Exploratory Research in Clinical and Social Pharmacy 10 (2023) 100278

Contents lists available at ScienceDirect

Exploratory Research in Clinical and Social Pharmacy

journal homepage: www.elsevier.com/locate/rcsop

Creation of the first regional medical resource map for use in a disaster

Akira Mitoya [a,b,*], Satoshi Okamura [b], Osamu Noguchi [b], Isao Saito [c], Hironori Nakura [d], Shinichi Iwai [a,1], Keiko Kishimoto [a]

[a] School of Pharmacy, Showa University, Shinagawa-ku, Tokyo, Japan
[b] Disaster Countermeasures Committee, Kita-ku Pharmacist Association, Kita-ku, Tokyo, Japan
[c] School of Pharmacy, International University of Health and Welfare, Ohtawara City, Tochigi, Japan
[d] Okayama University Institute of Academic and Research, Medicine, Dentistry and Pharmaceutical Sciences, Okayama City, Okayama, Japan

ARTICLE INFO

Keywords:
Natural disaster
Internet
Medical resource map
Safety confirmation
Technology
Status confirmation

ABSTRACT

Background: Japan is located on the Pacific Ring of Fire and experiences frequent earthquakes. In addition, as the climate is changing due to global warming, heavy rains have caused frequent floods recently. Following the occurrence of disasters, citizens often experience confusion regarding access to healthcare services. Moreover, health professionals often face uncertainty regarding the availability of medical services in their local area. The Tokyo Kita city Pharmacist Association (KPA) independently developed the pharmacist safety confirmation (PSC) and pharmacy status confirmation (PSTC) systems to provide information regarding pharmaceutical resources during a disaster. These systems are very useful; however, they only provide information about pharmacies. Using this system as a base, a regional medical resource (RMR) map was created in cooperation with the Medical Association and Dental Association to provide useful medical resource information for clinicians and citizens during a disaster.
Objectives: The study aimed to assess the effectiveness and reliability of the RMR map.
Methods: The PSC and PSTC systems were originally invented by the KPA. The systems were employed in the event of actual earthquakes and flood damages and have produced positive results. An RMR map was created as a new resource map system by updating the software and platform of PSC and PSTC, and its reliability and efficacy were verified using drills. Drills were conducted seven times from 2018 to 2021.
Results: Out of the 527 member facilities, 450 were registered. The response rate ranged from 49.4% to 73.8% and the system successfully created useful maps.
Conclusion: This is the first report on the creation of an effective RMR map that can be used for helping people during disasters in Japan.

1. Introduction

After a disaster occurs, many patients tend to rush to large-sized hospitals in a short period of time. To prevent such congestion, information about the availability of local medical resources is required so that mild cases can be sent to small-sized clinics. In the mainshock of the 2016 Kumamoto Earthquake, for example, 192 patients crowded the Kumamoto Red Cross Hospital 90 min after the disaster. It is a disaster base hospital that accepts critical cases from a wide area; however, 70% of these cases were judged to be mild cases by triage. There is a wide area disaster emergency medical information system (EMIS)[1] that is used in the event of a disaster. EMIS aims to collect and provide information related to medical care and relief, such as the operating status of large medical institutions across the wide area of the damaged districts. It shares information in the early phase immediately after a disaster occurs to find appropriate medical institutions for critical patients and transport them to these institutions in the wide area across the districts.

However, as described above, patients tend to concentrate in large hospitals, such as disaster base hospitals, which are not meant to cover mild cases. When the number of patients rushing to a hospital exceeds its capacity for acceptance, not only do the critical patients not receive medical services immediately (as the triage process takes time) but the mildly ill patients may also be left unexamined. They will have to wait for a long time or may need to go home temporarily without care. If there are clinics that can accept mildly ill patients in their local region, the patients do not have to move to other regions to see physicians, and they can be cared for immediately. However, a certain number of clinics will be required to accept a large number of patients in the event of a disaster. Additionally, when there is no information about the availability of various clinics, patients may congregate in one clinic; consequently, the clinic will quickly reach the maximum

* Corresponding author at: Kita-ku Pharmacist Association, 2-3-1 Oji kita-ku, Tokyo, Japan.
E-mail address: ymitoya2@happy.email.ne.jp (A. Mitoya).
[1] Deceased author.

http://dx.doi.org/10.1016/j.rcsop.2023.100278
Received 12 March 2022; Received in revised form 21 April 2023; Accepted 30 April 2023
Available online xxxx

patient capacity. These patients also need a pharmacy to fill prescriptions. If this information can be collected, collated, and shared effectively, appropriate institutions can be found, and timely medical care can be provided in each region to patients affected by disasters. In this way, large-sized hospitals can concentrate on serious to moderately injured people, and confusion can be avoided. However, no system is currently in place to share regional information on the availability of medical institutions in the event of a disaster in Japan. This study reports the development and creation of a new regional medical resource (RMR) map and verifies its efficacy and reliability.

The Kita city Pharmacist Association (KPA) has two existing and operational systems—the pharmacist safety confirmation (PSC) and pharmacy status confirmation (PSTC) systems—that were independently developed in a unique scheme to collect information. Because these systems are the basis of the development of the RMR map, brief overviews of these systems are provided as follows.

1.1. Pharmacist safety confirmation system in disaster situations[2]

The PSC is a private system handled by the KPA that was created in 2011 to confirm the safety of member pharmacists of the KPA at the time of earthquakes. The PSC system works as follows: 1) In the case of a disaster, the government sends a message to the citizens through the disaster prevention weather information email delivery service. 2) The system automatically identifies “a seismic intensity of 5 or higher” in the email message. 3) This triggers the PSC system to send messages to the members. 4) A “safety confirmation email” is sent automatically to all the KPA members' mobile phones. 5) Each member receives the email and informs the KPA of their safety by clicking the link in the email. 6) The responses from each member are processed on the server and displayed on the Internet. The data are shown in real time and the members' statuses can be confirmed without delay.

The first trial of the PSC system was conducted on October 10, 2012, 1 year after the Great East Japan Earthquake. Since then, training has been conducted more than twice every year. The PSC system succeeded not only in the drills but also in confirming members' safety during actual events.

1.2. Pharmacy status confirmation system

The PSTC system is another base for creating the RMR map and provides local pharmacy status information after disasters, such as the availability of dispensing, over-the-counter sales, and home care visits. The PSTC system reports the information to the disaster response headquarters and the relevant people in charge. This system was independently developed by our team and has been in operation since October 2013. It was developed based on the “pharmacy inventory search system”[3] that was previously created and operated by our team. Information such as pharmacies' email addresses and locations registered in the inventory search system was utilized as identifiers.

In the case of a disaster event, email questions regarding how pharmacies are damaged and whether they are open are sent to all members simultaneously. Members can choose an answer from multiple options according to their situation. The answers are sent to the server, automatically aggregated, and displayed on the Internet as a list of pharmacies and on the map at the same time. Thus, using its location and the availability of the physician in the vicinity, association members know which pharmacy can fill a prescription. The map can be enlarged or printed focusing on a specific area.[4] This system has recently been adopted by pharmacist associations in the surrounding seven cities—Adachi, Arakawa, Itabashi, Kita, Toshima, Taito, and Bunkyo cities.[5]

When a disaster occurs, the system for sharing the disaster situation has already been activated, but there is no system that collects and shares the opening status of medical institutions. The PSC and PSTC are the first and only systems to show the status of regional pharmacies during disasters in Japan. These systems were adopted to create the first RMR map for use in the event of a disaster, working with the Kita city Medical Association (KMA), Kita Dental Association (KDA), and Takinogawa Dental Association (TDA). Later, we collaborated with the Home-visit Nursing Station Association (HNA) and Judo Therapist Association (JTA). In the event of a disaster, availability of medical care is lower than normal. To help as many victims as possible, a multidisciplinary team should be in charge of medical care. Nurses are essential personnel in medical care. Judo therapists are familiar with emergency treatment for injured people, such as those that are injured during disasters.

1.2.1. Purpose

This study aimed to create a new system to map the status of RMRs during a disaster, called the RMR map, and verify its efficacy and reliability.

2. Methods

Kita city is a densely populated area of 20.61 km^2 with many housing complexes and a population of approximately 330,000. Patients in each local area are served by 267 medical clinics, 232 dental clinics, and 169 community pharmacies. The Tokyo North Medical Center is a regional disaster base hospital and is inundated with patients when a disaster occurs. However, as mentioned above, many patients will have mild cases.

By sharing information about the status of and damage to medical institutions in a region, the mildly ill patients can be triaged to appropriate clinics or pharmacies in the region, and the hospital will be able to provide medical services to critically ill patients appropriately, which is the true function of a disaster-based hospital during a disaster. To make this possible, a regional medical status information system, called the RMR map, was created by updating the PSTC system, which is conducted as a disaster countermeasure at the KPA. Satoshi Okamura of the KPA acted as the data manager for this study. The data were strictly managed by setting a password, and he was the only one with access rights. The program and resources to create the RMR map were ported from the PSTC system, which was created by the KPA using Hypertext Preprocessor, PHP.

The program runs on the KPA server itself. A facility-specific email address is registered in advance on the My Facility page in the system. For access, an ID and password for each facility is required, with precautions taken to prevent unauthorized access. In addition, latitude and longitude information for each facility is input and used when showing on the map. The inquiries are pre-configured and responses are included in the email, with four options for the answers and links are set for each option. The facility that received the email clicks the link of the one that corresponds to the appropriate response from the four options. Once clicked, the latitude and longitude information of the facility will be used to create a URL to be displayed on Google Maps. The selected reply and the time of reply are automatically recorded by the system. After sending the email, the response status at the specified time is programmed and aggregated by CSV for each group. The collected data are stored on the server of the KPA, but are not collated because it is an automatic program.

In the future, when the number of drills is accumulated, we will analyze whether the response status for each group and hour increases or decreases with the increase in the number of drills and formulate effective measures to obtain responses close to 100%. This analysis is planned for future implementation.

To expand the utility of the RMR map, we needed to input maximum information regarding medical resources into the database. A proposal was presented to the Disaster Countermeasures Conference for the use of this system with the Medical, Dental, and Pharmacist Associations, called “*Sanshi-kai*.” The proposal was accepted by the conference and approved by the KMA, TDA, and KDA. The information to be input into the system, such as the members' email addresses, was obtained and registered by each association.

We tested the system several times internally by sending messages to the program during its development. After it was confirmed that the program worked correctly, the RMR map was pilot drilled using a manual process to examine the validity. The messages direct the receivers to “Click the

Dr. oooo

This is a training for grasping the disaster situation in the event of a disaster.
Report current damage situation at your institution.
Please select the relevant link and answer.

A: Click the URL below in the case of "The facility has collapsed and there is no prospect of recovery."
http://www.kitayaku.or.jp/clube2/hazard.php?tel=oooo&qes=R&ans=A

B: Click the URL below in the case of "The facility is safe, but medical care cannot be provided at this time."
http://www.kitayaku.or.jp/clube2/hazard.php?tel=oooo&qes=R&ans=B

C: Click the URL below in the case of "There is no major damage to the facility. Medical care can be provided." http://www.kitayaku.or.jp/clube2/hazard.php?tel=oooo&qes=R&ans=C

Please click the applicable link.
The response status of each medical institution by each group
http://www.kitayaku.or.jp/clube2/kinou.php? tiku = 17 & qes = R Joint
http://www.kitayaku.or.jp/saigai.html You can check with.
Joint disaster prevention communication training for doctors, dental, and Pharmacy –

Osamu Noguchi,Chairman of the Kita Ward Pharmacist Association-

Fig. 1. Email for Kita city Pharmacists Association.

link" in the message to check if they read the message, and prompted them to click another link to send back information regarding their safety and availability. Through this pilot drill, we confirmed whether (1) messages were sent to members successfully, (2) answers from the members were returned by clicking the links, and (3) the program received answers from members and displayed markers on the map correctly. The drill using the manual process was conducted as if a disaster had occurred, although the RMR map is programmed to start automatically. The pilot drill was conducted only once and was deemed sufficient for testing the preliminary system as it was observed that the responses received from facilities were accurately reflected on the map.

On February 24, 2018, the KMA, KDA, TDA, and KPA joined the full-fledged drill held at the Tokyo North Medical Center. As part of the drill, the RMR map system was employed. The system sent messages to the members and the answers from each association were analyzed. The text and content of the email messages are shown in Fig. 1. The members' answers were displayed on the list and mapped automatically by the system. Responses were followed up for 12 h after the RMR map system was activated because the RMR system was expected to accrue sufficient data within this time frame. However, 12 h were insufficient, and the follow-up period was extended to 48 h. The RMR map is expected to provide information regarding the situations of 50% of members in 4 h and 70% in 8 h.

Drills were conducted 13 times since September 2017; of these, five drills were conducted within KPA member pharmacies and eight drills with KMA, KDA, and TDA. The member responders must be well-trained to respond with useful information as soon as possible using the RMR system. Therefore, responders needed to be informed on how to use the system daily with regular training. Communication drills are conducted three times a year.

Additionally, member pharmacies (KPA) were asked to send additional messages if they had drugs that might be needed to treat simulated patients during the drill. The pharmacies listed the drugs in stock, replied, and shared the lists using the system.

3. Ethical considerations

This survey involves medical institutions although it is operated by humans. Since the registered email address is unique to the facility and is already open to the public, it is not considered to be subject to ethical review in Japan. With the approval of the KPA Board of Directors, an investigation was initiated.

4. Results

A total of seven training sessions were planned to create an RMR map for members of the KMA, KDA, TDA, and KPA, in line with the disaster drill held in Kita city, Tokyo.

The results of medical status training after 24 h are shown in Table 1. The results of the Timeline Medical status drill are shown in Table 2. However, of the seven planned training drills, training sessions were only conducted on February 29, 2020 and March 27, 2021 due to the spread of the COVID-19 infection.

The first large-scale training was held in conjunction with the Kita city disaster training drill at the Tokyo North Medical Center on February 24, 2018. Out of the 527 member facilities, 450 were registered—197 from

Table 1
Results of medical status training after 24 h.

Date	KMA	KDA	TDA	KPA	Sub total	KNS	KJR	Total
2018/2/24	119/197 (60.4)	41/84 (48.8)	24/38 (63.2)	96/131 (73.3)	280/450 (62.2)			
2018/9/8	120/197 (60.9)	52/89 (58.4)	26/38 (68.4)	92/138 (71.0)	290/462 (62.5)			
2019/2/16	117/197 (59.4)	51/89 (57.3)	22/38 (57.9)	99/137 (72.3)	289/461 (62.7)			
2019/9/7	109/195 (55.9)	49/89 (55.1)	26/38 (68.4)	108/137 (78.8)	292/459 (63.6)			
2020/2/29	120/201 (59.7)	42/89 (47.2)	23/38 (60.5)	99/135 (73.3)	284/463 (61.3)	11/34 (32.4)	18/31 (58.1)	313/528 (59.3)
2020/10/28	121/201 (60.2)	47/89 (52.8)	18/38 (47.4)	99/134 (73.9)	285/462 (61.7)	10/34 (29.4)	14/29 (48.3)	309/525 (58.9)
2021/3/27	89/197 (45.2)	28/88 (31.8)	19/38 (50.0)	82/134 (61.2)	218/457 (47.7)	7/34 (20.6)	16/29 (55.2)	241/520 (46.3)

Table 2
Results of Timeline Medical status drill.

	5 min	30 min	3 h	6 h	24 h	48 h	72 h
2018/2/14	75/450 (16.7)	140/450 (31.1)			280/450 (62.2)		332/450 (73.8)
2018/9/18	15/462 (3.2)	130/462 (28.0)	231/462 (49.8)	258/462 (55.6)	290/462 (62.5)	318/462 (68.5)	
2019/2/16	82/461 (17.8)	155/461 (30.6)	241/461 (52.3)	264/461 (57.3)	289/461 (62.7)	310/461 (67.2)	
2019/9/7	68/459 (14.8)	130/459 (28.0)	231/459 (49.8)	258/459 (55.6)	290/459 (62.5)	309/459 (67.3)	
2020/2/29	57/528 (10.8)	120/528 (22.7)	228/528 (43.2)	274/528 (51.9)	313/528 (59.3)	343/528 (65.0)	
2020/10/31	68/525 (13.0)	133/525 (25.3)	246/525 (46.9)	277/525 (52.8)	309/525 (58.9)	336/525 (64.0)	
2021/3/27		43/520 (8.3)	97/520 (18.7)	158/520 (30.4)	241/520 (46.3)	257/520 (49.4)	

Table 3
Number of responses and response rate (%) after sending email.

Time	KMA	KDA	TDA	KPA	Total
	N = 197	N = 84	N = 38	N = 131	N = 450
5 min	32 (16.2)	9 (10.7)	4 (10.5)	30 (22.9)	75 (16.7)
10 min	43 (21.8)	10 (11.9)	6 (15.8)	36 (27.5)	95 (21.1)
20 min	55 (27.9)	16 (19.0)	11 (28.9)	42 (32.1)	124 (27.6)
30 min	59 (29.9)	17 (20.2)	12 (31.6)	52 (39.7)	140 (31.1)
1 day	119 (60.4)	41 (48.8)	24 (63.2)	96 (73.3)	280 (62.2)
3 days	138 (70.1)	50 (59.5)	29 (76.3)	115 (87.8)	332 (73.8)

the KMA, 84 from the KDA, 38 from the TDA, and 131 from the KPA. Table 3 shows the number of responses and the response rate for each hour. Figs. 2 to 5 show the opening status of the medical institutions 5 min, 30 min, 1 day, and 3 days after sending the email. Fig. 6 shows the damage status 3 days later. The total number of responses within 5 min after sending the email was 75 facilities (16.7%), of which 32 facilities were from the KMA (16.2%), nine from the KDA (10.7%), four from the TDA (10.5%), and 30 from the KPA (22.9%). The total number of responses within 30 min after sending the email was 140 facilities (31.1%), of which 59 facilities (29.9%), 17 facilities (20.2%), 12 facilities (31.6%), and 52 facilities (39.7%) were from the KMA, KDA, TDA, and KPA, respectively. The

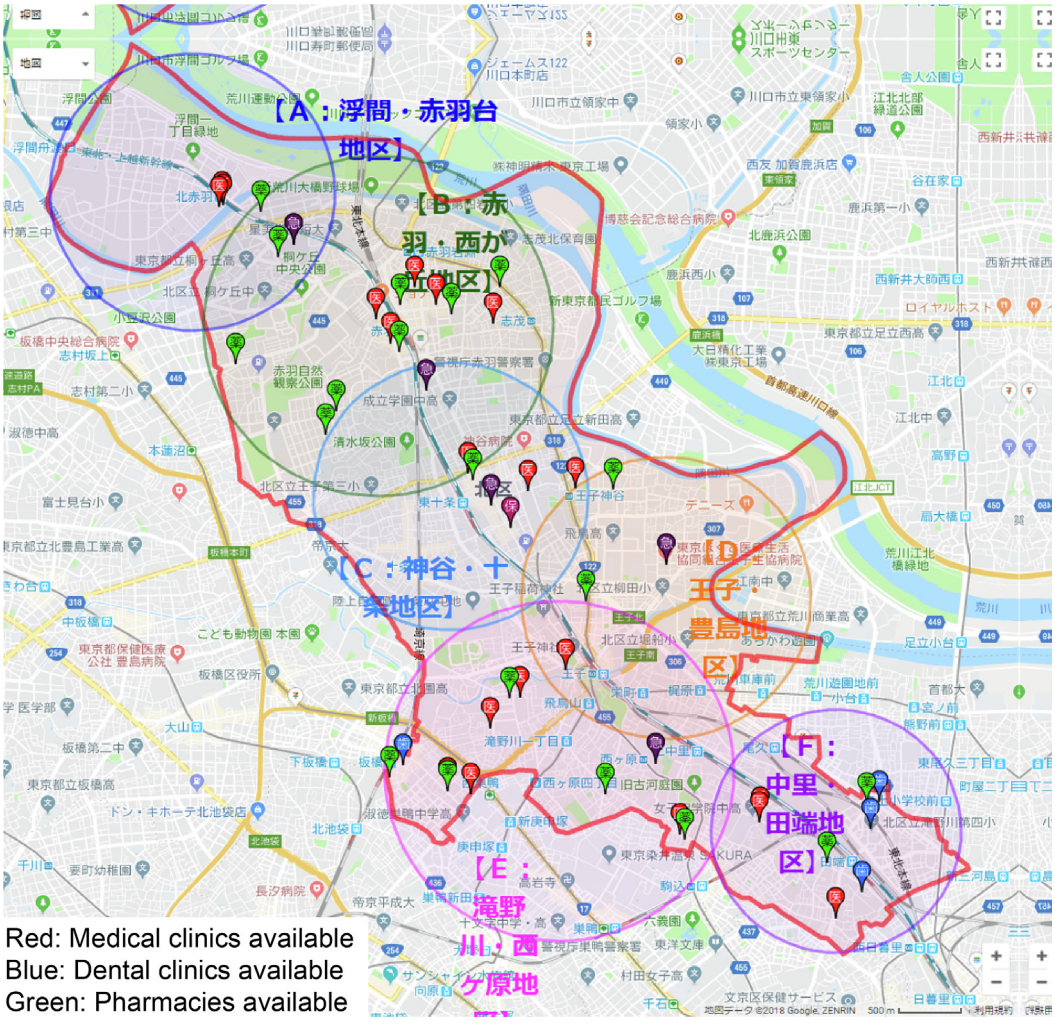

Fig. 2. Situation of medical institutions after 5 min.

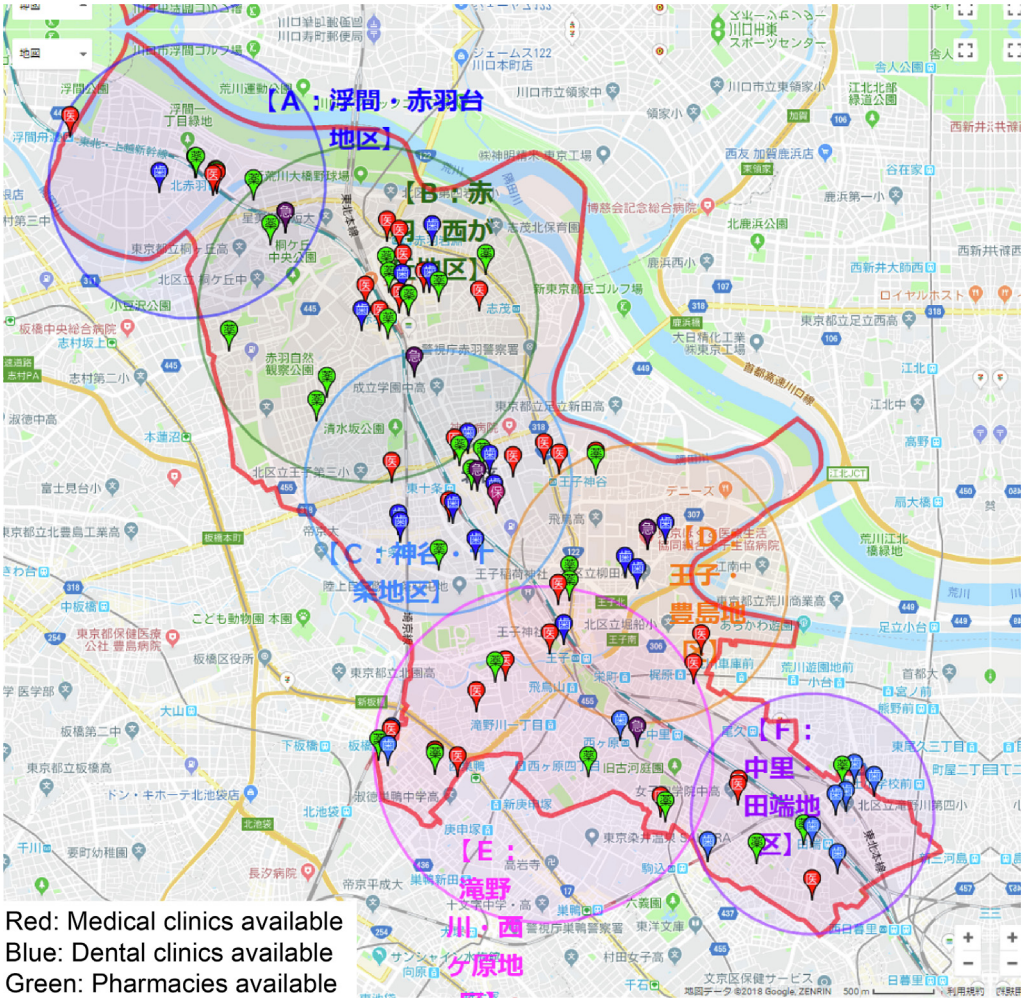

Fig. 3. Situation of medical institutions after 30 min.

total number of responses 1 day later was 280 (62.2%), of which 119 (60.4%), 41 (48.8%), 24 (48.8%), and 96 (73.3%) were from the KMA, KDA, TDA, and KPA respectively. The final tabulation was performed 3 days later, and the number of responses from all facilities was 332 (73.8%): KMA: 138 facilities (70.1%); KDA: 50 facilities (59.5%); TDA: 29 facilities (76.3%); and KPA: 115 facilities (87.8%).

The fourth medical resource map creation training was held at Hana to Mori Tokyo Hospital on September 7, 2019. During the training, inquiries were made about the member pharmacies' inventories of several medications considered to be necessary in the case of disaster. Regarding lice repellent, for example, 29 pharmacies replied that it was in stock 6 h after the initial email was sent. For insulin products, Novolin R Note Flex Pen® and Humarin R Note Million Pen®, 27 pharmacies answered that they had Novolin R Note Flex Pen® in stock and 11 pharmacies had Humarin R Note Million Pen® in stock.

The RMR map enables members to answer back by just selecting and clicking a link from five options. This system made it possible to grasp the situation in a specific area using the markers displayed at the location on the map in the shortest possible time. In addition, the RMR map provides information using a bird's-eye view of the area; hence, the damages to a specific area can be estimated at a glance. For example, in an actual case of a big typhoon hitting our city, most member facilities were safe; although, a small number of member facilities were damaged. The damaged facilities were scattered across a wide area. It could be assumed from the information on the map that the damage was not related to the terrain conditions of the pharmacies, and that it was safe to move the needed resources to the facilities.

5. Discussion

By using the RMR map system at the drills and collaborating with the pharmacist, medical, and dental associations, and other healthcare providers in the same area, the system could aggregate and share RMR information successfully. Approximately 450–528 facilities joined the seven drills and their response rates ranged from 47.7% to 63.6%. Although systems for collecting and sharing medical resource information in the event of a disaster have been developed in various ways,[6] our RMR map system is the first to map the information of a specific region in Japan. Tables 4 and 5 show the results of PSC and PSCT that have been operated in actual disasters. PSC was operated five times, and the response rate was 53.2% to 66.9%, whereas PSCT was operated four times, and the response rate was 52.6% to 75.1%. This result were similar to the response rate of the KPA, which was in operation when the disaster occurred. This suggests that similar responses can be obtained during an actual disaster, allowing for sufficient medical resources to be secured for individuals with mild symptoms, as demonstrated during the Kumamoto Earthquake. In addition to Kita City, the RMR map system is also in operation at pharmacist associations in the surrounding six districts, and although still in the training phase, a similar response rate (45.7% to 89.7%) has been obtained (Table 6). If we are able to construct an RMR map in cooperation with the medical and dental association in this area, it will undoubtedly be of great help in caring for people with mild symptoms in the event of a disaster.

The RMR map system can send any necessary inquiries simply and receivers can answer the questions easily by clicking the URL. As the damage

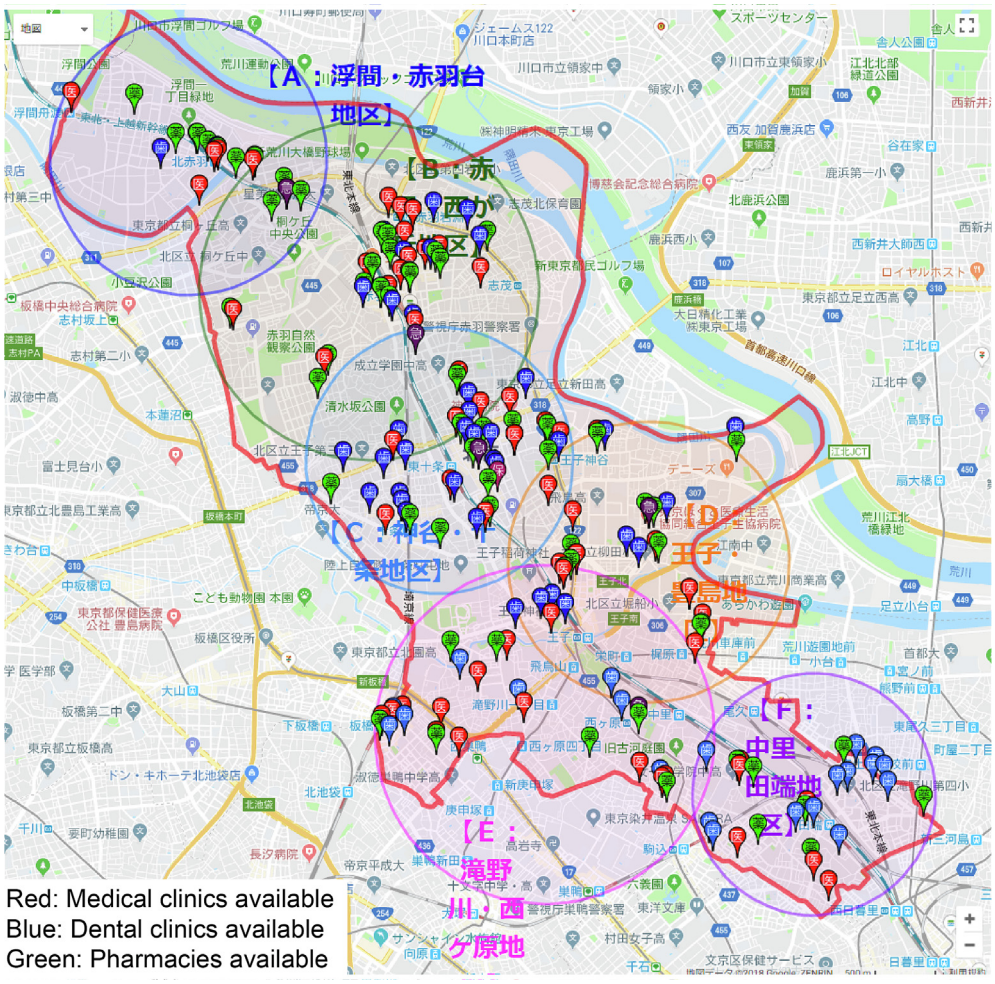

Fig. 4. Situation of medical institutions after 1 day.

statuses are collected based on each medical institution, not by individuals, it is possible to display information by locating and marking the medical institutions on the map. Providing a bird's-eye view of the area makes it easier to grasp the damage, and the disaster countermeasures headquarters can subsequently select areas in need of assistance. Another useful function of the RMR map is that anyone—including healthcare associations, the government, disaster response headquarters, shelters, and support teams—can view it in real time through a URL.

The time required to map the information is considerably short; However, the process of sending out the initial emails and waiting for responses to appear on the corresponding column of the web page can be time-consuming. Moreover, the RMR map system can update the information, which is immediately reflected in the aggregate result when the number of data items increases and the situation changes over time.

The RMR map can register 26 questions in advance, and register additional questions anytime. For example, when a question such as “Please let us know how crowded your site is” is sent, the receivers update the latest congestion status as needed, and the system display changes in real time, corresponding to the time at which the answers are received.

It is significant that the RMR map displays real-time information as this can be browsed by anybody with access to the URL and confirmed by relief teams, such as disaster response headquarters, medical relief centers, neighboring medical institutions, the Disaster Medical Assistance Team (DMAT), and the Self-Defense Forces. Based on the RMR map, it is possible to triage mildly ill patients concentrated in hospitals and send them to local clinics in the regions. Clinically, it is possible to display the patient acceptance status in real time to prevent patient concentration, and crowded clinics may connect with other clinics depending on the situation. By using the RMR map system, clinics can share patients to prevent overcrowding.

This system is also linked to pharmacy inventory search systems. This allows for the search of out-of-stock items, which is useful in situations where a large number of patients need to be accommodated with limited medical resources in the event of a disaster. Eventually, the system proved to be beneficial during the COVID-19 pandemic when there was a scarcity of face masks; customers were provided with information on the location of pharmacies that had masks in stock.

The aggregated results can be displayed separately on the map by arbitrary groups, such as a list of clinics, dentists, and pharmacies that can provide services or a list of sites that are closed due to the disaster. The damage situation can be identified by checking the status spreading on the map. Additionally, the RMR map can draw pictures or characters on the screen, and users can designate areas to be shown on the map. For example, the RMR map can show “collapsed sites due to disaster” or “capable of continuing medical care” separately, and these can be highlighted separately by drawing circles or characters on the map. These functions make it easier to understand the hazards in a situation. It can also be used to collect and display numerical values that change with time during a disaster, such as the number of shelters and vacant beds in hospitals.

We also found that the RMR map could collect the damage situation for each medical institution. The result can be displayed with a marker on the location of the medical institution on the map, making it easier to grasp the disaster situation from a bird's-eye view of the area. The RMR map can be a useful tool to judge which area requires urgent support.

Disasters are a series of applied problems happening in unexpected situations. The RMR system allows questions to be registered in advance;

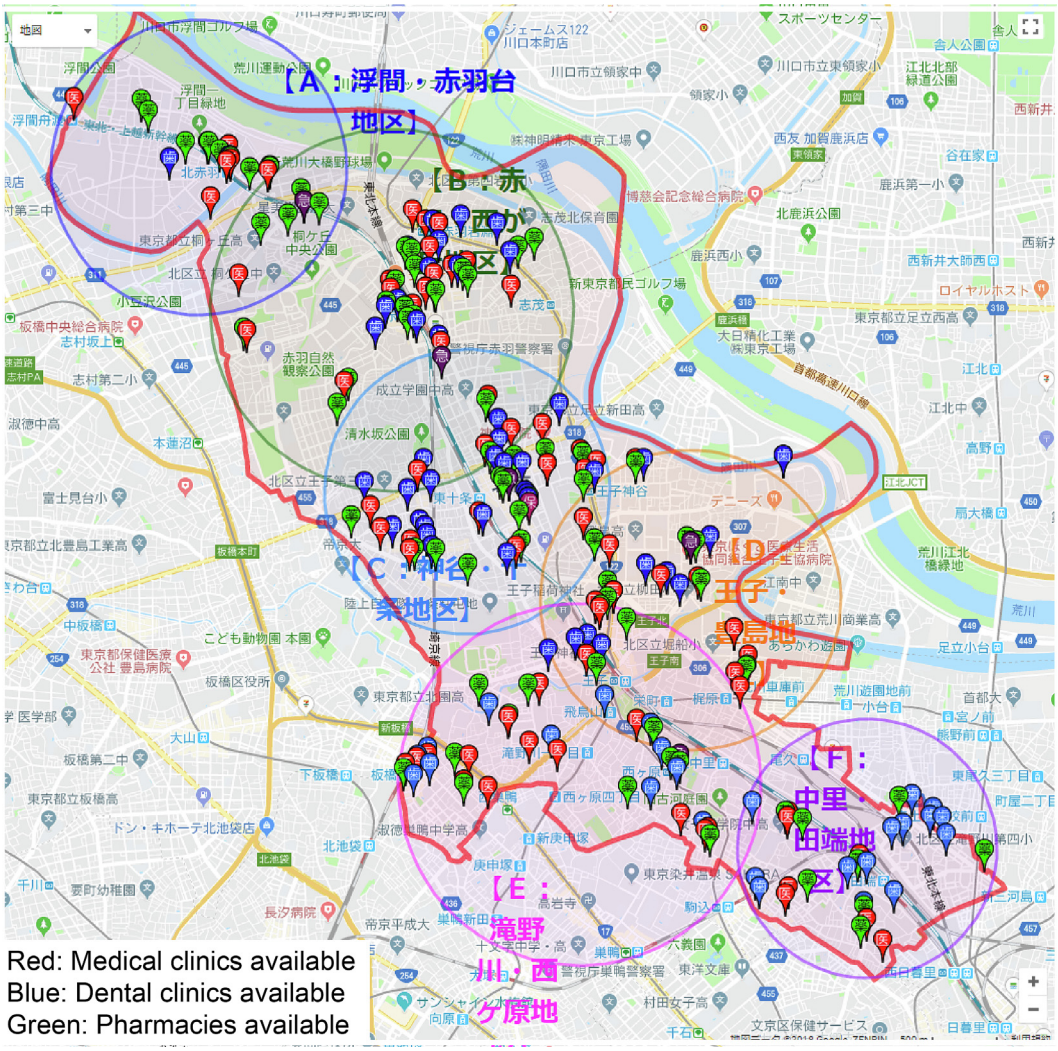

Fig. 5. Situation of medical institutions after 3 days.

however, if an unexpected problem arises, questions are newly created and sent to the group that has answers; for example, question about rare drug inventory are sent to the KPA. Once answers are obtained, the information is shared in the groups through the RMR map system. Eventually, when a drug that was not stockpiled was prescribed at a drill, we succeeded in obtaining and sharing information about the availability of the medications. As this system is linked with the inventory search system operated by the KPA, it is possible to search for drugs simultaneously while sending the inquiry.

This system has two weak points that need to be addressed. The first limitation is that not all institutions in the area have provided their contact details. Only 450 (85.4%) out of the 527 targeted facilities were registered. We had the opportunity for a face-to-face interaction with the directors of the Medical and Dental Associations; the system was introduced and explanations about how the system is convenient were provided to the associations. However, to the process of collecting email addresses from various facilities proved to be time-consuming, and the outcome was not entirely successful. Convincing facilities of the significance of joining the system can prove to be challenging at times. We will continue our efforts to explain the benefits and obtain consent and email addresses from other facilities to improve our system. Furthermore, it is crucial to exercise caution in handling private information.

The second objective is to increase the response rate, which has gradually declined every year. One of the reasons may be the operation of the system. How, when, and who responds to the system is not clear yet. The operation has been revised by making a rule; for example, designating the responsible personnel in each facility.

Yahoo! Japan has opened a site that provides a service for creating maps during disasters based on information posted by users, including data on lifeline dangerous areas and medical facilities. However, the RMR map is a unique feature that can be provided directly by the medical facilities themselves. In the United States, a nationwide system called the “Incident Command System” is used at all levels of the public and private sectors during disaster,[7] and a system that collects data on the operation status of pharmacies.[8] In addition, Healthcare Ready (https://Healthcare Ready/Rx On The Run) provides a service that provides medical information on a map in disaster areas. This is automatically displayed based on the opening information from the insurance claim status. However, the RMR map has the advantage of providing more accurate information because it asks whether a station has been opened as a result of a disaster and displays the result, but it takes time to respond to information disclosure. There is a disadvantage that all medical information cannot be displayed immediately because it takes time. In Japan, a disaster information sharing system using SIP4D[9] has been developed, and since 2019 the Cabinet Office has established an ISUT (Information Support Team) (https://www.bousai.go.jp/oyakudachi/isut/gaiyo.html) and began efforts to map and share the necessary information. If the RMR map is incorporated into such a system, it will be possible to quickly deliver medical information to evacuees who are looking for it. Therefore, it is anticipated that the RMR map system will be

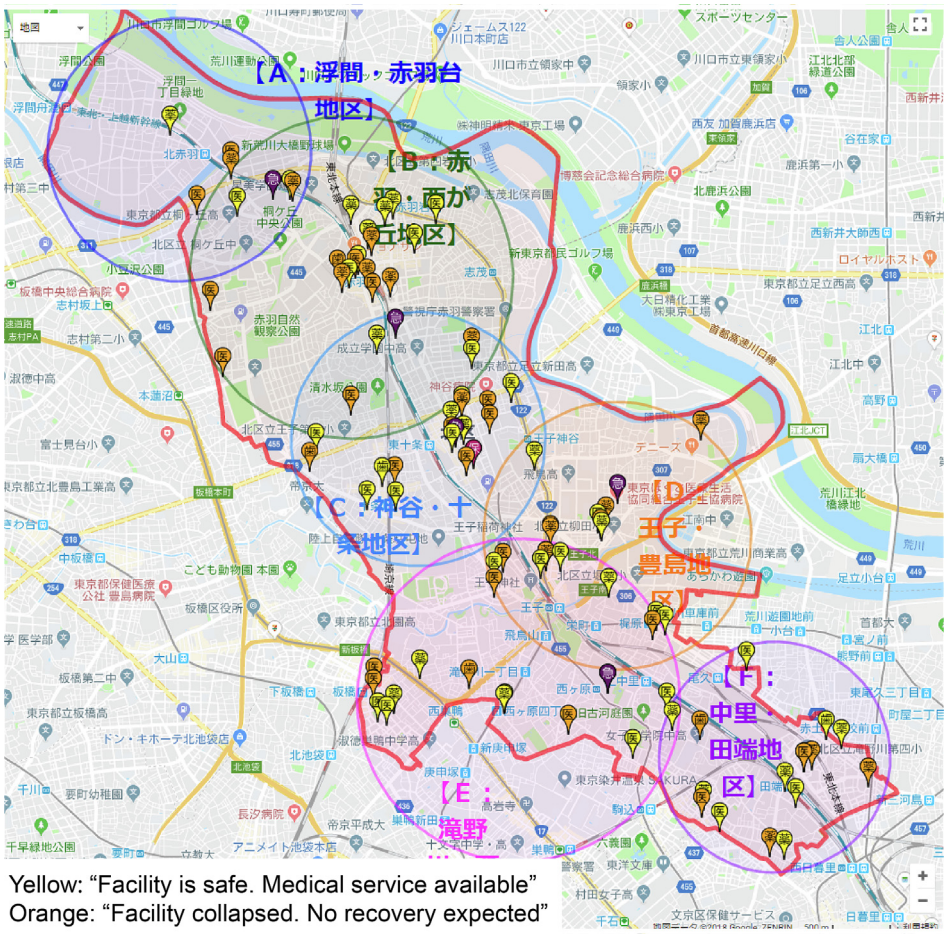

Fig. 6. Damage status of medical institutions after 3 days.

introduced nationwide, facilitating the delivery of medical care to those in need during disasters and saving as many lives as possible.

6. Limitations

In the event of a power outage affecting the server, the RMR system will cease operation, resulting in the discontinuation of the aggregation process and rendering the map display inaccessible.

Table 5
Results of the pharmacy status after disasters.

	Sent	Answers	Answer rate
Flood disaster, Sep.14.2015	124	86	69.3%
Typhoon No.15, Sep.11.2019	137	103	75.1%
Typhoon No.19, Oct.14.2019	137	72	52.6%
Earthquake, Feb.20.2021	133	93	69.3%

Table 4
Safety confirmation after disasters.

Date Epicenter earthquake intensity	Occurrence time	Sent time	Number sent	Answer number (Rate)
2014/9/16 South of Ibaraki M5.6 intensity 4	12:28	12:35	152	97 (63.8%)
2015/5/25 North of Saitama M5.5 intensity 5 weak	14:28	14:32	154	96 (62.3%)
2015/5/30 Ogasawara Island west area M8.5 intensity 5 strong	20:23	20:32	154	82 (53.2%)
2015/9/12 Tokyo Bay M5.2 intensity 5 weak	5:49	6:06	156	102 (65.4%)
2019/5/25 South of Chiba M5.1 intensity 5 weak	15:20	15:32	172	115 (66.9%)

Table 6
Results of the pharmacy status training, September 1, 2020.

	Members	Sent	Answers	Answer rate
Bunkyo	104	98	64	65.3%
Taito	114	105	48	45.7%
Toshima	167	120	72	60.0%
Kita	137	135	112	83.0%
Arakawa	82	78	70	89.7%
Itabashi	205	124	59	47.6%
Adachi	196	59	39	66.1%
Total	1002	719	464	64.5%

Bunkyo: The Bunkyo city Pharmacy Association (Bunkyo city, Tokyo); Taito: The Shitaya Pharmacy Association + The Asakusa Pharmacy Association (Taito city, Tokyo); Toshima: The Toshima city Pharmacy Association (Toshima city, Tokyo); Kita: The Kita city Pharmacy Association (Kita city, Tokyo); Itabashi: The Itabashi city Pharmacy Association (Itabashi city, Tokyo); Adachi: The Adachi city Pharmacy Association (Adachi city, Tokyo).

7. Conclusion

This is the first report on the creation of an effective RMR map, which can be used for helping victims during disasters in Japan. Although further investigation is necessary, the preliminary results suggest promising effectiveness of the map.

Declaration of Competing Interest

None.

Acknowledgements

We would like to express our sincere gratitude to all the people involved in the Shitaya-Asakusa Pharmacist Association, Kita city Administration, Kita city Medical Association, Kita Dental Association, Takinogawa Dental Association, Asakusa Pharmacist Association, Adachi city Pharmacist Association, and Bunkyo city Pharmacist Association.

We would like to thank Editage (http://www.editage.com) for English language editing.

References

1. Takeuchi I. Japan's disaster medical system. Jpn Med Assoc Mag 2020;149:S52–S58.
2. Igarashi Y. Information transmission and utilization. Jpn Med Assoc Mag 2020;149:S125–S127.
3. Tanikawa K. Recent status of the Kita Ward branch. Toyaku Mag 2011;33.
4. Okamura S. Confirmation of safety and pharmacy status in the event of a disaster. Toyaku Mag 2014;36.
5. Noguchi O. The role required of the district pharmacist association. Toyaku Mag 2017;39.
6. Obu T. Development of real-time disaster information collection / sharing / utilization system. Archit Inst Jpn Plan Diss 2017;82:2451–2459.
7. Murray RL. Responding to disaster: from and function of a pharmacy incident command structure. Am J Health-Syst Pharm 2021;78:2105–2109. https://doi.org/10.1093/ajhp/zxab240.
8. Sharpe JD, Clennon JA. Pharmacy functionality during the hurricane Florence disaster. Disaster Med Public Health Prep 2020;14:93-102.
9. Usuda Y. Effects and issues of information sharing system for disaster response. J Disaster Res 2017;12:1002–1014.