THE OUTCOME OF EMERGENCY PATIENT TRANSPORTED BY PUBLIC AIR AMBULANCE SERVICE IN THAILAND

Atchariya Pangma, Surasak Taneepanichskul*

College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand

ABSTRACT:

Background: There are insufficiency and less accessibility of public emergency medical service (EMS) among emergency patients in remote area of Thailand. Thai sky doctor service, which was initiated by National Institute for Emergency Medicine (NIEM), improved accessibility of emergency patients in urgent need to transfer by aeromedical service in rural and remote area of Thailand. However, there were lack of study about provision of this service in Thailand. The objectives of this study were to study characteristic and outcome of public air ambulance service (Thai sky doctor service) in Thailand.

Methods: A descriptive cross sectional study was conducted to investigate the outcome of transported emergency patient by Public air ambulance service (Thai sky doctor service) in Thailand. The purposive selection of data was used; and the secondary data of all patients was obtained from NIEM (N= 205). Additional interview data obtained from staff who worked with Thai sky doctor service system. These were 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, standard deviation were used for descriptive data; and Fisher's Exact test was used to analyze the factors associated with 1 day and 3 days outcome.

Results: Two hundred and five missions were requested for pubic air ambulance service in Thailand. 184 cases were transported; and 33 cases were not transported due to lack of aircraft, weather condition and patients was dead before being transported. There were identifiable characteristics of Thai sky doctor service and factors associated with 1 and 3 days 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. Patient severity was significant difference associated with 3 days outcome at the .05 statistical level (p = .033). There were facilitating and obstacle factors of this service.

Conclusion: Thailand has public air ambulance service policy with good public concern. Patient severity before air transport was associated with delayed 3 days outcome. Further study, there is a need to improve patient outcome and support public air ambulance service development.

Keywords: Air ambulance service; Aeromedical transport; Emergency medical services; Thai sky doctor service; Thailand

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INTRODUCTION

In Thailand, there are more than 4 millions of emergency patients per year [1]. In the past, all of them came to hospital by family or witness. Most of them were transported by car. Emergency Medical Service (EMS) system in Thailand established more than 50 years ago; but official establishment was in 2008 by Emergency Medical Acts BE. 2551. The emergency medical call center

* *Correspondence to: Surasak Taneepanichskul*
E-mail: surasakta@yahoo.com

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named Narenthorn Center and 1669 is emergency phone number for free public access. In addition, the number of emergency patient that utilizing EMS system is increasing year by year. There were 1.2 million cases in 2013 [1].

In remote area of Thailand, there are insufficiency of EMS service and less accessibility to public EMS among those emergency patients. Therefore, when they need to transfer a patient to higher facility, it may take longer time than the golden period of each specific diseases. For example, an acute ischemic stroke required to receive medication within 4.5 hrs. If those emergency patients live in remote area as Mae Hong Son province, northern of Thailand, then there would be risks of getting fatality and morbidity due to limitation of specialist and medical facility. Thus, regarding to the problem stream and requested from Mae Hong Son provincial public health office, the policy that initiate by National Institute for Emergency Medicine improved accessibility of emergency patient who are in urgent need to transfer by aeromedical service in rural and remote area of Thailand.

Aeromedical transport service in Thailand originally started from military mission which was more than 60 years ago. However, the civil aeromedical transport service in Thailand is operated recently by public and private organization that included hospital base service providers and none hospital base providers. Private air ambulance service is operated by private hospitals and assistance companies, which these are paid service. In addition, there are many private hospitals that setup this service for their patients. Nevertheless, Bangkok hospital (BDMS) is the first hospital in Thailand who served private/self-pay patients; and this is covered by insurance. The BDMS Sky ICU is a name of the first dedicated Helicopter Emergency Medical Service (HEMS) in Thailand, started for private service in 2007. This service is operated by Bangkok Helicopter Services Company, Bangkok Hospital under name of Bangkok Dusit Medical Service (Public Company), BDMS.

Moreover, public air ambulance service or named as "Thai sky doctor service (TSDS)" has been established under the initiative idea of Dr. Chatree Chareonchevakul, the first Secretary-General of National Institute for Emergency Medicinez [1]. His idea came from Her Royal Princess Sirinthorn's phrase when she gave advice to the high official level of government about helicopter medical service that this kind of helicopter emergency medical service would be useful for Thai citizen when they got severe illness.

Aeromedical collaboration policy is a policy of choice that initiated by National Institute for Emergency Medicine (NIEM), The collaboration made by (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 [1]. 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. There are so many rural or remote area of Thailand that may need air ambulance service but the first area selected for this policy implementation was Mea Hong Son, Northern region of Thailand.

Thai sky doctor service project has been launch since 2010. There were 205 requests and 217 patients involved. There was very few study about public air ambulance service in Thailand. The first study by Tadadej [2] is model and policy recommendation for Thailand's aeromedical service. Result of the study found that within the Emergency Medical Act of B.E. 2551 (2008), NIEM was 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), which it intends to provide medical airlift participation. It considered as the distinguish usable assembly parts model. Moreover, researcher gathered all essential problems found from the utilization and consideration to introduce the aero emergency medical policy recommendation to NIEM. Therefore, all emergency patients can access to the healthcare increasingly with equity, efficiently and sustainably. Since after the Thai sky doctor service was implemented there are no further study about provision of this service. This study intended to study characteristic and outcome of public air ambulance service (Thai sky doctor service) in Thailand.

Table 1 Demographic data

Data	n	%
Mission		
Request with transport	172	83.9
Request with no transport	33	16.1
Total	205	100.0
Patients		
Transport	184	84.8
No transport	33	15.2
Total	217	100.0
Transport mission		
Single patient	163	94.8
Multiple patients	9	5.2
Total	172	100.0

Table 2 Demographic data of patients transport and not transport mission

Variables	Transport mission (n=184) n(%)	Not transport mission (n=33) 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)
>1 month-1 year	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)
Non-Thai	17(9.1)	1(3.0)

MATERIALS AND METHODS

Sample size and sampling technique

Purposive selective from all patient records, those who were transported by public air ambulance service (Thai sky doctor service) in Thailand during 2010-2015. Sample size n= 217 cases from 205 requested mission and purposive selective from representative persons who associated with public air ambulance service in Thailand. National 1669 dispatch center (n=3), regional 1669 dispatch center (n=1), flight medical director (n=3), flight medical team (n=6). All missions during disaster response and incomplete data record were excluded.

Statistical analysis

Descriptive statistics as percentages, mean, median and standard deviation were applied in this study. Inferential statistics as Chi-square test and Fisher's exact test were applied in this study.

Ethical consideration

The thesis had been approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Sciences Group, Chulalongkorn University (COA No. 128.1/59 dated 10 October 2016).

RESULTS

The results showed that 205 missions were requested, 172 missions (83.9%) were transported and 33 missions were not transported (16.1%). 184 patients were transport (84.8%) and 33 patients were not transported (15.2%). Some transported mission were multiple patients transport (n=9, 5.2%), as shown in Table 1.

From 184 transported patients majority were male (67.4%), age group 15-59 years (58.2%), Thai nationality (89.3%) and Universal Coverage (UC) health insurance (53.3%). Trauma is major problem of transported patients (34.2%) follow by other (23.9%) and acute ST-elevation myocardial infarction (STEMI; 20.1%). Triage or acuity level 2 was the most frequent transported patients (57.6%). In none

Table 3 Demographic data of patients transport and not transport mission

Variables	Transport mission (n=184) n(%)	Not transport mission (n=33) n(%)
Health insurance		
Government	35(19.0)	4(12.1)
Social Security Fund (SSF)	6(3.3)	0(0.0)
Universal Coverage (UC)	98(53.3)	7(21.2)
Others	23(12.5)	20(60.0)
None	22(12.0)	2(6.1)
Disease groups		
Neonate-pediatric	2(1.1)	0(0.0)
Newborn	9(4.9)	2(6.1)
Obstetrics	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)
Others	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)

Table 4 Variables in transport mission

Variables	Transport mission (n=184) 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	
Royal Thai Army (RTA)	57(31.0)
Royal Thai Navy (RTN)	13(7.1)
Royal Thai Air Force (RTAF)	1(0.5)
Royal Thai Police (RTP)	30(16.3)
Ministry of Agriculture (MOA)	9(4.9)
Ministry of National Resource and Environment (MONRE)	3(1.6)
Bangkok Dusit Medical Services Company (BDMS)	16(8.7)
KAN Air	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)

transport mission, 33 patients majority were male (54.5%), age group 15-59 years (48.5%), Thai Nationality (97.0%), other health insurance (60.0%). Disease group mainly is other (36.4%) follow by stroke (21.2%), trauma (18.2%) and STEMI (18.2%). Triage or acuity level 2 is the most

Table 5 One day and 3 days outcome of emergency patients transported by public air ambulance service in Thailand

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

Table 6 The association between factors and 1 day and 3 days outcome of emergency patients

Factors	Fisher's exact test *p*-value	
	1 day outcome	3 days outcome
Gender	1.000	.139
Age	.292	.628
Disease group	.406	.173
Patient severity	.654	.033*
Medical team	1.000	.812
Response time	.599	.639
Transport time	.422	1.000

*$p < .05$

Table 7 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	*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)	

*$p < .05$

requested (75.8%) as shown in Table 2 and Table 3.

All of 184 transported patients requested and coordinated with national EMS dispatch center. Helipad is mainly use for transported by rotor wing (62.0%). Doctor and nurses are mostly medical team transport with patients (71.3%). Majority of aircraft providers were Royal Thai Army (RTA, 31.0%) and KAN Air (29.9%); Rotor wing is most common use (62.0%) with secondary mission (90.8%). Major of fund support service was NHS fund (53.3%). EMS fund is less (46.7%). As shown in Table 4. Main causes of not being able to transport patients in 33 cases were not having aircraft ready (42.4%) follow by other reason (30.3%) and dead before being transport (15.2%). 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%), as shown in Table 5. 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, as shown in Table 6 and Table 7.

DISCUSSION

From this study, 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. There are no significant differences between these factors and immediate 1 day. There is also no significant difference of delayed 3 days outcome with these factors. Davis, et al. [3] 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 [4, 5]. These data are limited; however, as transport times averaged less than 7 minutes and survival was the only outcome studied [2, 3]. Importantly, none of these studies have examined the effect of transport over long distance 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. Hartke, et al. [6] mentioned 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" [4]. Quinn, et al. [7] mentioned 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 [2].

This study found that patient severity was significant difference associated with delayed 3 day post air transport outcome of patient (Fisher's exact test P=.033, $p<0.05$). Nichol, et al. [8] suggested 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 with patient severity; it 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 transported. Other reason is not completed data (n=10, 30.3%). In Thailand, Thai sky doctor service had 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 problems 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 [9, 10]. 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 [11]. 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 [12]. Hon, et al. [12] mentioned 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; this may have reduced the role of weather and visibility as a major contributing factor". Our analysis suggests that focusing 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, nighttime flights. For these safety reasons pilots choose to refuse mission to prevent aircraft accident.

This study is cross-sectional descriptive study with interview data, 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. This service is highly utilized in rural or remote area. Data records were also limited for study.

CONCLUSION

Thailand public EMS was established for many years ago with ground transportation. Aeromedical transport began for military mission. Private air ambulance service was established in private insurance and pay service. Thai sky doctor service started in 2010 by initiative idea of former Secretary-General NIEM, Dr. Chatree Charoenchiwakul and his team. Collaboration under MOU is a tool for development. More than 1 million EMS cases per year were transported by ground ambulance; but only 205 missions were requested for pubic air ambulance service in Thailand. About 184 cases were transported and 33 cases were not transported due to lack of aircraft, weather condition; and patients died before being transported. There were identifiable characteristic of Thai sky doctor service and factors associated with 1 day and 3 days outcome post air transportation. Age, gender, disease group, medical team, response time and transport time were not associated with 1day and 3 days outcome. Patient severity was statistically significant associated with 3 days outcome. This study is an initial study of public air ambulance service (Thai sky doctor service). Further study may need to know more about patient outcome. Thai government should consider to have dedicated aircraft for public air ambulance service.

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