

Part 4

Summary

Radiation Medical Science Center for the Fukushima Health Management Survey
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In order to maintain and improve the health of people of Fukushima Prefecture during and since the accident at TEPCO's Fukushima Daiichi Nuclear Power Plant, the Radiation Medical Science Center for the Fukushima Health Management Survey (hereinafter "Center") has been conducting this large-scale health survey, consisting of a Basic Survey and four Detailed Surveys: Thyroid Ultrasound Examination, Comprehensive Health Check, Mental Health and Lifestyle Survey, and Pregnancy and Birth Survey. We have also been providing necessary support based on the results of the survey while offering information and conducting outreach activities to ensure a proper understanding of the effects of radiation. The main activities and results of each survey for the past 10 years are summarized as follows.

Basic Survey

[Actions and Results]

To address concerns regarding effects of radiation attributed to the nuclear accident, the Basic Survey was launched with the aim of estimating external exposure doses, based on individual behavioral records and mapping of air dose rates over the first 4 months, with estimates provided to each participant. This is intended to help maintain and promote the health of prefectural residents well into the future. The Basic Survey is available to all who were registered as residents in Fukushima Prefecture, as well as temporary residents at the time of the March 2011 earthquake (2,055,251 people).

As of March 31, 2020, there were 568,632 people out of 2,055,251 who responded to the survey, a response rate of 27.7%. The external exposure doses for the four months following the

nuclear accident were estimated for 466,367 people excluding radiation workers. As a result, the following findings were obtained.

1. In the whole prefecture, 99.8% of the residents were exposed to less than 5 mSv, 93.8% to less than 2 mSv, and the maximum exposure estimate was 25 mSv. The mean was 0.8 mSv and the median was 0.6 mSv.
2. International organizations such as UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation) estimated doses based on various assumptions of evacuation behavior, generally leading to overestimates of radiation exposure. The Basic Survey used records of behavior reported by residents, yielding more reliable dose estimates.
3. Individual results were not only sent to residents, but also overall results are shared with international organizations such as UNSCEAR and IAEA (International Atomic Energy Agency), so that they can better understand effects of the nuclear accident.
4. The dose estimation results obtained from this survey were considered as "not being at a level where health effects can be confirmed with a statistical significance in light of the scientific knowledge obtained to date" (Interim Report of the Fukushima Prefectural Oversight Committee for the Fukushima Health Management Survey).
5. By verifying the representativeness of those who participated in the Basic Survey, it was concluded that external exposure estimates reported so far reflect without bias the situation of the entire population of the prefecture.
6. A method for assessing internal thyroid exposure doses was developed in which information on behavior records obtained from the Basic Survey and information on air dose rates

obtained from an atmospheric diffusion simulation model were combined.

Dose estimation for those who submitted questionnaires is still ongoing; through March 2020, external exposure doses for a cumulative total of 554,320 people have been estimated, and most of them have been notified. As the response rate to the questionnaires slowed down, we have provided support for filling them out at various locations. We also created a simplified version of the questionnaire that can be filled out in a short period of time to improve the response rate. As a result, the response rate for people aged 0 to 9 at the time of the earthquake increased to 45.8%. In addition, the Center accepts requests to resend questionnaires through its website and at its call center, and also provides flyers on the Basic Survey at the counters of municipal offices, thus maintaining contact points for those who wish to know their own external exposure doses.

[For the future]

As more than nine years have passed since the Great East Japan Earthquake, it has become difficult to recall daily activities around the time of the nuclear accident. However, it is necessary to continue to maintain a contact point for those who want to know their external exposure in the early period after the accident.

In addition, it is expected that progress will be made in research to elucidate the initial internal exposure using the behavior records, etc., obtained from the Basic Survey.

Thyroid Ultrasound Examination (TUE)

[Actions and Results]

The increase in thyroid cancer in children due to internal exposure to radioactive iodine has been reported as a health hazard after the Chernobyl nuclear power plant accident. The exposure dose of radioactive iodine to the residents of Fukushima is said to be lower than that of Chernobyl. However, for the purpose of ascertaining the condition of the thyroid glands of Fukushima children and monitoring their health over the long term,

the Thyroid Ultrasound Examination program started for approximately 368,000 prefectural residents who were between the ages of 0 and 18 at the time of the disaster and for approximately 381,000 residents including those who were born in the year following the disaster in the Full-Scale Surveys, as described below.

The TUE implementation schedule was as follows: a Preliminary Baseline Survey (PBLs) was conducted over a period of three years to initially examine thyroid glands, followed by Full-Scale Surveys (FSS) for comparison with the PBLs results. In FSS, eligible persons are expected to receive thyroid examinations every two years until the age of 20, and then every five years thereafter at the age of 25, 30, and so on. Participants first received ultrasonography as a primary examination, and then, for those with certain findings, more detailed ultrasonography, urinalysis, and blood tests were performed as secondary confirmatory examination. Only when judged to be necessary, fine needle aspiration cytology has been performed.

In conducting thyroid examinations, we have established criteria to reduce the risk of over-diagnosis of thyroid cancer, explained the advantages and disadvantages of the examination to participants, and proceeded only with those who consented. In the case of examinations conducted at schools, information on examination dates is sent to eligible persons and their parents/guardians, with instructions for how to return their consent to the Center as a matter of free choice. The results of the past surveys are as follows.

1. Following the Preliminary Baseline Survey that started in October 2011, Full-Scale Surveys have been conducted. As of December 2020, the fifth-round survey is underway. For the convenience of participants, examinations were offered at designated facilities in and outside Fukushima Prefecture, including elementary, junior high, and high schools; some universities; and various public facilities, at times including evenings and holidays.
2. As of March 31, 2020, a total of 246 people had been diagnosed as having nodules thought to be malignant or suspicious for malignancy: 116 in the PBLs (the first round), 71 in the first

- FSS (the second round), 31 in the second FSS (the third round), 21 in the third FSS (the fourth round), and 7 in the survey for examinees at age 25.
- The detection rate of thyroid cysts, nodules, and thyroid cancer in children and adolescents by age group and sex was shown by the TUE.
 - The results of the PBLs and the first FSS (the second round) showed no clear dose-response relationship between the external exposure dose from the Basic Survey or the absorbed thyroid dose estimated by UNSCEAR and the detection rate of nodules diagnosed as malignant or suspicious for malignancy.
 - Based on a comprehensive evaluation of the results of the PBLs, the Oversight Committee expressed the view that thyroid cancers found thus far cannot be attributed to radiation. For the results of the first FSS, the Oversight Committee also noted that no causal relationship could be identified between radiation exposure and thyroid cancer detected at this time. Thus, the TUE program continues to address questions pertaining to the nuclear accident and thyroid cancer at each stage of its implementation.
 - In order to promote understanding of the advantages and disadvantages of receiving the thyroid examination, the characteristics of thyroid cancer, and the overall examination results, Thyroid Newsletters (13 issues thus far) have been sent to those eligible for examination. In addition, we have been conducting public relations and promotional activities such as on-location lectures for students (77 times with a total of 6,303 participants) and on-location information sessions for parents/guardians (217 times with a total of 8,783 participants), and web videos.

In addition, in order to respond to questions and anxieties about the thyroid examination, we have been providing support to those taking a primary examination and their parents/guardians by explaining in person the results after the examination at public venues and providing individual explanations through our call center and dedicated medical consultation line. In the confirmatory examination, our Thyroid Support

Team provides psychological and social support to participants and their families who are highly anxious about thyroid cancer and the health effects of radiation, by listening to their thoughts, providing them with appropriate information, and helping them to make decisions on their own. This helps to reduce the anxiety of the participants.

[For the future]

In the future, it will be necessary to continue the TUE program while ensuring the voluntary nature of the examinations, providing opportunities to receive examinations in line with the growth of eligible persons, and providing more careful explanations about the examinations, including advantages and disadvantages. It is also necessary to build and develop our cohort of examiners.

In addition, it is expected that data from other surveys, etc. will help identify any relationship between radiation caused by the nuclear accident and thyroid cancer, for which more support needs to be provided.

Comprehensive Health Check

[Actions and Results]

As a result of the March 2011 earthquake and nuclear power plant accident, many people had to live as evacuees, and their lifestyles and environment, including dietary and exercise habits, changed drastically. Periodic health checks under Japan's system of universal health coverage became harder to obtain, leading to increased anxiety about personal health. To address this, the Comprehensive Health Check (CHC) program has been conducted for approximately 210,000 residents of the 13 municipalities nationally designated as the evacuation zone in order to monitor their health status, prevent lifestyle-related diseases, and detect and treat diseases in their early stages.

Taking advantage of existing specific or general health check programs conducted by municipalities, the CHC incorporates such health check items as blood counts and urine occult blood tests for people aged 16 and above. In light of the

situation where residents of evacuation zones moved outside the prefecture, efforts have been made so that they, too, can receive health checks near their current residence. For those aged 15 and under, we have arranged for health checks at any designated medical facilities both in and outside the prefecture. The results of the CHC revealed the following.

1. A certain number of children aged 15 and under showed obesity, dyslipidemia, hyperuricemia, liver dysfunction, hypertension, and glucose intolerance after the earthquake. Subsequent follow-up showed that obesity had improved, but the improvement in dyslipidemia was delayed.
2. In the health checks for residents aged 16 and above, there was an increase in obesity, hypertension, dyslipidemia, diabetes, renal dysfunction, hepatic dysfunction, hyperuricemia, and polycythemia after the earthquake, suggesting that the health effects were mainly due to changes in the living environment caused by evacuation. On the other hand, liver dysfunction improved with improvement in exercise and diet.
3. The analysis of the results of these health checks and the changes in residents' living environment showed that an increase in metabolic syndrome has correlation with changes in diet and post-traumatic stress disorder (PTSD).
4. There was no change in the white blood cell count or its differential within one year after the earthquake, so no direct effects of radiation have been confirmed.
5. By assessing the health status of residents in the evacuation zone through health checks, we observed that decreases in physical activity and changes in dietary habits due to evacuation may have contributed to the increase in body weight and obesity and that evacuation may have contributed to the development of lifestyle-related diseases.

The CHC has helped to provide opportunities for health checks for people in the wake of major changes to their living environment. Health check results are sent to each participants, and for those

aged 15 and under, the results are explained by the responsible doctor.

In addition, we prepared a report on the analysis of health check results for each municipality; these are explained and opinions are exchanged at periodic briefing sessions with the 13 municipalities. As part of our activities to maintain and promote the health of prefectural residents, we also held health seminars, consisting of lectures by medical doctors and individual consultations by specialists, at events such as health check result reporting meetings and health classes conducted by the municipalities.

By proactively feeding back the health check results to the community, treatment rates have increased, with concomitant improvements in blood pressure and LDL cholesterol levels. Furthermore, we analyzed the incidence of lifestyle-related diseases in relation to lifestyle and mental health status, identifying potential causalities. Based on these findings, we have provided advice to municipalities and local residents on the importance of exercise and nutritional management, as well as mental health care and promotion of social engagement.

[For the future]

With regard to the health status of the residents of the 13 municipalities, as found through the CHC, an increase in lifestyle-related diseases has emerged with changes in the living environment caused by evacuation, etc. Therefore, it is necessary to continue the CHC and analyze its data to provide information and advice to municipalities, which are at the forefront of promoting the health of their residents.

In addition, in order to maintain and improve residents' health, it is necessary to promote effective measures such as encouraging local residents to raise awareness of health promotion in cooperation with municipalities.

Mental Health and Lifestyle Survey

[Actions and Results]

Many people have been suffering from anxiety and stress due to their experience of the Great East Japan Earthquake, the nuclear accident, and the evacuations that followed. In response, a survey on the physical and mental health and lifestyle of prefectural residents has been conducted with the aim of providing appropriate health, medical, and social support for residents in need. Questionnaires were sent to approximately 210,000 residents of 13 municipalities designated as the evacuation zone.

The questionnaire focused on physical and mental health issues related to stress caused by prolonged evacuation. We adopted high-risk assessment tools to assess general mental health (K6), risk of emotional and behavioral problems in children (SDQ), risk of drinking problems (CAGE), and obesity (BMI) as principle indicators. In addition, considering the specificity of this disaster, questions on other related items (exercise and sleep habits, drinking and smoking, dietary habits, radiation risk perception, and availability of consultation/counseling resources) were also included. As a result, the following was revealed.

1. Regarding the general mental health (K6) of adults (aged 16 and above), the proportion of those with high-risk scores on K6 was very high in the first year of the survey, but improved substantially during the first three years. However, there has been little recovery since then, and K6 scores have remained higher than national averages. In particular, it was shown that the proportion of those with high-risk scores was higher among those who had evacuated outside the prefecture than those who remained in the prefecture.
2. From the perspective of SDQ (Strengths and Difficulties Questionnaire), which assesses a child's emotional and behavioral state, the proportion of those with high-risk scores has also improved substantially compared to the first year, but it remains high among elementary and junior high school students. Parallel to the results for adults, the proportion of school-age

children with high-risk scores is higher among those who had evacuated outside the prefecture.

3. In terms of lifestyle habits, such as exercise, smoking, and drinking, there has been a gradual improvement compared to the first year of the survey. Especially for exercise habits, the situation is little different, and possibly better, than national data.
4. As for radiation risk perception, it improved to some extent in the first three years, but has remained almost unchanged since then. In other words, anxieties about the health effects of radiation exposure (delayed effects and next-generation effects) are still quite high. In addition, concerns about the effects of radiation exposure on the future generations have consistently been higher than concerns about the delayed effects of radiation exposure.
5. A strong association between the level of general mental health (K6) and radiation risk perception has been consistently observed.

The Mental Health Support Team, consisting of clinical psychologists, public health nurses, and other nurses, provided telephone support to a total of more than 30,000 people over the eight-year period from 2011 to 2018, who were identified in need of consultation and support regarding their mental health and lifestyle. According to a follow-up (interview) survey, conducted four years later, about 80% of the telephone support recipients expressed satisfaction with it, which suggests that the support was helpful, at least subjectively. Local survey results are reported to each municipality, and advice is provided based on the survey results. For residents identified as needing urgent support, information about them is shared with the Fukushima Center for Disaster Mental Health as well as responsible municipal authorities, and prompt follow-up is strongly encouraged.

Knowledge obtained through the survey and considered effective in promoting health and providing support is disseminated in a population-based approach. For example, we dispatch specialists and hold lectures for residents in response to requests from municipalities and other support organizations. Recently, we held

such opportunities in conjunction with briefing sessions with the 13 municipalities designated as the evacuation zone, a symposium jointly organized with Fukushima University, a workshop at the Fukushima Center for Disaster Mental Health; and other events hosted by the affected municipalities.

We have also provided relevant information at meetings of the Councils of Medical Facilities conducting Thyroid Examinations.

[For the future]

Future prospects for the Mental Health and Lifestyle Survey include an annual survey on items that may be directly related to support for those with depressive tendencies, sleep problems, drinking problems, etc., and to conduct a detailed survey similar to the previous surveys every three to five years, in consideration of the psychological burden on survey participants. In addition, it is expected that the findings from the survey will be reflected in measures for the care of affected residents.

With regard to the support program, the effectiveness of telephone support was recognized to a certain extent in the follow-up survey. As there are still many residents who evacuated to remote areas outside the prefecture, it is necessary to continue to provide telephone support, as has been done so far, to those who are eligible.

At the same time, in consideration of support for non-respondents who may be at high risk scores, the support program should be enhanced by strengthening a network with municipalities and support organizations through careful information sharing and opinion exchange, and by supporting health promotion and awareness-raising activities conducted by municipalities.

In addition, since the perception of radiation risk is strongly associated with depressive tendencies, it is necessary to provide more comprehensive support by deepening cooperation with organizations and departments that conduct risk communication.

Pregnancy and Birth Survey

[Actions and Results]

We have conducted the Pregnancy and Birth Survey in order to understand the physical and mental health of pregnant and nursing mothers in Fukushima Prefecture after the Great East Japan Earthquake and the nuclear power plant accident, to alleviate their anxiety and provide necessary care, and to help improve obstetric and perinatal services. Questionnaires are sent every year to 13,000 to 16,000 pregnant and nursing mothers who had received a Maternal and Child Health Handbook by municipalities in Fukushima, and those who had received one outside Fukushima but delivered their babies in the prefecture.

In addition, follow-up surveys are conducted four years after childbirth, considering the high proportion of depressive tendencies among respondents to the survey right after the earthquake. The purpose of the follow-up survey is to ascertain the health status of the respondents and continue to provide telephone support to those who need it. Questionnaires were sent to 7,300 main survey respondents whose babies were known to be alive four years after delivery as of 2015, and to 5,900 respondents as of 2018. As a result of these two follow-up surveys, the following points were revealed.

1. The number of pregnancies and childbirths in Fukushima Prefecture decreased in FY2012, but recovered in FY2013, and has been on a downward trend since then, similar to the national trend.
2. Based on the results of the surveys from FY2011 to FY2018, preterm births were 4.6% to 5.6% of all births, and 8.6% to 9.6% of all those born with a low birthweight. According to the same year's Vital Statistics, the national averages of preterm births and low birth weight babies were almost the same, ranging from 5.6% to 5.8% and from 9.4% to 9.6%, respectively.

Incidence of congenital anomalies ranged from 2.19% to 2.85%, which is close to the 3% to 5% that is generally reported.

3. Regarding the mental health of mothers, the

proportion of those with depressive tendencies decreased over time from 27.1% in the FY2011 survey to 18.4% in the FY2018 survey. Respondents to the FY2011 and FY2012 surveys still showed high levels of anxiety about radiation in the follow-up surveys four years later. The proportion of those with depressive tendencies was high among FY2011 and FY2012 respondents, at 25.6% and 25.7%, respectively. However, it turned to a decreasing trend over the years, with 23.5% among FY2013 survey respondents and 22.5% among FY2014 survey respondents.

4. The proportion of those identified in need of support based on responses to questions related to depressive tendencies was 13.1% in the FY2011 survey, but has decreased over the years to 6.4% in the FY2018 survey.
5. With regard to the content of telephone support, 29.2% of the respondents answered that they had concerns about radiation effects in the FY2011 survey, but the proportion decreased year by year to 3.4% in the FY2018 survey. Since FY2012, the top responses regarding their concerns have been "mother's own physical and mental state" and "child rearing (daily life) related issues."
6. Among comments written in the free comment section of the questionnaire, the proportion of comments regarding "radiation effects on the fetus/child" was 29.6% in the FY2011 survey, but has been decreasing year by year to 1.8% in the FY2018 survey.
7. Since the FY2012 survey, we have been asking whether or not respondents wish to become pregnant again or have another baby, and more than half of the respondents, ranging from 52.2% to 57.1%, responded that they wish to become pregnant again or have another baby.

By conducting the survey annually, we contributed to continuous monitoring of pregnant and nursing mothers in Fukushima Prefecture. In addition, we explained survey results at meetings convened for that purpose, organized for public health nurses, hospital nurses, and related organizations in the prefecture. Various conferences organized by the prefectural government also provided opportunities to share survey informa-

tion, and we also gave survey results to each municipality in response to their requests.

As the prevalence of depressive tendencies was particularly high immediately after the earthquake, follow-up surveys were conducted at four years post-partum, covering those who were pregnant or nursing a baby at the time of the earthquake, with aims to reduce their anxiety and provide necessary care and ongoing support.

For those who were identified in need of consultation and support based on their responses to both main and follow-up surveys, telephone support is provided by midwives, public health nurses, and other qualified support staff. In addition, when judged that individual home visits are necessary, we share information with the municipalities, and provide a help line and email address specific to this survey for easy of consultation. In response to anxiety about radiation effects, we made use of the "Physical and Mental Health Support Booklet for Children and Parents" and also prepared a leaflet to introduce an overview and results of the survey, which was enclosed with the survey questionnaire.

In the immediate aftermath of the disaster, the most common concern was about the effects of radiation, but since FY2012, the number of consultations has been decreasing year by year, with many consultation topics being about the physical and mental state of mothers themselves and issues related to child-rearing.

[For the future]

The Oversight Committee for the Fukushima Health Management Survey discussed and proposed to end the Pregnancy and Birth Survey in 2020, based on the fact that the prefectural and municipal governments have been enhancing various measures to create an environment where people can give birth and raise their children with peace of mind, and since Comprehensive Support Centers for Families with Children have been established in each municipality.

In the future, it will be necessary to actively disseminate the results of the survey, and to collaborate with the prefectural government on how to transfer the knowledge and practical know-how obtained through the survey and to support the maternal and child health services of the pre-

fectural and municipal governments, as well as the services of the Comprehensive Support Centers for Families with Children.

As for the follow-up survey, the Oversight Committee stated that the necessity of continuing follow-ups in the future needs to be examined based on the results of the second follow-up survey conducted in FY2019 and FY2020.

Public communications/International cooperation

[Actions and Results]

The results obtained from the Fukushima Health Management Survey (FHMS) are analyzed with statistical and epidemiological rigor for publication in academic journals and presentation domestically and internationally at symposiums and other events. The results of each survey have been widely disseminated within and outside the prefecture through various publications and public relations outlets, the use of our website, the holding of international symposiums, visits to municipalities, and participation in various events, all of which has contributed to a better understanding of the results. In particular, international symposiums have been held with the participation of prefectural residents, experts, and government officials, with the aim of explaining the results of the FHMS in an easy-to-understand manner, deepening discussions, and disseminating the results both domestically and

internationally. In questionnaire surveys conducted after such symposiums, we receive positive feedback and words of encouragement for the FHMS.

In addition, in order to provide information to help better understand the radiation and its effects, we have been conducting public relations activities such as holding periodic briefing sessions with 13 municipalities, holding health seminars, publishing pamphlets in Japanese and English, explaining the results and findings of the FHMS, making web videos explaining the advantages and disadvantages of receiving thyroid examinations, and enhancing our website.

[For the future]

As we approach the 10-year anniversary of the earthquake and the start of the survey, it is necessary to establish a new framework to understand the needs that have become increasingly diverse over time and to provide information, while conducting public relations activities in an engaging way, by utilizing various media and human resources for communication with the people of Fukushima.

In addition, it is necessary to continue international collaboration activities in order to obtain cooperation and support from international organizations related to radiation, and scientific advice and support from overseas experts, etc., in order to elucidate health effects related to the nuclear accident and to address people's anxieties.