

Original

# The Operation of a Doctor Helicopter in the Tochigi Prefecture

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## Summary

In January 2010, the Tochigi Prefecture launched the Doctor Helicopter Services at Dokkyo Medical University Hospital. More than ten years have passed since the implementation of the service, and the total number of requests has exceeded 9,000 while the number of dispatches without any significant accidents has reached 8,000. We now report on the performance of Tochigi prefecture's "Doctor Helicopter." Based on the total number of helicopter operations compiled by the hospital, we surveyed the number of requests, dispatches, and un-dispatched cases; the number of requests from each fire department; the status of cooperation with neighboring prefectures; the medical institutions to which the helicopter is transported; and the classification by injury and disease. The number of requests and dispatches has increased each year of the operation. Un-dispatched cases owing to duplicate requests also increased along with the number of requests. Many of the requests were from the fire department in medical control areas. The number of cases in which Tochigi's Doctor Helicopter was dispatched to neighboring prefectures was much higher than the number of cases received by the neighboring prefectures from Tochigi. Endogenous diseases were more frequently encountered than exogenous diseases during the study period, with cerebrovascular disease accounting for the most significant proportion. Moreover, more than 50% of the patients were transported to the base hospital. Tochigi Prefecture Helicopter Emergency Medical Services are now indispensable for emergency medical care in the prefecture.

**Key Words:** Doctor Helicopter, HEMS, Northern Kanto Wide-Area Cooperation, Aeromedicine

## Introduction

In Japan, helicopter emergency medical services (HEMS) are called a "Doctor Helicopter" (*Doctor-Heli*). The *Doctor-Heli* is equipped with emergency medical equipment's, medical drugs, and is accompanied by medical emergency specialists and nurses capable of

transporting the patients from the scene or medical institutions. Once the medical staff is dispatched to the scene via the *Doctor-Heli*, they promptly start life-saving treatment and transport the patient to a medical institution in order to improve the life-saving rate. The speed of the *Doctor-Heli* is approximately 200 km/h. If the emergency site is within a 50 km radius of the

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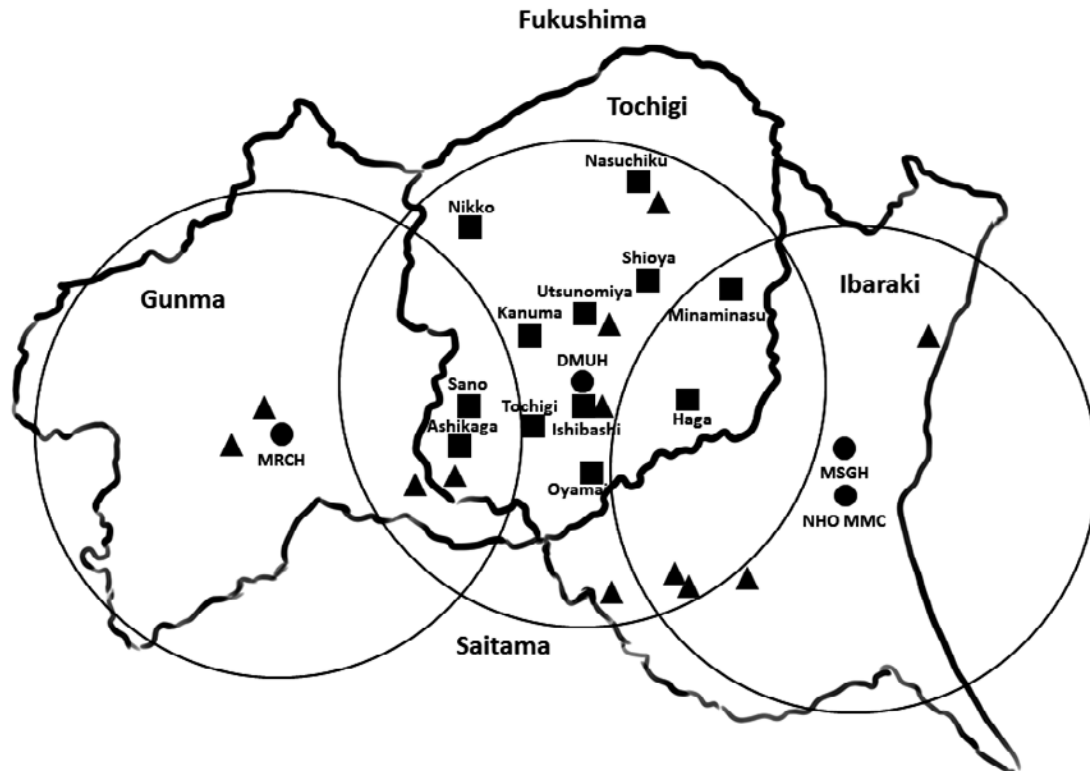
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**Figure 1** Northern Kanto Wide-Area Cooperation

The figure shows a map of three northern Kanto prefectures. This is the meaning of the marks below:

Small circle: Base hospital in each prefecture

Square: Each fire department in Tochigi prefecture

Triangle: Tertiary emergency medical institution in each prefecture

Large circle: 50 km radius from each base hospital. This is the range of dispatch by doctor helicopters in each prefecture.

DMUH: Dokkyo medical University Hospital; MSGH: Mito Saiseikai General Hospital; NHO MMC: National Hospital Organization Mito Medical Center; MRCH: Maebashi Red Cross Hospital.

base hospital, it can there approximately 15 minutes after takeoff and start life-saving treatment.

In Japan, the Ministry of Health, Labour and Welfare promotes helicopter services and each prefectural government is the leading operator of the service. In the Tochigi Prefecture, the *Doctor-Heli* service began on 20 January 2010, with the Dokkyo Medical University Hospital as the base hospital and has been operating since then without significant accidents. In this article, we report on the operation of the Tochigi *Doctor-Heli* for ten years: from FY2009 to FY2019, where the fiscal year is from April 1 to March 31 of the following year. This fiscal year corresponds to the total period of operation reports submitted annually to the Japanese Society for Aeromedical Services.

Tochigi Prefecture stretches approximately 84 km from east to west and 98 km south to north and is in

the northern part of the Kanto region. It is the 20th largest prefecture in Japan. It borders the Ibaraki prefecture to the east, Gunma prefecture to the west, Ibaraki, Gunma, and Saitama prefectures to the south, and Fukushima prefecture to the north (Fig. 1). It has a population of approximately 1.92 million and consists of 14 cities and 11 towns, with 12 fire departments.

In Japan, emergency medical services are incorporated into the firefighting organization. Requests for *Doctor-Heli* dispatch are regulated by Japan's Civil Aeronautics Law and Civil Aeronautics Law Enforcement Regulations. Based on this legal basis, the Communication Command Division of the fire department or the emergency medical team request *Doctor-Heli* dispatch.

The criteria for requesting dispatch<sup>1)</sup> are:

1. When danger to life is imminent or suspected to

be imminent.

2. When a patient is in critical condition and may require a long time for transport.

3. When it is necessary to shorten the transport time due to emergency diseases (e.g., multiple trauma)

4. When a doctor is needed for emergency diagnosis and treatment at the emergency scene.

The “Basic Agreement on Wide-Area Cooperation among Ibaraki, Tochigi, and Gunma Prefectural Doctor Helicopters” was signed on 26 March 2011, and the operation began on 1 July 2011<sup>2</sup>. With increases in the number of helicopter dispatch requests, there have been cases where flight medical staff could not dispatch because of duplicate requests. This agreement aims to strengthen the emergency medical system by establishing a mutual support system with the Ibaraki and Gunma prefectures, which share common problems. This “Northern Kanto Wide-Area Cooperation” agreement allows the prefecture to request the support of Doctor Helicopters from neighboring prefectures, which enables efficient operation (Fig. 1). The request criteria for such a scenario are as follows:

1. When the *Doctor-Heli* cannot be dispatched due to a duplicate request within the prefecture.

2. When the *Doctor-Heli* of the prefecture cannot respond to the situation alone because of multiple injured or sick patients.

3. When the need for transfer to a hospital and the patient’s condition is urgent.

4. When the *Doctor-Heli* is inoperable due to aircraft malfunction.

In the emergency medical care system, medical control (MC)<sup>3</sup> is used to ensure the quality of the decisions and procedures performed by paramedics. Since the Tochigi *Doctor-Heli* is a prefectural project, it covers all MC areas in the prefecture.

## Methods

Using the data compiled by Dokkyo Medical University Hospital from the start of operations (from January 20, 2010, to March 31, 2020), we examined the following items for each fiscal year.

### 1. Total number of requests and their classification

We recorded all requests and their classification as on-the-scene cases, interhospital transfer cases, mission

aborts after takeoff, and un-dispatched cases.

### 2. Classification of un-dispatched cases

We recorded un-dispatched cases as duplicate requests, canceled before takeoff, due to bad weather, time constraints, inapplicability, and machine trouble.

### 3. The number of requests for on-the-scene dispatches per fire department and their classification

We recorded the requests and their classification as dispatches and cancellations from each fire department. “Cancellations” contain both un-dispatched and aborted cases after takeoff.

### 4. Results of helicopter operations for the Northern Kanto Wide-Area Cooperation

We compared the number of cases in which Tochigi *Doctor-Heli* flew to neighboring prefectures to the number of cases in which Ibaraki and Gunma *Doctor-Heli* flew to the Tochigi prefecture.

### 5. Classification of injuries and illnesses

We classified the injuries and illnesses in patients transported by the Tochigi *Doctor-Heli* by endogenous and exogenous factors.

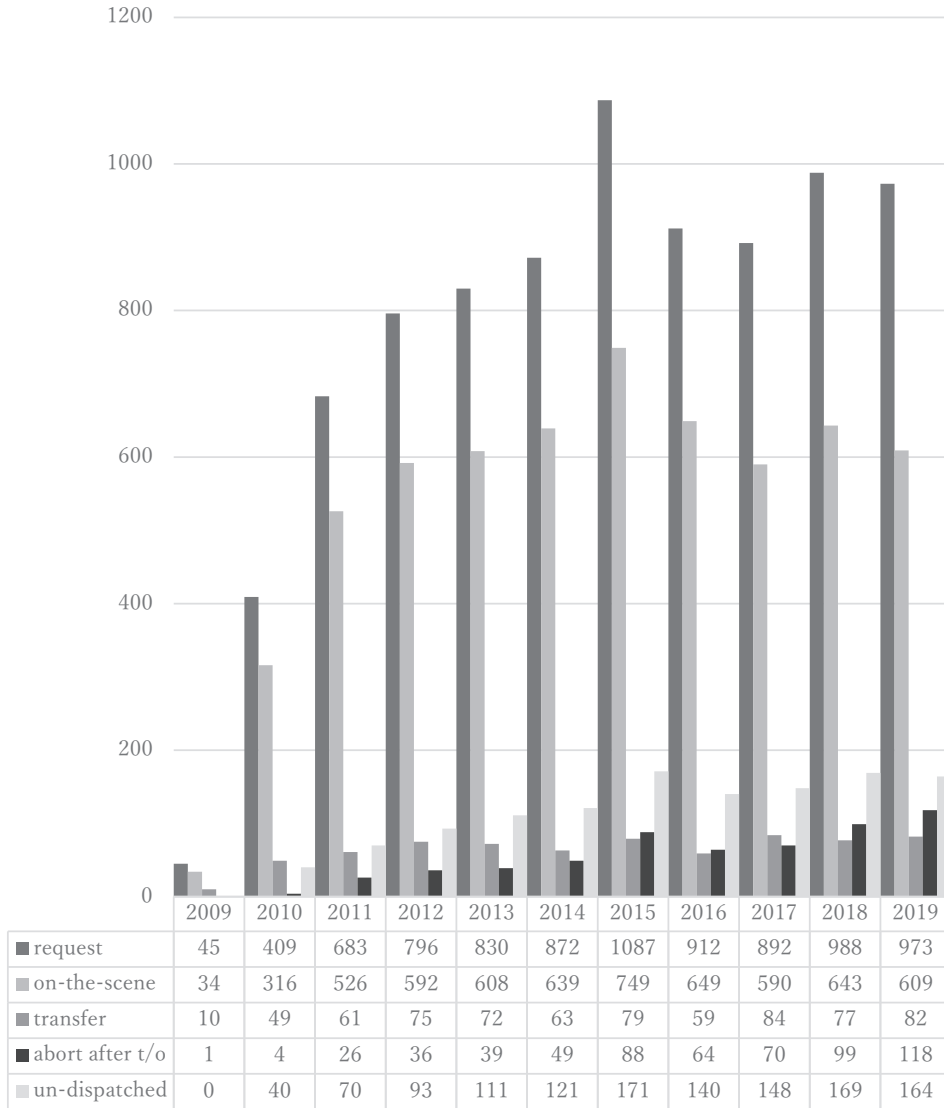
### 6. Classification of transport to medical institutions

We counted the number of on-the-scene dispatches and interhospital transfers for each medical institution. For interhospital transfers, we recorded the number of cases in which the patient was carried out of the medical institution and in which the patient was received from another medical institution.

## Results

### 1. Total number of all requests and their classification

In FY2009, the first year of operation, the number of requests was small partly because the period was only approximately two months (Fig. 2). In FY2010, the number of requests was 409 and the on-the-scene dispatches were 316. From FY2011, the number of requests began steadily increasing and reached a high of 1,087 requests and 749 dispatches in FY2015. Since then, the number of requests has fluctuated between 900 to 1,000, and on-the-scene dispatches have re-



**Figure 2** Total number of requests and their classification

The figure shows the number of requests for each fiscal year from FY2009 to FY2019.

The classification of the number of requests is as follows.

On-the-scene: on-the-scene dispatches

Transfer: transfer interhospital cases

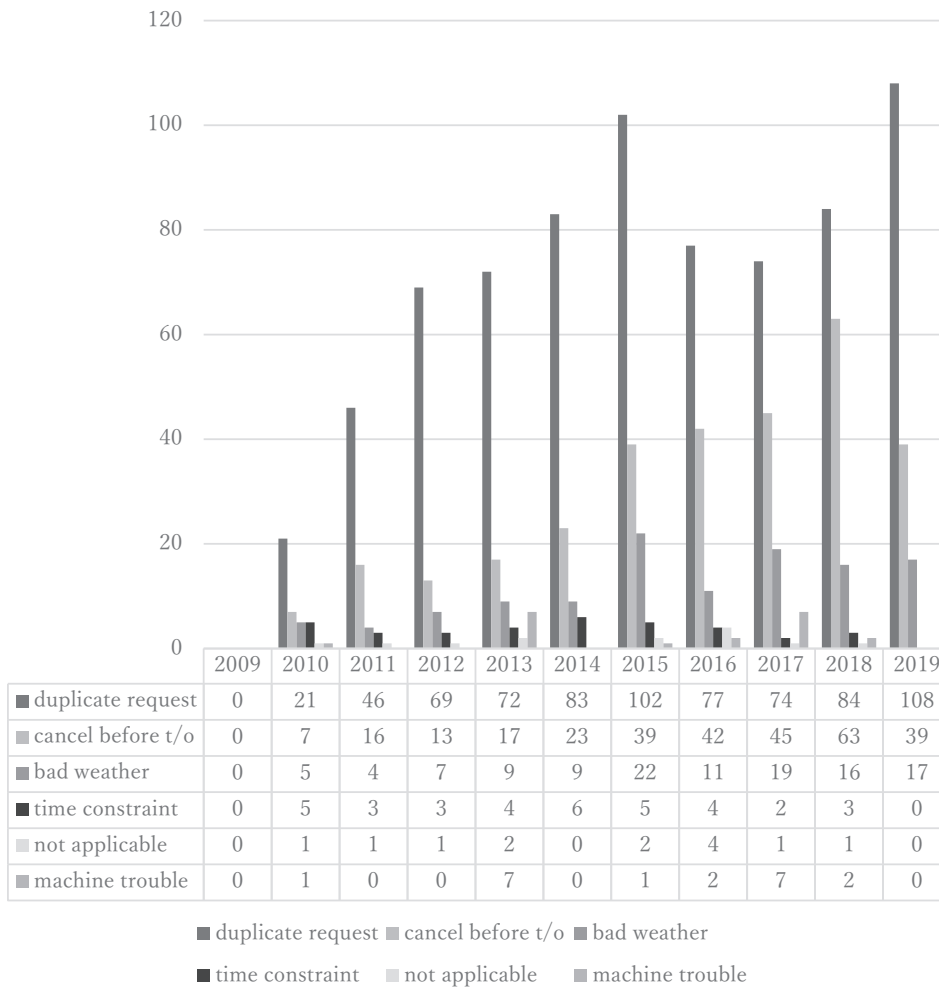
Abort after t/o: cases aborted for some reason after takeoff

Un-dispatched: un-dispatched cases for some reason

mained at approximately 600. The number of interhospital transfers increased to 61 until FY 2011. Since then, there have been approximately 60 to 80 cases per year. The number of mission aborts after takeoff gradually increased to 49 until FY2014. Since then, there has been a shift of approximately 60 to 120 cases per year. The number of un-dispatched cases also showed an upward trend, shifting between 140 and 170 since FY2015.

**2. Classification of un-dispatched cases**

Fig. 3 shows the classification of the number of un-dispatched cases. Duplicate requests gradually increased after the operations began, reaching 102 in FY 2015. After that the number decreased to 74 but rose again to 108 in FY2019. Duplicate requests account for approximately 60% of the total number of un-dispatched cases. The number of cancellations before takeoff increased every year, reaching a maximum of 63 in FY2018. Bad weather remained in the single dig-



**Figure 3** Classification of un-dispatched cases

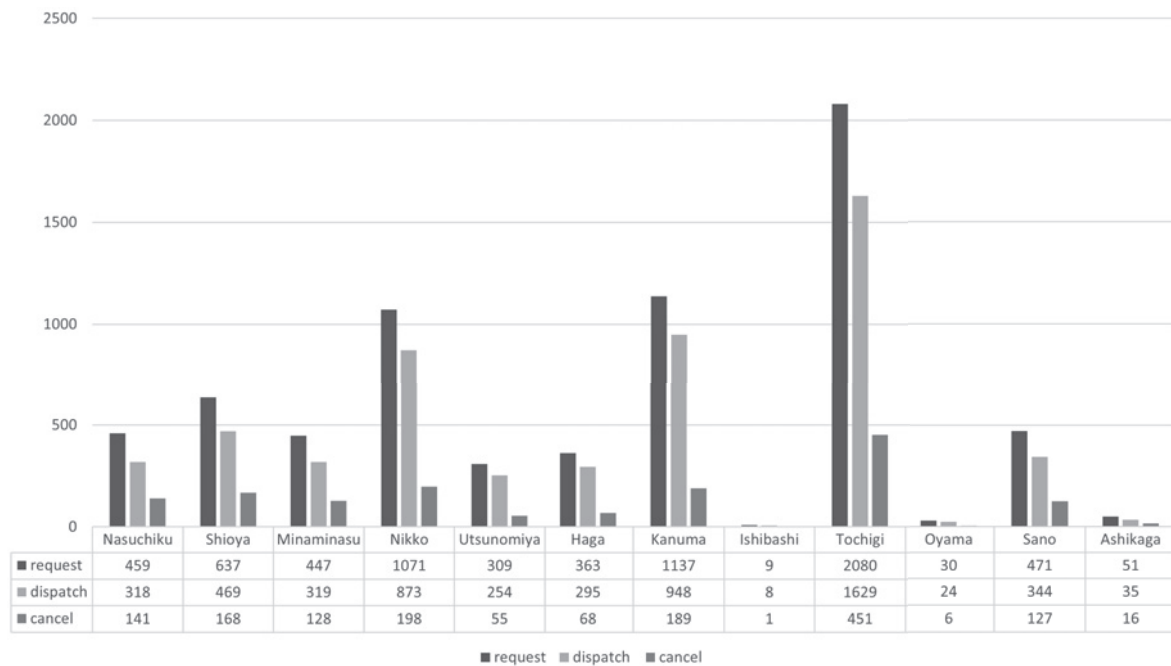
The classification of un-dispatched cases for each fiscal year from FY2009 to FY2019 is as follows:  
 Duplicate request: one that was requested but could not respond because another case was being handled.  
 Cancel before t/o: those in which the request was responded to but canceled for some reason before takeoff  
 Bad weather: captain’s judgment that the weather is too bad to fly  
 Time constraint: requests made after the end of the operation and deemed unacceptable  
 Not applicable: cases that the operation staff deemed not suitable for dispatch  
 Machine trouble: the aircraft was deemed unable to fly due to a malfunction

its until FY2014 but has generally been in the double digits since FY2015. Time constraints remained in the single digits, with zero to six cases per year. Inapplicability remained at zero to two off-label cases per year, except for FY2016, when there were four cases. There were seven aircraft malfunctions in FY2013 and FY 2017. Other than that, malfunctions ranged from zero to two cases per year.

**3. The number of requests for on-the-scene dispatches per fire department and their classification**

Higher number of cases were recorded in the To-

chigi City Fire Department jurisdiction, with 2080 requests, 1629 dispatches, and 451 cancellations, followed by the Kanuma City and Nikko City Fire Department (Fig. 4). The Nasu Area and Minaminasu Wide-Area Fire Department in the northern part of the prefecture were far from the base hospital and thus had many requests (459 and 447, respectively) and dispatches (318 and 319, respectively). On the other hand, the cancellation rate (the ratio of cancellations to requests) was 22%, 17%, and 18% in Tochigi, Kanuma, and Nikko City Fire Department, respectively, which had the most requests. The jurisdiction of other fire



**Figure 4** The number of requests for on-the-scene dispatches per fire department and their classification

The figure shows the number of requests for on-the-scene totals from FY2009 through FY2019 from each fire department. The classification of the requests is as follows.

Dispatch: on-the-scene dispatches

Cancel: include un-dispatched cases and cases aborted after takeoff

Nasuchiku: Nasu Area Fire Department; Shioya: Shioya Wide-Area Fire Department; Minaminasu: Minaminasu Wide-Area Fire Department; Nikko: Nikko City Fire Department; Utsunomiya: Utsunomiya City Fire Department; Haga: Haga Wide-Area Fire Department; Kanuma: Kanuma City Fire Department; Ishibashi: Ishibashi Area Fire Department; Tochigi: Tochigi City Fire Department; Oyama: Oyama City Fire Department; Sano: Sano City Fire Department; Ashikaga: Ashikaga City Fire Department

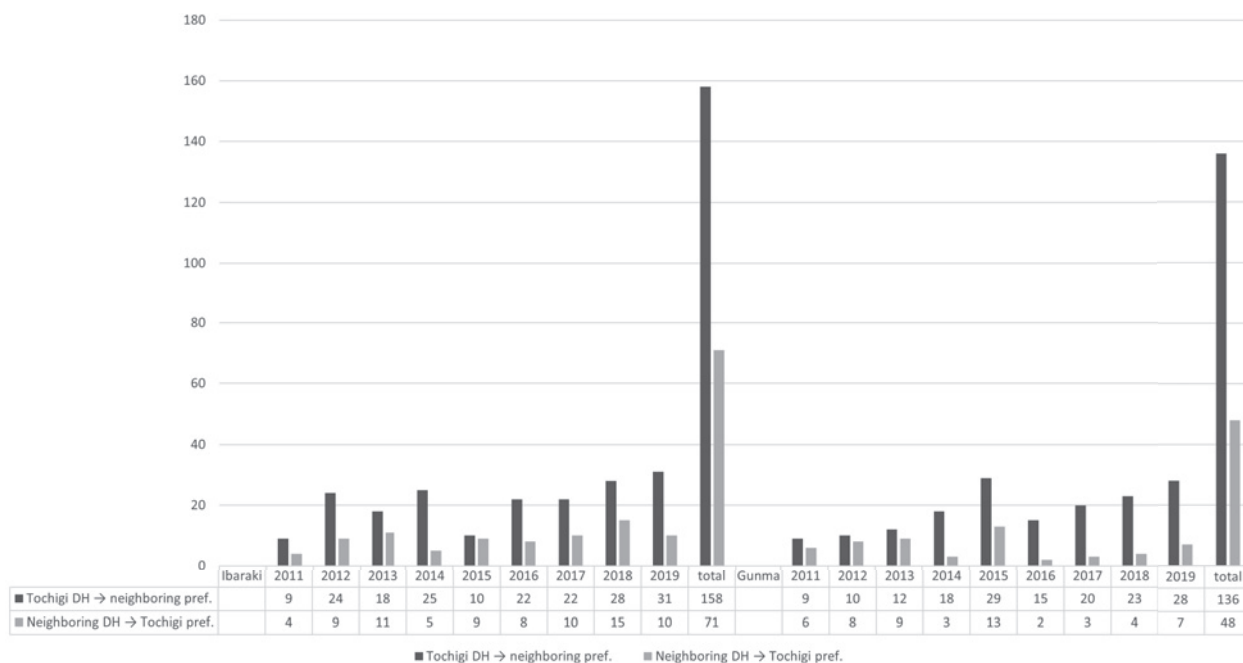
departments with more than 400 requests had cancellation rates in the high 20s to around 30%. Similarly, in the cases of two fire departments with 300 or more requests, the cancellation rate was less than 20%.

#### 4. Results of helicopter operations for the Northern Kanto Wide-Area Cooperation

Fig. 5 shows the number of the Tochigi *Doctor-Heli* dispatches to neighboring prefectures and *Doctor-Heli* dispatches by neighboring prefectures to Tochigi. The Tochigi *Doctor-Heli* dispatches were higher than the neighboring ones throughout. The Tochigi *Doctor-Heli* dispatched 158 times to Ibaraki Prefecture and 136 times to Gunma Prefecture during the aggregate period. In comparison, there were 71 *Doctor-Heli* dispatches from Ibaraki and 48 dispatches from Gunma to Tochigi.

#### 5. Classification of injuries and illnesses

Table 1 shows the classification of injury and disease that led to the on-the-scene requests. The total number of cases for the entire period was 2796 for exogenous diseases and 3293 for endogenous diseases. Physical trauma was the most common exogenous cause, with 1041 cases of traffic accidents and 1174 cases of other trauma. Other factors such as intoxication, heatstroke, and anaphylaxis accounted for 581 cases. Among the endogenous diseases cerebrovascular diseases were the most common, with 1131 cases (306 cases of cerebral infarction, 152 cases of subarachnoid hemorrhage, 355 cases of cerebral hemorrhage, and 318 other cases). There were 587 cases of cardiovascular diseases (342 cases of acute coronary syndrome, 117 cases of aortic aneurysm/dissection, and 128 other cases). The details of the diagnosis were unknown for the 318 other cerebrovascular disease cases and 128 other cardiovascular diseases because the physician transported the patient



**Figure 5** Results of helicopter operations for the Northern Kanto Wide-Area Cooperation

The figure shows the number of helicopter operations in Tochigi, Ibaraki, and Gunma prefectures for each fiscal year from FY2009 to FY2019.

Tochigi DH → neighboring pref.: Tochigi doctor helicopter dispatched to Ibaraki and Gunma prefectures

Neighboring DH → Tochigi pref.: Ibaraki/Gunma doctor helicopter dispatched to Tochigi Prefecture

The left side of the figure shows helicopter operations between Tochigi and Ibaraki prefectures, and the right side shows helicopter operations between Tochigi and Gunma prefectures.

to another hospital. There were 1575 endogenous disease cases other than cerebrovascular and cardiovascular diseases.

**6. Classification of transport to medical institutions**

Table 2 shows the number of patients transported from emergency scenes to medical institutions and interhospital transfers. The “other” include tertiary and secondary emergency medical institutions in neighboring prefectures and all medical institutions except for tertiary emergency institutions in Tochigi Prefecture. For interhospital transfers, we recorded the number of cases in which the patient was carried out of the medical institution and in which the patient was received from another institution. Dokkyo Medical University Hospital, the base hospital, transported the most significant number of patients (3467 in total), followed by Saiseikai Utsunomiya Hospital (631 cases) and Nasu Red Cross Hospital (412 cases). The number of transports to other medical institutions was 1,088. As for the tertiary emergency medical institutions in the prefecture that requested Tochigi *Doctor-Heli* to transfer

interhospital patients, the Nasu Red Cross Hospital had the highest number of cases (128), followed by the base hospital (85 cases). There were 448 requests from the other medical institutions. Dokkyo Medical University Hospital, the base hospital, was the medical institution that received the most significant number of interhospital transfers by helicopter, 459. Other tertiary medical institutions in the prefecture were in the lower double digits, except for Jichi Medical University Hospital (59).

**Discussion**

At the beginning of the operation, the number of requests was small (Fig. 2). Several months before the operation, medical staff visited each fire department to explain the operation of the *Doctor-Heli* and conducted several drills, but the fire departments were not sure of the situations in which they should request the *Doctor-Heli*. In June of 2010, the medical staff of *Doctor-Heli* visited every fire department and conducted educational activities again to explain that the *Doctor-Heli* is one of the tools of the fire department just like an



**Table 1** Classification of injuries and illnesses

Exogenous	Total		2796
	Trauma	TA	1041
		Other	1174
	Other than trauma		581
Endogenous	Total		3293
	CardVD	ACS	342
		AN/AD	117
		Other	128
		Total	587
		CerbVD	CI
	SAH		152
	CH		355
	other		318
		Total	1131
	Other disease		1575

The table shows the classification and total number of exogenous and endogenous diseases from FY2009 to FY2019.

#### Exogenous disease

TA: traffic accident; other: falls, tumbles, slips, damage by machinery, etc.; other than trauma: toxicosis, heat-stroke, anaphylaxis, etc.

#### Endogenous disease

CardVD: cardiovascular disease; ACS: acute coronary syndrome; AN/AD: aortic aneurysm or dissection.

CerbVD: cerebrovascular disease; CI: cerebral infarction; SAH: subarachnoid hemorrhage; CH: cerebral hemorrhage.

ambulance, and that they should use it to make effective use of our medical staff. Consequently, the number of requests increased. On-the-scene dispatches constituted most of the cases (Fig. 2), and although there was also an increase in interhospital transfer cases, they have remained almost unchanged since FY2015. Unlike ordinary ambulance interhospital transfers, we consider that interhospital transfer by *Doctor-Heli* did not increase much because requests for transfers are restricted to highly urgent cases, such as aortic dissection, acute coronary syndrome, or therapeutic intervention for severe trauma. With the increase in requests and dispatches, the number of mission aborts after takeoff and un-dispatched cases increased (Fig. 2).

We expect that early medical intervention for patients will be possible by requesting a *Doctor-Heli* as soon as possible after receiving an emergency call at the fire department. Specifically, a request may be made before contact with the injured person if the fire

**Table 2** Classification of transport to medical institutions

DMUH	on-the-scene transfer		3467
		request	85
		accept	459
NRCH	on-the-scene transfer		412
		request	128
		accept	13
SUH	on-the-scene transfer		631
		request	14
		accept	33
JMUH	on-the-scene transfer		261
		request	4
		accept	59
ARCH	on-the-scene transfer		228
		request	32
		accept	16
other	on-the-scene transfer		1088
		request	448
		accept	131

The table shows the transport classification and total number of patients transported to medical institutions from FY2009 to FY2019.

DMUH: Dokkyo Medical University Hospital; NRCH: Nasu Red Cross Hospital; SUH: Saisaikai Utsunomiya Hospital; JMUH: Jichi Medical University Hospital; ARCH: Ashikaga Red Cross Hospital; other: secondary medical institutions in Tochigi Prefecture (in part including tertiary and secondary medical institutions in neighboring prefectures).

Transfer: transfer interhospital; request: number of cases in which a helicopter was requested to transfer a patient to another medical institution; accept: number of patients accepted from another medical institution; other: other medical institutions.

department or emergency team determines that treatment at the scene or early transport is likely necessary. However, if the emergency team judges that the severity or urgency of the injury or illness is not high when it comes to contact with an injured or sick person, it is recommended that they immediately cancel the request, which is hypothesized as the reason behind the increase in the number of mission aborts after takeoff. Some of the cases of mission abortion after takeoff include cases where the flight operation staff canceled the request owing to bad weather conditions, but we did not examine these classifications in detail in



this report.

In 60% of the un-dispatched cases, the *Doctor-Heli* was not dispatched due to duplicate requests (Fig. 3). Although the Northern Kanto Wide-Area Cooperation was launched in 2011, the number of fire departments that can request *Doctor-Heli* from a neighboring prefecture for a duplicate request is limited: if the emergency site in each prefecture are outside a 50 km radius of the base hospital in the neighboring prefecture, they cannot request the *Doctor-Heli* from that prefecture. On the other hand, a previous study found that “duplicate requests in Tochigi while Tochigi *Doctor-Heli* was dispatching to neighboring prefectures” accounted for 14.2% of all dispatches to neighboring prefectures and 8% of all duplicate requests in Tochigi<sup>4</sup>. Duplicate requests may have increased even more since the start of cooperation. If we can reduce the number of unnecessary requests by reviewing cooperation norms and improving the quality of the initial assessment and systemic observation of the emergency team, we may reduce the number of duplicate requests. We assume that most cases of cancellation before takeoff are because the emergency teams contacted and assessed the patient before the helicopter took off, and then canceled the request because they judged the patient’s condition to be minor upon reaching the scene, but we did not examine the detailed breakdown in this report. Poor weather conditions includes thundercloud outbreaks, typhoons, heavy snow, rainstorms, and strong winds, but the captain is left to judge the weather conditions on the day of the flight. Even during the same day, it is not uncommon for weather conditions to change from time to time, thus hindering the functioning of the *Doctor-Heli*. As for time constraints, the fire departments made most of the requests after operation hours. Even if the request had been made before the end of the operation hours, the operation staff may decline the request considering the location and sunset time.

The Tochigi, Kanuma, and Nikko City fire departments made many *Doctor-Heli* requests (Fig. 4). All these areas were under the MC of the base hospital. Many helicopter requests might have been made because the fire department staff can easily recall the *Doctor-Heli*, as the base hospital holds more post-event validations than those in other MC areas. The total

number of requests and dispatches for the two fire departments in the northern part of the prefecture is also high. The tertiary medical institutions in the northern part of the prefecture employ “Doctor Car,” but the coverage area is broad and depending on the location it may take almost an hour from the hospital. Because *Doctor-Heli* can fly within 13-20 minutes from the base hospital to this northern area, we expect the frequency of requests in this area to increase. Another reason may be that only a few medical institutions are equipped to provide emergency services in the first place. The number of requests and dispatches from the Sano City fire department was also high because there was only one secondary medical institution in this area that could handle emergency patients, the fire department requested the *Doctor-Heli* for emergency cases.

At the time of conducting this research, the Tochigi Prefecture has not conducted any post-event validation of the Northern Kanto Wide-Area Cooperation. Out of the 5955 Tochigi *Doctor-Heli* dispatches (Fig. 2), 294 (5%) were dispatched to neighboring prefectures (Fig. 5). This is more than double the number of dispatches from neighboring prefectures to the Tochigi Prefecture. Moreover, as previously mentioned, “duplicate requests” increased while Tochigi *Doctor-Heli* was dispatching to neighboring prefectures<sup>4</sup>. This hypothesis needs to be verified in the future. In addition, it may be a good idea to review the cooperation between the Ibaraki and Gunma prefectures, such as allowing mutual requests.

Among the exogenous diseases, the percentage of “trauma” was high (Table 1). Trauma, cerebrovascular disease, and cardiovascular disease are most commonly observed in HEMS<sup>5,6</sup>. Tochigi HEMS showed a similar trend, but the number of cases of cerebrovascular disease was higher than that of cardiovascular diseases. In addition, in our previous report, cerebrovascular disorders were the most common of all neurological emergency conditions<sup>7</sup>. One of the reasons for this may be that the incidence of stroke is still higher in Japan than in Western countries<sup>8</sup>. In addition, as shown in Table 1, although the number of pediatric seizures was not indicated in this study because they were included in “other diseases,” previous studies have demonstrated many seizures in patients under five years of age<sup>7</sup>. We

have been working with pediatrics to establish a strategy for cases of pediatric convulsive status<sup>9</sup>. In any case, *Doctor-Heli* as HEMS may be useful for severe trauma, cerebrovascular disease, and cardiovascular disease<sup>10,12</sup>.

The number of cases transported to the base hospital was overwhelmingly large at 3,467 (57%) (Table 2). Saiseikai Utsunomiya Hospital had 631 cases (10.4%) and the remaining tertiary medical institutions in the prefecture had a transport rate of approximately 4 to 7%. It is possible that if the urgency and severity of the disease are high, more cases will inevitably be transported to the base hospital, considering the time it takes to negotiate acceptance with other hospitals. There were 128 (18%) transfer requests from the Nasu Red Cross Hospital and 85 (12%) from the base hospital. The prefecture's remaining three tertiary emergency hospitals accounted for approximately 0.6 to 4.5%. Although we did not examine the detailed classification of interhospital transfers caused by injuries and diseases, many interhospital transfers by *Doctor-Heli* are for emergency surgery or systemic control for cases such as acute aortic dissection, myocardial infarction, or severe trauma. The Nasu Red Cross Hospital does not offer cardiovascular surgery. Moreover, it cannot provide catheter intervention for trauma on Sundays and holidays. Staff in this hospital often choose transfers by the *Doctor-Heli*, considering its location in the northern part of the prefecture. The number of base hospital cases is also relatively high. The base hospital conducts many surgeries daily. Surgeons and anesthesiologists are often too busy to handle emergency surgeries. Therefore, emergency medical physicians of the base hospital sometimes transfer patients from the base hospital to other medical institutions. As for transfers from tertiary care hospitals in the prefecture, 459 (64.6%) were to the base hospital, and the transfer rate to the remaining four hospitals was approximately 1.8-8.3%. The above result may be because each department in the base hospital actively accepts critically ill patients, but it may also be because the base hospital is an environment where we can use the *Doctor-Heli* relatively efficiently. In the future, we would like to evaluate the usefulness of the *Doctor-Heli* for interhospital transfer by recording the degree of urgency and severity in each case.

## Conclusion

We present a report of the Tochigi Prefectural HEMS. The number of requests and dispatches increased annually. In addition, the number of dispatches to neighboring prefectures is relatively high. The number of cases that cannot be handled due to duplicate requests has increased, which requires an investigation. Transports to the base hospital from on-the-scene dispatches and other medical institutions interhospital transfers to the base hospital are high. These results indicate that the Tochigi prefectural HEMS is indispensable for emergency medical care.

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## Disclosure Statements

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## References

- 1) Tochigi Prefecture Doctor Helicopter Operation Manual for the public. (Japanese) <https://www.dokkyomed.ac.jp/files/hosp-m/info/00073-041.pdf>.
- 2) Wide-area cooperation between Tochigi Prefecture/Ibaraki Prefecture, Gunma Prefecture's doctor helicopter service. Tochigi Prefectural Government homepage. (Japanese) <http://www.pref.tochigi.lg.jp/e02/houdou/h23doctor-heli02.html>.
- 3) Holroyd BR, Knopp R, Kallsen G: Medical control: Quality assurance in prehospital care. *JAMA*. **256**: 1027-1031, 1986.
- 4) Wake K, Ohnishi T, Uchida M, et al.: A current status of Helicopter EMS in Tochigi Prefecture with Tochigi Doctor-Heli service in collaboration with neighboring Doctor-Heli services in North Kanto areas. *J of Jpn Soc for Aeromed Serv* **17**: 3-10, 2017. (Japanese)
- 5) Alstrup K, Møller TP, Knudsen L, et al.: Characteristics of patients treated by the Danish Helicopter Emergency Medical Service from 2014-2018: a nationwide population-based study. *Scand J Trauma Resusc Emerg Med* **27**: 102, 2019. <https://doi.org/10.1186/s13049-019-0672-9>.
- 6) Rzońca P, Świeżewski SP, Jalali R, et al.: Helicopter Emergency Medical Service (HEMS) Response in Ru-

- ral Areas in Poland: Retrospective Study. *Int J Environ Res Public Health* **16**: 1532, 2019. <https://doi.org/10.3390/ijerph16091532>.
- 7) Hoshiyama E, Noguchi T, Wake K, et al: Characteristics of Emergency Neurological Patients Who Were Transported by Helicopter Emergency Medical Services in Tochigi, Japan. *Tohoku J Exp Med* **255**: 79-89, 2021. <https://doi.org/10.1620/tjem.255.79>.
- 8) Furuta Y, Ninomiya T: Epidemiology of stroke in Japan and comparison with the world. *Nihon Rinsho* **74**: 549-553, 2016. PMID: 27333738. (Japanese)
- 9) Ohnishi T, Imataka G, Kikuchi J, et al: Therapeutic strategy for status convulsives in childhood at Emergency & Critical Care Center of Dokkyo Medical University Hospital. *Dokkyo J of Med Sciences* **42**: 59-62, 2015. (Japanese)
- 10) McVey J, Petrie DA, Tallon JM: Air versus ground transport of the major trauma patient: a natural experiment. *Prehosp Emerg Care* **14**: 45-50, 2010. <http://doi.org/10.3109/10903120903349788>.
- 11) Silliman SL, Quinn B, Huggett V, et al: Use of a field-to-stroke center helicopter transport program to extend thrombolytic therapy to rural residents. *Stroke* **34**: 729-733, Epub PMID: 12624299, 2003. <https://doi.org/10.1161/01.STR.0000056529.29515.B2>.
- 12) Henry TD, Sharkey SW, Burke MN, et al: A regional system to provide timely access to percutaneous coronary intervention for ST-elevation myocardial infarction. *Circulation* **116**: 721-728, Epub PMID: 176734572007, 2007. <https://doi.org/10.1161/CIRCULATIONAHA.107.694141>.



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