

Nation-Wide Implementation of Disaster Medical Coordinators in Japan

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In the 2011 Great East Japan Earthquake (GEJE), successful medical and public health coordination by pre-assigned disaster medical coordinators saved many affected people, though the coordination itself had difficulties. This study aims to clarify the implementation and the challenges of disaster medical coordinators in Japan. We performed questionnaire surveillance in 2012 and 2014 to all prefectural government on assignment of disaster medical coordinators, their expected roles and supporting system. Out of all 47 prefectures, assignment or planning of disaster medical coordinators jumped up from four (8.5%) to 43 (91.5%) by the end of 2015. The most expected role is the coordination with Japan Disaster Medical Assistant Team (DMAT) and with other early responders. The evacuation center management, public health coordination and preparedness before disaster are less frequently expected. The supporting materials, human resource, and tools for communication vary according to the prefecture. Successful implementation requires the effort of health and governmental stakeholders. The coordination between prefectural and local coordinators and the coordination between medical and public health authorities still need to be improved. The roles of disaster medical coordinators depend on the local context and types of hazards. Education and training to build fundamental capacity is necessary. In conclusion, Japanese disaster medical system rapidly implemented disaster medical coordinator after GEJE. Their roles and standardization are challenging, but education, training and systematic support by the local government will enhance the effective preparedness and response of the health sector in disasters.

Keywords: capacity building; coordination; disaster medical coordinator; Sendai Framework for Disaster Risk Reduction; standardization

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Introduction

On March 11, 2011, Great East Japan Earthquake with M9.0 and its ensuing tsunami hit the eastern half of Japan (Shibahara 2011). This biggest earthquake ever recorded in Japan resulted in 18,456 direct deaths and lost, 6,220 injuries (As of March 1, 2016, National Police Agency <http://www.bousai.go.jp/2011daishinsai/pdf/torimatome20160308.pdf>). Triple devastation by the earthquake, tsunami and the radiological accident in Fukushima nuclear power plant created 470,000 displaced people in total.

Japan had prepared the disaster medical response system after experiencing the Great Hanshin Awaji Earthquake (GHAJ) in 1995 when the “preventable disaster death” was recognized for the first time (Yamanouchi et al. 2015).

Japanese disaster medical system has following five fundamental structures;

1. Disaster Base Hospital (DBH), which is generally the tertiary hospitals strengthened against hazards and has the capacity to cope with multi-casualty events including management of the following items.

2. Japan Disaster Medical Assistant Team (DMAT), which is mobile, trained in basic knowledge of disasters and principles of Command, Safety, Communication, Assessment, Triage, Treatment and Transport (CSCATTT) (Kondo et al. 2009; Sammut et al. 2001).

3. Wide Area Transportation and Staging Care Unit (SCU), which are the system to transport the patients from resource lacking affected area to the distant area for better medical care.

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4. Emergency Medical Information System (EMIS), which is internet-based geographical information system (GIS) to show the location, properties, and function of DBHs, the current location of DMAT, affected healthcare facilities, evacuation centers, and field hospitals in real time.

5. Disaster Medical Coordinators, who coordinate the medical and public health relief operations and logistics in the headquarters (HQ) of local government, DBH and SCU.

All of the system maximized the effectiveness of health response, but the medical and public health coordination remained as one of the gaps in medical response in GEJE.

One of the successful examples was the medical and public health coordination of Ishinomaki Zone Joint Relief Team (Ishii 2011). Ishinomaki Red Cross Hospital was the only undamaged DBH in the severely damaged area and became the local HQ of DMAT, Red Cross Relief Teams and others. In 2010, before GEJE, Miyagi Prefecture assigned Dr. Ishii, T. as one of the disaster medical coordinators. The network council in the Ishinomaki area coordinated the efforts of pertinent institutions such as the fire, public health and police departments, Self Defense Forces (SDF), medical associations and nearby hospitals to prepare for disaster. In September 2010, the Ishinomaki Red Cross Hospital concluded agreements of support with the telecommunications company; a construction company; and a community of restaurants and drinking establishments in the city of Ishinomaki to provide telecommunications equipment such as satellite mobile telephones, tents, and the meals in the hospital. This pre-disaster preparedness and the medical coordination created huge differences in the outcome of the health of affected people during the GEJE. Under the supervision by pre-assigned medical coordinators, the Ishinomaki Zone Joint Relief Team successfully conducted the prevention of infectious disease outbreak, assessment and support of evacuation centers, and many other operations. The Joint Relief Team assessed the health status of 46,480 evacuees in 328 evacuation centers with treatment of 53,696 people at evacuation centers until activities ended (Ishii 2011). This success convinced the health care professionals working in the field of disaster medicine about the importance of disaster medical coordinator and led to the foundation of the ACT Institute of Disaster Medicine (<http://www.dm-act.jp/>) to promote the education of disaster medical coordinators.

Another successful example was coordination network of concerned experts for hemodialysis (Masakane et al. 2016). Japanese Association of Dialysis Physicians (JADP) established a disaster information network on dialysis therapy including the dialysis facilities, national and local governments after experiencing the GHAE in 1995. This network correctly grasped the extent of damage and immediately established a dialysis support system during GEJE. This resulted in the successful wide area transportation of 661 patients who need hemodialysis in Miyagi and

Fukushima Prefecture to the distant Hokkaido, Niigata and Tokyo areas (Masakane et al. 2016). Japan DMAT and disaster medical coordinators played significant roles in the coordination of transportations in SCU, sending and accepting DBHs.

On the other hand, because of the spatiotemporal scale of the disaster, medical and public health relief did not always match the needs of affected people and hospitals. Many of the hospitals in the coastal area of Miyagi Prefecture did not receive relief from outside until the third day after GEJE, and two of these hospitals got the first relief team on Day 7 and 9 respectively (Sasaki et al. 2014). The coordination of health responders had difficulties with lack of information, training and common terminology and concept resulting in imbalanced distribution of relief teams and delay of health care provision to the affected people. Thus, the Ministry of Health, Labour and Welfare (MHLW) called the Study Group four times and officially reported the direction of renovated disaster medical system in October 31, 2011 (MHLW 2011) to issue the Director-General Notice from Health Policy Bureau to plan the medical and public health coordination mechanism (MHLW 2012) including the assignment of “disaster medical coordinator” (MHLW 2015).

Hyogo Prefecture where GHAE struck in 1995 assigned the first disaster medical coordinators in 1996. However, only four (8.5%) out of 47 prefectures assigned disaster medical coordinators before GEJE in 2011. MHLW recommended the assignment of disaster medical coordinators in each prefecture after GEJE, but it is not mandatory. The aim of this study is to clarify the current situation of assignment of disaster medical coordinators, their expected roles and the supporting system in Japan.

Materials and Methods

We sent the questionnaire surveillance in December 2012 to the Department of Health and Welfare of all prefectures in Japan asking the assignment or planning of assignment of disaster medical coordinators. We also asked the year of (planned) assignment, number of coordinators, hierarchical structure, division of local government in charge, required profession or capability, first method of communication from prefecture, location of action, expected role of coordinator, supporting budget, human resource and material to accomplish the role, mutual agreement between prefecture and other stakeholders, and the handling of medical records after disaster.

We re-sent the questionnaires in April 2014 to the prefectures that had not assigned the coordinator in 2012. The overall answers of 2012 and 2014 were accumulated in one Excel file (Microsoft, WA, USA) and analyzed using JMP (SAS Institute, NC, USA), to figure out the whole picture in Japan.

Results

Assignment

All 47 prefectures replied to the 2012 questionnaire (100% response). Out of 47, 17 prefectures (34.0%) had already assigned and 20 prefectures (42.6%) were planning

to assign disaster medical coordinators in March 2013. Thus, we re-sent the questionnaire to the “not-yet” prefectures in April 2014 and confirmed that assignment rapidly increased after GEJE and reached to more than 90% by the end of 2015 (Fig. 1). In five prefectures (10.6%), the coordinators were classified into two levels (prefectural and local) as a hierarchical structure (Fig. 2A), while other 29 prefectures (61.7%) assigned disaster medical coordinators in an equal level (Fig. 2B). Ten prefectures (21.2%) had not defined the detailed structure by April 2014. The num-

bers of disaster medical coordinators vary significantly among prefectures from single person to more than 160 members including medical and pharmaceutical coordinators (Fig. 3).

Properties

Table 1 summarizes the requirement of professional capabilities of disaster medical coordinators. Thirty-three prefectures (70.2%) requested disaster medical coordinator to be a medical doctor, but four prefectures (8.5%) addi-

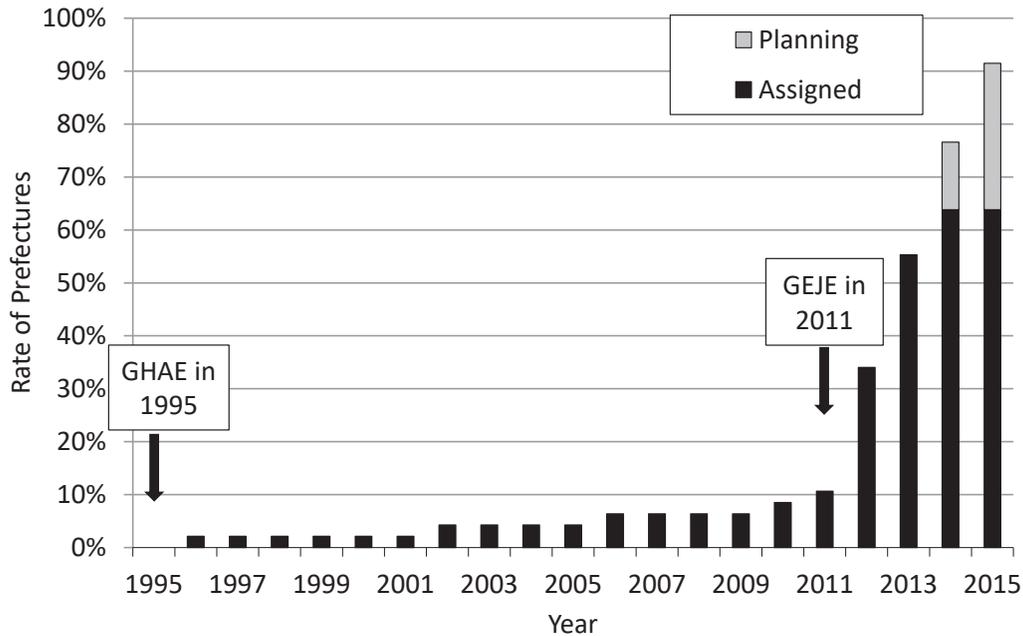


Fig. 1. Prefectural assignment of disaster medical coordinators in Japan. After Great Hanshin Awaji Earthquake (GHAE) in 1995, disaster medical coordinator was first assigned in Hyogo Prefecture, but only 4 prefectures followed. After Great East Japan Earthquake (GEJE) in 2011, most of the prefectures began assignment of disaster medical coordinators. Black bars: number of assigned prefectures. Gray bars: number of planning prefectures. In 2014 and 2015, there were the planning prefectures that had not determined the time of assignment (As of May 2014).

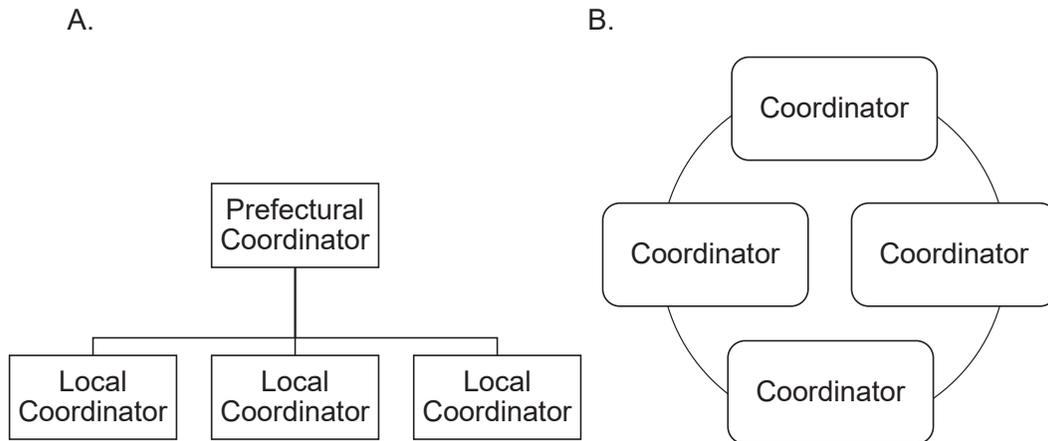


Fig. 2. Types of hierarchical structure.
 A: Two level assignment of prefectural coordinator and local coordinators.
 B: Simple assignment of disaster medical coordinators.

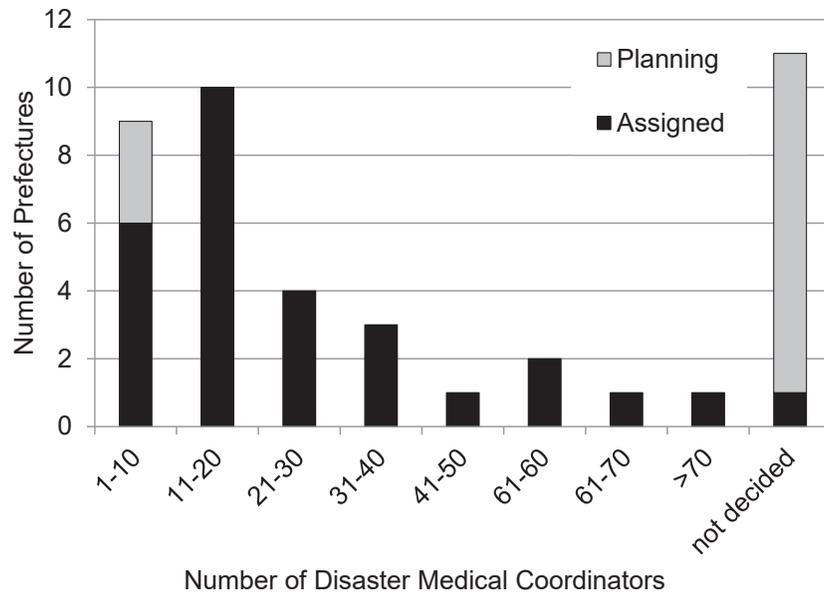


Fig. 3. Number of disaster medical coordinators in each prefecture.

The number of disaster medical coordinator differs among prefectures. Black bar: number of assigned prefectures, Gray bars: number of planning prefectures.

Table 1. Requirement of professional capabilities of disaster medical coordinators.

		Assigned Pref. (n = 30)	Planning Pref. (n = 13)
Profession	Medical Doctor	27	6
	Pharmacist	4	-
	Nurse	2	-
	Undecided	-	7
	Unanswered	3	-
Certification	DMAT member	16	-
	Advanced DMAT member	16	1
	Head of Health Office	1	-
	Board of Emergency Medicine	2	-
	Japan Red Cross relief team	1	-
	Board certified medical doctor	1	-
	Japan Medical Association Team	1	-
	Disaster Medical Coordinator Training Course	2	1
	Recommendation from Disaster Base Hospital	1	-
	Dentist	1	-
	Undecided but one of above	-	1
	Undecided	-	1
	Unanswered	9	10

tionally assigned pharmacist, two (4.3%) assigned nurse as a coordinator. Ten prefectures (21.3%) had not decided the requirement by April 2014. Thirty-three prefectures

(70.2%) require disaster medical coordinators to be a certified Japan DMAT member or an advanced DMAT member. Only one prefecture assigned the director of health office as

a disaster medical coordinator. Three prefectures (6.4%) were requesting the certification of disaster medical coordinator seminar provided by ACT Institute of Disaster Medicine or other organizations. Twenty prefectures (46.5%) had not decided the required capability of disaster medical coordinators.

The first contact methods after onset of disaster from the prefectural government to the affiliated disaster medical coordinators were mainly by the cell phones and E-mails. Seven prefectures (14.9%) were assuming that disaster medical coordinators should autonomously gather at the prefectural office without any notice. Fourteen prefectures (29.8%) had not decided the detail of first contact method. Twenty-nine prefectures (61.7%) were assuming that disaster medical coordinator should act within the prefectural HQ. Six out of these 29 prefectures specifically name it as the Disaster Medical HQ. In the prefectures assigning two classes of disaster medical coordinators, they expect prefectural coordinators in prefectural HQ and local coordinators to act in the DBH, Health Offices and affiliated facilities after onset of disaster (Fig. 2).

Expected Roles

The questionnaire asked 25 items that can be the roles of disaster medical coordinators. Fig. 4 shows the number of prefectures that answered yes to each item.

Preferred roles of disaster medical coordinators were gathering the information of local hospital in the affected area, coordinating with the HQ, coordinating the distribu-

tion of medicine and supplies, coordinating with co-medical staffs, management of wide-area transportations and assessing the health status of evacuation center. Coordination with DMAT, Red Cross Medical Team, Japan Medical Association Team (JMAT), SDF, University Hospitals, DBH and international Emergency Medical Teams (iEMT) and ambulatory teams using EMIS, and education and training were also highly expected roles of disaster medical coordinators. On the other hand, coordination between the disaster medical coordinators, management of stockpile of medicine, settlement and management of field hospitals, management of morgue, public health and non-communicable disease, mental health and response to the media were less frequent roles of disaster medical coordinators.

Supporting resource

Table 2 shows the supporting facility, material and other resource for disaster medical coordinators. Even in the 30 prefectures that already had assigned disaster medical coordinators, only 20 recognized EMIS as an essential tool for coordination. The number and the affiliation of supporting personnel from the prefectural government differs among prefectures. Nine (19.1%) prefectures assigned one or two personnel exclusively assisting disaster medical coordinators even before onset of disaster. Twenty-one prefectures (44.7%) assigned one or few personnel to assist disaster medical coordinator when necessary. Seventeen prefectures had not decided the detail of supporting personnel. Most of the disaster coordinators belongs to each hos-

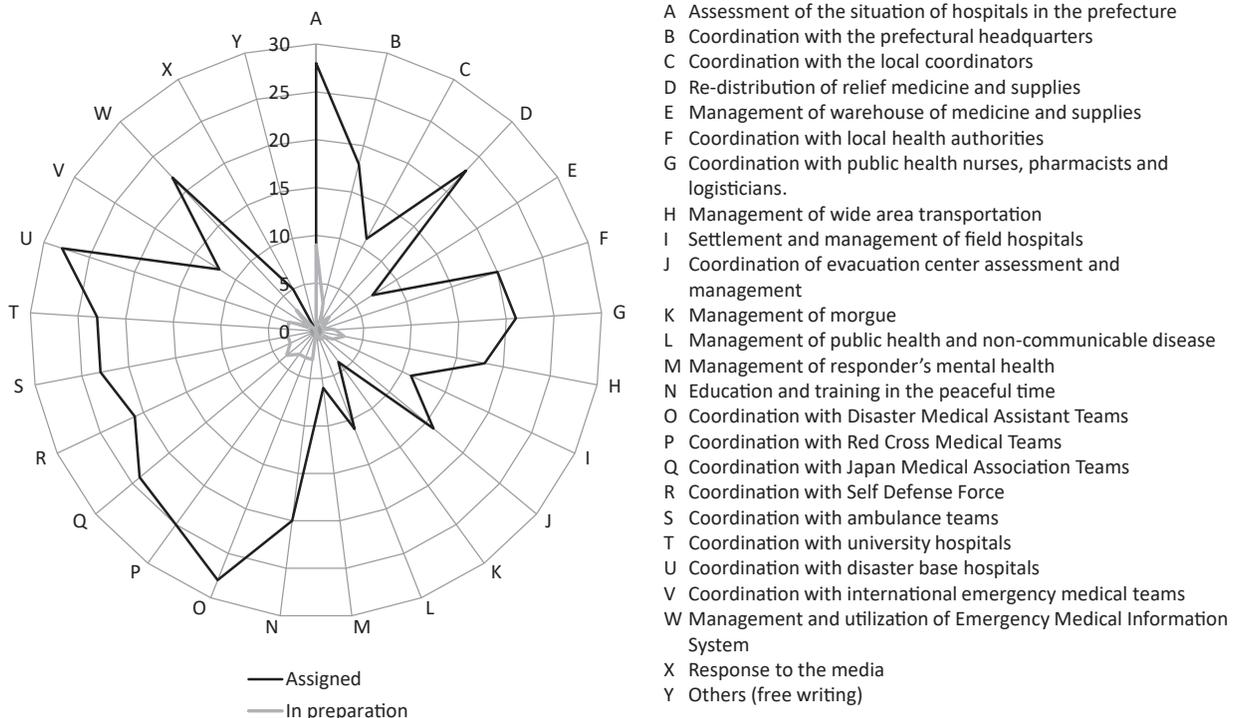


Fig. 4. Expected roles of disaster medical coordinators.

The radius indicates the number of prefectures expecting each role. The actual questions translated in English is listed in the right panel. Black line: number of assigned prefectures. Gray line: number of planning prefectures.

Table 2. Facilities and other resources to support disaster medical coordinators.

	Assigned Pref. (n = 30)	Planning Pref. (n = 13)
Exclusive room	3	-
List of health care facilities in the area	12	2
Database	2	-
Exclusive phone line	5	-
Exclusive computer terminal	4	-
Exclusive wireless communication tool	2	-
Emergency vehicle	-	-
Tent for field hospital	-	-
Emergency Medical Information System (EMIS)	20	3
Exclusive satellite phone	7	2
Exclusive TV conference system	1	-
Napping room	-	-
Shower	-	-
Education and training tools	3	1
EMARGO system® for pre-disaster training	2	-

pital or organizations other than the prefectural government and there is no additional salary as the coordinator. Twenty-two (46.8%) prefectures compensate the salary to the disaster medical coordinator according to the time of duty. Eight prefectures (17.0%) do not pay extra money for disaster medical coordinator mostly because they are employee of prefectural hospital or organization.

Agreement of mutual support

Thirty-six prefectures (76.6%) have agreement with other prefectures for the mutual help at the time of disaster as of April 2014. All of the agreement include the health aspect with four prefectures precisely defined the medical and public health support at the time of disaster. However, the backup of medical records is the individual effort of the hospitals. Only one prefecture has a mutual agreement of backup system of medical records with a distant prefecture.

Discussion

This is the first nation-wide surveillance of prefectural assignment of disaster medical coordinators in Japan. This successful nation-wide implementation shows how a disaster-prone country can build back better after a huge disaster. After GEJE, health responders, healthcare providers and researchers recognized the importance of medical and public health coordination because the spatiotemporal distribution of medical and public health needs were so diverse. Furthermore, this success was achieved by the involvement of both national and prefectural level stakeholders. The GEJE strongly reminded that Japan is disaster prone country with integrated economic and technological social system together with aging so that the health damage by future

disaster will be much more complicated. Scientific research is indicating the high possibilities of Tokyo Metropolitan Earthquake and South Trough Earthquake with Tsunami (Cabinet Office, Government of Japan 2015). The risk awareness made the MHLW to issue the Director-General Notice to plan the medical and public health coordination mechanism (MHLW 2012) including the assignment of “disaster medical coordinator” (MHLW 2015). The prefectural governments with high risk of future disaster are also keen to implement the disaster medical coordinators.

In the middle of the affected area, it was difficult to grasp what is going on and the multiple medical relief activities will add another chaotic situation to the aftermath of disaster (Ishii 2011). Thus, network of coordinators based on common terminology and standardized training are critically important to both supporting side and receiving side.

Disaster medical coordinator is an old concept with new name. One of the established systems is Regional Disaster Medical Health Coordinator (RDMHC) or Regional Emergency Coordinators (RECs) in the USA. There are two expected functions of the RDMHC; 1) to coordinate the acquisition of medical and health mutual aid in response to a request from upper governmental or federal organizations in support of a state medical/health response to a major disaster, and 2) to respond to Operational Areas requesting mutual aid assistance for disasters within the region. The RDMHC will locate, mobilize and/or arrange transportation for resources requested, and also may coordinate the receipt of casualties evacuated from the disaster area and will serve as an information source to the state medical and health response system (Walker et al. 1996).

The scope of operation includes preparedness, increased readiness, pre-impact, impact/immediate response, sustained response and recovery phases to improve overall response and readiness. This is a part of National Disaster Medical System (NDMS) of the USA established in 1983 and currently under control of the Department of Health and Human Services (HHS) through Assistant Secretary for Preparedness and Response (ASPR), in its role as coordinator of Emergency Support Function #8 (ESF-8) of National Response Framework (FEMA, Federal Emergency Management Agency 2008; HHS 2017). ASPR has placed RECs in each HHS region throughout the country. With a wide variety of backgrounds including healthcare, emergency management, environmental health, public administration, human services, public health, and engineering, the RECs offer a wealth of skills and experience in emergency planning and response. RECs has responded and showed its flexibility to the disasters caused by various types of hazard including Haiti earthquake 2010, Mexican Gulf Oil Spill 2010 and many others (HHS 2017). Recognition of critical importance of coordinated operations in disaster medical response led to the assignment of first disaster medical coordinator in 1996 in the GHAE affected Hyogo Prefecture, but nation-wide assignment did not follow until 2011 GEJE in Japan.

The standardization and training of disaster medical coordinators are the challenging issues. The ACT Institute of Disaster Medicine is organizing two-day training course and had educated more than 2,000 health care workers (as of January, 2017). The training course consists of basic understanding of disaster and disaster medicine, and several group-works to learn how to manage wide affected area as a coordinating team in the prefectural HQ and support receiving facilities to accept number of assistance teams and materials from outside of affected area. The assessment and management simulation of evacuation centers are also important topics (ACT Institute of Disaster Medicine 2017).

National Institute of Public Health (NIPH) of Japan also organizes training course of Disaster Health Emergency Assistance Team (DHEAT) that could supplement disaster medical coordinators in the transition from acute to chronic phases after disaster. DHEAT coordinates the reconstruction of damaged health functions and preventable health management in evacuation centers by collecting and analyzing the information. NPHI educates on the information collection skill, assistance on public health activities, coordination of public health activities, support-receiving capacities to build up the capacity as a team leader of health emergency management in the local governments (Kanatani 2016).

As shown in Fig. 4, the expected role of disaster medical coordinator is mainly to acquire the information of the affected hospital situations and to coordinate various relief aids. On the other hand, the assessment and management of evacuation center and public health management did not get high priority. Every disaster has different hazard and

exposure level, vulnerability of community and the coping capacity. The medical needs in disaster is not only the injuries. The surge of medical and public health needs for infectious disease, mother and child health, non-communicable disease (NCD), mental health and rehabilitation will appear. The medical and public health needs and the damage of local health facilities vary according to the local context and the type of hazard. Therefore, the medical and public health assistance to the affected area should be well coordinated before actual operation. Japan DMAT requests the member to follow Command and control, Safely, Communication, Assessment, Triage, Treatment and Transportation (CSCATTT) (Sammur et al. 2001) in its training courses, emphasizing the importance of coordination before action (Kondo et al. 2009). After GEJE, the Japan DMAT training program focuses more on the coordinating skills rather than the emergency medical care including confined space medicine. Hospital evacuation, preparations to receive DMATs at damaged hospitals, coordination when DMAT activities are prolonged, and safety management and communication during helicopter on-board became the new items incorporated in the revised training program (Anan et al. 2014). Education and training of disaster medicine for every health care professions in the school is necessary to facilitate the implementation of the health aspect of Sendai Framework for Disaster Risk Reduction (UNISDR, United Nations International Strategy for Disaster Reduction 2015, 2016).

In 2016 Kumamoto Earthquake in Kyushu Island, the disaster medical coordinators of Kumamoto Prefecture organized the health cluster meetings with various stakeholders, including DMAT, other medical relief teams, Japan Rehabilitation Assistance Teams, Disaster Psychiatric Assistance Teams and local health authorities and local government to coordinate the medical and public health needs of affected people and the relief resources. The coordination successfully led to several hospital evacuations during repeated after-shakes, prevention and early detection of deep vein thrombosis of the people sleeping in the cars and improvement of evacuation center environment in hot early summer (MHLW 2016). The nation-wide implementation of the disaster medical coordinators expedited the efficient response. Kumamoto Prefecture had assigned nine prefectural level coordinators in June 2013. The predefined roles of the disaster medical coordinators in Kumamoto Prefecture were as follows in order to:

1. Advise disaster medical system in the prefecture including pre-disaster phase.
2. Assess and analyze the medical needs in the affected area.
3. Assess and advise to prefectural request of outer DMAT relief.
4. Coordinate the accepting health facilities in the acute phase after disaster.
5. Coordinate the medical relief teams to the affected area.

6. Coordinate accepting the outer DMAT and medical relief teams.

7. Other issues requested by Governor.

The gaps and challenges identified for better disaster mitigation were the pre-assignment of local (sub-prefectural) level coordinators and the coordination between the medical and public health stakeholders. Our research revealed that five prefectures assigned the two levels of coordinators, while 29 prefectures assigned one level (Fig. 2). In the five prefectures that assigned two levels, the numbers of prefectural coordinators vary from one to 11, the local coordinators vary from several to 29 (data not shown). In the remaining 29 prefectures, the numbers of coordinators vary from several to 170 (including pharmacists) (Fig. 3). In Japan, the geographical and functional context of medical and public health system in each prefecture are diverse. Consequently, it is not easy to tell which structure in Fig. 2 is better. Pre-disaster cooperation of prefectural and municipal governments and the health stakeholders are critical to make disaster medical coordinators to be flexible and functional in disaster.

In summary, the strength of the Japanese disaster medical coordinator is the assignment by prefectural government assuring the coordination with the prefectural HQ. The medical coordinators who are most familiar with the prefectural health system to adapt the outer support into the local context will enhance the efficiency of the disaster medical and public health relief. The weakness, however, the style of assignment and its supporting system, depends on the prefectural government. Nation-wide standardization of knowledge and competencies for coordination in both medical and public health aspects are mandatory.

In conclusion, a nation-wide questionnaire surveillance revealed that Japan has rapidly increased the pre-assigned disaster medical coordinators under current national disaster medical system. Their roles and standardization are challenging, but education, training and systematic support by the assigning local government will enhance the effective preparedness and response of the health sector in disasters.

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Author Contributions

S.E. conducted the research, performed statistical analyses and wrote the manuscript. A.M., T.S., T.E.C.J-K., and H.S. cooperated to summarize the results and peer reviewed the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

References

- ACT Institute of Disaster Medicine (2017) Disaster medical coordinator training course. <http://www.dm-act.jp/kenshu.html> [Accessed: June 6, 2017] (in Japanese).
- Anan, H., Akasaka, O., Kondo, H., Nakayama, S., Morino, K., Homma, M., Koido, Y. & Otomo, Y. (2014) Experience from the Great East Japan Earthquake response as the basis for revising the Japanese Disaster Medical Assistance Team (DMAT) training program. *Disaster Med. Public Health Prep.*, **8**, 477-484.
- Cabinet Office, Government of Japan (2015) Disaster Management of Japan. http://www.bousai.go.jp/1info/pdf/saigaipamphlet_je.pdf [Accessed: August 7, 2017].
- Federal Emergency Management Agency (FEMA) (2008) Emergency Support Function #8 – Public Health and Medical Services Annex. <https://www.fema.gov/pdf/emergency/nrf/nrf-esf-08.pdf> [Accessed: July 4, 2017].
- Ishii, T. (2011) Medical response to the Great East Japan Earthquake in Ishinomaki City. *Western Pac. Surveill. Response J.*, **2**, 10-16.
- Kanatani, Y. (2016) Training course of Disaster Health Emergency Assistance Team (DHEAT). http://www.phcd.jp/02/soukai/pdf/soukai_2016_tmp16.pdf [Accessed: June 17, 2017] (in Japanese).
- Kondo, H., Koido, Y., Morino, K., Homma, M., Otomo, Y., Yamamoto, Y. & Henmi, H. (2009) Establishing disaster medical assistance teams in Japan. *Prehosp. Disaster Med.*, **24**, 556-564.
- Masakane, I., Akatsuka, T., Yamakawa, T., Tsubakihara, Y., Ando, R., Akizawa, T., Minakuchi, J. & Nitta, K. (2016) Survey of dialysis therapy during the Great East Japan Earthquake Disaster and recommendations for dialysis therapy preparation in case of future disasters. *Renal Replacement Therapy*, **2**, 48.
- Ministry of Health, Labour and Welfare (MHLW) (2011) Official report of Study Group for Disaster Medical System. <http://www.mhlw.go.jp/stf/shingi/2r9852000001tf5g-att/2r9852000001tf6x.pdf> [Accessed: June 17, 2017] (in Japanese).
- Ministry of Health, Labour and Welfare (MHLW) (2012) Director-General Notice from Health Policy Bureau (0321-2) Improvement of medical and public health response in disaster. <http://www.mhlw.go.jp/file/06-Seisakujouhou-10800000-Iseikyoku/0000089039.pdf> [Accessed: June 17, 2017] (in Japanese).
- Ministry of Health, Labour and Welfare (MHLW) (2015) Guidance of medical service division, Damages and Response to Great East Japan Earthquake. <http://www.mhlw.go.jp/file/06-Seisakujouhou-10800000-Iseikyoku/0000103405.pdf> [Accessed: June 17, 2017].
- Ministry of Health, Labour and Welfare (MHLW) (2016) Medical and public health relief in Kumamoto Earthquake. <http://www.mhlw.go.jp/file/05-Shingikai-10801000-Iseikyoku-Soumuka/0000136146.pdf> [Accessed: August 7, 2017] (in Japanese).
- Sammur, J., Cato, D. & Homer, T. (2001) Major Incident Medical Management and Support (MIMMS): a practical, multiple casualty, disaster-site training course for all Australian health care personnel. *Emerg. Med.*, **13**, 174-180.
- Sasaki, H., Egawa, S. & Yamanouchi, S. (2014) Surveillance of

- support receiving plan for disaster in the hospitals affected by Great East Japan Earthquake.
<http://www.irides-icdm.med.tohoku.ac.jp/pdf/a2014-02-20-1.pdf>
[Accessed: June 16, 2017] (in Japanese).
- Shibahara, S. (2011) The 2011 Tohoku earthquake and devastating tsunami. *Tohoku J. Exp. Med.*, **223**, 305-307.
- United Nations International Strategy for Disaster Reduction (UNISDR) (2015) Sendai Framework for Disaster Risk Reduction 2015-2030.
http://www.preventionweb.net/files/43291_sendaiframeworkfordren.pdf
[Accessed: July 27, 2016].
- United Nations International Strategy for Disaster Reduction (UNISDR) (2016) Bangkok Principles for the implementation of the health aspects of the Sendai Framework for Disaster Risk Reduction 2015-2030.
http://www.who.int/hac/events/2016/Bangkok_Principles.pdf
[Accessed: Aug. 23, 2016].
- U.S. Department of Health and Human Services (HHS) (2017) National Disaster Medical System.
<https://www.phe.gov/Preparedness/responders/ndms/Pages/default.aspx>
[Accessed: June 6, 2017].
- Walker, W.B., Lathrop, A., Center, B. & Grenslitt, J. (1996) Regional disaster medical/health coordinator: Interim emergency plan.
http://cchealth.org/ems/pdf/regional_disaster_medical_health_coordinator_plan.pdf
[Accessed: July 3, 2017].
- Yamanouchi, S., Sasaki, H., Tsuruwa, M., Ueki, Y., Kohayagawa, Y., Kondo, H., Otomo, Y., Kido, Y. & Kushimoto, S. (2015) Survey of preventable disaster death at medical institutions in areas affected by the Great East Japan Earthquake: a retrospective preliminary investigation of medical institutions in Miyagi Prefecture. *Prehosp. Disaster Med.*, **30**, 145-151.
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