85	2	87	
	(97.7)	(2.3)	(100.0)	

From the table we could see that 71.3% and 28.7% were received air transportation by Doctor with nurses and only nurses respectively. In addition, there was no statistically significant between doctor with nurses, nurses and 1 day outcome of emergency patients. Meaning that either the patient be transported by air with doctor with nurses or nurses only did not have any difference in transportation outcome.

4.3.6 The association between response time and 1 day outcome of emergency transported patients.

Table 15 Fisher's Exact Test to find association between response time and 1 day outcome of emergency transported patients. (n=85)

Response time	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
< 1 hr.	6	0	6	.599
	(7.1)	(0.0)	(7.1)	
1-3 hrs.	53	1	54	
	(62.4)	(1.2)	(63.5)	
>3 hrs.	24	1	25	
	(28.2)	(1.2)	(29.4)	
Total	83	2	85	
	97.6)	2.4)	(100.0)	

To describe the table above regarding to the response time, 63.5%, 29.4% and 6% were achieved the response time at 1-3 hours, more than 3 hours and less than 1 hour respectively. Therefore, it indicated no statistically significant between response time and 1 day outcome of emergency patient.

4.3.7 The association between transport time and 1 day outcome of emergency transported patients.

Table 16 Fisher's Exact Test to find association between transport time and 1 day outcome of emergency transported patients. (n=84)

Transport time	1 day outcome of emergency patients		Total	*Fisher's exact* p-value
	Admit, n (%)	Dead, n (%)		
< 4.5 hrs.	63 (75.0)	1 (1.2)	64 (76.2)	.422
>4.5 hrs.	19 (22.6)	1 (1.2)	20 (23.8)	
Total	82 97.6)	2 2.4)	84 100.0)	

In reference to the results in this table we could see clearly that 76.2% and 23.8% of 1 day outcome emergency patient were taken transport time less than 4.5 hours and more than 4.5 hour respectively. However, there were no statistically significant between transport time and 1 day outcome emergency patients and it could be described that there were no different in transport time and 1 day outcome of emergency patients.

4.3.8 The association between gender and 3 days outcome of emergency transported patients.

Table 17 Fisher's Exact Test to find association between gender and 3 days outcome of emergency patients. (n=184)

Gender	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
Male	107	4	13	124	.139
	(58.2)	(2.2)	(7.1)	(67.4)	
Female	50	6	4	60	
	(27.2)	3.3)	2.2)	32.6)	
Total	157	10	17	184	
	(85.3)	(5.4)	(9.2)	(100.0)	

To describe the association between gender and 3 days outcome of emergency patient found that there were no statistically significant. 67.4% and 32.6% were male and female respectively. In addition, 85.3% and 9.2% of 3 days outcome of emergency patients were admit and dead respectively.

4.3.9 The association between age group and 3 days outcome of emergency patients.

Table 18 Fisher's Exact Test to find association between age group and 3 days outcome of emergency patients. (n=177)

Age	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
≤1 month	7	0	2	9	.628
	(4.0)	(0.0)	(1.1)	(5.1)	
2-12 months	3	0	1	4	
	(1.7)	(0.0)	(0.6)	(2.3)	
2-14 years	7	0	0	7	
	4.0)	(0.0)	(0.0)	(4.0)	
15-59 years	93	6	8	107	
	(52.5)	(3.4)	(4.5)	(60.5)	
≥60 years	41	3	6	50	
	(23.2)	(1.7)	(3.4)	(28.2)	
Total	151	9	17	177	
	(85.3)	(5.1)	9.6)	(100.0)	

To analyze the association between age and 3 days outcome of emergency patients found that there were no statistically significant and it could be implied that there were no different between age group and 3 days outcome of emergency patients. Furthermore, in this study found most of the 3 days outcome emergency patients were age between 15-59 years old, more than 60 years old and less than 1 month old, 60.5%, 28.2% and 5.1% respectively.

4.3.10 The association between disease groups and 3 days outcome of emergency transported patients.

Table 19 Fisher's Exact Test to find association between disease groups and 3 days outcome of emergency patients. (n=184)

Disease group	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
Neonate-Ped	1	0	1	2	.173
	(0.5)	(0.0)	(0.5)	(1.1)	
Newborn	7	0	2	9	
	(3.8)	(0.0)	(1.1)	(4.9)	
OB	7	1	0	8	
	(3.8)	(0.5)	(0.0)	(4.3)	
STEMI	33	2	2	37	
	(17.9)	(1.1)	(1.1)	(20.1)	
Stroke	21	0	0	21	
	(11.4)	(0.0)	(0.0)	(11.4)	
Trauma	54	2	7	63	
	(29.3)	(1.1)	(3.8)	(34.2)	
Other	34	5	5	44	
	(18.5)	(2.7)	(2.7)	(23.9)	
Total	157	10	17	184	
	(85.3)	(5.4)	(9.2)	(100.0)	

From the study of the association between disease group and 3 days outcome of emergency patients found that there were no statistically significant which indicated that there were no different between disease groups and 3 days outcome of emergency patients. Additionally, it showed clearly that 34.2%, 23.9% and 20.1% were Trauma, other and STEMI respectively. It also showed that 85.3%, 9.2% and 5.4% of 3 days outcome of emergency patients were admit. However, majority of dead found in trauma group at 3.8%.

4.3.11 The association between patient severity before transportation and 3 days outcome of emergency transported patients.

Table 20 Fisher's Exact Test to find association between patients' severity before transport and 3 days outcome of emergency transported patients. (n=184)

Patient severity	3 day outcome of emergency patients			Total	*Fisher's exact* *p*-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
Level 1	51 (27.7)	2 (1.1)	2 (1.1)	55 (29.9)	.033*
Level 2	88 (47.8)	4 (2.2)	14 (7.6)	106 (57.6)	
Level 3	18 (9.8)	4 (2.2)	1 (0.5)	23 (12.5)	
Total	157 (85.3)	10 (5.4)	17 (9.2)	184 (100.0)	

*$p < .05$

It could be seen clearly that there was statistically significant between patients' severity before transportation and 3 days outcome of emergency patients which reflected that 3 days outcome of emergency patients were different between each level of patients' severity. It also found 57.6%, 29.9% and 12.5% were level 2 or Emergency, level 1 or Resuscitation and level 3 or Urgent respectively.

Considering those patients who were admit to the hospital found that majority of them were level 2 Emergency, 47.8%. Additionally, 2.2% and 7.6% were level 2 Emergency and level 3 Urgent respectively.

4.3.12 The association between medical team and 3 days outcome of emergency patients.

Table 21 Fisher's Exact Test to find association between medical team and 3 days outcome of emergency transported patients. (n=87)

Medical team	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
Doctor with nurses	57	2	3	62	.812
	(65.5)	(2.3)	(3.4)	(71.3)	
Nurses	23	0	2	25	
	(26.4)	(0.0)	2.3)	(28.7)	
Total	80	2	5	87	
	(92.0)	(2.3)	(5.7)	(100.0)	

This study showed that there were no different in 3 days outcome of emergency patients between medical team both doctor with nurse and nurse only, therefore there were no statistically significant. 71.3% and 28.7% were doctor with nurses and nurses respectively.

4.3.13 The association between response time and 3 days outcome of emergency patients.

Table 22 Fisher's Exact Test to find association between response time and 3 days outcome of emergency patients. (n=85)

Response time	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
< 1 hr.	5	0	1	6	.639
	(5.9)	(0.0)	(1.2)	(7.1)	
1-3 hrs.	49	2	3	54	
	(57.6)	(2.4)	(3.5)	(63.5)	
>3 hrs.	24	0	1	25	
	(28.2)	(0.0)	(1.2)	(29.4)	
Total	78	2	5	85	
	(91.8)	(2.4)	(5.9)	(100.0)	

To analyze the result in this table, found 63.5%, 29.4% and 7.1% were 1-3 hours, more than 3 hours and less than 1 hour respectively. In addition, there were no different in 3 days outcome of emergency patients between each different response times and there were no statistically significant.

4.3.14 The association between transport time and 3 days outcome of emergency patients.

Table 23 Fisher's Exact Test to find association between transport time and 3 days outcome of emergency patients. (n=84)

Transport time	3 day outcome of emergency patients			Total	*Fisher's exact* p-value
	Admit, n (%)	D/C, n (%)	Dead, n (%)		
< 4.5 hrs.	58	2	4	64	1.000
	(69.0)	(2.4)	(4.8)	(76.2)	
>4.5 hrs.	19	0	1	20	
	(22.6)	(0.0)	(1.2)	(23.8)	
Total	77	2	5	84	
	(91.7)	(2.4)	(6.0)	(100.0)	

In this table showed 76.2% and 23.8% were transported less than 4.5 hours and more than 4.5 hours respectively. Furthermore it illustrated that there were no different between 3 days outcome of emergency patients and transport time and there were no statistically significant.

Chapter 5

DISCUSSION, LIMITATION, CONCLUSION, AND RECOMMENDATION

5.1 Discussion

From this study, 217 patients from 205 requested mission around Thailand were enrolled to this research. Some were excluded due to not meet eligible criteria of this study. The most frequent request region is Health region 1 (n=116, 63.0%) and the most frequent destination of transport patient is also Health region 1 (n=115, 62.5%).

172 missions (184 patients) were transport and 33 missions (33 patients) were not transport. Some transport missions have multiple patients transported. These data were secondary data collected from NIEM aeromedical transport patient record during 2010-2015. Primary data was also collected from participants who working for Thai Sky doctor service more than 1 year. In depth and focused group interview were perform with informed consent.

From demographic data, this study found that male (n=124, 67.4%) could access to this service more than female (n=60, 32.6%). Age group of transported patients found that age 15-59 years is the most frequent transport (n=107, 60.5%), age >60 years (n=50, 28.2%), age < 1 month (n=9, 5.1%), age 1-15 years (n=7, 4.0%) and age 1 month – 1 year (n=4, 2.3%) respectively. Almost all of transported patients are Thai (n=167, 89%) but none Thai also able to use this service for free service (n=17, 9.1%). Health insurance that cover expense of public air ambulance service are EMS fund (n=86, 46.7%) and NHS fund (n=98, 53.3%) but the most frequent use this service categorized by health insurance for hospital expense of transport patients are UC (n=98, 53.3%). Another health insurance are GOV.(n=35, 19.0%), other (n=23, 12.5%) and SSS (n=6, 3.3%) but no health insurance (n=22, 12.0%) accordingly.

All of transported patients are associated with National EMS dispatch center (n=184, 100.0%), Regional 1669 EMS dispatch center (n=184, 100.0%) and Flight medical director (n=184, 100.0%) accordingly. Aircraft provider who support public air ambulance service under MOU between NIEM and multiagency was found that the most frequent transport aircraft of state aircraft is RTA (n=57, 31.0%). Another state aircraft that use for transport are RTP (n=30, 16.3%), RTN (n=13, 7.1%), MOA (n=9, 4.9%), MONRE (n=3, 1.6%) respectively. KAN is most frequent of private aircraft provider (n=55, 29.9%), BDMS is the least frequent (n=16, 8.7%). Aircraft type is more transport by Rotor wing (n=114, 62.0%). Fixed wing is also use but lesser than RW (n=70, 38.0%). Secondary mission (n=167, 90.8%) is more frequent than primary mission (n=17, 9.2%) in Thailand. Medical team for public air ambulance service is operated by 2 level of care team, Doctor with nurses (n=62, 71.3%) and Nurses (n=25, 28.7%). There were some missing data of medical team from secondary data collection.

Patient condition that most frequent request public air ambulance service for transport is emergent or level 2 (n=106, 57.6%). The resuscitative or level 1 (n=55, 29.9%), urgent or level 3 (n=23, 12.5%) are lesser. The most frequent disease group of transported patients is trauma (n=63, 34.2%) least frequent is Neonate-Ped (n=2, 1.1%).

The immediate 1 day outcome post air transportation was admitted 182 cases (98.9%), Dead 2 cases (1.1%) and delayed 3 day out come post air transportation was admitted 157 cases (85.3%), dead 17 cases (9.2%) and discharge 10 cases (5.4%). Discharged cases within 3 days may resulting from their condition are resolved.

From this study found that gender, age, disease group, medical team, response time and transport time are not associated with immediate 1 day post transport outcome of Public air ambulance service in Thailand (p=1.000, p=.292, p=.406, p=.654, p=1.0, p=.599, p=.422) respectively. There are not significant difference

between these factors and immediate 1 day. Delayed 3 days outcome also not significant difference with these factors. Davis et al.[24], suggested that transport times do not adversely affect patient outcomes; however, this preliminary study involved only ground transports from a scene with short transport times. More recent studies have determined that transport times are not associated with survival in large out of hospital cardiac arrest populations.[25] [26] These data are limited, however, as transport times averaged less than 7 min and survival was the only outcome studied.[25] [26] Importantly, none of these studies have examined the effect of transport over long distances or interfacility transport from acute care facilities to tertiary care centers capable of specialized post-arrest care. While the risks of repeat cardiac arrest or clinical deterioration during transport exist, critical care transport team are trained to address these situations. A. Hartke , et al. mention that "It is important to note that transport time was not associated with the presence of any decompensation during critical care transport team care. Transport of resuscitated cardiac arrest patients to a tertiary care facility via critical care transport team is feasible, and the hazard of critical events is relatively constant over the first hour of transport".[27] Janis M. Quinn mention that "several factors were identified that show a trigger point for the escalation of mode of transport to a helicopter. These factors included a ground transport time of greater than 45 minutes in combination with an unstable neurologic or respiratory condition. It is important to note that transport time alone did not result in a higher tendency to choose a helicopter. Decision makers were found to be fairly conservative in choosing to mobilize a helicopter".[28]

This study found that patient severity was not significant difference associated with immediate 1 day post air transport outcome. (Fisher's exact test P=.654) but Patient severity was significant difference associated with delayed 3 day post air transport outcome of patient. (Fisher's exact test P=.033, $p<0.05$). Graham Nichol, et

al. [29] suggesting that referral of post-cardiac arrest patients to a facility with a comprehensive care plan may improve outcome despite the risk of transport. In this study, severity of patient before transportation promoted referring facility to send patient to higher facility. Air transportation is a choice of referring system in their region. This study found that immediate 1 day outcome is not associated factor with patient severity may assume that medical team had well trained and enough competency to transport severe condition of patients. Delayed 3 days outcome shown associated with patient severity may assume that severity of patients before transportation is too severe to recover and beyond receiving hospital capability.

This study 33 cases were not transport for few reason, not ready aircraft is the most frequent (n=14, 42.4%). Dead before transport (n=5, 15.2%) and weather condition (n=4, 12.1%) are also reasons for not transport. Other reason is not completed data (n=10, 30.3%). In Thailand, Thai sky doctor service was no dedicated aircraft for public air ambulance service. It is operated under MOU with agreement as aircraft available only. Then availability and readiness of aircraft are major problem for this service. Weather condition is also important for flight safety concerned. This reason make mission not operable. Many countries have dedicated aircraft for air medical transport that could make system function work well.[14, 30] In the United States, after an approximate doubling of helicopters dedicated to air medical transport before 1995, the number of aircraft providing air medical transport services grew by 130% between 1995 and 2008.[31] Globally, similar trends have been observed in air medical transport activity. As aeromedical transport becomes part of the global mainstream, we must remember that accident rates of 0.56-0.73 per 10,000 missions have been documented, with fatal air medical transport incident rates between 0.04-0.23 per 10,000. Moreover, fatal incidents may be more likely to occur in air medical transport than in general aviation.[21] Heidi H. Hon, et al.[21] mention that “although our ability to make conclusions is very limited, one can

speculate that better flight coordination and improved awareness of flight conditions across the entire continuum of air medical transport infrastructure may have reduced the role of weather and visibility as a major contributing factor. Our analysis suggests that focus in prevention should now shift to improving safety during night time flight conditions. This should be facilitated by providing pilots with additional training, augmented vision capabilities, equipping aircraft with terrain awareness and warning systems and using more selective approaches to high-risk, night time flights." For these safety reasons pilots choose to refuse mission to prevent aircraft accident.

From interview data shown that the strong policy support are most influence facilitating factors for Thai sky doctor service. Collaboration between multi agencies was made this service could started well, aircraft could fly with quick communication, medical team could assembly with aircraft in short time, financial support from major fund, 1669 regional dispatch center know guideline for service and medical director's decision are also important part of successful of mission. Request for service at day time is much easier to successful than at night time. In the other hand, in some region or some situation such as some area do not have aircraft, no medical directors, no medical team or medical not confidence to fly with military aircraft due to safety concerned may obstacles for this service.

5.2 Limitation

This study use Cross sectional Descriptive study to identify characteristic of Thai Sky doctor service and associated factors with limitation of data. Public Air ambulance service (Thai Sky doctor service) is a new medical service in Thailand that few patients can access by selective criteria. Although this free public service will not charge to patients directly but government fund would support the service with high cost, high value and this service usually limit use in rural or remote area.

Data records are also limit for study because of some of data collection were missing and not complete especially in disaster situation.

5.3 Conclusion

Thailand public EMS was established for many years ago with ground transportation. Aeromedical transport was started for military mission. Private air ambulance service was established in private insurance and pay service. Thai sky doctor service was start since 2010 by initiative idea of former Secretary-General NIEM, Dr.chatree charoenchiwakul and his team. Collaboration under MOU is tools for development of this project. More than 1 million EMS case per year were transported by ground ambulance but only 205 missions were request for pubic air ambulance service in Thailand. 184 cases were transported and 33 cases were not transport due to lack of aircraft, weather condition and patients was dead before transport. There were identified characteristic of Thai sky doctor service and factors associated with 1 and 3 day outcome post air transportation. Age, gender, disease group, medical team, response time and transport time were not associated with 1 and 3 days outcome. Patient severity was statistically significant difference associated with 3 days outcome.

5.4 Recommendation

Thai sky doctor service system is a new public aeromedical transport in Thailand. There is very few study about characteristic and its outcome. This study is an initial study of Public air ambulance service (Thai sky doctor service) of Thailand. Further study may need to know more about cost-effectiveness, patient outcome compare between air and ground transportation or public concern about new service. To improve quality and accessibility of air transportation for emergency patients who need urgent transportation, NIEM and MOPH should promote to have dedicated aircraft for public air ambulance service in all health regions which need urgent transportation service from lower medical facility to higher facility to improve outcome of critical patient.

REFERENCES

1. NIEM, *EMS situation report 2013* 2013: Bangkok.
2. Pangma, A., *Emergency aeromedical service guideline revision 2014*, NIEM, Editor. 2014: Bangkok.
3. http://www.oxforddictionaries.com/definition/english/value. access on 17 Sep 2015].
4. http://www.oxforddictionaries.com/definition/english/collaboration. access on 17 Sep.2015].
5. Tadadej, J., *Model and Policy Recommendations for Thailand's Aero Medical Service*, in *Social science* 2011, Maefahluang University.
6. Young, T.V., T.V. Shepley, and M. Song, *Understanding agenda setting in state educational policy: An application of Kingdon's multiple streams model to the formation of state reading policy.* education policy analysis archives, 2010. **18**: p. 15.
7. Shah, M.N., *The Formation of the Emergency Medical Services System.* American Journal of Public Health, 2006. **96(3),**: p. 414–423.
8. Pozner, C.N., et al., *International EMS Systems: The United States: past, present, and future.* Resuscitation, 2004. **60**(3): p. 239-244.
9. Secretariat, A., *ASEAN Socio-Cultural Community Blueprint*. 2009: Jakarta. p. P6-P11.
10. Teichman, P.G., Y. Donchin, and R.J. Kot, *International aeromedical evacuation.* New England Journal of Medicine, 2007. **356**(3): p. 262-270.
11. Margolis, S.A. and V.A. Ypinazar, *Aeromedical retrieval for critical clinical conditions: 12 years of experience with the Royal Flying Doctor Service, Queensland, Australia.* The Journal of emergency medicine, 2009. **36**(4): p. 363-368.
12. O'Connor, J., *The royal flying doctor service of Australia: The world's first air medical organization.* Air medical journal, 2001. **20**(2): p. 10-12.
13. Martin, T., *Aeromedical Transportation: a clinical guide*. 2006: Ashgate Publishing, Ltd.
14. Nishikawa, W. and Y. Yamano, *An overview of the development of helicopter emergency medical services in Japan.* Air medical journal, 2010. **29**(6): p. 288-291.
15. Tanigawa, K. and K. Tanaka, *Emergency medical service systems in Japan: past, present, and future.* Resuscitation, 2006. **69**(3): p. 365-370.
16. http://www.hemnet.jp/english/where/index.html. *Where are they deployed?* 2015.
17. http://kanchanapisek.or.th/kp6/sub/book/book.php?book=20&chap=8&page=t20-8-infodetail02.html. *history of aviation medicine in Thailand*. Thai encyclopedia for children 2015.
18. NIEM, *Emergency Medical Act BE.2551*. 2008.
19. NIEM, *Emergency medical operation*, in *Annual report 2014*. 2014.
20. Snooks, H., et al., *The costs and benefits of helicopter emergency ambulance services in England and Wales.* Journal of Public Health, 1996. **18**(1): p. 67-77.
21. Heidi H. Hon, M., Thomas R. Wojda, MD, Noran Barry, MD et.al., *Injury and fatality risks in aeromedical transport:focus on prevention.* Journal of Surgical Researh, August 2016. **204**: p. 297-303.
22. Gilboy N, T.T., Travers D, Rosenau AM. , *Emergency Severity Index (ESI): A Triage Tool for Emergency Department Care, Version 4. Implementation Handbook 2012 Edition.* , M.A.f.H.R.a.Q. Rockville, Editor. November 2011., AHRQ Publication.

23. NHTSA, *Guide For Interfacility Patient Transfer*, DOT, Editor. April 2006.
24. Davis DP, F.R., Aguilar S, Metz M, Ochs G, McCallum-Brown L, Ramanujam P, Buono C, Vilke GM, Chan TC, Dunford JV., *The feasibility of a regional cardiac arrest receiving system.* Resuscitation, 2007 **74(1)**: p. 44-51.
25. Spaite, D.W., Bobrow, B. J., Vadeboncoeur, T. F., Chikani, V., Clark, L., Mullins, T., & Sanders, A. B. , *The impact of prehospital transport interval on survival in out-of-hospital cardiac arrest: Implications for regionalization of post-resuscitation care.* Resuscitation, 2008. **79(1)**: p. 61-66.
26. Daniel W. Spaite, M., , , , et al., *Effect of Transport Interval on Out-of-Hospital Cardiac Arrest Survival in the OPALS Study: Implications for Triaging Patients to Specialized Cardiac Arrest Centers* Annals of Emergency Medicine, 2009. **54**(2): p. 248-255.
27. A. Hartke, B.E.M., J.C. Rittenberger, C.W. Callaway, F.X. Guyette, *Incidence of re-arrest and critical events during prolonged transport of post-cardiac arrest patients.* Resuscitation, 2010. **81**: p. 938-942.
28. Janis M. Quinn, M.C.P., Mark Adler,Ann & Robert H., *Factors Associated With Mode of Transport Decision Making for Pediatric-Neonatal Interfacility Transport.* Air medical journal, 2015. **34**(1): p. 44-45.
29. Graham Nichol, E.T., Clifton W. Callaway, Jerris Hedges,Judy L Powell,Tom P. Aufderheide, Robert Lowe, Todd Brown,Tom Rea,John Dreyer,Dan Davis,Ahamed Idris, and Ian Stiell., *REGIONAL VARIATION IN OUT-OF-HOSPITAL CARDIAC ARREST INCIDENCE AND OUTCOME.* JAMA, 2008. **300**(12): p. 1423-1431.
30. Matsumoto, H., et al., *Effectiveness of a "doctor-helicopter" system in Japan.* Isr Med Assoc J, 2006. **8**(1): p. 8-11.
31. Flight_Safety_Foundation, *Helicopter Emergency medical services*

(HEMS): industry risk Profile. 2009.

APPENDIX

Measurement Tools 1

Patients record number..... Date of Mission.....

Part 1 Individual Characteristic of Patient

Gender ☐ M ☐ F

Age (year) .....

Type of health security scheme ☐ UC ☐ SSS ☐ GOV ☐ other ☐ None

Nationality ☐ Thai ☐ None Thai

Part 2 Emergency disease group

☐ Stroke ☐ STEMI ☐ Trauma ☐ OB ☐ Newborn ☐ Ped-Neonate ☐

Other

Part 3 Patient severity

Level of Acuity/Triage ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Part 4 Mission request output

☐ Mission successful ☐ Mission successful (Aborted, Missed)

Part 5 if aborted or missed, what is reason for Mission Aborted or Missed ?

☐ Death before transport ☐ Not ready Aircraft ☐ Weather condition ☐ other

If Mission done please continue

Part 6 Mode of Air ambulance service

☐ Primary mission ☐ Secondary mission (interfacility)

Part 7 National EMS Dispatch Center

☐ NIEM ☐ Other

Part 8 Regional 1669 EMS Dispatch Center

Health Region ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 13

Part 9 Flight destination

☐ Within Region ☐ Cross Region

Part 10 Type of Aircraft

☐ Fixed Wing (FW) ☐ Rotor Wing (RW)

Part 11 Flight Time (one way) compare to Ground Time

Flight time ..... Hrs

Ground Time ..... Hrs.

Part 12 Flight response time .....Hrs

Part 13 Number of Patient

☐ Single ☐ Multiple

Part 14 Aircraft provider

☐ RTA ☐ RTN ☐ RTAF ☐ RTP ☐ MOA ☐ MONRE ☐ BDMS ☐ KAN

Part 15 Airport or Helipad use

☐ Airport ☐ Helipad (None Airport)

Part 16 Medical Team

☐ Doctor with nurses ☐ Nurses

Part 17 Patient outcome within 1 days after mission

☐ Admit ☐ Dead ☐ D/C

Part 18 Patient outcome within 3 days after mission

☐ Admit ☐ Dead ☐ D/C

Part 19 Payer for air ambulance service

☐ EMS Fund ☐ NHS Fund

Measurement Tools 2

Personal / Group In depth Interview

Code Sex age

What is your profession?

How long you work for Public air ambulance service in Thailand?

What are your roles in Public air ambulance service?

In your opinion, What are facilitating factors or obstacle factors for Public air ambulance service?

VITA

Curriculum Vitae

Name : Dr. Atchariya Pangma

Nationality: Thai Date of Birth: 13 August 1970

Professional Education and Training Qualification

1994 Medical Doctor ,Srinakarinwirot University, Bangkok Thailand.

1995 Diploma in Aviation Medicine , Institute of Aviation Medicine ,RTAF.

2002 Diploma in Family Medicine ,Thai Medical Council.

Work Experienced

I have direct experiences in service provision, service developments, education, and policy developments in emergency and crisis medicine. I served as a flight doctor for RTAF and Bangkok Hospital from 1995-2009, which I managed more than 200 patients on flights around the world and more than 1,000 cases on ground ambulance . I have been actively involved in providing emergency medicine training for doctors, nurses, and emergency medical technicians (EMT). Over the past six years, I have been actively involved in developing and implementing Public aeromedical services(THAI SKY DOCTOR SYSTEM) in Thailand. At a policy level under Emergency Medical Acts BE.2551 , I had worked on developments of national policies on emergency medical services. I am also involved in developing a diploma-degree EMT program into a bachelor-degree program on emergency Paramedic which will be the first of its kind in Thailand. More over, I have been invited to be an external specialist for Ph.D. Candidate examination at Maefahluang University and Khonkean University. During the 2011 Mega floods in Thailand, I took an important role in public evacuation and patient retrieval and transport by cars, boat and airplanes. During my working in Bangkok Hospital I took major roles for EURAMI and CAMTS accreditation standard. Currently I am being a director of Bangkok Aeromedical Transport center, BDMS.