


Original Article

Overview of doctor-staffed ambulance use in Japan: a nationwide survey and 1-week study

Yutaka Igarashi,¹  Shoji Yokobori,¹ Hidetoshi Yamana,² Kosuke Nagakura,³ Jun Hagiwara,¹ Tomohiko Masuno,¹ and Hiroyuki Yokota¹

¹Department of Emergency and Critical Care Medicine, Nippon Medical School, Tokyo, ²Emergency Department, Tsukuba Medical Center Hospital, Tsukuba, and ³Faculty of Medicine, Nippon Medical School, Tokyo, Japan

Aim: In Japan, standard prehospital care is provided by emergency medical services teams. Doctor-staffed ambulances play a role in facilitating the immediate treatment of critically ill patients to increase the survival rates. However, little is known about their activities. We revealed the present situation of doctor-staffed ambulances in Japan.

Methods: First, we surveyed all the fire departments in Japan and determined whether a doctor-staffed ambulance was present within their district boundary. Second, we surveyed hospitals that operate doctor-staffed ambulances in their system to list their activities during a 1-week period.

Results: Of 133 hospitals that operated a doctor-staffed ambulance, 73 (55%) replied to our questionnaire. Only 26 (36%) of them provided 24-h ambulance deployment. Additionally, 51 (70%) of hospitals bore the operational costs of ambulances. Within 1 week, 345 doctor-staffed ambulances were dispatched, but 97 (28%) were cancelled. In total, 62 patients (28%) were diagnosed with cardiac arrest, 48 (19%) with trauma or burns, 36 (15%) with stroke, and 22 (9%) with acute coronary syndrome; 159 (58%) were transferred to a tertiary emergency medical center.

Conclusions: Doctor-staffed ambulances have the advantage of deployment at night and in urban areas compared to doctor-staffed helicopters. Among the 73 hospitals that responded to the questionnaire, doctor-staffed ambulances were dispatched almost as frequently as doctor-staffed helicopters. However, doctor-staffed ambulances did not receive adequate funding. Future data collection is necessary to determine the efficacy of doctor-staffed ambulances among hospitals that operate this service.

Key words: Doctor-staffed ambulance, emergency life-saving technician, Japan, prehospital care, survey

INTRODUCTION

IN JAPAN, STANDARD prehospital care is provided by emergency medical services teams, including paramedics, in providing prehospital emergency medical care. The list of procedures that paramedics are allowed to carry out has been expanded to provide medical aid for critically ill patients as early as possible. Paramedics are only allowed to administer crystalloids to patients in shock, glucose to patients with hypoglycemia, and epinephrine to patients with cardiac arrest; in addition, they are permitted to intubate patients

with cardiac arrest. However, to increase the survival rate, doctors are required to travel to the site of medical emergency by helicopters or vehicles to provide medical care.

The use of doctor-staffed helicopters reduces the time to contact with a doctor and the transportation time;^{1–4} however, they are expensive, and their utility is affected by factors such as place, weather, and time. Alternatively, the doctor-staffed ambulance, which is defined as a motor vehicle for ground transportation of a physician and/or a patient, including “a rapid response car” (only delivering physicians without patients’ transfer), have the advantage of being cost-effective for use and maintenance. They are deployed all over Japan according to hospital and local circumstances.

There have been few surveys of doctor-staffed ambulance use in Japan, and little is known about them, whereas emergency medical services utilizing helicopters are well promoted and widespread. The aim of this study was to clarify the current status of doctor-staffed ambulance use in Japan.

Corresponding: Yutaka Igarashi, MD, PhD, Department of Emergency and Critical Care Medicine, Nippon Medical School, 1-1-5 Sendagi, Bunkyo-ku, Tokyo 113-8603, Japan. E-mail: igarashiy@nms.ac.jp.

Received 31 Oct, 2017; accepted 24 Apr, 2018; online publication 4 Jun, 2018

Funding Information

This research was supported by the General Insurance Association of Japan.

METHODS

Survey of fire departments

FIRST, WE SENT a questionnaire to all fire departments in Japan and determined whether doctor-staffed ambulances were available within the boundaries of their districts in June 2016.

Survey of hospitals

Next, based on the first survey, we identified hospitals that operated a doctor-staffed ambulance as part of their system and examined their activities for 1 week. The following data regarding the operating system were collected.

1. Operation system: this was classified into three types (hospital car, workstation, and pick-up systems). In the hospital car system, a doctor and nurse were delivered by a vehicle owned by the hospital, following a request from the fire department. In the workstation system, emergency medical services were deployed from a workstation at the hospital. A doctor and nurse were delivered by an ambulance, along with the emergency medical services team. In the pick-up system, the emergency medical services team would pick up a doctor and nurse from the hospital and deliver them to the scene by an ambulance.
2. Operation time (whether 24 h or only in the daytime; daily or on weekdays only)
3. Number of registered staff (including doctors, nurses, emergency life-saving technicians, and logisticians)
4. Number of staff dispatched to the site (including doctors, nurses, emergency life-saving technicians, and logisticians)
5. Existence of criteria for dispatching the doctor-staffed ambulance
6. Certification of emergency driving
7. Institution or organization bearing operational costs
8. Subscription of insurance and financial resources.

In addition, the hospitals were asked the following questions regarding activities from July 18 to 24, 2016: (i) number of doctor-staffed ambulances dispatched, (ii) number of cancellations, (iii) patient characteristics (sex and age), (iv) date and time of use (weekday or weekend; day shift or night shift), (v) patients' diagnosis (cardiac arrest, trauma or burn, stroke, and acute coronary syndrome), (vi) procedures carried out (administration of i.v. lines, ultrasonography, drugs, electrocardiography, intubation, thoracic drainage, and transcutaneous pacing), (vii) transferred hospital type (tertiary emergency medical center, secondary emergency medical center, and non-transfers). Emergency medical

centers were classified into three types: tertiary, secondary, and primary. A tertiary emergency medical center provides emergency and critical care, and a secondary emergency medical center provides emergency medical services requiring hospitalization.

RESULTS

ONE HUNDRED AND thirty-three hospitals operating a doctor-staffed ambulance were identified from 123 fire departments. Among these, 73 hospitals (55%) replied to our questionnaire. The distribution of doctor-staffed ambulances is shown in Figure 1. The red dots indicate hospitals that replied, whereas the blue dots indicate hospitals that did not reply.

Operating system

In total, 58 (79%) of hospitals used the hospital car system, 11 (15%) used the workstation system, 11 (15%) used the pick-up system, and six hospitals used more than one system.

Furthermore, 31 (42%) of hospitals operated ambulances on weekdays during the daytime, 26 (36%) operated them every day for 24 h, 11 (15%) operated them every day during the daytime, and 3 (4%) operated them on weekdays for 24 h.

The median numbers of registered staff were 6 doctors (interquartile range [IQR], 2–11), 8 nurses (IQR, 0–12.3), 0 paramedics (IQR, 0–2), and 1 logistician (IQR, 0–3.3). The median number of staff dispatched to the site was 4 (IQR, 3–5): 1 doctor (IQR, 1–2), 1 nurse (IQR, 1–1), 1 emergency paramedic (IQR, 0–1.3), and 1 logistician (IQR, 0–1). Fifty-one (70%) hospitals had criteria for dispatching doctor-staffed ambulances, and 55 (75%) hospitals employed drivers who were trained and certified in emergency driving. Additionally, 51 (70%) hospitals bore the operational costs of ambulances, whereas in 13 (18%) of hospitals the local government bore the costs. The hospitals have a general insurance account for 73%: the hospitals that pay an insurance premium account for 83%, the prefectural government for 6%, municipal government for 8%, and doctors' office for 2%.

One-week study

In 1 week, 345 doctor-staffed ambulances were dispatched, and 97 (28%) were cancelled. One hundred and eighty-eight patients (56%) were men and 141 (44%) were women. The highest age demographics were 60s and 70s, with 64 patients each. Two hundred and thirty-three patients (73%) were treated on weekdays and 86 (27%) on weekends

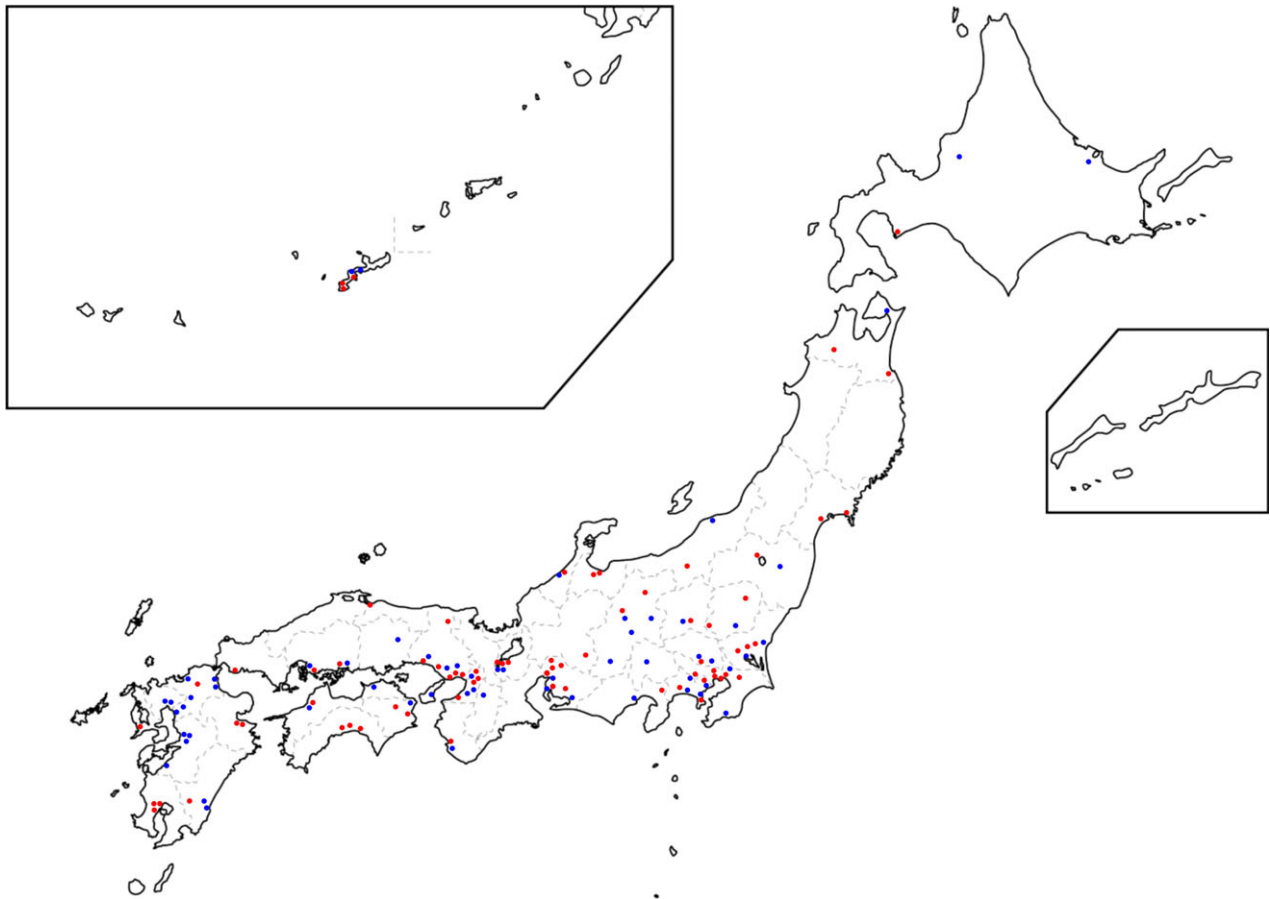


Fig. 1. Distribution of doctor-staffed ambulances in Japan. Red dots indicate hospitals that replied to our questionnaire, and blue dots indicate hospitals that did not reply.

(Fig. 2); 215 patients (68%) were treated during day shifts and 102 (32%) during night shifts. Forty-eight patients (28%) were diagnosed with cardiac arrest, 36 (19%) with trauma or burns, 36 (15%) with stroke, and 22 (9%) with acute coronary syndrome. An i.v. line was secured in 170 patients, ultrasonography was carried out in 98 patients, drugs were given to 82 patients, electrocardiography was undertaken in 53 patients, intubation was carried out in 26 patients, thoracic drainage tubes were inserted in two patients, and transcutaneous pacing was carried out in one patient. In total, 159 (58%) patients were transferred to tertiary emergency medical facilities and 86 (32%) to secondary emergency medical facilities; 22 (8%) patients were not transferred.

DISCUSSION

DOCTOR-STAFFED AMBULANCES WERE operated by 133 hospitals in Japan in 2016, and they were



Fig. 2. Proportion of patients treated by doctor-staffed ambulances during the night shift, based on data for the week July 18 to 24, 2016 supplied by 73 Japanese hospitals.

dispatched almost as frequently as doctor-staffed helicopters. However, doctor-staffed ambulances did not receive adequate funding compared with doctor-staffed helicopters.

Doctor-staffed ambulances were dispatched 345 times per week in the 73 hospitals that replied to our questionnaire; accordingly, we estimated that they are dispatched approximately 18,000 times per year (345×52 weeks). From April 2016 to March 2017, doctor-staffed helicopters were dispatched to the scene 17,688 times in 51 hospitals. If all hospitals replied the questionnaire, the annual number of dispatched doctor-staffed ambulances would exceed the number of doctor-staffed helicopters. In total, 58% of patients were transferred to tertiary emergency medical facilities, and 68% of critically ill patients were diagnosed with cardiac arrest, trauma, stroke, or acute coronary syndrome. This study also revealed that 32% of the patients were treated by doctor-staffed ambulances during the night shift. Doctor-staffed helicopters are only able to operate during the day, so that a doctor-staffed ambulance has some advantage during night-time (Fig. 2).

Unlike doctor-staffed helicopters, doctor-staffed ambulances do not receive sufficient funds. A doctor-staffed helicopter receives a subsidy of ¥1.7 hundred million from the government and local authorities. Conversely, half of the hospitals that operate a doctor-staffed ambulance bear the operational costs themselves. In 12% of hospitals, the insurance premium is paid by local authorities.

There is little evidence indicating that doctor-staffed ambulance use improves patient outcomes. However, many studies have described that doctor-staffed helicopter use is beneficial for patients with cardiac arrest,⁵ trauma,^{1–4,6–9} stroke,^{10,11} and acute coronary syndrome.¹² This research has reported a decrease in mortality rates and a reduction in the time to tertiary treatment for critically ill patients. According to our survey, 68% of patients with these four diseases were treated by a doctor-staffed ambulance, although various criteria were used. However, a few studies have denied any benefits for trauma patients¹³ and have cautioned regarding longer on-scene times.⁹

A limitation of this study is that, because the data collection rate was 55%, our findings might not reflect the actual status of doctor-staffed ambulance use in Japan.

To our knowledge, this is the largest investigation on the actual status of doctor-staffed ambulance use in Japan. Doctor-staffed ambulances were operated by 133 hospitals in Japan in 2016, and they were dispatched almost as frequently as doctor-staffed helicopters. However, hospitals that operated a doctor-staffed ambulance did not receive adequate financial support for operational costs compared with doctor-staffed helicopters. A liaison council for doctor-staffed ambulances should be established to cooperatively

resolve this problem. A database is also required for determining the effectiveness of doctor-staffed ambulance use. Four hospitals in Tokyo have already initiated data registration for assessing their effectiveness.

CONCLUSIONS

TO OUR KNOWLEDGE, this is the largest investigation on the actual status of doctor-staffed ambulance use in Japan. A doctor-staffed ambulance has the advantages of use during night-time and in urban areas compared with doctor-staffed helicopters. They were dispatched almost as frequently as doctor-staffed helicopters in the 73 hospitals that replied to our questionnaire. The annual number of dispatched doctor-staffed ambulances would exceed the number of doctor-staffed helicopters. In the future, we aim to collect data for assessing the effectiveness of doctor-staffed ambulance use among hospitals that operate them.

ACKNOWLEDGEMENTS

THIS STUDY WAS supported by a medical research grant on traffic accidents from the General Insurance Association of Japan.

DISCLOSURE

Approval of the research protocol: N/A.

Informed consent (if applicable): N/A.

Registry and the registration no. of the study/trial: N/A.

Animal studies (if applicable): N/A.

Conflict of Interest: None.

REFERENCES

- 1 Hesselfeldt R, Steinmetz J, Jans H *et al.* Impact of a physician-staffed helicopter on a regional trauma system: a prospective, controlled, observational study. *Acta Anaesthesiol. Scand.* 2013; 57: 660–8.
- 2 Jung K, Huh Y, Lee JC *et al.* Reduced mortality by physician-staffed HEMS dispatch for adult blunt trauma patients in Korea. *J. Korean Med. Sci.* 2016; 31: 1656–61.
- 3 Funder KS, Rasmussen LS, Lohse N, Siersma V, Hesselfeldt R, Steinmetz J. Long-term follow-up of trauma patients before and after implementation of a physician-staffed helicopter: a prospective observational study. *Injury* 2016; 47: 7–13.
- 4 Garner AA, Mann KP, Poynter E *et al.* Prehospital response model and time to CT scan in blunt trauma patients; an exploratory analysis of data from the head injury retrieval trial. *Scand. J. Trauma Resusc. Emerg. Med.* 2015; 23: 28.

- 5 Sunde GA, Heltne JK, Lockey D *et al.* Airway management by physician-staffed Helicopter Emergency Medical Services – a prospective, multicentre, observational study of 2,327 patients. *Scand. J. Trauma Resusc. Emerg. Med.* 2015; 23: 57.
- 6 Den Hartog D, Romeo J, Ringburg AN, Verhofstad MH, Van Lieshout EM. Survival benefit of physician-staffed Helicopter Emergency Medical Services (HEMS) assistance for severely injured patients. *Injury* 2015; 46: 1281–6.
- 7 Taylor C, Jan S, Curtis K *et al.* The cost-effectiveness of physician staffed Helicopter Emergency Medical Service (HEMS) transport to a major trauma centre in NSW, Australia. *Injury* 2012; 43: 1843–9.
- 8 Garner A, Rashford S, Lee A, Bartolacci R. Addition of physicians to paramedic helicopter services decreases blunt trauma mortality. *Aust. N. Z. J. Surg.* 1999; 69: 697–701.
- 9 Ringburg AN, Spanjersberg WR, Frankema SP, Steyerberg EW, Patka P, Schipper IB. Helicopter emergency medical services (HEMS): impact on on-scene times. *J. Trauma* 2007; 63: 258–62.
- 10 Funder KS, Rasmussen LS, Lohse N *et al.* The impact of a physician-staffed helicopter on outcome in patients admitted to a stroke unit: a prospective observational study. *Scand. J. Trauma Resusc. Emerg. Med.* 2017;25:18.
- 11 Nakagawa Y, Morita S, Akieda K *et al.* Critical role of the “Doctor-Heli” system on cerebral infarction in the superacute stage—report of a outstanding pilot case. *Tokai J. Exp. Clin. Med.* 2005; 30: 123–6.
- 12 Hesselfeldt R, Pedersen F, Steinmetz J *et al.* Implementation of a physician-staffed helicopter: impact on time to primary PCI. *EuroIntervention* 2013; 9: 477–83.
- 13 Irola TT, Laaksonen MI, Vahlberg TJ, Palve HK. Effect of physician-staffed helicopter emergency medical service on blunt trauma patient survival and prehospital care. *Eur. J. Emerg. Med.* 2006; 13: 335–9.