Chapter III

Struggle Against Radioactivity

Risk communication specialists propose that the fear of ignorance, indifference and prejudice surpasses the fear of radioactivity, and emphasize the power of science in the fight against damage caused by misinformation. This chapter focuses on the fundamental approach adopted by medical professionals by using objective data to accurately solve problems.

Record of Radiation Monitoring Activities by the Faculty of Life Sciences and Social Medicine

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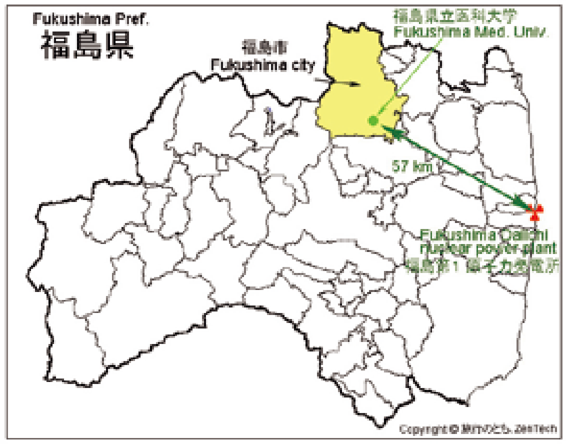
After the March 11, 2011 earthquake, all except a very few of the faculty members of the Life Sciences and Social Medicine Department were advised to stay in their homes awaiting further instructions because of ongoing efforts to conserve the limited stores of food and water that was essential to maintain the functioning of the university hospital. With the emission of radiation from the nuclear reactor, the circumstances of the disaster became increasingly severe and the faculty took on the role of monitoring the amount of radiation. The Life Sciences and Social Medicine Department faculty members were responsible for 1. 24-h monitoring of radiation in the environment; 2. Posting real-time radiation monitoring results on the Internet; and 3. Radiation surveillance inside the hospital and contamination surveillance of incoming hospital patients. As the vice dean of the medical school, I attended the meetings for the University Disaster Response Headquarters and other university-wide meetings and was responsible for contacting the patients and delegating matters to the faculty of the Life Sciences and Social Medicine Department. What follows is my record of the events.

1. 24-hour Monitoring of Radiation in the Environment

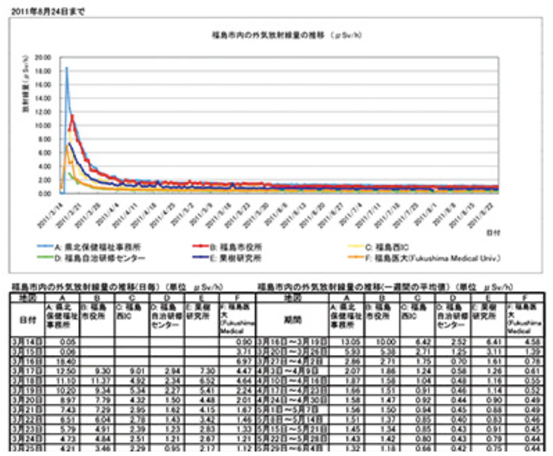
On the afternoon of Wednesday, March 16, the Life Sciences and Social Medicine Department faculty members received an order from the University Disaster Response Headquarters to monitor radiation levels 24 hours a day and report the results to the members of the university community. This order was prompted because of the marked rise in radiation levels (as high as 24 μSv/h) all around Fukushima City, including the medical school's campus, on the evening of March 15. The purpose of this order was to enable rapid response capability, should the levels rise further to so-called Code Red levels, in order to keep the university community informed in real time, and dispel unwarranted anxiety among members of the university community. Radiation measurements were conducted by Mr. Oba, the Radiology Department's technician, from 10:00 am March 13 to 5:00 pm March 16. Mr. Oba took the measurements on a voluntary basis while performing his

other duties. The faculty of the Life Sciences and Social Medicine Department continued taking the measurements after March 16 as a part of their monitoring activities. Starting at 6:00 pm on March 16, the faculty from each division of the Life Sciences and Social Medicine Department gathered and a 24-hour schedule was decided for assigning the measurement duties. The measurements were first taken with the Radiology Department's ionization chamber dosimeter (see figure at left) in front of the university hospital's guard booth. From March 18 onward, a new system was used once Web-posting functionality was implemented. The measurement results were promptly reported to the Department of Medical Information that posted them through the groupware called Desknet's and to electronic medical charts. Once the conditions of the nuclear reactor retreated from the critical state, measurements were taken less frequently, with six per day (on the hour) from March 18, three per day from March 22, two per day from April 1, and one per day from May 12. After May 12, the faculty of the Radioisotope Center took measurements on weekdays, while the Life Sciences and Social Medicine Department took on this task on weekends and holidays. And, from June onward, the non-weekday measurements were discontinued and the Radioisotope Center faculty assumed responsibility for all of the data collection. The measurement results have been posted on Desknet's and are available at the following address. http://cello.cc.fmu.ac.jp/background/background.pdf



2. Posting Real-Time Radiation Monitoring Results on the Internet

On Thursday, March 17, Professor Wada of the Department of Cell Science suggested that the labor of 24-hour radiation monitoring could be reduced if the measured data were broadcasted via a web camera. After conducting a verification test, the idea proved to be feasible and was put into practice from March 18. The new device put into operation was a Geiger counter-style radiation survey meter owned by Professor Wada. It was placed on the window side of the courtyard of the Academic Information Center. Chief Examiner Sato, in charge of Information Systems, and Chief Examiner Sakuma handled the set up of the image transmission system. Although initially there was trouble with the server going offline at times, improvements were made, and therefore, stable image transmission was achieved on March 24. It was suggested to the University Disaster Response Headquarters that the measurement images should be widely transmitted over the Internet. This suggestion was approved and broadcasting commenced on March 25. The website included a map showing the locations of the Fukushima Daiichi Nuclear Reactor and Fukushima Medical University as well as a graph showing changes in the radiation levels in Fukushima City (see the figure to the upper right). Explanatory information was provided in English and Japanese. Professor Sekine (who was a non-tenured lecturer at that time) in the Department of Immunology was responsible for the English text. At that time, there were a few sources of radiation level data provided in real time. Consequently, after going live, access to the website



increased dramatically, with daily unique access counts rising over 10,000. The broadcasts continue to this day. As of August 3, 2012, site visitors (by access count) totaled over 30 million (see the chart below). http://www.fmu.ac.jp/home/lib/radiation/

3. Radiation Surveillance Inside the Hospital and Contamination Surveillance of Incoming Hospital Potients

As the water supply resumed, the hospital was reopened to incoming patients after the three-day weekend ending Tuesday, March 22. Consequently, the Radiology Department technicians were required to return to their regular duties while the tasks of radiation surveillance inside the hospital and monitoring the radiation contamination for incoming patients was assigned to the faculty of Life Sciences and Social Medicine. In precise terms, contamination surveillance of incoming hospital patients meant separating, at the entrance of the hospital, those people who had come from within a 20 km range of the nuclear power plant (the separating was handled by the staff of the Nursing School), and measuring their radiation level with a Geiger–Müller counter. The measurements were handled by a team of Japan Self-Defense Forces members (from the Chemical Weapons Response Division, dispatched to the hospital after the official Nuclear Emergency Situation declaration), faculty members from the Life Sciences and Social Medicine Department, and student volunteers. The measurements took place from 7:00 am, when the hospital entrance opened, to 8:00 pm (later changed to 6:00 pm), with faculty of Life Sciences and Social Medicine arranging the work schedule. Visitor surveillance was conducted from Tuesday, March 22, to Friday, March 25.

Monitoring was also conducted within the hospital to assess the degree to which admitted patients had been exposed to radiation. A NaI scintillation counter was used to measure, at specified physical locations, those areas of the hospital with patients deemed to be of particular sensitivity to radiation. The areas included the NICU (3rd floor) and Pediatrics (4th floor, west) with infants/children highly susceptible to radiation, the ICU (3rd floor) and the Emergency Room (4th floor, east) with frequent use of artificial respirators using outside air. These measurements were conducted three times a day from March 22–24, and once a day from March 25. Also, from April 18, weekday measurements were undertaken by members of the Radioisotope Center, and responsibility for weekend measurements was assigned to the faculty of Life Sciences and Social Medicine. From May 11, the schedule for taking measurements changed to two times a week, on weekdays only, of which the Radioisotope Center faculty took full charge.

In addition to the above-mentioned activities, starting form April, a team formed by the Dean of the Medical School went into action to measure campus radiation levels, as it was determined that regular, long-term monitoring at multiple points within the university was necessary. The details of the measurements performed by this team have been reported by Professor Tsuneo Kobayashi at the Fukushima Society of Medical Science Symposium (organized on July 18, 2011).

Overview of Fukushima Medical University's Post-Disaster Wide-Ranging Medical Relief Efforts

Planning and Financial Affairs Division

1. Background

- Many Fukushima residents were forced to seek refuge in shelters or remain confined to their homes because of the Great East Japan Earthquake and the ensuing incident at the Fukushima Daiichi nuclear power plant.
- Futaba Kosei Hospital, Fukushima Prefectural Ono Hospital, and various other regional medical institutions were shut down in the same manner, which caused a sharp increase in the burden on other hospitals and clinics in the surrounding area.
- An advanced emergency medical support team made rounds at evacuation shelters in Iwaki. A community and family medicine division conducted medical examinations and health checkups for people confined to their homes in the voluntary evacuation zone (regions within a 20–30-km radius of the imperiled Fukushima Daiichi nuclear power plant). Such relief activities continued from Monday, March 28, until Friday, April 1, 2011, in order to reduce the burden on local medical institutions and improve the safety and security of the daily activities of people experiencing long-term impacts of the disaster.
- Starting on Monday, April 4, 2011, the relief provision zone and medical support team organization were expanded throughout the prefecture, based on performance indicators and local needs.

2. Summary

Refer to **Chapter 1, page 50**.

[Reference Material]

Results of Advanced Emergency Medical Support Activities

(March 28, 2011–June 17, 2011)

Results of relief activities (pediatrics and infections, economic measures, circulatory conditions, psychiatric health care team)

Region	North Fukushima	Central Fukushima	South Fukushima	Aizu	Minamiaizu	Soso	Iwaki	Total
No. of clinical records	766	795	68	265	0	693	1,376	3,963

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Lessons from Fukushima: What We Can Learn about Psychiatric Care from the Radiation Exposure Incident

Special Report

Shin-ichi Niwa

Key Words: *nuclear accident, low-dose radiation exposure, psychiatric care, emergency evacuation, electronic patient records*

1. What Happened

Together with Hiroshima and Nagasaki, the name "Fukushima" has gained worldwide recognition as yet another site of radiation exposure in Japan. The March 11, 2011 Great East Japan Earthquake and tsunami were followed by the Tokyo Electric Power Company's Fukushima Daiichi nuclear power plant accident on March 12. On March 16, radiation contamination peaked such that the average atmospheric radiation dose for that day in Fukushima City was about 18 μSv/h (Image 1). In September, some areas in Fukushima City were still reporting radiation doses of 1.3 μSv/h (City Hall) and 2.2 μSv/h (City Hall, Oonami Branch Office).

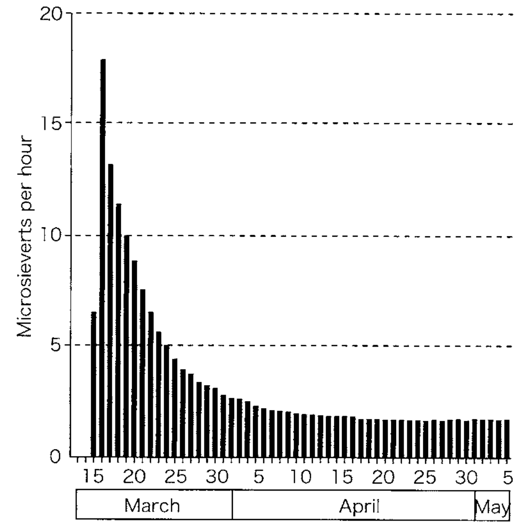

Image 1: Daily Average Radiation in Fukushima City
(Science, May 20)

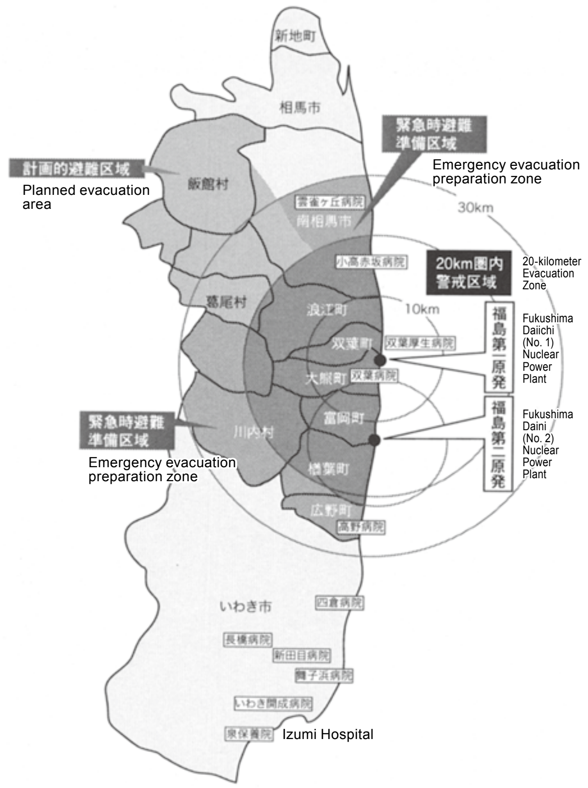

Image 2: Relative Locations of Hospitals with Psychiatric Treatment Facilities in the Hamadori Area of Fukushima and the Fukushima Daiichi and Daini Nuclear Power Plants

There are two hospitals in the emergency evacuation preparation zone within 30 kilometers of the Daiichi plant, and three hospitals within the 20-kilometer evacuation zone. These hospitals were forced to transfer some or even all of their patients to other hospitals. The four hospitals to the north of the nuclear power plant in particular transferred all their patients to other hospitals. (source: Fukushima Association of Psychiatric Hospitals).

A lesson of the Fukushima complex disaster for psychiatric professionals : A foreword
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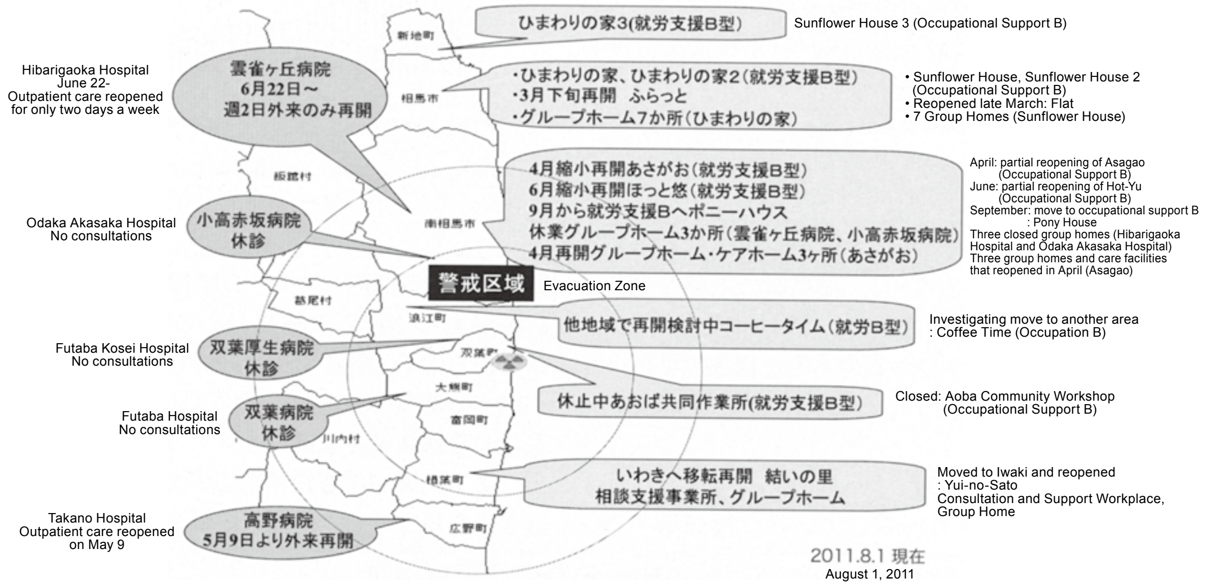

Image 3: Status of Psychiatric Welfare Facilities (e.g., Workshops and Group Homes) and Hospitals with Beds for Psychiatric Patients in the Soso area of Northern Hamadori after the Disaster
(source: Kazuma Yonekura, Soso Health and Welfare Office)

This radiation contamination has forced the relocation of 113,000 people (as of July 2011), and the transfer of 10,000 of the 240,000 Fukushima elementary, middle, and high school students to schools outside the prefecture (as of May, source: Ministry of Education, Culture, Sports, Science and Technology). The incident has adversely affected Fukushima's main industries of agriculture, fishing, and tourism, and stirred up anxiety in parents with small children. The radiation contamination has uprooted the lives of countless people.

Also, the nuclear accident has significantly changed psychiatric care, healthcare, as well as our welfare system. There are five hospitals with psychiatric treatment facilities within 30 kilometers of the Fukushima Daiichi plant (Image 2). From March 12 to 17, four hospitals to the north of the plant—Futaba Kosei Hospital, Futaba Hospital, Odaka Akasaka Hospital, and Hibarigaoka Hospital—were ordered to transfer their inpatients and forced to close down; Takano Hospital to the south of the plant also had to transfer their psychiatric patients to another hospital. These sudden patient transfers were conducted under absolute chaos, and some patients even passed away from the stress and the cold weather outside. At one stage, a total of over 840 psychiatric hospital beds were rendered unusable. There are many workshops and group homes within 30 kilometers of the plant that were also forced to close (Image 3). Some patients and users of psychiatric, healthcare, and welfare facilities were evacuated to other areas of Fukushima or outside the prefecture and, thus, many facilities voluntarily closed down. Moreover, those who stayed back no longer had access to their regular facilities.

2. What We Needed to Prepare

Frankly, I never imagined encountering a radiation exposure incident myself or that a nuclear accident would cause such social chaos and enormous setbacks to our psychiatric medical system. I had grown accustomed to the "myth of safety". But the catastrophe actually occurred, and we were all made to realize the possible recurrence of such events in the future. Thus, we who experienced these events must broadly share our experiences with those inside and outside Japan, emphasize that such events could occur again, and identify measures to address them.

There are 55 nuclear power plants in Japan that are either operational, under periodic inspection, or offline (as of July 2011, Image 4). These spread across 13 prefectures, from Hokkaido to Kyushu. The possibility that a disaster such as a massive earthquake might strike these areas and cause radiation exposure on par with the Fukushima incident cannot be denied. Thus, psychiatric care providers in Japan must realize and think about how to respond to these events and address them not as a hypothetical situation, but as a real possibility.

Managers and employees of psychiatric care facilities certainly never dreamed that their entire hospitals would be ordered to evacuate. And just where on earth would they evacuate their patients to? What should they do if they were unexpectedly ordered to complete this evacuation within a day or two? On March

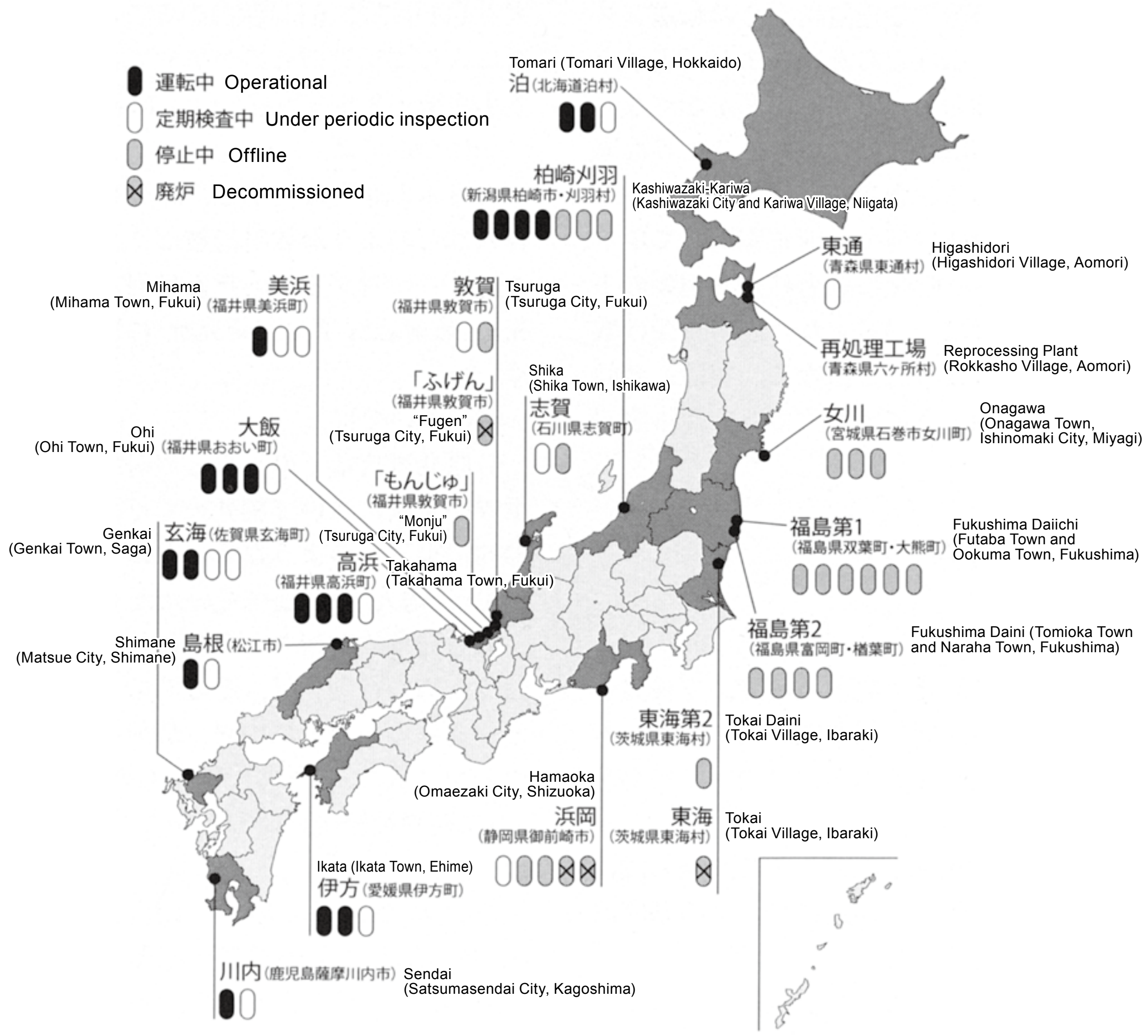

Image 4: Nuclear Power Plant Operations in Japan
(as of July 2011, source: Kyodo News)

12, when this situation actually transpired, employees of the Fukushima Prefecture's department of health and welfare (disability welfare division) and employees at my FMU neuropsychiatry course were swamped with work for days, trying to secure transferee hospitals. I have heard of agreements between neighboring prefectures about the transport of aid supplies in times of disaster, but we must also create mutual agreements about patient transfers between hospitals in neighboring prefectures.

Problems with electronic patient records are also a major issue. If the electronic record system is submerged in water or has no power supply, nothing can move forward. We must create a data transfer system that separately and concurrently stores information in a remote location. Electronic patient records are a great resource in normal times; however, in times of emergency, such as when power is lost or the hospital operates like a wartime field, hospital electronic records are useless. When transporting patients, if you do not place information about the patient's name, diagnosis, and medication on top of the stretcher, it can cause confusion for the receiving hospital. Several such instances were seen during the disaster in Fukushima.

3. Goals of this Special Report

This special report

A) shares, from the viewpoint of the victims and the support crew of the Fukushima nuclear accident, the experiences of being at the scene, the impact on psychiatric medicine, and the psychiatric states of the victims.

B) provides basic information about nuclear power in Japan and possible disasters and radiation exposure from nuclear accidents.

C) illustrates disasters and radiation exposure from nuclear accidents from Japan and the world to provide information on mental trauma and related care.

D) aims to share guidelines for psychiatric care facilities affected by nuclear disasters.

Regarding A),

1) Dr. Tetsuo Kumakura of the Kanamoriwashin Group reports on the evacuation from his hospital. Dr. Kumakura manages Hibarigaoka Hospital, one of the hospitals forced to transfer its patients and close down on March 17 because it is located within 30 kilometers of the Fukushima Daiichi plant.

2) Dr. Akira Wada (mind–body medicine department, FMU Hospital) reports on the transfer of psychiatric inpatients after the disaster and nuclear accident.

3) Dr. Takako Konishi (Musashino University), who provided aid and psychiatric healthcare to other aid workers, reports on the psychiatric health of over 50,000 refugees (as of July 10, 2011), stranded because they could not return to their original dwellings due to the Fukushima Daiichi nuclear power plant accident.

Regarding B),

4) Dr. Takako Tominaga (National Institute of Radiological Sciences) shares information about the true state of nuclear power in Japan, the types of radiation exposure incidents that are possible in the event of a nuclear accident, and potential treatment measures.

Regarding C),

5) Dr. Hideyuki Nakane (Nagasaki University) writes about nuclear disasters and radiation exposure incidents from across the world and associated psychiatric disorders.

6) Dr. Yoshiharu Kim (National Center of Neurology and Psychiatry) assisted in the creation of the National Institute of Radiological Sciences manual. Dr. Kim provides guidelines to avoid radiation exposure and ways of providing psychiatric healthcare in the event of a nuclear accident.

7) Dr. Seiko Minoshita (Kawamura Gakuen Woman's University) shares her research about psychiatric disorders associated with the Tokaimura nuclear accident in Japan, causing two deaths and 667 cases of radiation exposure.

Regarding D),

8) The Self-Defense Forces, fire departments, and police departments were mobilized to support the evacuation of inpatients in hospitals within 30 kilometers of the Fukushima Daiichi nuclear power plant in response to the nuclear accident. Dr. Shin-ichi Tokuno (National Defense Medical College) provides guidelines in case a nuclear disaster requires an entire medical facility to evacuate its patients.

4. Addressing Anxieties about Low-Dose Radiation Exposure

It was around March 16, as I recall, that FMU Hospital began to distribute iodine solutions to employees aged 40 and younger, assuming repeated explosions at the Fukushima Daiichi plant. In case of a Chernobyl-style nuclear reactor explosion, or atmospheric radiation continually measuring above 20 μSv/h, the hospital would issue a code red alert. According to the alert, all employees aged 40 and younger are instructed to swallow these iodine solutions and others in the contaminated zones must shut all windows in the hospital buildings and stay indoors for 72 hours. Iodine is not to be consumed repeatedly, but the risk of a shortage still remains. Thus, I walked with a co-worker to pharmacies across the town to buy povidone-iodine solution; however, every pharmacy we went to was already out of povidone-iodine. I was shocked at the strength of people's wariness and anxieties that led them to buy up all the iodine.

Thankfully, no code red alert was issued. But people's wariness about radiation exposure grew stronger as the actual levels of radiation contamination became clear.

Parents of infants and small children were particularly concerned. Many families kept their children outside of Fukushima until their schools reopened in April. Several parents used the summer vacation in August as an opportunity to transfer their children to schools outside the prefecture. Each area was differently affected, but in the case of Fukushima City, about 10% of children in elementary schools transferred to a different school.

While some experts were saying "there are areas in the world with natural radiation levels much higher than those in Fukushima, but there is no data that they have high cancer rates, so it should be fine," others were saying that "the risks from low-dose radiation exposure are still not clear, and we cannot be sure of their long-term effects." Thus, people became confused with the ambivalence in expert scientists' opinions. Moreover, because the government did not provide effective decontamination measures for the expanding contaminated area, the number of families abandoning the prefecture increased.

"Safety" and "peace of mind" are two concepts that generally go hand in hand. However, even rational explanations that low-dose radiation exposure is scientifically safe do not assure peace of mind; people separated the concepts of safety and peace of mind. Peace of mind came after decontamination activities began, even though the decontamination efficacy was uncertain.

Another interesting point is whether anxiety about radiation exposure resulted in an increased number of visits to medical facilities by people with radiophobia. I interacted with nearby psychiatrists and psychosomatic doctors about their patients for the three months after the nuclear accident. Based on the impression I received, it seems that there was no increase in patients with radiophobia or hypochondria related to radiation exposure. I made it a point to share this finding during my lectures. But once, while talking with an internal medicine doctor in Fukushima, I learned that this doctor's office had clearly seen outpatients with suspected hypochondria. I also spoke with non-psychiatric health physicians at every opportunity I got, and was informed that many patients visited otolaryngologists asking whether their recent nosebleeds were a result of radiation. It appears that the psychiatrists had not fully discovered all cases of radiophobia or radiation-related hypochondria. To bring to light the anxieties about low-dose radiation exposure and its effects on psychiatric health care and to formulate measures to address these anxieties, we must conduct broad surveys together with non-psychiatric health physicians.

5. What We Hope to Learn from "Lessons from Fukushima"

The goal of this special report is to have Japan's psychiatric care professionals learn from the lessons from Fukushima. In addition, they must realize, think about, and act upon these lessons when caring for psychiatric disorders caused by nuclear disasters and radiation exposure.

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Responses to Radioactive Contamination and the Evacuation Order after the Great East Japan Earthquake

Mitsuru Munakata*

Summary

At 2:46 pm on March 11, 2011, a massive earthquake of magnitude 9.0 hit eastern Japan. Various areas within Fukushima Prefecture also experienced tremors recorded at 6.0 or stronger. In addition, an enormous tsunami struck Japan's Pacific coastline from Soma and Minami Soma cities to Iwaki city. Located between these cities, the Fukushima Daiichi (No. 1) and Daini (No. 2) nuclear power plants lost electrical power to their core cooling equipment because of the earthquake and tsunami. Once the control of the reactor core was lost, meltdown occurred, spewing particulate matter containing high-level radiation to the surrounding area. Looking back at this unprecedented complex disaster, this book provides an account of the medical infrastructure within Fukushima Prefecture, medical response by Fukushima Medical University (FMU), and public health surveys still occurring within the prefecture today.

Key words: *earthquake, tsunami, nuclear power plant accident, disaster medicine*

Introduction

At 2:46 pm on March 11, 2011, a tremendous earthquake of magnitude 9.0 occurred in eastern Japan. Tremors of 6.0 or stronger were recorded in Fukushima City, and subsequent to the earthquake, a devastating tsunami struck the Pacific coastline from Soma and Minami Soma cities to Iwaki city. Located between these cities, the Fukushima Daiichi (No. 1) and Daini (No. 2) nuclear power plants lost the function of their core cooling apparatus because of the disaster. The nuclear reactor core went out of control resulting in the meltdown of Unit 1 Reactor. Hydrogen explosions occurred on March 12, in Unit 1 Reactor, and March 14, in Unit 3 Reactor, emitting highly radioactive particulate matter to the Tohoku and Kanto regions (Figure 1).

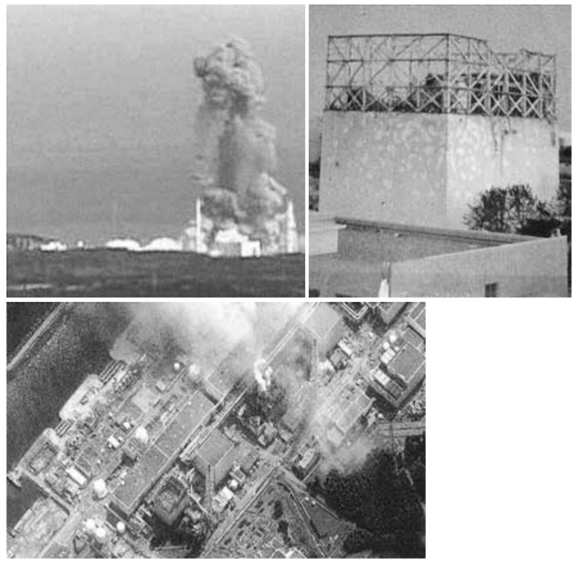


Figure 1: Fukushima Daiichi (No. 1) Nuclear Reactor out of Control

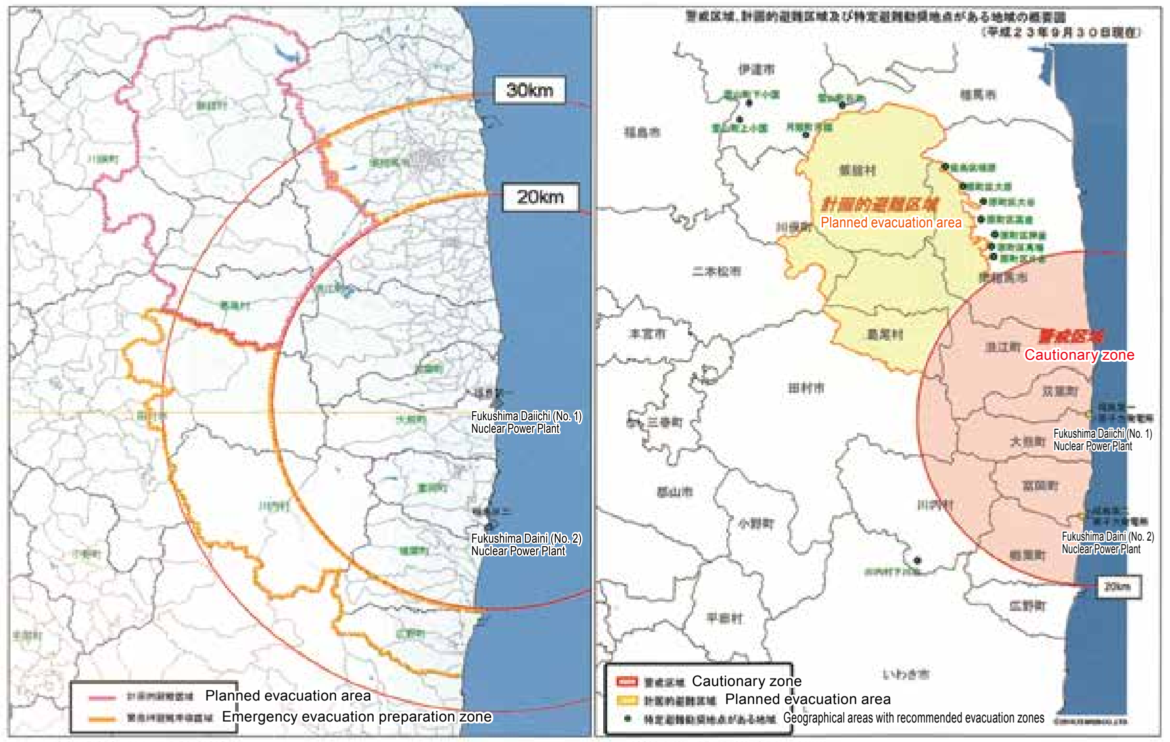
At 8:50 pm on March 11, an evacuation order was issued for people within a 2 km radius surrounding the nuclear power facility. Then, at 9:23 pm, the distance changed to a 3 km radius, followed by a 10 km radius evacuation order at 11:20 am on March 12, which was then expanded to 20 km at 9:00 pm on the same day. Furthermore, on March 15, an order was issued for everyone within a 20–30 km radius of the plant to take shelter indoors. Afterwards, using data from the System for Prediction of Environmental Emergency Dose Information and local on-site measurement results, the area within a 20 km radius of Fukushima Daiichi nuclear power plant was designated as a "planned evacuation area" on April 22. The area included Katsurao Village, Namie Town, Iitate Village, part of Kawamata Town, and part of Minami Soma City. Then, on June 16, areas outside the planned evacuation area where annual cumulative radiation levels were predicted to exceed 20 mSv were designated as recommended evacuation zones, and policies were enacted to support each household in securing destinations for refuge (Figure 2). As of October 11, 2012, 1,846 Fukushima residents perished and 120 were missing. 18,007 homes had been destroyed, 52,001 homes had sustained 50% damage, and 144,586 had sustained partial damage. 18,464 residents were living in shelters within the prefecture and 35,892 were refugees living outside the prefecture.

A multitude of medical responses were necessitated by the disaster. During the earthquake, patients were injured by toppled buildings, etc. individuals were hurt by the tsunami, hospital patients within the evacuation zone had to be transported elsewhere. Medical care was needed for those employed at the Tokyo Electric Power Company who were exposed to radiation or injured while working to contain the accidents at the power plant. Since FMU is a prefectural (public) university corporation, it was designated as the base for disaster medical assistance teams (DMAT) immediately after the disaster. The university was responsible for functioning as a hub in Fukushima Prefecture for medical care for the compound earthquake, tsunami, and nuclear disaster because of the school's status as a "secondary emergency facility specialized in emergency radiation medicine." Looking back at the critical period during this complex disaster, this book provides an account of the medical infrastructure within Fukushima Prefecture, medical response by FMU, and public health surveys still occurring within the prefecture today.

Damage Caused by the Earthquake and the Response by FMU

Fortunately, the student body of the university itself did not suffer any significant harm from the disaster. Some sports team members attending a training camp in Sendai city were slightly injured, but no other students, university hospital patients, or university staff were seriously injured. University facilities, despite being more than 20 years old, were not subject to any significant damage. Electrical power was not lost, but there was no water supply for eight days because of damaged caused to the water intake pipes in close proximity to the local dam.

From the hypercritical period two weeks after the disaster through the critical period that followed, normal hospital operation and scheduled surgeries were halted



a. April 22, 2011 b. June 16, 2011

Figure 2: Evacuation Zone Following the Fukushima Daiichi (No. 1) Nuclear Reactor Accident

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(Inside Fukushima City)   (Minami Soma city)

Figure 3: State of Disaster Conditions within Fukushima Prefecture (March 11, 2011)

and we dedicated all activities toward specialized disaster response. Thirty-five DMATs from across the country gathered at FMU and provided emergency medical support to areas throughout the prefecture. Emergency aid vehicles and helicopters from Fukushima and nearby prefectures also gathered on the campus. Of course, physicians, nurses, and technicians from medical departments across FMU, as well as faculty, researchers, and student volunteers cooperated to provide emergency medical care. Immediately after the disaster, a large number of emergency patients were expected. However, until Day 3 (58 h after the earthquake), fewer patients had arrived than expected. In triage, the numbers totaled 168 patients: 93 green tag, 44 yellow tag, 30 red tag, and 1 black tag. In later days, it became clear that more harm was caused by the tsunami than that by the earthquake. Since the onset of a tsunami basically results in either life or death, the vast majority of tsunami survivors did not present with external injuries, etc. (Figure 3). In other areas, some hospitals within the city were rendered unable to provide care, and several dozen patients on artificial respirators were rushed to our university hospital. In addition, because of the disrupted water supply, our hospital and several others lost their dialysis treatment facility, which meant that we had to locate facilities that could perform dialysis so that we could transport patients to those locations. The network including the Japan Society for Dialysis Therapy and others was instrumental in this effort and helped tremendously to transport quite a number of patients in ambulances and helicopters to the Kanto area.

On March 12, it became clear that a true nuclear accident had occurred, soon followed by two hydrogen explosions. As explained above, the size of the evacuation zone increased rapidly, meaning that the university's off-site center in Okuma Town was of no use and had to be quickly changed to the Fukushima prefectural building. A radiation emergency medical assistance team also arrived on the scene and was stationed at FMU for a long period, during which it provided medical care to radiation victims. At this point in time, the scale of the nuclear accident was considered to be of a magnitude that might be equivalent to that of the Chernobyl explosions, which would cause a code red alert to be issued and call for a survey assessing the safety of all university students, university hospital patients, and university faculty. A code red alert is issued depending on: 1. Communication from the off-site center, 2. TV and Internet broadcasts, and 3. Environmental monitoring reporting radiation greater than 100 µSv/h. In these cases, announcements on campus, in the hospital, as well as on electronic medical charts indicated the code red status. If a Code Red alert is issued, all windows and building entrances are immediately closed, air circulation equipment is halted, individuals are prohibited from leaving the buildings (except in emergencies), and if going outdoors are necessary, N95 medical masks and protective clothing are required. Fortunately, none of this was actually necessary, as no further reactor core explosions occurred, and therefore, no code red alerts were issued.

However, with the emergency evacuation zone declaration, hospital patients inside the zone who were unable to evacuate on their own, as well as individuals in welfare facilities, had to be transported to safety. Self-Defense Forces members, fire department officers, and local municipality officials were the chief actors who cooperated to fulfill this need. Approximately 1,300 people were helped to evacuate the Soso area (Hamadori in Fukushima Prefecture extending from Soma City to Hirono Town), and our hospital played a pivotal role because of our location as a relay point in the area. We set up beds for triage in the outpatient waiting area and the Nursing School training room while conducting 175 examinations to assess which patients were fit to continue traveling to their evacuation destinations and which needed to be temporarily hospitalized. A total of 125 patients were judged to require temporary admittance. These examinations were performed by physicians from all of the internal medicine departments and from the community/family medicine department, with assistance from the Nursing School faculty and others.

Once the transportation of patients from the evacuation area had progressed to a degree, our activities gradually shifted toward medical care for the refugees themselves. We were grateful to have DMATs, physicians from local medical associations, physicians from the Japan Medical Assistance Team, and supporting physicians from central hospitals in the prefecture take responsibility for primary care at each evacuation center. In addition to these individuals, a number of physicians, nurses, and others gathered as volunteers from regions across Japan and assisted with the activities mentioned above. In this process, in order to enhance the organization of these activities and boost the overall medical care in response to the disaster, FMU worked to put in motion a university-wide framework in order to support the broad emergency medical response in the region. The following were our three main activities.

1. Supporting Advanced Emergency Medical Care

Drawing on experience from the 1995 Great Hanshin Earthquake, it was known that the need for advanced medical care was bound to arise at each evacuation center. Consequently, an Economy Class Syndrome Medical Team, that is, a specialist team able to address certain specific medical needs, prepared themselves to respond to deep vein thrombosis, embolism, and similar conditions. Using compact ultrasound devices, the team visited each evacuation center to conduct an early detection and treatment, along with providing preventative awareness information. By the time the rounds came to an end on May 11, 2,200 examinations had been performed and approximately 10% of them resulted in the detection of thrombosis. From April 25, a team of two doctors and two nurses/technicians from the Kingdom of Jordan joined this team. In addition, by June 2, when they finished taking rounds, the Pediatrics and Infectious Diseases Team visited a total of 31 evacuation centers, dispensing advice on caring for infants during the crisis and providing preventative awareness information for avoiding the spread of infectious diseases in the group living facilities. Medical teams from the Kingdom of Thailand joined this team as well, adding two doctors and two nurses from May 9 onward. The Mental Care Team received volunteers across Japan and worked to provide mental care in each prefecture, centering on the evacuation centers. Finally, the Nursing School Team primarily focused their efforts on supporting the activities of public health nurses, whose critical importance became evident in this disaster.

2. Providing Medical Care within the 20–30 km Zone surrounding the Nuclear Power Plant

Fukushima Prefecture stood out in that a nuclear accident occurred in addition to the earthquake and tsunami aftermath. Consequently, there was a large gap

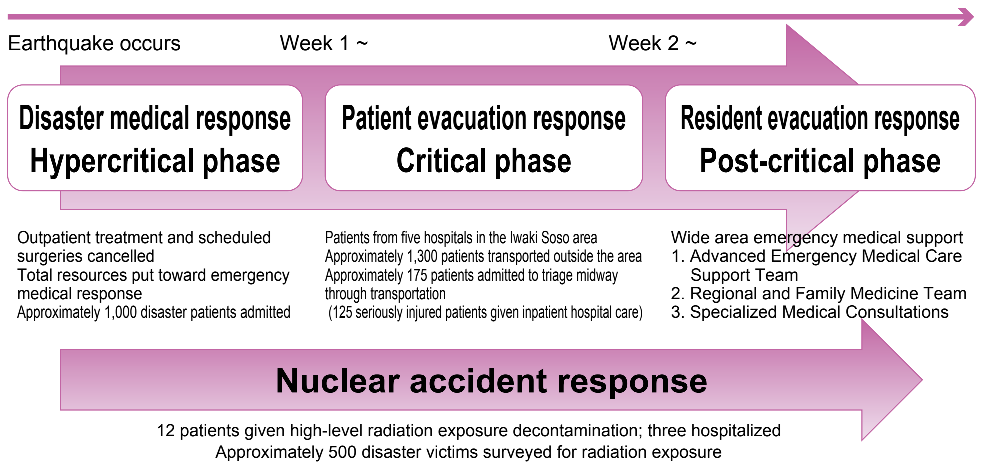

Figure 4: Summary of Fukushima Medical University's Response Activities

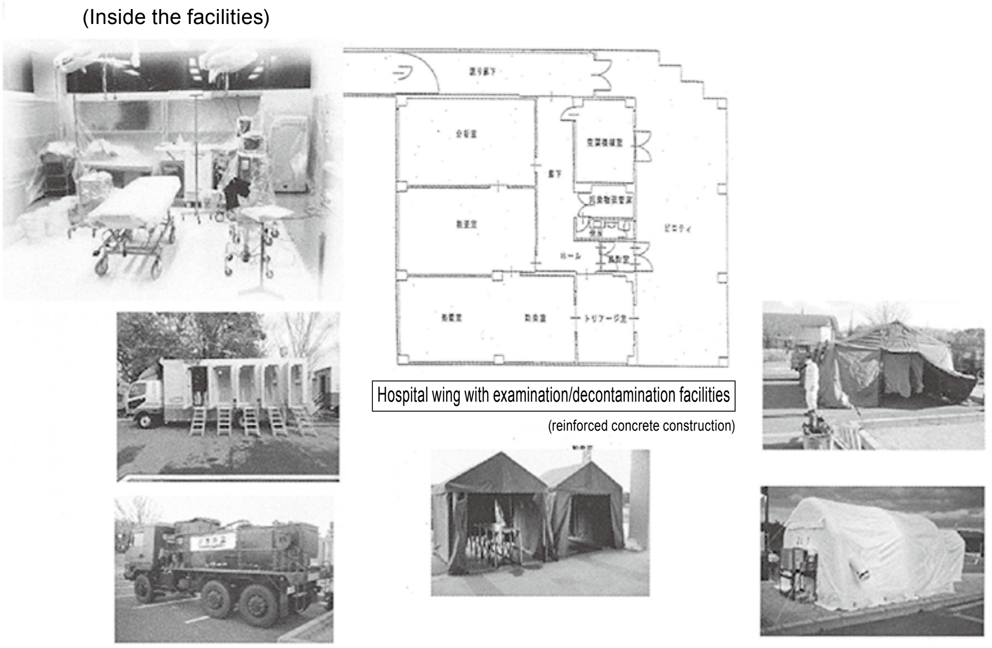

Figure 5: Secondary Emergency Facilities Specialized in Emergency Radiation Medicine and Decontamination/Stand-by Facilities Set up around Them

that remained in the coverage area handled by the DMATs. This area was the 20–30 km radial zone designated as an "emergency evacuation preparation zone" around the Fukushima Daiichi nuclear power plant. With complications surrounding radiation exposure, the area had received no emergency medical support whatsoever. Consequently, three teams were formed consisting of members from FMU's regional and family medicine department, Nagasaki University, Nagasaki Medical Association, Self-Defense Force's sanitation and hygiene division, Soma City Municipal Hospital, and others. The teams worked to assess the number of remaining patients and provide them support. Despite the efforts, which had now been concluded, to transport patients from the wider area, it became clear that 150 were still remaining. These 150 were unable to evacuate on their own, so the teams worked to bring medical care to the individuals. The entire experience drove home the extreme importance of administering welfare support, not to mention medical care, when there is a large-scale disaster like this.

3. Offering Specialized Medical Consultations

In the evacuation shelters, patients were present on a daily basis in need of specialized medical care, hospital admittance, etc. However, the evacuation shelters were not created keeping this need in mind, which makes supplying specialized medical care a considerable problem. As a result, FMU organized an Advanced Medical Consultation Team using our expertise as the prefecture's only university hospital. The team consisted of specialists versed in cerebrovascular disease, cardiac conditions, respiratory conditions, diabetes, kidney conditions, etc., and were available throughout the day for phone calls from the evacuation shelters and region's central hospitals. In addition to offering consultations in each of their specialties, the physicians of this team offered referrals to nearby hospitals for patients in need of admittance, and helped to get critical patients accepted into university hospitals.

Medical Response to the Nuclear Power Plant Accident (Figure 5)

Prompted by the criticality accident in September 1999 at JCO Co., Ltd., FMU established decontamination facilities (as part of its function as a secondary emergency facility specialized in emergency radiation medicine) in the eastern wing of its hospital buildings, and four bio-clean rooms in the ICU and hospital wings. The measurement and analysis equipment included full-body Geiger counters, high directivity monitors, body surface monitors, αγ radionuclide analysis equipment, β radionuclide analysis equipment, neutron monitors, portable monitors, survey meters for each type of ray, etc. And for decontamination and emergency care for those exposed to radiation, FMU was installed with burn bath equipment, movable basic bath tubs, air mattresses, fully-enclosed sanitary stretchers, patient monitoring equipment, portable x-ray machines, ultrasound diagnostic equipment, artificial respirators, sustained, slow-speed blood purification equipment, etc.

During the Fukushima disaster, the first step was temporary radiation screening and decontamination tents set up around the hospital's decontamination wing by Self-Defense Forces members and members of the Japan Atomic Energy Agency. Patients that did not have a critical level of exposure were first given a simple contamination examination at these tents. Those that registered significant contamination were given outdoor full-body showers, etc. before being admitted to the hospital wing. Inside the hospital's decontamination wing was the triage room and beyond that were the decontamination and treatment rooms. Priority was given to decontamination for patients in stable condition. For those whose vital signs were unstable, the priority was to bring them back to a stable condition. The next step was to examine internal radiation exposure in the adjoining examination rooms. On the basis of these results, patients were either sent home, hospitalized, or led to a third radiation treatment facility. In the case of the Fukushima disaster, 12 patients were given high-level radiation decontamination, three of whom were hospitalized. In addition, approximately 500 other disaster victims were examined, one portion of which received decontamination treatment.

Currently, full-body Geiger counters are still being used to assess the ongoing internal condition of radiation levels of Self-Defense Forces members, fire department officers, local municipality officials, and others who were actively involved in the evacuation area during the critical phase of the disaster.

Moving toward Recovery

Six months after the earthquake, a long-awaited announcement was made on concrete steps toward cold shutdown of the nuclear reactor, and the path toward recovery began in earnest. At 6:11 pm on September 30, 2011, the "emergency evacuation preparation zone" declaration officially ended. Currently, the area is split into the three classifications of cautionary zone, planned evacuation area, and recommended evacuation zone (Figure 2b), and the residents of Minami Soma city and other districts are slowly beginning to return to their home. At present, the radiation levels in Fukushima City and Koriyama city are still relatively high, though far below the annual 20 mSv level that is thought to pose any sort of health risk. However, expectant mothers, infants, elementary school children, and their parents are still understandably concerned over the risks toward children from radiation exposure, and a portion of them continue to live as refugees outside the prefecture. In addition, a large number of residents use their own Geiger counters to continuously monitor radiation levels as they go about their daily lives.

For its part, FMU is tasked with correctly surveying and recording the health effects of this unprecedented nuclear incident, as well as looking after the protection of the mental and physical health of our prefecture's residents while we fulfill the historic duty of reaffirming the infrastructure to build a new future. In concrete terms, we have established a Radiation Medical Science Center. This center will work to assist with a wide variety of activities, from decontamination efforts after nuclear power plant accidents, to the long-term protection, reassurance, and care of Fukushima's residents. In addition, we have partnered with the Fukushima prefectural government to conduct the Fukushima Health Management Survey targeting approximately two million local residents. On November 1, a special ceremony was held with FMU President Shin-ichi Kikuchi and Vice President Shun-ichi Yamashita for unveiling the plaque of the Radiation Medical Science Center (Figure 6). Although there are still serious issues surrounding staffing and budgetary constraints, we have begun a direct survey starting with the residents of the planned evacuation area, and have mailed survey forms to all residents of Fukushima Prefecture, to estimate the levels of radiation exposure. In addition, we have begun ultrasound examinations targeting infants, students, etc. from 0–18 years of age to monitor and assess the present state of thyroid tumor occurrence in approximately

Figure 6: Plaque Unveiling Ceremony at the Radiation Medical Science Center

360,000 young people. With support from all parts of the country, we have started weekend screenings at our university hospital and have so far examined approximately 3,000 people. Going forward, we would like to gradually expand the scope of the examinations, with the cooperation of medical institutions inside and outside the prefecture, to put in place a framework for offering the examinations in each geographical region.

Conclusion

The above gives a general overview, focusing on the activities of Fukushima Medical University, of one part of the medical response effort amid the radiation contamination with evacuation orders issued in the aftermath of the March 11 Great East Japan Earthquake. Despite our designation as a secondary emergency facility specialized in emergency radiation medicine, the outstanding nature of the disaster created circumstances in which our entire university was forced into delivering an ad hoc response. We offer our heartfelt gratitude to the university hospital staff, medical and nursing school faculty, research fellows, students, and administrators who rallied in support of efforts that are still ongoing and their support will be further called upon going forward.

Finally, our sincere condolences are extended to the individuals who lost their lives in this disaster and we are extremely grateful for the warm signs of support and sympathy that have been sent by everyone inside and outside Japan.

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Great East Japan Earthquake and Tsunami and Ensuing Radiation Exposure Issues

Contribution of Fukushima Medical University and its Orthopedics Department, and the Current State of Fukushima Prefecture

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Key words: *earthquake, radiation exposure, orthopaedic trauma*

Almost one year has passed since the March 11, 2011 Great East Japan Earthquake and tsunami and the ensuing nuclear power plant accident. Unfortunately, the nuclear radiation issues in Fukushima still do not show signs of dissipating.

Fukushima Medical University (FMU) is located in Fukushima City, about 60 kilometers inland from the areas directly affected by the tsunami. In this article, we compile our experiences as part of FMU's orthopedics department and how we provided backup support from the hospital to the affected areas. Please refer to other chapters about the role of orthopedic surgeons in the coastal areas damaged by the tsunami. Here we discuss not only our experiences as a backup support hospital but also the current state of medical care in Fukushima given the unceasing nuclear radiation issues.

The Few Days after the Earthquake (Supercritical Stage: Disaster Medical Care)

On the day of the earthquake, two FMU orthopedic surgeons provided medical care for tsunami victims in Hamadori, an area of coastal Fukushima ravaged by the tsunami. When the earthquake struck, the two surgeons were at Futaba Kosei Hospital (Futaba Town) and Fukushima Prefectural Ono Hospital (Okuma Town). The physician at Ono Hospital could not return to Fukushima City, so on his way home, he stopped by Futaba Kosei Hospital, where he joined the other FMU physician and local staff to provide early-stage treatment to the victims of the earthquake and tsunami. The two physicians returned to Fukushima City the following evening, after observing a decrease in the arrival of earthquake and tsunami victims.

After the earthquake, at the university hospital, we fully prepared for the specialized and emergency treatment of patients with post-earthquake trauma. We suspended all scheduled surgeries and outpatient care, and requested patients whose homes suffered little damage to leave the hospital so that we could secure more beds. We also placed many temporary beds under the main hospital entrance and set up check-in facilities in the nursing department for patients who did not need hospitalization but could not return home. To care for emergency patients, we had clinical (junior) residents volunteer in the emergency department. Up to 35 Disaster Medical Assistance Teams (DMATs) with 180 members assembled at FMU Hospital.

Expecting the transfer of many trauma patients rescued from collapsed homes (as was the case during the Great Hanshin-Awaji Earthquake), the orthopedics department had at least six staff members on duty throughout the day to perform emergency surgeries. In addition, there were other members on call at home in case we needed more help. Hospital staff on duty worked in shifts, overseeing green-tagged outpatients (explained below) after emergency outpatient triage. We had implants and other items necessary for surgery air-shipped from support hospitals, organizations, and groups across the country to Fukushima Airport, the only operating airport in the entire southern Tohoku region.

However, three days after the earthquake, the

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university hospital received only 168 people for emergency outpatient care related to the disaster, a number contrary to our anticipation. Of these 168 patients, 93 were green-tagged (mild injuries and deferred patients), 44 were yellow-tagged (moderate injuries and palliative care), 30 were red-tagged (serious injuries and prioritized care), and one was black-tagged (deceased). Eventually, a few seriously injured patients were transferred from the disaster area to our backup support hospital within the supercritical stage after the earthquake. This is because most of the disaster fatalities were caused by the tsunami and none by the collapse of homes or buildings. After the earthquake, the FMU orthopedics department performed 11 provisional surgeries on 10 patients in a week, and four trauma patients were transported from the coastal Hamadori area after having suffered direct injury from the earthquake or tsunami.

About One Week after the Earthquake (Critical Stage: Evacuee Patient Care)

Due to the complete blackout of the Tokyo Electric Power Company's Fukushima Daiichi nuclear power plant after the earthquake, residents in the areas around the plant were ordered to evacuate on March 11. With the ensuing nuclear accident and threat of radiation exposure, the evacuation zone was gradually expanded. By March 15, the evacuation zone encompassed areas within 20 kilometers of the Fukushima Daiichi plant and 10 kilometers of the Fukushima Daini plant. An order to take refuge indoors was also issued for those between 20 and 30 kilometers from the Daiichi plant (effective until April 27, see Reference 7). At the time, 13 hospitals within these areas had 1,333 patients. FMU Hospital took in 175 patients, including those transported from coastal hospitals by Self-Defense Forces helicopters and ambulances or buses and others who made a stopover before proceeding to hospitals in the Aizu area of Fukushima and outside the prefecture. The entire school worked to admit and dispatch transferred patients; clinical residents conducted triage in the emergency department while student volunteers, administrative employees, and introductory course faculty provided help. Thankfully, there were no fatalities during the transfer of patients. In addition, when it came to dispatching patients, the junior clinical residents were prompt in receiving instructions and moving things along. In fact, their self-initiative and achievements were admired by a professor who arrived from another university to provide support. (Please see Further Reading sections 4, 5, 9, and 12 for accounts on the junior residents' work and thoughts during the disaster and radiation exposure crisis).

Two Weeks and Beyond after the Earthquake (Chronic Stage: Caring for Evacuees)

The university hospital personnel were unharmed and the buildings undamaged by the earthquake. We had electricity but lost water supply. The water outage was fixed a week after the earthquake, so we were able to resume outpatient consultations and scheduled surgeries. On March 22, we reopened outpatient care in the internal medicine and obstetrics departments. We gradually expanded our services while keeping an eye on trends in patient visits, and on March 28, we resumed outpatient care in all departments. After discussions with the surgery, anesthesia, and trauma departments, surgeries were rescheduled in order of priority. On March 22, the orthopedics department performed surgery on a non-ambulatory patient with cervical myelopathy. Effective April 4, we were able to return to our normal surgery routine.

Meanwhile, health care issues arose for people whose homes were lost to the tsunami, for evacuees from the zones evacuated due to radiation exposure, for those who took indoor refuge in the area 20–30 kilometers from the Fukushima Daiichi nuclear power plant, and for whose government and medical services were paralyzed. In response, on March 28, we formed two broad-based emergency medical teams: a high-level emergency support team with representatives, including those from internal medicine, pediatrics, and mind–body medicine, who would visit evacuation centers; and an at-home medical care team that would assess the conditions of those living alone and provide medical support accordingly. In particular, the latter team collaborated with not only FMU but also Nagasaki Prefecture, Nagasaki City, Nagasaki University, the Nagasaki Prefectural/City Medical Association, the Self-Defense Force, fire departments, local medical and dentistry associations, local medical facilities, local governments, Health and Welfare offices, and the Japanese Association of Psychiatric Social Workers. They conducted door-to-door surveys in Minamisoma, Tamura, Iwaki, Namie, Hirono, and Iitate. This survey was conducted on 393 patients receiving home care, five of whom required immediate medical attention. The survey continued till the end of May, after which it was taken over by local governments, local medical facilities and others (Please refer to Reference 11 for other bodies involved).

Table 1: Number of Orthopedic Inpatients Injured in the Disaster (March–June, 2011)

This table shows the number of orthopedic inpatients directly affected by the earthquake or tsunami. The figures do not cover all of Fukushima Prefecture. The number of orthopedic patients that required hospitalization due to the disaster was not as high as we had anticipated.

	Number of orthopedic inpatients affected by the disaster				Number of beds
	March	April	May	June	
Iwaki	18	14	9	4	1,034
Kenpoku	38	25	5	8	1,322
Koriyama, Kenchu, and Kennan	23	10	6	3	1,106
Aizu, Minamiaizu	2	5	5	4	260

Care at the Orthopedic Departments in Fukushima

Each hospital provided care to the best of its capacity. In particular, Fukushima Prefectural Oono Hospital dispatched full-time orthopedic surgeons within the evacuation zones (20 kilometers from the Fukushima Daiichi plant and 10 kilometers from the Fukushima Daini plant). Once the evacuation orders were disseminated, the surgeons left with little more than the clothes on their backs. They had to move to temporary evacuation centers outside of the evacuation zone without patient records and documents. They also began referring patients to other facilities, including our hospital. The patients' referral forms began with the surgeons apologizing for the lack of patients' medical records, due to which they could not provide detailed information.

Table 1 may not cover all data from the entire prefecture, but it shows the number of seriously injured orthopedic patients requiring hospitalization due to the disaster at FMU orthopedics department and other hospitals. Examining this data shows that not many orthopedic surgery patients needed hospitalization because of the disaster.

The authors have been providing outpatient consultations at Kashima Kosei Hospital in the Kashima Ward of Minamisoma, approximately 32 kilometers from the Fukushima Daiichi plant. Kosei Hospital does not have a full-time orthopedic surgeon; thus, we were sent from the hospital to provide outpatient consultation three times a week before the disaster (two full days and one afternoon) and four times a week post disaster, that is, after the holidays in May (three full days and one afternoon).

Image 1 shows the trend of outpatient consultations before and after the disaster. The number of patients fell after the earthquake due to the temporary suspension of hospital services. In addition, the population of Minamisoma as of the end of December 2011 is only about 60% of what it was before the disaster. However, the number of patients increased due to the many temporary housing units built around the hospital and the increase in elder-patient visits. At the temporary housing facility, few children received compulsory education. Many families have been forced to live apart, with the elderly staying in temporary housing close to their homes and children living in different areas to prevent exposure to radiation.

Caring for Those Exposed to Radiation

Prior to the hydrogen explosion in the Fukushima Daiichi Unit 1 Reactor, pressure valves were opened to relieve the built-up pressure, with possible release of radioactive radiation, suggesting potential risk of radiation exposure to local residents. But the opening of the pressure valves was not effective as hydrogen explosions occurred in the Unit 1 Reactor on the 12th and in the Unit 3 Reactor on the 14th. On the 15th, an explosion in Unit 2 was heard and Unit 4 caught fire. According to our records, four patients suspected of radiation exposure visited the university hospital on the night of the 12th. Thereafter, the radiology department

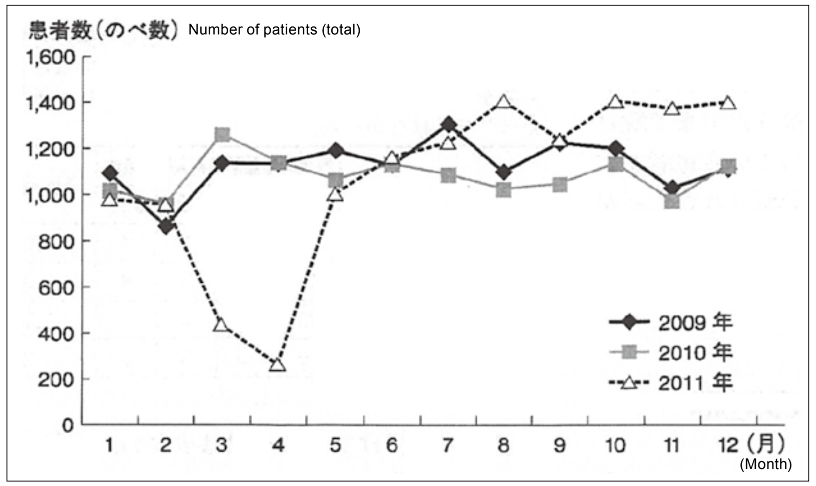

Image 1: Change in the Numbers of Orthopedic Outpatients at Kashima Kosei Hospital

After the earthquake, the number of patients decreased due to the temporary suspension of hospital services. But with the construction of many temporary housing facilities around the hospital, more patients are being seen now than before the disaster.

Image 2: Care for Patients Exposed to Radiation

a: Surgery rooms for patients exposed to radiation: all equipment is covered with plastic sheets so that it is not contaminated by radioactive substances.
b: Surgery room drills (orthopedic surgery): by simulating an actual surgery, we were able to verify a given procedure used to avoid secondary radiation exposure.

conducted radiation screenings of patients with suspected exposure, such as those within 20 kilometers of the Fukushima Daiichi plant. Patients showing counts of 100,000 or more on the scintillation counter were treated as exposed patients and underwent decontamination procedures. Very few patients had counts above 100,000 and needed decontamination. Most patients with higher counts saw these measurements sharply drop after taking off shoes and clothes or washing their hair.

The hospital announced that it would issue a code red alert (close windows, stop ventilation, and do not go outdoors, among other instructions), if further large-scale explosions occurred. An abstract sense of dread proliferated through the hospital and the medical school on hearing about the possibility of a code red alert. But thankfully, no such alert was issued.

As a secondary radiation exposure facility, the university hospital conducted initial treatment and decontamination of workers from the Fukushima Daiichi plant and others with high levels of radiation exposure. We had to decide whether to send them to a tertiary radiation exposure facility or continue treatment at our hospital. From March 14 to 30, a total of 11 people were transported to our hospital from the Fukushima Daiichi plant; none of them were critical. We had prepared for all contingencies, such as patients needing to stay for further treatment after decontamination, by covering all equipment in the surgery room with plastic sheets and regularly conducting mock surgeries and patient transportation in the surgery rooms (Image 2). Considering patients with orthopedic injuries might be frequently transported, orthopedic surgeons also participated in these simulations. Fortunately, since the day of the earthquake, we have not used the surgery rooms for patients with high levels of radiation exposure.

Student Volunteers

At the time of the earthquake, fifth-year students in the School of Medicine were in their bedside learning (BSL) classes and fourth-year students were in their basic medical science classes (researching topics as assignments part of the curricula). After the earthquake, the university hospital requested these students to volunteer in exchange for meals and lodging, and willing students volunteered. From the 12th, student volunteers came under the direct supervision of the Emergency Response Headquarters and followed instructions by the authors. The volunteers' tasks included transporting specimens, collecting medicines, guiding patients and DMATs, and in the words of the students themselves, "tasks that fill in the gaps" and "work that the duty staff are unable to do."

We optimally used their capacity and support from March 14 to the early morning of March 15, when several patients arrived simultaneously in a Self-Defense Forces helicopter and police buses from within the 20-kilometer radius around the Fukushima Daiichi plant. We were notified beforehand that many patients would arrive at once, but had no confirmation of when and if

Table 2: Number of Student Volunteers from FMU's School of Medicine

At the time of the earthquake, many students between their second and sixth years volunteered in some capacity (data from May 2011).

School year	1	2	3	4	5	6
Number of questionnaire respondents	91	72	60	44	75	19
Number of volunteers (%)	9 (9.8)	23 (32)	26 (43)	17 (39)	40 (53)	18 (98)
Average number of volunteer activities	4.1 (1~30)	3.1 (1~15)	4.4 (1~14)	5.1 (1~14)	4.5 (1~15)	4.6 (1~20)

they were coming. Anyhow, patients were suddenly transported to the hospital. Under the guidance of emergency department physicians, the students were the primary force behind moving the patients in and around the hospital.

We had many student volunteers from the School of Medicine and other schools. Table 2 shows survey results of the volunteer activities of FMU students. A large number of students volunteered in whatever capacity they could. The volunteer activities of FMU students have already been reported by Shiga University, Kagawa University, the Japan Association of Public Universities, the Kyushu Chapter of the International Federation of Medical Student Associations (IFMSA), and other institutions. We are currently working on sharing our experiences with students across the country. (Please refer to Further Reading sections 1, 2, 3, and 10 for more information about the volunteer activities of FMU students and the students' own volunteering experiences).

Importance of Disaster Education

On September 25, 2010, the FMU emergency department conducted drills assuming that an earthquake had occurred directly beneath Fukushima City. The drills also included the participation of the fire department, Self-Defense Forces, and DMATs. In our simulation, that considered many patients had been transported to the university hospital, we explored locations to conduct triage and establish the DMAT headquarters as well as how to transport patients with the help of the Self-Defense Forces and the fire department. Thus, after the March 11 earthquake, our hospital was able to set itself in motion rather quickly and without large setbacks. This reaffirmed the importance of regularly conducting drills to prepare for the disaster.

We have already noted the considerable support and help we received from student volunteers in moving patients. At the time, the only issue we faced was that the student volunteers did not know the best way to move patients from their wheelchairs to the beds or from the floor or beds to their wheelchairs. However, now they have all learned how to do so from their on-the-job training. This brings to our notice that proper transfer and transport of patients was not part of the School of Medicine curriculum. Also, despite being one of the few medical schools in the country to be located in the same prefecture as a nuclear power plant, they had absolutely no hands-on training about radiation exposure. We now plan to establish an Emergency Medicine Research Center in the university hospital through a grant. In addition, to learn from our experiences with this disaster and the Great Hanshin-Awaji Earthquake, we must conduct hands-on disaster training in medical and postgraduate schools. Furthermore, such drills must be conducted not only among physicians but also among medical professionals and members of a wider community. We should aim for a Fukushima Prefecture, or at the very least, a Fukushima Medical University, that is resilient to disasters.

Radiation Exposure Issues

One cannot avoid the topic of radiation exposure when discussing the Great East Japan Earthquake and tsunami in Fukushima. The primary issue after the Fukushima Daiichi nuclear power plant accident is of low-dose, long-term radiation exposure. Radiation exposure can be divided into external and internal exposure (exposure by ingesting radioactive matter while eating). Currently, we know to a certain extent the effects of high-dose external radiation on health from the experiences with the atomic bombing of Hiroshima and Nagasaki. But, regarding low-dose, long-term exposure, we can only extrapolate possible health problems from previous findings. Nevertheless, as the extent of external and internal exposure becomes clearer, by logically and rationally considering previous findings, we believe that it will not cause long-term health problems. However, the sentiments of the community toward the issue of radiation are adversely affected by the instinctual fear of radiation and by the fact that without the accident, there would have been no radiation exposure. Fukushima Prefecture has begun the task of conducting a 30-year follow-up health survey of the 2.02 million prefectural residents. This has been initiated to not only protect the health of residents but also leave evidence of the experiences of Fukushima for the future. For residents to have peace of mind, we must act to reliably protect their health, release radiation exposure data, and discover how much risk it poses when compared with other health hazards. Much of the public's confusion and uneasiness toward radiation probably originates in people misinterpreting the radiation numbers. Thus, it is important to convey the true health effects and relative risk that radiation poses when compared with other hazards.

Effects of the Great East Japan Earthquake, Tsunami, and Radiation on Medical Care in Fukushima

The Great East Japan Earthquake and tsunami and the ensuing radiation problems have significantly affected Fukushima's medical care. Compared with national

Table 3: Changes in the Number of Physicians Working at Medical Facilities (Compared with March 1, 2011)

Compared with data prior to the earthquake, Fukushima's 138 hospitals saw a decrease of 71 physicians.

Medical care area	Number of hospitals (March 1, 2011)	Actual number of full-time doctors			Increase or decrease in full-time doctors		
		March 1, 2011	August 1, 2011	September 1, 2011	March–August	August–September	March–September
Kenpoku	32	665	681	679	16	▲2	14
Kenchu (Koriyama)	22	536	521	506	▲15	▲15	▲30
Kenchu (all other cities)	11	71	72	72	1	0	1
Kennan	10	110	116	113	6	▲3	3
Aizu	19	238	242	239	4	▲3	1
Minamiaizu	1	12	15	14	3	▲1	2
Soso	16	120	61	61	▲59	0	▲59
Iwaki	27	261	258	258	▲3	0	▲3
Total	138	2,013	1,966	1,942	▲47	▲24	▲71

figures from 2008 to 2010, although the national average number of healthcare professionals per 100,000 people increased from 212.9 to 219.0, the figure in Fukushima decreased from 183.2 to 182.6. Fukushima was one of only two prefectures to show a decrease at the time (Reference 8). Fukushima's population before the disaster was about 2.02 million people and, even before the disaster, there were about 735 physicians working at medical facilities, a small number when compared to the national average. Based on a prefectural survey completed after the disaster, the number of physicians at Fukushima's 138 hospitals decreased by 71 between March 1 and December 1, 2011. Compared with the numbers effective August 1, there was a decrease of 24 doctors. These figures breakdown as a decrease of 59 physicians in the Soso area, which houses the nuclear power plant, and a decrease of 30 physicians in Koriyama. Meanwhile, Fukushima, home of FMU, and other parts of the Kenpoku area saw an increase of 14 physicians (Table 3). Thus, Fukushima could not take in all of Soso's physicians who were forced to evacuate and could no longer practice at their respective hospitals and could not control the drain of physicians out of the prefecture. The Kenpoku area, including Fukushima, which was exposed to relatively high levels of radiation, did not have an outflow of physicians. Despite this, it is unclear why there was an outflow from Koriyama, which suffered similar conditions. We speculate the reason to be the retreat of physicians who had originally been sent from the Kanto region of Japan.

The number of clinical residents has also been affected. Of the 70 physicians who started their residencies in Fukushima in April 2011, four of them changed their residency locations to those outside the prefecture; this was done after the disaster due to exceptional circumstances. For the 2012 matching program, the number of matches in Fukushima was 61 residents, the lowest number since the start of the new clinical residency program (the average number of matches in Fukushima for the past eight years is 76.6). This was also the ninth lowest number of matches in the country. The percentage of positions filled by matches (fill rate) was 41.8%, the lowest rate among 47 prefectural and city governments (Reference 6). We must work toward having more clinical residents throughout Fukushima by emphasizing a unique type of residency one can only get in Fukushima, based on our core prefectural clinical residency hospital network, and the Emergency Medicine Research Center.

Residents living within 20 kilometers of the Fukushima Daiichi plant or in planned and specially recommended evacuation zones, with relatively high levels of radiation, lived as evacuees similar to those whose homes were washed away in the tsunami. In particular, Iwaki saw an influx of over 30,000 evacuees, surpassing the capacity of welfare, government, and medical facilities. Addressing the lack of doctors in the Soso area, on January 27, 2012, the Ministry of Health, Labour and Welfare renamed its Soso Region Medical Professionals Provision & Support Center, established in Minamisoma's Soso Office of Health and Welfare, to the Soso Region Medical Treatment & Welfare Reconstruction Support Center. This resulted in an increase in Ministry personnel from two to three to bolster welfare services in Iwaki City.

As of the end of December 2011, only three of the 16 inpatient medical facilities in the Soso area have resumed inpatient functionality to the pre-disaster level. Seven facilities within the 20-kilometer radius of the nuclear power plant have shut down altogether (Image 3). In particular, hospitals with psychiatric departments have lost all inpatient care, with one hospital reopening

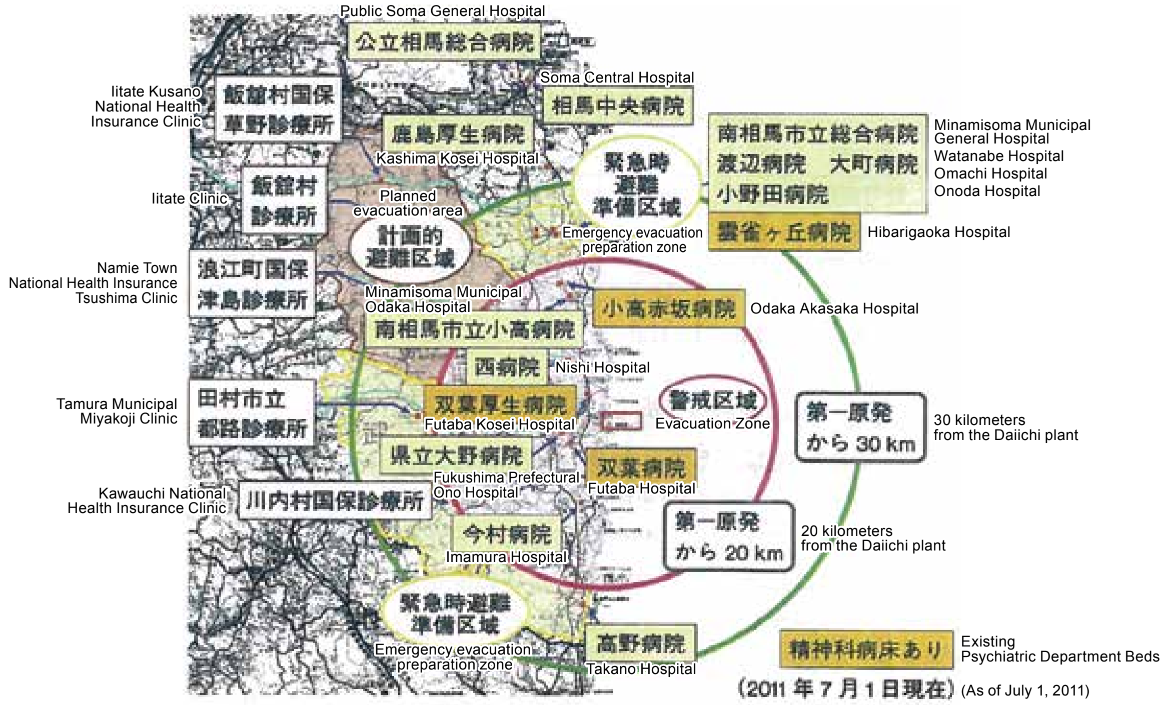

Image 3: Medical Facilities in the Soso Area

As of the end of December 2011, of the 16 hospitals in the Soso area, eight hospitals have completely stopped functioning and five have only partially resumed inpatient and outpatient care. The only hospitals that have stayed fully functional are three hospitals, which are more than 30 kilometers from the Fukushima Daiichi nuclear power plant. The emergency evacuation preparation zone was lifted on September 30, 2011.

outpatient care. Soma City also established psychiatric outpatient care facilities. With help from across the country, a psychiatric outreach clinic was established, and one hospital has planned to resume inpatient psychiatric care. Meanwhile, analyzing each locale, the population in Minamisoma has dropped from over 70,000 to 10,000 because of the radiation scare; however, now that it is no longer an emergency evacuation preparation zone and elementary, middle, and high schools have reopened, the population has recovered to 40,000. Table 4 shows the current state of four hospitals in the old Haramachi Ward of Minamisoma, the core area for medical facilities in the city. Securing nurses and other health professionals, in addition to physicians, is proving to be difficult, and the recovery of medical care is nowhere in sight. Nevertheless, as long as there are people in the community, we should strive to provide a bare minimum level of medical care, but the path ahead of us is difficult.

Future Developments and Issues

As we pass from the critical to the chronic stage, we must continue to think about long-term care within the narrow fields of medicine and welfare. Long-term care is difficult to accomplish only with individual efforts, especially in widespread disasters. Thus, it is effective to build systems through which we can help each other in times of need, with support agreements not only within Fukushima but also at the hospital, prefectural, and municipal levels. Regular disaster medicine education, including fostering public awareness, is also important.

As medical professionals, our top priority now is to address, however diminutively, the health concerns that prefectural residents voice. In particular, the health management survey administered throughout the prefecture and the reconstruction of medical and welfare facilities in the Iwaki and Soso area are some of the steps we are taking to allay these concerns. As those survivors of the disaster and radiation issues, it is our duty to share

Table 4: Medical Facilities in the Haramachi Ward of Minamisoma City (effective October 25, 2011)

The actual number of inpatients is only 23.5% of the number of authorized beds, the number of physicians is 61.9% of that before the disaster, and the number of nurses is 50.8% of that before the disaster.

		Hospital A	Hospital B	Hospital C	Hospital D
Inpatients	Actual number of inpatients	100	33	53	0
	Authorized beds	230	199	188	175
Number of employees	Number of physicians (before the disaster)	7 (12)	7 (8)	8 (12)	4 (10)
	Number of nurses (before the disaster)	113 (151)	30 (79)	approx. 28 (95)	35 (83)

our experiences with future generations.

Conclusion

Fukushima's recovery will take decades and requires the efforts of its residents. But to get recovery off the ground, we need the help and support of everyone across the country. We hope this article helps to increase understanding about the current state of Fukushima.

References: Further Reading

1) ふくしま県民のためのIT医療情報誌、医療人、未来へ羽ばたく医療人Vol.1.福島県立医科大学学生災害ボランティア活動報告会レポート。
http://iryo-jin.com/magazin/?p=3109
2) ふくしま県民のためのIT医療情報誌、医療人、未来へ羽ばたく医療人Vol.2.学生災害ボランティアに参加した福島県立医大生へのインタビュー。
http://iryo-jin.com/magazin/?p=3813
3) 福島県立医科大学　震災特設ページ、【特集】私たちからのメッセージ「災害医療の現場でがんばっています!」。学生ボランティアからのメッセージ。
http://www.fmu.ac.jp/byoin/29saigai/message_0320.html
4) 福島県立医科大学　震災特設ページ。【特集】私たちからのメッセージ「災害医療の現場でがんばっています!」。研修医からのメッセージ。
http://www.fmu.ac.jp/byoin/29saigai/message_0321.html
5) 福島県立医科大学　震災特設ページ。【特集】私たちからのメッセージ「災害医療の現場でがんばっています!」。指導医からのメッセージ。
http://www.fmu.ac.jp/byoin/29saigai/message_0321_2.html
6) 医師臨床研修マッチング協議会。平成23年度研修医マッチングの結果。
http://www.jrmp.jp/koho/2011/2011kekka_koho.pdf
7) 官邸ホームページ、東電福島原発　放射能関連情報。
http://www.kantei.go.jp/saigai/anzen.html#避難 区 域等の設定
8) 厚生労働省。平成22年（2010年）医師・歯科医師・薬剤師調査の概要。
http://www.mhlw.go.jp/toukei/saikin/hw/ishi/10/dl/kekka_1.pdf
9) 日経メディカルCadetto.カデット特集。大震災で僕らは…Vol.6.原発は不安でしたが、病院に残りました。福島県立医大の研修医が体験した大震災。
http://medical.nikkeibp.co.jp/leaf/all/cadetto/magazine/1102-t3/201107/520599.html
10) 日経メディカルCadetto.カデット特集。大震災で僕らは……Vol.7.福島から避難しても、何かをせずにはいられませんでした。福島県立医大の医学生が体験した大震災。
http://medical.nikkeibp.co.jp/leaf/all/cadetto/magazine/1102-t3/201107/520782.html
11) 週刊医学界新聞第2932号（2011年6月13日）。葛西龍樹氏（福島医大教授・家庭医療学）に聞く
http://www.igaku-shoin.co.jp:80/paperDetail.do?id=PA02932_02
12) 週刊医学界新聞第2932号（2011年6月13日）。そして研修は続いてゆく。福島医大のポスト3.11.
http://www.igaku-shoin.co.jp/paperDetail.do?id=PA02932_01

Overview of Resources and Support Received from Other Universities

Planning and Financial Affairs Division

1. Background

- Deliveries of a wide variety of provisions, including medical supplies, ceased because gas stations in the area could no longer provide fuel for workers' trucks; thus, the workers were unable to carry out their jobs.
- The University has received supplies of the types and amounts listed below, contributed by the following universities:
  Chiba University, Dokkyo Medical University, Miyazaki University, Tokyo Medical University, Juntendo University, Niigata University, Hiroshima University, Kyoto Prefectural University of Medicine, University of Shizuoka, and Mie University.
- The following is a list of the primary items received:

Medical gloves	Approx. 200 boxes
Medical gowns	9 boxes
Drinking water	1,800 liters
Toilet paper	17 boxes
Diapers	Approx. 1,100 pairs
Baby food	Approx. 500 servings
Sheets	Approx. 500 pieces
Baby wipes	Approx. 350 units
Pocket dosimeters	10 units

- Apart from the institutions listed above, the University has also received supplies from businesses and local hospitals.

Fukushima Medical University's Emergency Medical Care for Radiation Victims

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Fukushima Medical University

Located in Fukushima Prefecture's Hamadori region, Tokyo Electric Power Company's Fukushima Daiichi and Daini nuclear power plants sustained major damage from the offshore earthquake of magnitude 9.0 and the resulting tsunami that struck the Tohoku region at 2:46 pm on March 11, 2011. The standard emergency procedures for nuclear power plants—shut down, cool down, and close off—were immediately initiated after the quake; however, the ensuing tsunami exceeded anticipated magnitude, damaging electrical and emergency backup power supplies to the Fukushima Daiichi nuclear power plant. This resulted in a loss of the plant's cooling systems, thus damaging and melting fuel rods, and subsequently triggering the hydrogen explosion. The hydrogen explosion tore through the building housing the plant, releasing radioactive material and causing a Level 7 nuclear disaster. The Fukushima Medical University Hospital, designated as a secondary radiation treatment facility for nuclear disaster, was overwhelmed by the unexpected events. This manuscript aims to convey the development of the Fukushima Medical University (FMU) response to the radiation exposure and the experiences that the authors were left with from facilitating the response.

Fukushima Prefecture Nuclear Disaster Prevention Plan and Radiation Emergency Medical Response Framework

The FMU Hospital, where the authors work, had installed various diagnostic equipment in its emergency radiation treatment facilities completed in 2001. These facilities were built as part of the measures taken for radiation exposure medical care (through a supplementary budget approved in 1999) that were prompted by the criticality accident in 1999 at JCO Co., Ltd. in Tokai. The Fukushima Prefecture radiation emergency medicine manual[*1] (May 2003) stipulates, as part of the Fukushima Prefecture nuclear disaster prevention plan, FMU's role as a secondary radiation treatment facility. As such, FMU is responsible for the secondary treatment and hospitalization of radiation exposure victims when initial medical care or secondary medical care facilities cannot provide adequate contamination treatment or in the case of a large-scale calamity. In addition, FMU compiled a radiation medicine manual[*2] (May 2002). Since 2001, FMU has been participating in the nuclear disaster training exercises held annually in Fukushima Prefecture. On August 25, 2007, the 11th Radiation Emergency Medicine Forum was held in Fukushima City, and current and future strategies for handling stable iodine were discussed. In the nuclear disaster training exercises held on October 23, 2007, drills were conducted for distributing stable iodine.

Fukushima Prefecture supplies electricity to the Tokyo metropolitan area, which has 10 nuclear power reactors at two different plants (approximately 20% of Tokyo Electric Power Company's supply comes from Fukushima Prefecture). In return, the prefecture receives various subsidies, including proceeds from a nuclear fuel tax. In addition, an emergency medical response framework (Figure 1) for radiation exposure has been put in place.[*3]

To encounter accidents or disasters, an 18-member team of medical specialists was formed at FMU as the Fukushima emergency radiation medicine response unit. The unit includes a leader (head of the radiology department), sub-leader (head of ER), two physicians (from the radiology department and ER), five nurses (from the nursing department), seven radiologists, and two administrators.

Within Fukushima Prefecture, Fukushima Prefectural Oono Hospital, Futaba Kosei Hospital, Imamura Hospital, Fukushima Rosai Hospital, and Minami-Soma Municipal Hospital are designated as

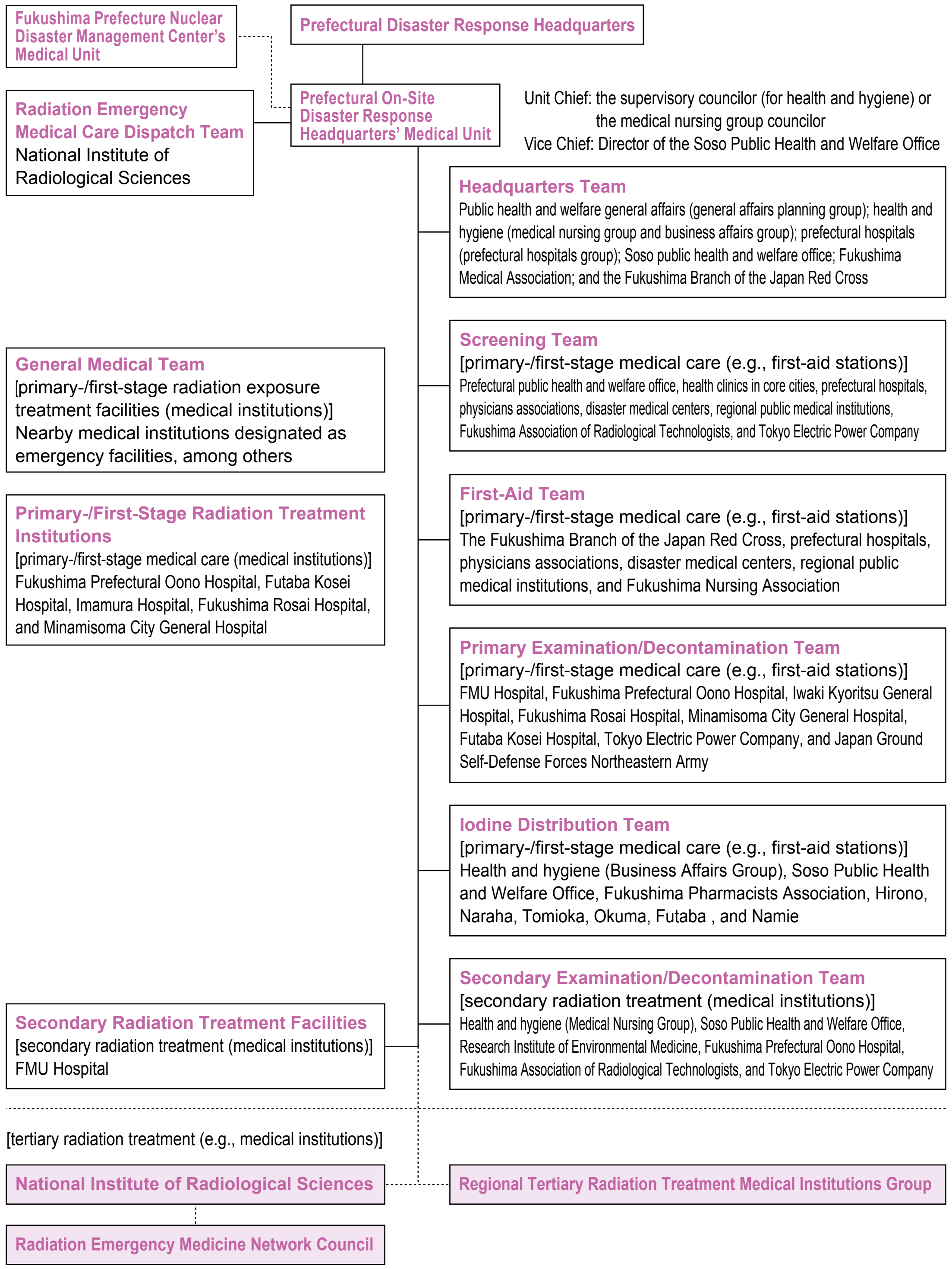

Figure 1: Radiation Emergency Medical Response Framework

primary treatment facilities for radiation exposure, while FMU Hospital is a secondary treatment facility. In the eastern Japan area, the National Institute of Radiological Sciences (NIRS) is a tertiary treatment facility, and Hiroshima University fulfills the same role in western Japan.[*4]

Fukushima Medical University's Emergency Medical Care for Radiation Victims

On March 12, the day after the massive earthquake, the emergency radiation treatment ward was prepared to receive patients. Standard protocol is to proceed after receiving information from the medical unit of the Joint Council for Nuclear Emergency Response, organized under the Fukushima Nuclear Disaster Management

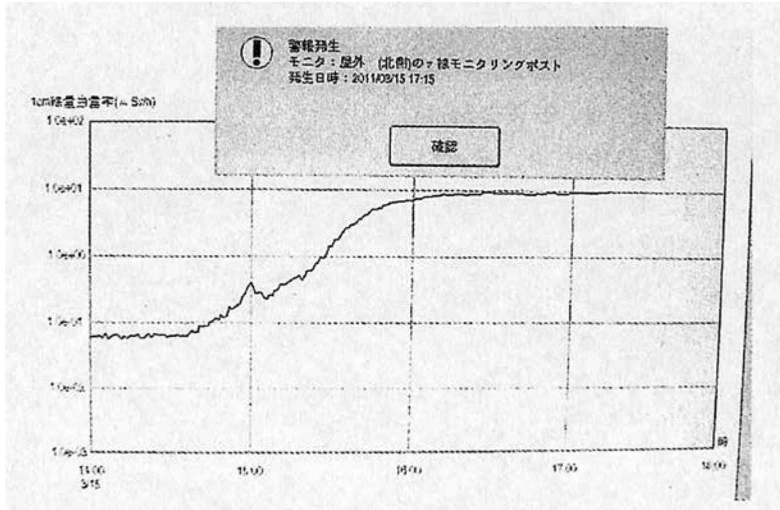

Figure 2: FMU Nuclear Medicine Department monitor on March 15

Center (an off-site center in Okuma). However, after the earthquake, there was absolutely no contact from these groups. Despite having no direction or instruction, we braced ourselves to handle radiation exposure and contaminated patients and started screening general patients arriving at the hospital entrance on March 12. The first treatments started in the evening when a patient arrived claiming to have experienced radiation exposure in Futaba.

Thereafter, an explosion in Unit 3 Reactor that injured several people was reported on March 14. One of the injured was brought to FMU by ambulance. Since our water supply had been cut off, we were unable to perform full-body decontamination. However, since the patient did not have severe radiation exposure, we partially decontaminated and admitted the patient into the ICU for treatment of external injuries. The patient was released several days later. Another patient sustained external injuries due to the explosion on March 14 and was brought to us in a Self-Defense Forces helicopter.[*5] Since the hospital's water supply was still cut off, full-body decontamination had to be carried out with water from a Self-Defense Forces' water supply truck. Although we had prepared for this in training, performing it for the first time was an experience fraught with anxiety.

At approximately 3:00 pm on March 15, it began to rain in Fukushima City. The alarm at the monitoring station in the FMU nuclear medicine department was sounded, giving the first signal of widespread radiation contamination in the city (Figure 2). In the several days that immediately followed the earthquake, disaster response efforts were believed to apply to evacuees from within the 20–30 kilometers radius of the power plant and those working at the plant. However, it became clear from March 15 that even we, who were 60 kilometers from the area, were also exposed to the risk of being contaminated. Nevertheless, information was hard to come by, with the exception of television, radio, and newspaper reports. We continued to face a series of difficult decisions in an environment with limited information.

On March 24, an ambulance brought two patients who had walked through pools of radioactive water when they entered the power plant buildings without wearing protective boots. Once the hospital's water supply resumed, we made our best attempts to give the patients full-body decontamination treatment, focusing on their legs. However, this was more difficult than anticipated, and after a day of hospitalization, the patients were transferred to NIRS for radiation exposure tests and further treatment of their legs.

Twelve patients assumed to be contaminated inside the nuclear power plant were treated by the FMU radiation exposure emergency medical team. Nevertheless, this is a small number considering the level of the nuclear accident. In addition, the injuries handled were relatively minor, which is certainly a miracle of sorts.

Irradiated Zone Reaches Our Doorstep!

On March 15, the off-site center's medical unit was transferred to the Fukushima government offices,[*5] improving the flow of communication. From there on, we started to receive regular instructions. It was also very heartening to have the support of the Self-Defense Forces and the Japan Atomic Energy Agency with the decontamination efforts. The ranks of the radiation medicine emergency response unit were bolstered by the addition of staff from Nagasaki University, Hiroshima University, and the Nuclear Safety Research Association.

Radioactive material was confirmed to have spread into Fukushima City, with radioactive cesium contaminating the ground from March 15 to 17 and again on March 22, but no new material entered afterwards. During this period, preparations were made for an estimated 100 patients needing radiation decontamination treatment. Eventually, the scale of the incident was not par for the course, but facilities were prepared at gymnasiums, pools, among others that were being used as convalescence space; space was also secured by removing parked vehicles. Also, preparations were made for treating contaminated workers from the power plant and evacuees in need of care. In addition, responses were simulated for when and how to administer stable iodine to those living in Fukushima City and plant workers who might be in need of treatment for high-level (more than 1 Sv) radiation exposure. It was far beyond our expectations when the readings for full-body Geiger counters rose above the limit values; this was due to environmental contamination in the soil around the FMU radiation ward (the full-body counters had been prepared to test internal radiation exposure) (cf. also WBC, Part 3, Chapter 5). Several measures were being taken for the first time, and we proceeded while receiving advice from the Japan Radiological Society, the Japanese Society of Nuclear Medicine, the Japanese Association for Acute Medicine, and others through numerous emails and telephone calls.

We continued with various simulations aimed at handling the possible repercussions of the nuclear accident; however, from April, the criticality of the situation reduced. Nevertheless, airborne radiation continued to receive a good deal of attention due to the radioactive cesium embedded in the soil. In addition to our work addressing the contamination, we now had to handle the difficult problem of assessing radiation levels.

The goal of the FMU radiation medicine emergency response unit was focused primarily on medical care for the plant workers, who would plausibly have high-level radiation exposure or high-concentration radiation contamination. As the seriousness of the situation diminished, we were able to turn some of our attention to examining and managing the health care of the fire fighters and Emergency Medical Technicians (EMTs) who were working alongside us. These exams, conducted even today, are being expanded to a range beyond fire department officers to encompass police and civil servants, who enter the hazardous zones as part of their work.

Recently, numerous reports and comments have been circulating from an array of individuals connected to media organizations. These reports have been a cause of consternation with their free opinions and conflicting claims of "danger from ambient radiation" versus "safety at current levels." In mid-May, the Japan Radiological Society held a meeting for its Safeguarding Commission in that professional opinions were assembled. FMU participated in the event as an ad hoc member. An official statement from the Commission on "fundamental approaches to radiation exposure stemming from the nuclear disaster" was announced in early June.[*6]

When August arrived, we were contacted by a local municipality that had been contaminated by the radiation. Although it was not our area of expertise, we felt it was our duty to respond to queries from our local neighbors and, to this day, we provide advice with the help of consultation from Fukushima City and Date City. As part of this experience, we have realized that the central government's policies and opinions have not been reaching these local municipalities, and a considerable amount of time and effort is necessary for information to trickle down and educate residents of the area.

Future Challenges for Emergency Radiation Medicine

Although presently radiation is not being released from the power plant, there is a high possibility that it might. Going forward, there is a myriad of challenges surrounding responses to additional radiation emissions, how and where to administer stable iodine, how to communicate information on the emissions, and how to convey instructions to remain indoors, evacuations, among others. Moreover, the emergency manuals need to be revised and training exercises based on them need to be held. In particular, it is vital to expand the scope of training and that of participants.

In the future, issues surrounding radiation exposure in the general population, over and above power plant workers, will be a major task to address. However, other tasks also remain, such as providing information and advice to citizens, working at risk communication to ease anxiety over radiation exposure, devising strategies for assessing and explaining external radiation doses (using, for example, so-called "glass badges" that passively collect radiation information), creating strategies for assessing and explaining internal radiation doses (using white blood cells (WBC) as a measure), and addressing the matter of psychiatric health care.

Lessons and Future Hopes from the Perspective of a Medical Professional

What follows is a straightforward and concise collection of what we feel is needed based on our experiences of the natural disaster.

1. We need to acknowledge the importance of drafting a manual and implementing training. Even if incomplete, a manual must be made. Training exercises must be repeatedly held (both conceptual and actual exercises are important). Finally, plans must be made for incidents on the largest scale conceivable.
2. We need to acknowledge the importance of mutual understanding between on-site personnel and central government personnel, particularly during a frantic disaster. Additionally, a framework for communicating decisions and instructions based on this mutual understanding and exercises to practice such communication are important.
3. We need to acknowledge the importance of sanctioning individual decisions at the scene of the disaster, if they are deemed meritorious by those on the scene.
4. We need to acknowledge the importance of respecting individual decisions made at the disaster site when communication is not forthcoming from the authorities. Training is very important for all of this. At the time of an emergency, the following approach is required from the individuals involved.
5. Medical professionals must be trained in general radiation exposure treatments and must unfailingly spread knowledge to the general populace about radiation and measures to deal with it.
6. FMU must revamp its framework for emergency radiation treatment and decontamination. Procedures for the use of stable iodine tablets must be established and supplies must be supplemented or stockpiled. Similarly, internal radiation sequestering agents such as Prussian blue or chelating agents must be stocked. A framework for assessing and explaining to citizens external radiation doses (e.g., with glass badges) must be put in place as a supplement to the prefectural health survey system. Similarly, a framework for assessing and explaining to citizens internal radiation doses (WBC) must be created.

In addition to the above, Fukushima Prefecture's health care system must be re-equipped and upgraded. Competent graduates must be retained within the prefecture as health care professionals. The level of health care must be raised (by implementing greater accessibility), and advanced medical facilities and equipment must be introduced. We dream of a bright future for FMU and the revival of Fukushima Prefecture.

References

*1 福島県保健福祉部, 福島県緊急被ばく医療活動マニュアル（平成15年5月制定）.
*2 被ばく医療施設運営委員会マニュアル作成部会「福島県立医科大学医学部附属病院被ばく医療活動対応マニュアル」（平成14年5月8日制定）.
*3 青木芳朗，医学のあゆみ，239（10），973-976（2011）.
*4 神谷研二ら, 医学のあゆみ, 239（10）, 977-984（2011）.
*5 谷川攻一ら， 日本救急医学会雑誌，22（9），782-791（2011）.
*6 日本医学放射線学会放射線防護委員会，原子力災害に伴う放射線被ばくに関する基本的考え方．http://www.radiology.jp/modules/news/articl.php?storyid=931
*7 大津留晶， 日本病院会雑誌， 1112-1116（2011）.
*8 宍戸文男ら, Surgery Frontier,18（4）, 369-372（2011）.

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The Results of Thyroid Examinations, Our Goals, and Future Prospects

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Introduction

On March 11, 2011, the Tokyo Electric Power Company's Fukushima Daiichi nuclear power plant suffered major damage after the Great East Japan Earthquake. As a result, a large amount of radioactive material was released to the atmosphere from the damaged plant. Last May, Fukushima Prefecture decided to conduct the Fukushima health management survey. The survey consists of a basic survey and four detailed surveys, one of which is a lifelong ultrasound study of the thyroid glands of children in Fukushima Prefecture between the ages of 0 and 18 years at the time of the accident. A little less than 40,000 participants have already been examined to date. Results of the primary examination have been reported while the secondary examination is currently being carried out. Physicians of the Medical Association may be required to explain or provide some guidance regarding this survey during their routine medical practice. Herein, I would like to explain the outlines of this project, hoping to summarize the information and to promote further understanding of the project.

Overview of the Thyroid Examination

The subjects selected for the primary examination were approximately 360,000 residents of Fukushima Prefecture (including those who evacueted to other prefectures), who were approximately ≤18 years of age at the time of the earthquake. Ultrasound examination of the thyroid gland is performed. The protocols for further examination are as follows. When the primary examination reveals a nodule of ≥5.1 mm or cyst of ≥20.1 mm (cysts containing a solid area were considered as nodules), a confirmatory secondary examination will be carried out. The participants with unremarkable results who are not selected for the secondary examination will be provided the same primary screening examination 2.5 years later, which will be repeated at 2-year intervals until the age of 20, and then at 5-year intervals afterward.

The secondary examination, which is a more detailed confirmatory ultrasound study, determines whether a fine-needle aspiration cytology should be performed, on the basis of the diagnostic procedures by the Committee on Thyroid Terminology and Diagnostic Criteria of the Japan Association of Breast and Thyroid Sonology[1], and the ultrasound diagnostic criteria of thyroid nodules (tumors) by the Japan Society of Ultrasound in Medicine[2]. Furthermore, the blood levels of FT4, FT3, TSH, TgAb, TPOAb, and Tg, as well as the urine iodine levels of all participants will be measured. On the basis of the results of these examinations, participants are recommended to have either a routine follow-up, re-examination and follow-up at the facility for secondary examination, or have treatment such as surgery.

Characteristics of Thyroid Cancer, Particularly in Children

With regard to the various types of thyroid cancers, 94%–95% of the cases are differentiated cancers consisting of papillary and follicular thyroid cancer. Such cancers have a 10-year survival rate of 95%–96% and they have the best prognosis among all solid cancers. In contrast, undifferentiated thyroid cancers are rare with an incidence of 2%, and they have one of the worst prognoses among all solid cancers with the average survival period of 6 months[3,4]. Although there is no definitive epidemiological study conducted regarding pediatric thyroid cancer, it is generally estimated that 1 in 1–2 million children are affected annually. Statistics from the 29th review of Thyroid Surgeries indicate that pediatric thyroid cancer is extremely rare, with 0.1% of the patients aged ≤19 years, and 0.03% of the patients aged ≤14 years[4]. Children and adolescents with thyroid cancer have much better long-term outcomes than adults. Even when the cancer appears to be advanced, having spread to the lymph nodes and lungs at the time of diagnosis as in the case of pediatric papillary thyroid cancer in particular, the vast majority of pediatric patients with thyroid cancer have a good long-term prognosis when appropriately treated[5]. The prognosis of thyroid cancer, particularly differentiated cancer, is associated with age and becomes less favorable when the patient is older. In the TNM classification by UICC, the cancer staging for differentiated thyroid cancer in patients aged ≥45 years ranges from stages I through IV, but there are only stages I and II for those under the age of 45 years. This is because of their better prognosis, and distant metastases are classified as stage II while all others are classified as stage I[3]. Furthermore, undifferentiated cancer grows rapidly, having a very poor prognosis, unlike the differentiated cancer. In addition, this cancer is rare in patients <50 years of age. Taking these points into consideration, pediatric thyroid cancers are considered to have favorable prognoses. It is also known that some thyroid cancers are induced by radiation.

Characteristics of the Ultrasound Thyroid Examination

When performing thyroid examinations on pediatric populations, the use of computed tomography or scintigraphy should be limited because they may increase unnecessary radiation exposure. Ultrasound imaging, on the other hand, is noninvasive and thus appropriate for pediatric thyroid screening examination.

Ultrasound images are relatively easily obtained by placing the probe on the neck region. However, visualization may differ depending on the skills of each examiner. Therefore, a highly experienced examiner is required for this examination. Thanks to the advances in ultrasound instruments, even nodules approximately 1 mm in size can be visualized. The ultrasound was previously used to diagnose the presence or absence of a condition. If an abnormality such as a nodule was found, the patient was sent to a specialist who would then perform a fine-needle aspiration biopsy, and excise multiple microcarcinomas of a few millimeters in size. More recently, however, the ultrasound has also been used for qualitative diagnoses, and to a certain degree a diagnosis could be made even without a fine-needle aspiration biopsy. For cancers such as that of the mammary gland, detecting almost impalpably small cancers can contribute to a better survival rate. In contrast, exploring small thyroid cancers and excising them is not our main objective because as much as 36% potential cancers (latent cancers) were found in the thyroid gland during autopsy, and most of them were microcancers <10 mm in size[5].

Implementation of the Primary Examination

The Fukushima health management survey was launched in July 2011, starting with a basic survey using questionnaires. The thyroid gland examination as one of the detailed surveys was carried out on weekends and holidays between October 9 and November 13 of the same year at Fukushima Medical University Hospital. Of the roughly 4,000 target residents of Iitate Village, Namie Town, and Yamakiya District in Kawamata Town, 3,765 residents sought to take part in this examination. Subsequently, from November 14 to December 16, on Monday through Friday, the visiting examinations were performed in Kawamata Town and Minami-soma City. A total of 10,677 residents have undergone these examinations, of which 1,977 were from Kawamata Town excluding Yamakiya District and 8,700 were from Minami-soma City. By the end of last year, the total number reached 14,442.

From January 2012 until March 23, 2012, a total of 28,099 residents participated in the study from the remaining government-designated evacuation zones of Date City, Tamura City, Hirono Town, Naraha Town, Tomioka Town, Kawauchi Village, Okuma Town, Futaba Town, and Katsurao Village (22,614 of them were the residents of Fukushima municipalities while 5,485 of them were evacuees outside the prefecture, as of November 21, 2011). A total of 38,114 residents out of the 47,766 target population, consisting of 10,274 in Date City, 6,180 in Tamura City, and 7,218 in the other evacuation zones participated, with a 79.8% participation rate (Table 1). Most of the participants from Iitate Village, Kawamata Town, Date City, or Tamura City resided within Fukushima Prefecture while as many as 22%–33% of participants from Minami-soma City, Namie Town, and other evacuation zones were from other prefectures.

The breakdown of the participation rate by age group was as follows: 77.5% between 0–5 years of age, 84.9% between 6-10 years of age, 84.5% between 11–15 years of age, and 68.7% aged ≥16 years, with the highest rate seen in the 6–15-year-old age group, because many of them were tested at schools. The children between 0–5 years of age, for whom performing examination was suspected to be difficult even by the specialists, had a nearly 80% participation rate, and all of them were successfully examined.

Primary Study Results Notice

Before being sent out by mail, results of the primary

Table 1. Thyroid Screening Participation Rates in 2011 (as of March 31, 2012)

Target area	Target population (person) A	Number of participants (person) B	Participation rate (%) B/A	Results by age group				Number of the residents outside Fukushima Prefecture in B (person) C	Participation rate (%) C/B
				0–5 years	6–10 years	11–15 years	16–18 years		
Tamura City	7,080	6,180	87.3	1,477 people 85.9%	1,774 people 98.0%	1,947 people 93.8%	982 people 66.5%	27	0.4
Minami-soma City	12,529	9,636	76.9	2,757 people 75.1%	2,691 people 78.8%	2,679 people 81.3%	1,509 people 70.4%	2,601	27.0
Date City	11,357	10,274	90.5	2,389 people 87.1%	2,930 people 96.8%	3,256 people 96.4%	1,699 people 76.8%	149	1.5
Kawamata Town	2,403	2,188	91.1	536 people 91.5%	609 people 96.4%	686 people 95.3%	357 people 76.8%	32	1.5
Hirono Town	1,077	691	64.2	167 people 65.5%	167 people 66.8%	244 people 70.1%	113 people 50.4%	114	16.5
Naraha Town	1,429	939	65.7	219 people 63.3%	269 people 74.3%	283 people 68.4%	168 people 54.7%	141	15.0
Tomioka Town	2,940	1,696	57.7	433 people 56.4%	455 people 62.0%	531 people 59.9%	277 people 50.3%	405	23.9
Kawauchi Village	357	230	64.4	57 people 63.3%	76 people 76.8%	59 people 66.3%	38 people 48.1%	41	17.8
Okuma Town	2,386	1,542	64.6	478 people 61.4%	432 people 68.0%	446 people 72.1%	186 people 52.5%	262	17.0
Futaba Town	1,204	716	59.5	217 people 59.1%	181 people 61.1%	207 people 61.8%	111 people 53.9%	357	49.9
Namie Town	3,645	2,922	80.2	814 people 80.5%	769 people 83.5%	822 people 79.7%	517 people 75.9%	984	33.7
Katsurao Village	233	147	63.1	40 people 71.4%	43 people 69.4%	41 people 61.2%	23 people 47.9%	12	8.2
Iitate Village	1,090	917	84.1	242 people 87.0%	259 people 86.0%	255 people 84.2%	161 people 77.4%	56	6.1
Others*	36	36	100.0	people %	7 people 100.0%	10 people 100.0%	19 people 100.0%	2	5.6
Total	47,766	38,114	79.8	9,826 people 77.5%	10,662 people 84.9%	11,466 people 84.5%	6,160 people 68.7%	5,183	13.6

*"Others" indicates participants outside the evacuation zone designated by the government, who undertook the thyroid screening mainly at schools.

■The examination was performed in 2011 for residents in the evacuation zone designated by the government.
■From October 2011 to March 2014, 79.8% of the target population (38,114 people) have participated in the examination

study were first examined and confirmed by the medical image screening committee made up of multiple specialists. The results were categorized into three classes, A, B, and C, where classes B and C were required to have a secondary examination. Class A was further categorized into subclasses A1 with no nodule or cyst, and A2 with nodules of ≤5 mm or cysts of ≤20 mm. Those who were classified as A1 or A2 were encouraged to undergo re-examination after 2.5 years, then every 2 years until age 20, and every 5 years after that. We included the mixed cysts that contained some solid parts in the category of nodule; thus, those classified as cysts in our context were considered benign. However, when they reach the size of ≥20.1 mm, mass effect may result. That was why those with cysts >20.1 mm were also encouraged to participate in the secondary study in case those cysts needed to be aspirated. Many nodules <5 mm are often difficult to distinguish from cysts, and are considered benign during ultrasound screening. All images of the A2 nodules were re-examined along with the B and C classes. If the routine re-examination in 2.5 years appeared to be too long a wait, these A2 cases were classified as class B and encouraged to participate in the secondary examination. In the routine clinical setting, the class A2 examination result is unremarkable and may not even be brought up. Re-examination in 2.5 years is usually considered sufficient for early detection. However, given that one of the aims of this survey is to promote the community's understanding of their thyroid status over the long term, we considered it important to inform residents of our results and observations so that they could be aware of their individual conditions. We hope this reporting will help decrease concerns among residents who may consider seeking second opinions. We would also like to emphasize that the results of the primary examinations were assessed by various specialists who gathered from across the country from the outset, followed by the re-examinations performed by the committee that similarly consisted of specialists in the field.

Those in classes B and C will undergo a secondary examination. Those in class C have an urgent need for further examination. Those in class B still require a secondary examination in <2.5 years, although it is not as urgent. For both B and C classes, a detailed secondary ultrasound examination is performed along with blood

Table 2. Results of Thyroid Screening in 2011 (as of March 31, 2012)

Total number of participants			38,114 people		
Examination result		Classification	Number of people (person)	Rate (%)	
Class A	(A1)	No nodule or cyst	24,468 participants	64.2%	99.5%
	(A2)	Nodules ≤5.0 mm or cysts ≤20.0 mm	13,460 participants	35.3%	
Class B		Nodules ≥5.1 mm or cysts ≥20.1 mm	186 participants	0.5%	
Class C		Immediate secondary examination required based on thyroid condition	0 participants	0%	

[Screening result classification]
• Those with A1 and A2 results will be followed up at the next examination (2014 onward)
• hose with B or C results will undergo a secondary examination (the timing and location of the secondary examination will be notified)

*Some of the A2 results are classified as B when clinically indicated based on the thyroid condition

(Reference)

Examination results		Number of participants (person)	Rate (%)	Total
With nodules	≥5.1 mm	184 participants	0.48%	386 participants (1.0%)
	≤5.0 mm	202 participants	0.52%	
With cysts	≥20.1 mm	1 participant	0.002%	13,380 participants (35.1%)
	≤20.0 mm	13,379 participants	35.10%	

*Mixed cystic-solid nodules were also observed

and urine tests, and if clinically indicated on the basis of our criteria, fine-needle aspiration cytology will be performed to determine if the lesion is benign or malignant. Therefore, it is expected that many cases will require no cytology examination following the ultrasound screening.

Depending on the individual result, the residents in class B may have different recommendations, such as a usual re-screening after 2.5 years similar to that in class A, a follow-up screening in a few months to a year, cytology examinations, or a surgical treatment.

Classification of the Thyroid Ultrasound Examination Results

Table 2 shows results of 38,114 participants, who underwent thyroid examination by the end of March 2012. Only 186 or 0.5% of the participants were classified as class B, which requires a secondary examination. None were classified as class C, in which lesions were suspected to be malignant and required immediate re-examination. Most participants were classified as A1 or A2, who were recommended a routine re-screening after 2.5 years. Approximately 30% of them were classified as A2. The findings of A2 results are generally a small nodule or a colloid cyst without nodular components, which are so insignificant that those participants are often not even referred to specialists in the routine clinical setting. Most are cysts, and >90% of them are multiple cysts of ≤5 mm. Only 0.5% had nodules of ≤5 mm, which are difficult to differentiate from cysts and are considered benign. All of these cases were re-examined by a specialist, and if malignancy was strongly suspected despite its small size of ≤5 mm, or if the routine re-examination in 2.5 years appeared to be too delayed, they were classified as B. There was one such case.

Secondary Examination

The external expert committee advised that the facility to be used for the secondary examinations should have a medical specialist of the Japan Thyroid Association, the Japan Association of Endocrine Surgeons, or the Japanese Society of Thyroid Surgery, and a medical specialist of the Japan Society of Ultrasound in Medicine (a body surface/general medical specialist). Because the secondary examination is currently applicable for only 0.5% of the participants, it has been undertaken at the Fukushima Medical

University Hospital since March. The above criteria for the suitably qualified facility for the secondary examination will be important in determining the facilities outside Fukushima Prefecture to serve the residents who have evacuated or moved to other prefectures. A more detailed confirmatory ultrasound examination is performed as the secondary examination. Following the secondary examination, it is then determined whether or not to perform fine-needle aspiration cytology on the basis of the diagnostic procedures in the revised edition of the Guidebook for Thyroid Ultrasound Screening[1] as well as the ultrasound diagnostic criteria of thyroid nodules (tumors) by the Japan Society of Ultrasound in Medicine[2]. Furthermore, the blood levels of FT4, FT3, TSH, TgAb, TPOAb, and Tg, as well as the urine iodine levels of all subjects will be measured. On the basis of the results of these tests, participants are offered one of the following: a routine follow-up, re-examination or follow-up at a secondary examination facility, or treatment such as surgery, as appropriate.

Future Prospects

The thyroid ultrasound examination is to be provided to all the residents in Fukushima aged 18 years or younger at the time of the earthquake, from the areas outside the evacuation zones, including Fukushima City and Koriyama City, from May 2012 to the end of March 2014.

A second round of examinations will commence from April 2014. Participants will then undergo thyroid examinations every 2 years until age 20, and every 5 years after that, for the rest of their lives.

We are in the process of designating and contracting other suitably qualified facilities to serve the evacuees living in other prefectures, so they will also be able to participate in the examinations.

This study was supported by the following seven academic societies: the Japan Thyroid Association, the Japan Association of Endocrine Surgeons, the Japanese Society of Thyroid Surgery, the Japan Society of Ultrasound in Medicine, the Japanese Society of Sonographers, the Japanese Society for Pediatric Endocrinology, and the Japan Association of Breast and Thyroid Sonology. The external committee formed by specialists from these seven societies is responsible for complying with the diagnostic criteria, qualifying the examiners, selecting the external facilities, and so forth.

Examiners for the primary screening examination are indicated to be a medical specialist of either the Japan Thyroid Association, the Japan Association of Endocrine Surgeons, the Japanese Society of Thyroid Surgery, or the Japan Society of Ultrasound in Medicine (a body surface/general medical specialist), a medical sonographer (specializing in the body surface), or a pediatric specialist of the Japan Endocrine Society. It was also recommended that the confirmatory secondary examination be performed at institutions that employ suitably qualified examiners of the Japan Association of Endocrine Surgeons, the Japanese Society of Thyroid Surgery, or the Japan Society of Ultrasound in Medicine (a body surface/general medical specialist).

For this long-term study, which will be conducted in the Fukushima cities from May 2012 onward, participation by local medical professionals within the prefecture is essential. Therefore, we are planning to develop a certification system whereby those professionals not meeting the criteria listed above will attend numerous relevant seminars such as the thyroid ultrasound screening training, undertake the appropriate examinations, and once qualified, will be able to contribute to this study.

For further sharing of information and examination results as well as developing a long-term follow-up system, the joint efforts and collaboration of relevant specialists and institutions will be critical. Your further support will be greatly appreciated.

Conclusion

An increase in thyroid cancer incidence is not expected in Fukushima, judging from the amount of radiation released during this incident, which is not equivalent in scale to the external and internal radiation exposures observed after the disasters in Hiroshima, Nagasaki, and Chernobyl. It is expected, however, that continuing a series of these large-scale, detailed examinations will result in the detection of a certain number of thyroid cancers far earlier than before, even though these may not be unrelated to this nuclear power plant accident. After 4–5 years in Chernobyl and 10–15 years in Hiroshima and Nagasaki, there was a rise in the thyroid cancer incidence observed among those who were <20 years at the time of the incidents. The situation in Fukushima differs significantly from these incidences. Therefore, in order to help monitor the long-term thyroid status, it is critically important to share with the community information about their thyroid status for the next few years, which is apparently unrelated to this nuclear reactor accident. The concern will not be eradicated by these rapid assessments, nor will the incidence of thyroid cancer be prevented by the examination itself. We believe, however, that developing the long-term health evaluation system, in which the residents may participate and may be monitored for their lifetime, will contribute to their overall well-being and reassurance. In other words, we have established a system that can monitor the thyroid status of our residents for the duration of their lifetime following this accident. We will continue to monitor and promote the life-long thyroid health of the children in Fukushima. To achieve this goal, further collaboration and understanding provided by the community of medical societies will be greatly appreciated.

References

1) 鈴木眞一、日本乳腺甲状腺超音波会議、甲状腺用語診断基準委員会編、甲状腺超音波ガイドブック改訂第2版、診断の進め方、3. 結節性病変. pp28_29、南江堂、東京、2012.
2) 日本超音波医学会用語・診断基準委員会、平成20・21年度結節性甲状腺腫用語診断基準検討小委員会、甲状腺結節（腫瘤）超音波診断基準（案）、超音波医学38:27-30、2011.
3) 鈴木眞一、甲状腺腫瘍の予後と予後因子、日本臨床69　増刊2:388-391、2011.
4) 第29回甲状腺外科検討会当番世話人報告.甲状腺癌の10年生存率. 1996.
5) 日本内分泌外科学会、日本甲状腺外科学会（編）:甲状腺腫瘍診療ガイドライン、金原出版、東京.
6) 鈴木眞一、臨床重要課題「福島県民健康管理調査における甲状腺検査」の経過報告、甲状腺学会ニュースレター19号:11-24、2011.

Establishment of a Partnership with Hiroshima University and Nagasaki University for Medical Care Countermeasures for the Fukushima Nuclear Accident
Kickoff Meeting: Overview of Conference on Research by Institutions on the Effects of Radioactivity

Planning and Financial Affairs Division

1. Background

i. Establishment of a Partnership with Hiroshima University and Nagasaki University

a. Purpose

The University entered into a partnership with Hiroshima University and Nagasaki University for establishing closer contact and cooperation with respect to teaching, research, and clinical activities in the wake of the incident at the Fukushima Daiichi nuclear power plant.

b. Date

Saturday, April 2, 2011, 14:00–14:15

c. Venue

Fukushima Medical University, Nursing Department Bldg. 1F, Department Head's Office

d. Attendees

National University of Hiroshima	ASAHARA Toshimasa, President
National University of Nagasaki	KATAMINE Shigeru, President
Fukushima Medical University	KIKUCHI Shin-ichi, President

ii. Kickoff Meeting for Medical Care Countermeasures for the Fukushima Nuclear Incident: Conference on Research by Institutions on the Effects of Radioactivity

a. Purpose

Inviting members and exchanging ideas regarding the promotion of proper understanding of radiation and establishing a conference on the effects of radioactivity aiming to establish a framework for the examination of the wide-ranging and long-term impact of radiation contamination (Members: National Institute of Radiological Sciences, Kyoto University Radiation Biology Center, Nagasaki University, Hiroshima University, Radiation Effects Research Foundation, and the Institute for Environmental Sciences).

b. Date

Saturday, April 2, 2011, 14:00–16:15

c. Venue

Fukushima Medical University, Nursing Department Bldg. 1F, Conference Room S101

d. Attendees

Members of the Conference on the Effects of Radioactivity, Fukushima Medical University, Fukushima Prefecture

iii. Membership in the Conference on the Effects of Radioactivity

a. Summary

Acceptance of membership in the Fukushima Medical University Research Conference on the Effects of Radioactivity

b. Date

Wednesday, April 27, 2011, 17:00–18:00

c. Venue

Aviation Conference Hall (Tokyo Metro Area)

d. Attendees

Medically qualified members of the Research Conference on the Effects of Radioactivity, Fukushima Medical University