Chapter 39

Disaster and Medical Information (Medical Records)

Field of expertise: Disaster Medical Informatics Lab

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Summary

The development of medical information technology has contributed not only to the efficiency of medical treatment but also to medical safety. The Great East Japan Earthquake reaffirmed the significance of remote backup of data and medical information sharing among regions. It is important for disaster countermeasures to seamlessly link medical care during normal times and during disasters. It is necessary to establish an information system that can be effectively used in everyday medical practice and to create an environment in which it can be used in the event of a disaster.

Keywords: medical information, personal health records, medical information and communication technology, regional cooperation systems, remote backup

Introduction

Information Technology (IT) plays an important role in the efficiency and safety of medical treatment. In the aftermath of the Great East Japan Earthquake, many hospitals were able to maintain their hospital information systems, but immediately after the disaster, unstable power supply made it difficult to operate them. In addition, medical records were lost in hospitals that were damaged by the tsunami, and the need for measures to prevent the loss of medical information was recognized more than ever.

1: Problems Revealed by the Great East Japan Earthquake

What happened?

The evolution of information technology has become indispensable for improving the quality of medical care by addressing the high level of specialization, complexity, safety, and speed required in medicine. Without a hospital information system, it would be impossible to check tests, prescriptions, and names of diseases, and it would take a long time to get a correct understanding of patients' conditions. For example, the system contributes to safety by checking contraindications and erroneous medications, such as medication combinations, dosages, and allergies, but these become difficult.

With this shift to IT in medical services, medical records have shifted from paper records to electronic records, and are now stored on hospital information system servers as electronic medical record information (medical information). Since a system shutdown would have a significant impact on medical operations, measures have been taken to ensure stable operations, such as duplicating servers and installing emergency power supplies. In addition, backups are made in case medical information is lost due to hardware failure, so that system failures can be comprehensively predicted and dealt with. Our response to the earthquake was also prepared as an extension of this system.

The reality of the damage

In the Great East Japan Earthquake, according to the survey report by the Ministry of Health, Labor and Welfare (2011), the damage to medical institutions in the three prefectures of Iwate, Miyagi, and Fukushima is shown in Table 39-1. According to the survey report by the Ministry of Internal Affairs and Communications (Ministry of Internal Affairs and Communications, 2012), 27.3% (n=11) of hospitals had data loss, and 60% (n=15) of hospitals had business systems that could not be used. In addition, 78.9% (n=19) of the hospitals had conducted disaster drills and prepared response manuals before the disaster, but the situation exceeded their expectations due to the tsunami. According to the data of Japan Association for Medical Informatics (Kondo, 2013), about 60% (n=55) of hospital information systems were difficult to operate in the early stage of the disaster. In the case of systems that were not damaged by the tsunami, most of them were back to normal operation in three days. One of the reported reasons for the early operation difficulties was the unstable power supply immediately after the disaster. It is also reported that the loss of paper medical records and backup data due to the tsunami made it difficult to restore medical records (medical information).

Table 39-1. Damage to hospitals and clinics in the affected areas

	Number of hospitals	Complete destruction	Partially damaged	Number of clinics		Complete destruction		Partially damaged	
				Medical	Dental	Medical	Dental	Medical	Dental
Iwate Prefecture	94	3	59	927	613	38	46	76	79
Miyagi Prefecture	147	5	123	1,623	1,065	43	32	581	367
Fukushima Prefecture	139	2	108	1,483	919	2	5	516	374
Total	**380**	**10**	**290**	**4,033**	**2,597**	**83**	**83**	**1,173**	**820**

Ministry of Health, Labor and Welfare, Health Policy Bureau. Summary as of July 11, 2011

2: Paradigms Destroyed by the Earthquake

Conventional wisdom and necessary responses

In order to avoid system downtime, hospital information systems have generally employed system failure countermeasures based on so-called redundancy, in which servers and power supply units are duplicated to improve the operating rate. In addition, to protect the data from physical failure of the server, the data was backed up periodically and stored in a state removed from the server. If the backup data was stored in the same location as the server, it could be destroyed along with the server in a fire, etc. Therefore, it was common practice to store the backup data in a different location within the same hospital.

In the Great East Japan Earthquake, hospitals that were spared or suffered only minor damage due to their earthquake-resistant structures and other preparations had difficulty operating their hospital information systems immediately after the disaster, but were able to start operations as soon as the electricity supply was restored. On the other hand, hospitals that were severely damaged by the tsunami lost not only their paper medical records but also the medical information in their hospital information systems, including backups.

If it were your family hospital, it would be difficult, even temporarily, to receive proper treatment despite the high demand for medical care that comes with the disaster. Some people with chronic diseases such as hypertension and diabetes had medicines that they had to take regularly, but could not take them with them during the evacuation. In a disaster situation, it would be difficult to obtain and safely take medicines if they do not remember their regular medications and their hospital records are missing.

Through these experiences, it became clear that conventional system failure countermeasures were inadequate for the disaster. We recognized the necessity of storing backup data in remote areas that would not be affected by the disaster, and the need for a system that would allow other hospitals to access medical information even if some hospitals were severely damaged, or in other words, we needed a system that would allow each hospital to share its medical information within the region. In addition, in order to respond quickly and correctly at evacuation centers, it is now considered necessary to have a system that allows patients themselves to own and provide their medical information so that correct medical information is available at any time.

3: A New Approach

The Gemini Project

In the wake of the Great East Japan Earthquake, it became clear that conventional disaster preparedness measures for hospital information systems were not sufficient. In the 2012 fiscal year, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) launched The Gemini Project, in which backup data of the hospital information systems of 42 national universities and 46 university hospitals across Japan are stored in data centers located in eastern and western Japan. If the server is repaired after the disaster, the system can be restored from the stored data. Unless the earthquake strikes at the same time in areas more than 1,000 kilometers away, it is highly unlikely that medical information will be lost. In addition, the system has a medical information reference function, which makes it possible to refer to pre-earthquake information such as test values, names of diseases, and prescriptions when it is difficult to operate the system early in the disaster.

MMWIN

Due to the disaster, some hospitals will not be able to provide medical functions, and the supply-demand balance of regional healthcare will be disrupted. In order to cope with this situation, a system that can share medical information in the region was expected. In Miyagi Prefecture, the Miyagi Medical and Welfare Information Network (MMWIN) was established to share information among hospitals, clinics, pharmacies, and nursing care facilities in the prefecture. Like The Gemini Project, it has a backup storage function and a medical information reference function. The system was expanded to include the Ishinomaki and Kesennuma medical areas in 2012, the Sendai area in 2013, and the Kenhoku and Kennan medical areas in 2014. At the end of March 2020, the number of registered consenting patients exceeded 100,000 and the total number of backup patients exceeded 14 million. In addition, clinics in Fukushima Prefecture, which is adjacent to the Miyagi-Kennan medical area, have also joined, steadily expanding the scope of the program. It is important that such earthquake preparedness and patient information sharing be useful in the day-to-day provision of medical care. If it cannot be used in normal times, it is unlikely to function effectively in times of disaster. Currently, the Ministry of Health, Labor and Welfare is promoting the division of roles among medical institutions, such as hospitals that perform surgeries and highly specialized treatments, and clinics that manage day-to-day symptoms. Sharing medical information among hospitals is also useful in terms of medical efficiency and safety, as it means that accurate information can be grasped among medical personnel instead of relying on vague memories of patients' disease names and prescribed medications. The disaster response of medical information contributes to the quality of medical care among hospitals and in the community.
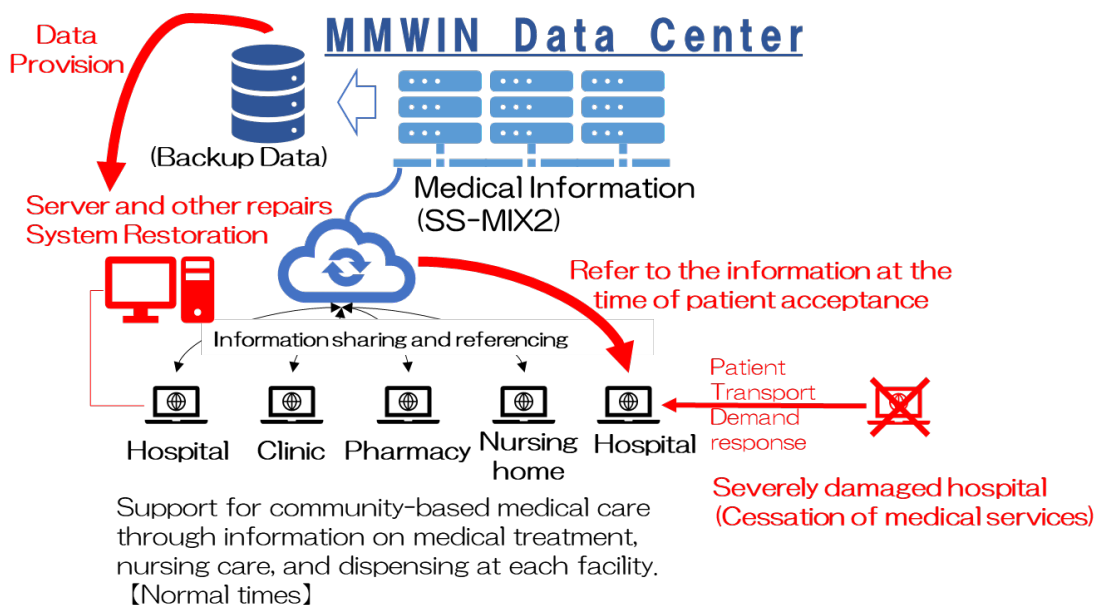

Figure 39-1. The MMWIN schematic diagram

4: Achievements and the Future

A new approach to disaster science

According to a July 2020 tally by the Reconstruction Agency, the number of evacuees outside their own prefectures due to the Great East Japan Earthquake was 29,706 from Fukushima Prefecture, 3,841 from Miyagi Prefecture, and 944 from Iwate Prefecture. These evacuees are unlikely to benefit even if the hospital information system is restored with backups and even if information is shared in the community. Hospitals in the evacuation areas do not have the medical information they had before, and in effect, it is almost as if they have lost it.

The Ministry of Health, Labor and Welfare has been promoting data health reform and is working to make it possible for people to use their own medical information at any time. This is called a Personal Health Record (PHR) and includes a system that allows people to access and carry their own medical information on their smartphones. If you carry your own medical information as a PHR before the disaster, you may be able to provide medical information to hospitals in the evacuation area. Also, if you evacuate with only the clothes on your back and you cannot bring your regular medication with you, having the correct medical information will allow you to receive and take your medication with peace of mind during the evacuation.

Conclusion - from the authors

A system that realizes seamless community-based medical care not only improves the quality of community-based medical care, but is actually a system that is resistant to disaster. Hospitals and communities are preparing for disasters by using this system in normal times. However, the benefits of this system are limited to those who live in the area. If they move out of the area, they will effectively lose their medical information. In order to solve these problems, a PHR system that is centered on individuals, who carry their own medical information and use it at their own will, is needed to deal with the disaster.

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