Original Article

Effectiveness of Recruiting Specialist Physicians for Critical Elderly Patients in Remote Islands

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A R T I C L E   I N F O

Article history:
Received 22 July 2009
Received in revised form 8 December 2009
Accepted 28 August 2010
Available online 26 June 2012

Keywords:
care,
emergency air medical transport (EAMT),
remote island

S U M M A R Y

Background: A previous study demonstrated the effectiveness of video-telemedicine in reducing the frequency of unnecessary air medical transports and costs for screening of patients requesting emergency air medical transport (EAMT). The purpose of this study is to investigate the effectiveness of recruiting specialist physicians for critical patients, especially elderly patients, in remote islands.

Methods: This study compares one prospective and two historical cohorts. Stage 1 (S1) was the stage without preflight screening and stage 2 (S2) was followed with preflight video-telemedicine screening. Stage 3 (S3) was the stage involving recruiting specialists from the main island. Effectiveness estimates were calculated comparing monthly EAMT applications, actual flights and approval rate among the three stages.

Results: There were 948 EAMT applications, including 685 S1 patients, 137 S2 patients (45 elderly patients) and 126 S3 patients (56 elderly patients). Patient demographics among the three groups were similar. We showed a decreasing trend in monthly EAMT applications from 19.60 (S1), 13.70 (S2) to 7.88 (S3) (p < 0.05). The average number of flights/month also significantly decreased from 19.60 (S1), 12.50 (S2), to 6.75 (S3) (p < 0.05). The approval rate of EAMT requests among 3 stages fell from 100% (S1), to 91.2% (S2), and 85.7% (S3).

Conclusion: Recruiting specialist physicians from the main island to remote islands not only reduces EAMT requests significantly, but also improves care for critical elderly patients in remote islands.

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1. Introduction

The demand for emergency air medical transport (EAMT) services has increased in Taiwan as well as other countries in recent years. The geographical situations in the island nation of Taiwan with the lack of development of medical manpower and facilities on remote islands, have resulted in a growing need for EAMT to the main island of Taiwan.1,2 The lack of a preflight screening mechanism resulted in rapid growth of unnecessary flights, which in turn increased government expenditures of NT$200,000,000 (US$6,250,000) each year. For cost containment, the Taiwan government health authority established the National Aeromedical Consultation Center (NACC), a physician-based helicopter dispatch center, for the preflight screening of patients requesting EAMT services. A previous study demonstrated that the incorporation of a screening mechanism with the assistance of a video-telemedical system significantly reduced the frequency of unnecessary air medical transports and consequently saved costs.1 However, EAMT may not be the best solution for medical needs on remote islands and rural areas considering flight safety and cost.3–5

In addition to EAMT, there are other public health measures to improve medical care in remote locations, for example, the recruitment of specialist physicians from the main island. However, there are few studies available on deployment of specialists in reduction of EAMT. Our objective in this current study is to determine the effectiveness of recruiting specialist physicians from the main island for critical patients, especially elderly patients in remote islands.

2. Materials and methods setting

2.1. Definitions

2.1.1. Study design and the patient selection

The design is a cohort study, using a historical comparison. The study population was defined in three stages. Stage 1 (S1) and stage...
Results are evaluated by frequency distributions in each stage. All \( p \) values were two tailed, and a value of \( p < 0.05 \) was considered to be statistically significant.

### 3. Results

A total of 948 EAMT applications were included in all three stages. There were 685, 137 and 126 applications in S1, S2 and S3, respectively. There were 45 elderly patients in S2 and 56 elderly patients in S3. Patient demographic data among the three groups were similar for gender, age and classification of medical conditions. Patient age had a bimodal distribution, with peaks at 61–75 years and under 15 years (Table 1). Non-traumatic patients comprise the majority of cases; there were 75.6% in all patients and 84.2% in elderly patients (Table 2). The percentage of all-aged and elderly patients’ medical conditions in S3 was similar to that in S1 and S2 (Table 3 and Table 4). Stroke was the most common medical condition of EAMT, while head injury was the leading cause in surgical cases.

#### 3.1. Analysis of the EAMT Flight

In S1, there were 685 EAMT applications and flights in 35 months. The average number of monthly applications and actual flights were both 19.6. In S2, among 137 EAMT applications, 125 were carried out in 10 months. The mean number of monthly applications and actual flights were 13.7 and 12.5, respectively. For elderly patients, there were 4.5 applications/month and 4.5 actual flights/month in S2. In S3, there were 126 EAMT applications, but only 108 EAMTs were completed in 16 months. For elderly patients, there were 3.5 applications/month and 3.5 actual flights/month in S3. The average number of monthly applications and actual flights were 7.9 and 6.8, respectively (Fig. 1). Analysis of the EAMT applications over the three stages shows a decreasing trend in the average number of EAMT applications \((p < 0.05)\) and actual flights/month \((p < 0.05)\) (Fig. 1). The approval rate of EAMT requests decreased from 100% in S1, 91% in S2, and 84% in S3.
in S2 to 86% in S3 (Fig. 2). For elderly patients, the approval rate of S2 and S3 is 100%.

In S3, there were 18 patients who did not meet the criteria for EAMT transfer, including 12 patients who remained in Penghu Island and received the same level of care as in level 1 hospital. Four of the patients were transferred by scheduled commercial flights and one was transferred by regular shuttle ferry. One patient expired at the ER before transport. None of the 18 patients had medicolegal complications.

4. Discussion

This is the first report to evaluate the effectiveness of both a video-telemedicine system and specialist-recruiting measures to reduce the frequency of EAMT of remote islands, especially for elderly patients. The study demonstrates the stepwise reduction in the number of unnecessary flights. Our previous study\(^1\) showed that physicians in NACC using the video-telemedicine system could immediately evaluate the need for EAMT and thus avoid unnecessary air medical transport. The present study demonstrates that physicians recruited from a tertiary medical center in the main island Taiwan to a local medical facility in remote islands, further reduced the need for EAMT. The analysis of monthly EAMT applications and actual flights showed a significant decrease in three stages. Re-allocation of medical manpower, as well as the NACC screening system not only have a “gatekeeper” function but also increased capabilities of managing critical patients, especially for elderly patients in remote islands.

The shortage of manpower and facilities in remote hospitals has necessitated EAMT for prompt and definitive treatment of critical patients, especially for elderly patients. EAMT is becoming an increasingly important factor in improving the quality of primary care and avoiding medicolegal issues\(^1,2,11\). The previous study demonstrated that intervention with NACC using video-telemedicine as the first intervention, could reduce unnecessary air medical transport. These results are similar to those reported by Gong et al\(^12\) and Lyznicki et al\(^13\) who showed that pre-flight medical screening of patients may assure both the patient and physician of the safety of air travel and prevent complications such as in-flight emergencies. A well-defined and integrated triage system has been widely suggested for effective management of EAMT\(^14,15,16,17,18\). The present study also demonstrates that specialist physicians in remote hospitals could manage critical conditions, especially for elderly patients and further reduced the need for EAMT.

4.1. Limitation

The findings from this present study may not be applicable for islands or rural areas with a small population. The ideal population has not yet been identified. In the present study, we found Penghu Island had as much population as for the study measures. No specialists were recruited in smaller islands located at the east

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<th>Medical disease</th>
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CV = cardiovascular medicine; GI = gastroenterology; Neuro = neurology; Ortho = orthopedic surgery.

**Table 4**
The analysis of subspecialist needs in medical, surgical and obstetrics/gynecology conditions for EAMT of elderly patients by stages.

**Fig. 1.** EAMT flights and applications per month in three stages. *p = 0.039, **p = 0.003.

**Fig. 2.** Approval rate of EAMT request in three stages.
coast of Taiwan, such as Lutao (population: 3089) and Lanyu (population: 3820).

The patient care quality of specialist physicians cannot be quantified in this study.

5. Conclusion

We have studied two measures in reducing EAMT from a remote island. The first, a preflight screening with video-telemedicine by physicians in NACC and the second, a physician-relocating system to Penghu Island. We found that these measures significantly reduced the frequency of EAMT and improved the care of critical patients, especially elderly patients in remote islands.

Conflict of interest statement
All contributing authors declare no conflict of interest.

References