2024年 福島県立医科大学『県民健康調査』国際シンポジウム
公立大学法人福島県立医科大学放射線医学県民健康管理センター
国際シンポジウム事務局（広報・国際連携室）
✉ kenkani@fmu.ac.jp　Tel: 024-581-5454(平日9～17時)
2024 Fukushima Medical University International Symposium on the Fukushima Health Management Survey
Secretariat of International Symposium
Office of Public Communications and International Cooperation, Radiation Medical Science Center for the Fukushima Health Management Survey, Fukushima Medical University
✉ kenkani@fmu.ac.jp, TEL: +81-24-581-5454 (Weekday, 9a.m. - 5 p.m. JST)

Session 1 【Insights - what we have learned from the people of Fukushima】

Basic Survey
—Experience in dose estimation involving around two million people

Tetsuo Ishikawa

Radiation Medical Science Center

for the Fukushima Health Management Survey

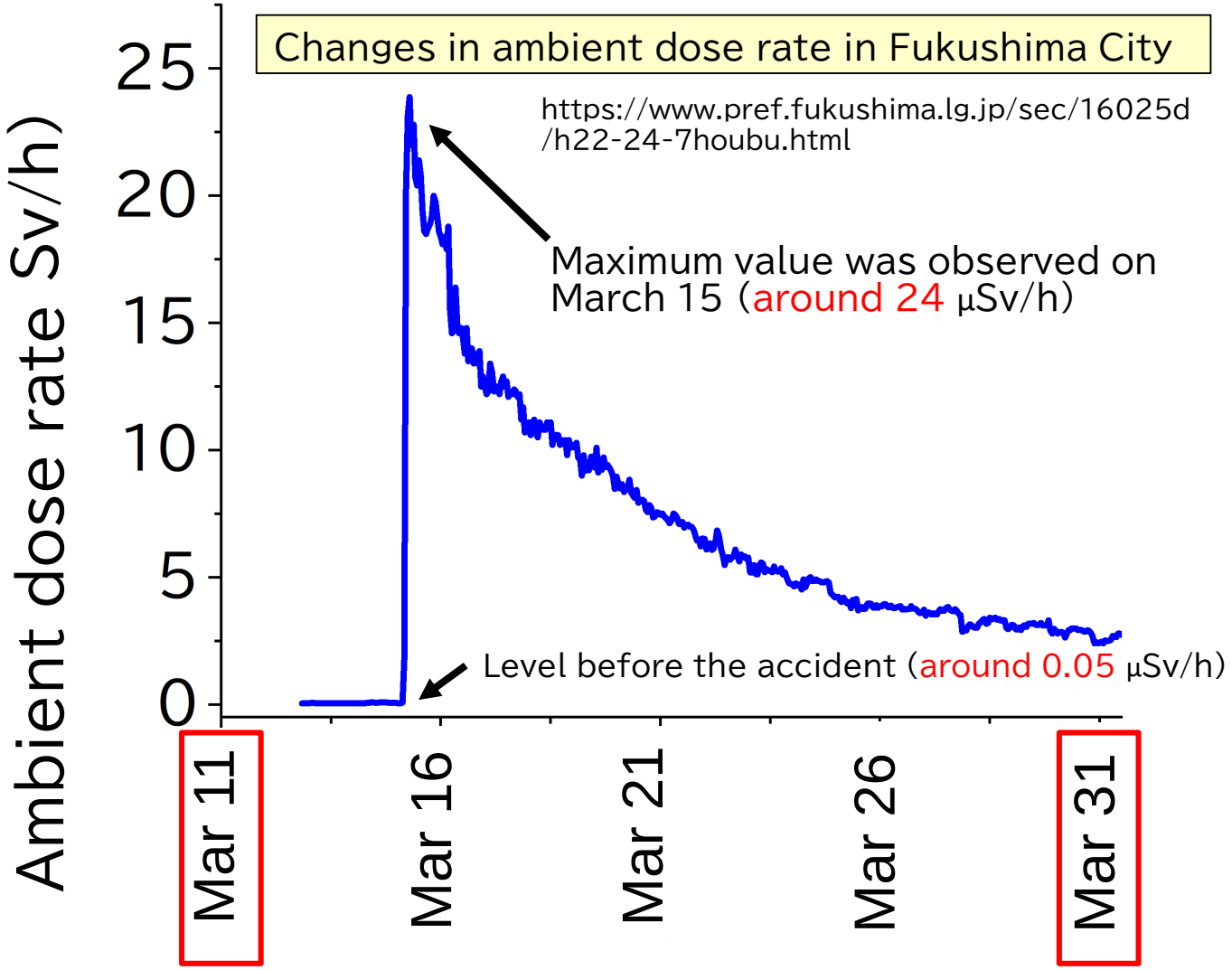
Fukushima Medical University

Circumstances in the early post-accident period

Environmental radiation level (ambient dose rate) jumped up

It was difficult for residents to get information on their radiation exposure dose levels, because radiation measurement devices such as monitoring posts or personal dosimeters were not widely available

Changes in ambient dose rate in Fukushima City



Monitoring post
(The device indicating ambient dose at that place)

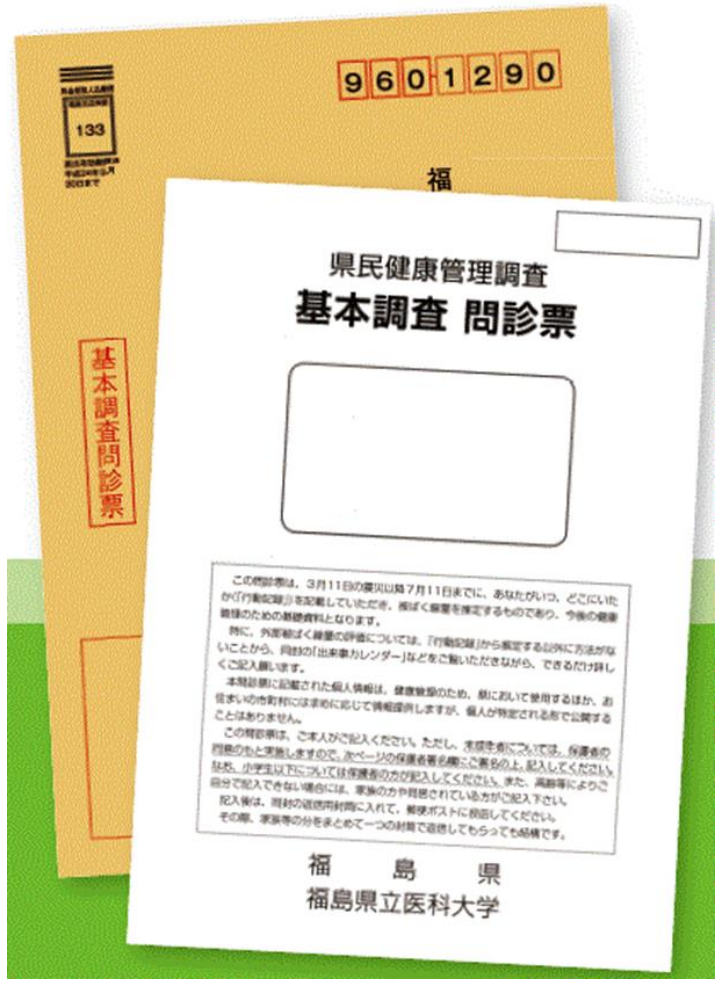
These devices were not widely available just after the accident

Personal dosimeter
(The device which records integrated exposure dose for a person who wears it)

https://www.city.fukushima.fukushima.jp/hoken-hk/bosai/bosaikiki/shinsai/hoshano/hosha/hkenkou-kanri190205.html

Purpose and eligible people for the Basic Survey

- Residents were asked to record and send back information on their behavior in the early post-accident period (self-administered questionnaire). Individual external doses (exposure doses from radiation in environment) were estimated based on their behaviors and notified to respondents by post.
- The purpose was to ascertain the level of exposure of the entire population of the prefecture due to the accident and to link such data to the improvement and maintenance of their health into the future.
- Eligible people were registered residents in Fukushima Prefecture between March 11 and July 1, 2011 (around 2.06 million people). Questionnaires were distributed from June 30, 2011.

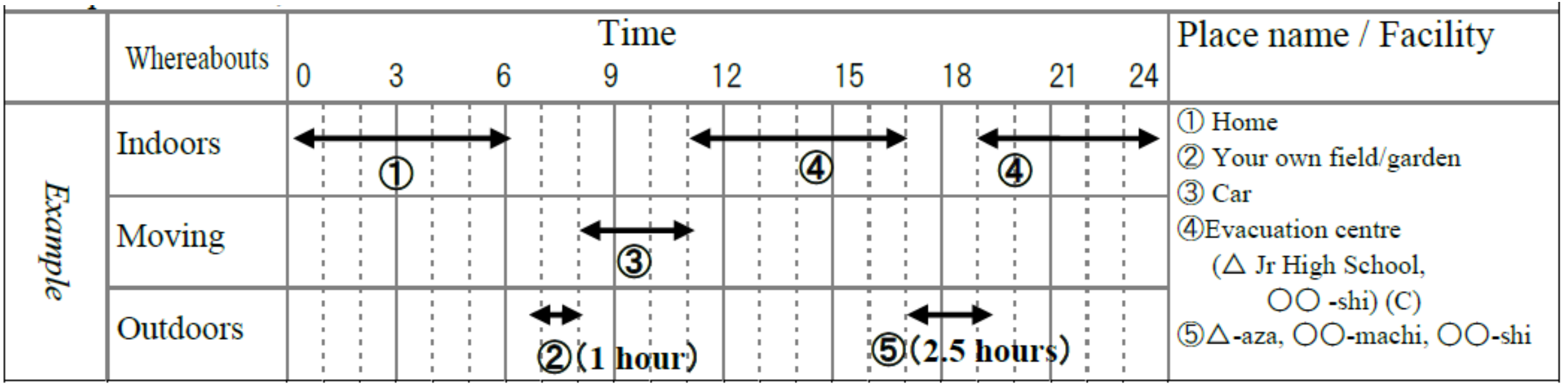


- Those who lived in the prefecture between March 11 and July 1, 2011, but whose resident registration was outside the prefecture.
- Those who lived outside the prefecture and commuted to work or school in the prefecture.

For those who fall into the above two categories, questionnaires are sent upon their request.

Sample of behavior record sheet to the questionnaire (major part)

Behavior record sheet form for the period from March 11, 2011(the day of earthquake) to March 25



The items to be filled in for the period from March 26 to July 11, are:

- Area(s) of residence
- Average time spent outdoors per day
- Place of regular outing (place of employment or education), etc.

Period for dose estimation: four months from March 11, 2011 to July 11, 2011

Infants and children are also included in the eligible people
For minors: Guardian's signature is required for submission of the questionnaire

Outline of dose calculation method

Information on whereabouts including staying indoor or outdoors

Dose reduction effects by staying indoors is also considered

Questionnaire survey

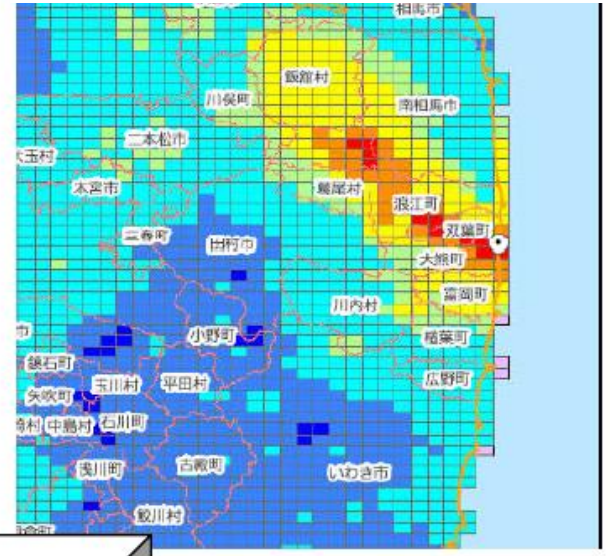
Whereabouts are converted to the longitude and the latitude data

Source: National Institutes for Quantum Science and Technology
"System overview", The external exposure doses estimation evaluation system
https://www.qst.go.jp/uploaded/attachment/2123.pdf

Results of ambient dose measurements

Digitized behavior records

Daily ambient dose rate maps



Individual doses were estimated by superimposing digitized behavior records and ambient dose rate maps

National Institute of Radiological Sciences (current name: National Institutes for Quantum Science and Technology) developed a computer program for this calculation

Flow of the Basic Survey

Dose estimation for individual respondents

Distribute questionnaire form

Collect questionnaire responses

Digitize behavior records

Estimate doses using calculation program

Send results to respondents

Providing scientific information to individuals about radiation exposure in the early post-accident period, when there was no sufficient information was made available for residents.

Questionnaire writing support

Ask the respondents and supplement records, if an address or building name is ambiguous (more than 60,000 people)

Example: “I was at my relative’s house” (such information cannot be converted to longitude and latitude, and dose estimation is not possible)

Number of responses peaked at around 8,000 per day

Analysis to identify the general trend

Aggregate the dose estimate data

Report to the Oversight Committee
Publish in academic journals

Scientific data and insight on the situation of radiation exposure in Fukushima are disseminated nationally and internationally

Activities to support completing the questionnaire (writing support) and study on representativeness

Writing support was mainly offered at the following places

- Temporary housing facilities
- Thyroid Ultrasound Examination venues (public facilities)
- Health check venues in municipalities
- City halls and other government buildings, etc.

Writing support booth

Overall response rates for the entire prefecture: 27.7%
(as of March 31, 2023 for all 59 municipalities)

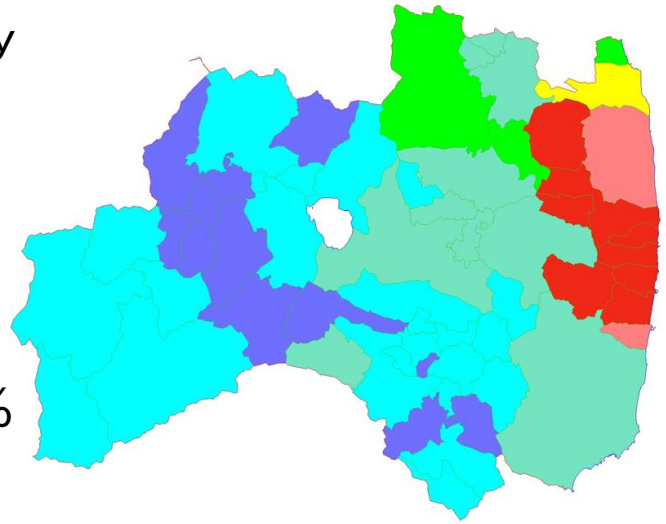
The response rates more than 50% : 8 municipalities
The response rates 40% - 50% : 2 municipalities
(Areas marked in red in the right figure)

Response rates by municipality

>50%

40 - 50%

Other areas: less than 40%



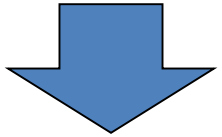
Ishikawa T et al.: Radiat Environ Med 8(2) 118-126 (2019)

The results of the study on representativeness indicate that the dose distributions obtained thus far are considered also to be unbiased dose distributions for the entire prefecture.

Notification to individuals of exposure doses

The results of dose estimation are sent to each individual

Major part of the result report



Notification of exposure doses

The result of external exposure doses estimation based on your responses to the questionnaire of the Basic Survey is as follows:

Estimated external exposure doses received during “estimation period” is printed here were estimated at:

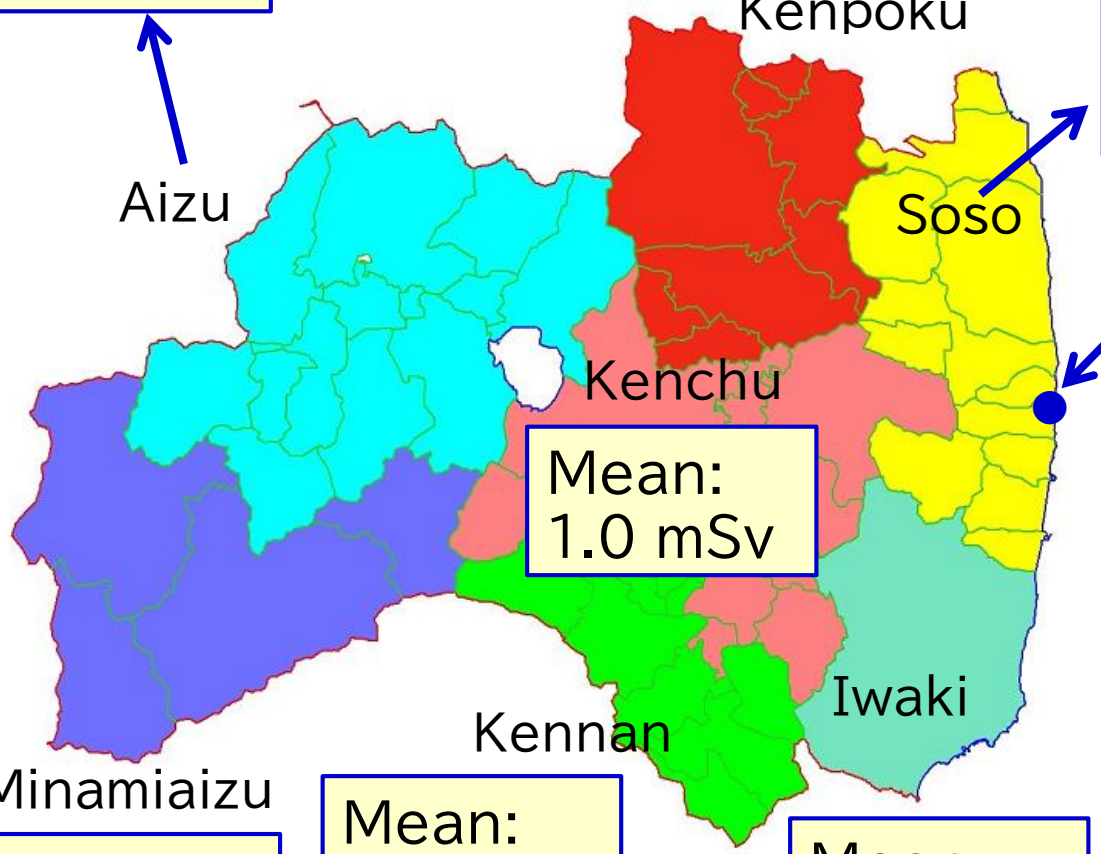
Estimated exposure doses (mSv)

The results of dose estimation has been sent to around 555,000 respondents including those with behavior records of less than 4 months

Estimated external doses over the four months following the accident (as of March 31, 2023)

Sources: materials for 48th Oversight Committee Meeting

Mean doses for each region



< 1 mSv: 77.3%
< 2 mSv: 94.9%
< 3 mSv: 97.2%
Mean: 0.7 mSv

The distribution of 467,256 respondents, excluding former radiation workers

< 1 mSv: 62.2%
< 2 mSv: 93.8%
< 3 mSv: 99.3%
Mean: 0.8 mSv
Maximum: 25 mSv

Evaluation by Oversight Committee

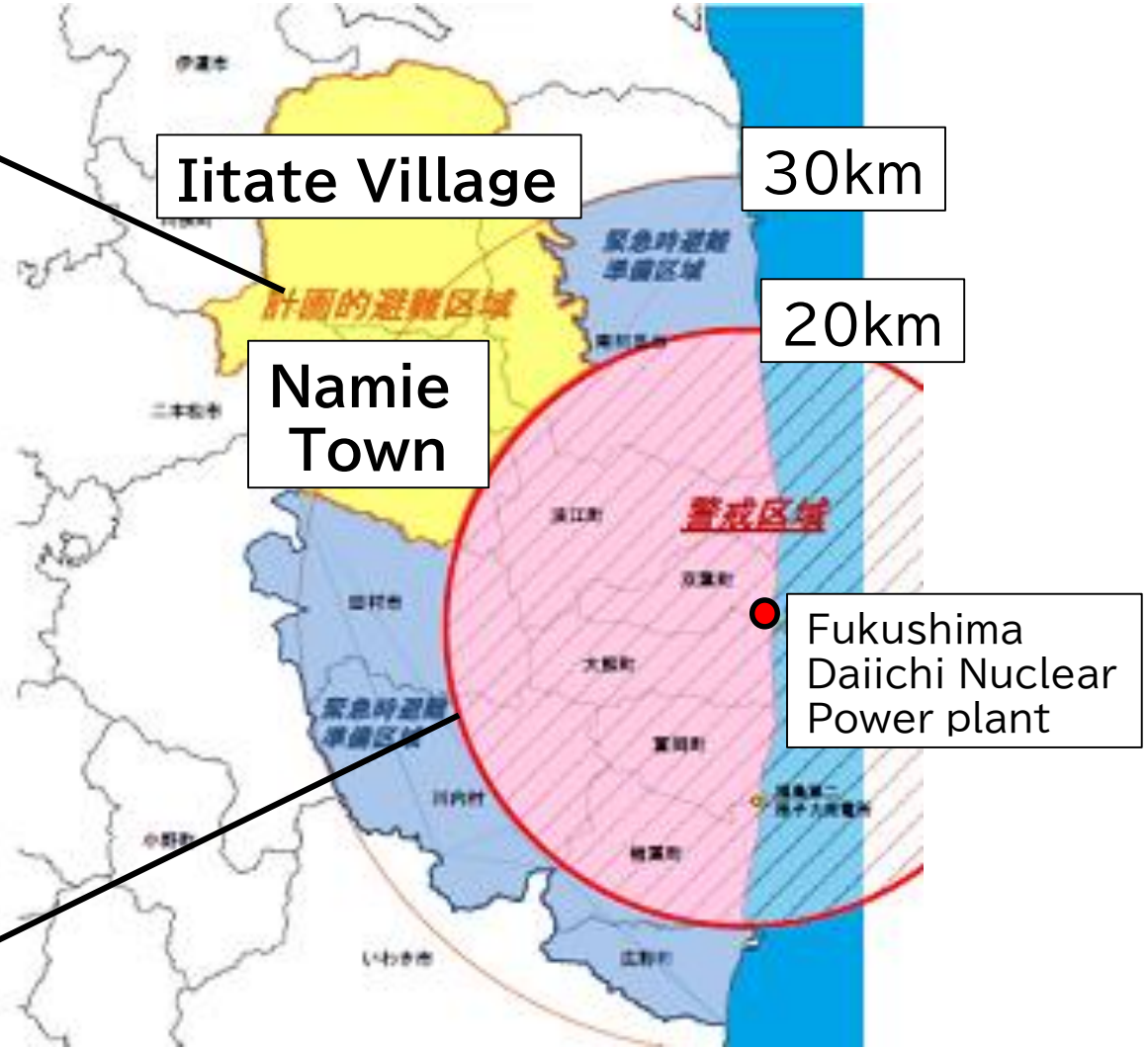
Radiation doses estimated so far are unlikely to cause adverse effects on health, although this conclusion is based on external exposure doses estimated only for the first four months following the accident

Importance of behavior records in dose estimation

On April 22, 2011, “Planned evacuation zone” (area marked in yellow in the right figure) was established, because the cumulative dose received by residents was likely to reach 20 mSv within one year after the accident

The residents were instructed to evacuate within around one month. Actual timing of evacuation was considered to be different among the residents

The national government issued the evacuation order for the 20 km radius on March 12, 2011 (the next day of the earthquake)



https://www.pref.fukushima.lg.jp/site/portal/cat01-more.html

Importance of behavior records in dose estimation (Namie Town and Iitate village)

WHO: World Health Organization
UNSCEAR: United Nations Scientific Committee on the Effects of Atomic Radiation

Major assumptions used for estimating the first-year dose after the accident

Almost less than 10%

WHO 2012 report
10～50 mSv
(Adults in Namie Town and Iitate Village)

Residents stayed in the planned evacuation zone for four months and then evacuated out of it
They spent 8 hours outdoors per day

UNSCEAR 2013 report
5.0, 7.0 mSv (Adults in Namie Town)
7.8, 8.0 mSv (Adults in Iitate Village)

Two typical evacuation scenarios were assumed for Namie Town and Iitate Village, each

UNSCEAR 2020/2021 report
0.25～3.1 mSv (Adults in Namie Town)
0.36～5.5 mSv (Adults in Iitate Village)

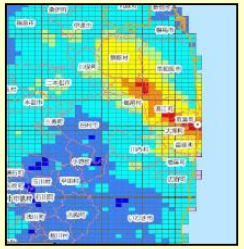
Actual evacuation patterns estimated from behavior records obtained in the Basic Survey (5 typical patterns for Namie Town and 4 typical patterns for Iitate Village)

石川徹夫:福島原発事故・県民健康調査① 被災者の被ばく線量推計. 公衆衛生 87巻, 1094-1102 (2023)より引用(一部改変)

Assessment of internal thyroid exposure doses using behavior records

Behavior records after the accident

+ Ambient dose rate maps



Estimation of external exposure doses (Basic Survey)

Conversion to external thyroid doses

+

Results from projects other than the Basic Survey

Behavior records after the accident

+ Airborne radioiodine concentrations in the early post-accident period (estimation by computer simulation)

Estimation of internal thyroid doses (via inhalation)

+

Behavior records after the accident

+ Waterborne radioiodine concentrations in the early post-accident period (estimation by combination of simulation and measurements)

Estimation of internal thyroid doses (via ingestion)

Behavior records obtained in the Basic Survey

Total thyroid doses are used for case-control studies on thyroid cancer

Summary -significance of the Basic Survey for estimating doses in the early post-accident period-

- Basic Survey estimates individual external doses, when measuring instruments were not widely available. Notification of exposure doses was sent to around 555,000 respondents.
- The mean dose for the whole prefecture was 0.8 mSv and the maximum dose was 25 mSv.
- Although the activities to improve the response rate has been continued, it has not changed substantially, thus, we implemented “Study on representativeness.” As a result of the study and its analysis, it indicated that the dose distributions obtained thus far are considered to be an unbiased depiction of dose distribution for the entire prefecture.
- According to the Oversight Committee evaluation, radiation doses estimated so far are unlikely to cause adverse effects on health, although this conclusion is based on external exposure doses estimated only for the first four months following the accident.
- In contrast to the overestimation of doses initially reported by international organizations based on the assumption of safety first perspective, the more close and realistic estimations are reported with the special significance of assessments based on the behavior records obtained through the Basic Survey.
- Behavior records obtained from the Basic Survey were also used to evaluate internal thyroid exposure doses.

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