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Thyroid cancer in Fukushima: 9 years after the multiple nuclear meltdowns

On February 13th, 2020, the Oversight Committee of the Fukushima Health Management Survey presented the new set of thyroid cancer data (up until September 30th, 2019). After the initial screening of approximately 300,000 children who were living in Fukushima Prefecture at the time of the multiple nuclear meltdowns or were born shortly thereafter (2011-2014), follow-up examinations were carried out every two years. The second examinations has already been completed, the third one is in its final phase and the fourth series of examinations has now been underway since 2018. During the past nine years, three trends have emerged quite clearly:

Trend 1: Rising number of thyroid cancer cases

In the initial examination of children in Fukushima Prefecture, 101 thyroid cancer cases were confirmed in the years 2011-2014 (14 additional cases had pathological findings in the fine needle aspiration, a form of biopsy, but have not yet been operated on). Fukushima Medical University explained this unexpectedly high number of cases as a result of a screening effect. This term describes the phenomenon that more cases of disease are identified in large-scale screening than would be expected in the same population and over the same period of time from clinical symptoms alone.

While the exact extent of the screening effect in children in Fukushima cannot be quantified, the increased cancer rates in subsequent examinations cannot be the result of a screening effect, because all these children had already been screened before and were found to be free of cancer-suspicious lesions. These lesions must therefore have developed between the screening examinations.

In the second screening round (2014-2016), 52 cases of cancer were found (with 19 additional cases with suspicious fine needle aspiration results, which have not yet been operated on). In the third screening round (2016-2018) a further 24 cases were found (with six more suspected cases not yet operated on). In the current fourth round, eight new cases were discovered (with eight additional suspected cases still waiting for confirmatory tests).

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Adolescents in the study population who reach the age of 25 are excluded from the official screenings and transferred to a newly created study called “Age 25 Milestone Screening”. In this cohort, exactly one newly diagnosed thyroid cancer case has been registered so far, three further histologically suspected cases are still waiting for confirmatory surgery. The number of unrecorded cases, however, is likely to be significantly higher: the participation rate in this offshoot study lies at just 9.6 %. The creation of a new study cohort is seen by some as a measure by Fukushima Medical University to further reduce the number of identified cancer cases.

Examination	Confirmed cancer cases	Suspected cancer cases
1. Screening (2011-2014)	101	14
2. Screening (2014-2016)	52	19
3. Screening (2016-2018)	24	6
4. Screening (2018-2020)	8	8
Age 25 Milestone Screening (2017)	1	3
Fukushima Medical University Hospital	11	?
Total	**197**	**50 (+)**

In addition, 11 thyroid cancer cases have been diagnosed in children from the examination cohort, but outside of the formal screening examinations. These 11 cases were found at the collaborating Fukushima Medical University Hospital in the period of time until June 2017 and were not officially added to the results of the thyroid screening, although they showed identical tumor entities and occurred in patients who were actually part of the examination cohort of the thyroid study. This unique situation is the direct consequence of Fukushima Medical University's controversial decision not to include patients in their data who were diagnosed outside of the actual screening study, even if they were diagnosed and treated at FMU's own university hospital. By sending patients to the so-called "clinical follow-up track", they are essentially leaving the confines of the formal screening study, which leads to a systematic decrease of cancer cases registered by the study.

There is no way of knowing whether there have been additional "unofficial" cases since June 2017 or whether other hospitals have diagnosed and treated thyroid cancer cases in patients affected by Fukushima fallout. It is important to remember that patients from contaminated areas outside of Fukushima Prefecture are not centrally registered, so the number of unreported cases of thyroid cancer in patients who were children in the contaminated areas at the time of the nuclear meltdowns may be significantly higher than suggested by the data of Fukushima Medical University.

This having been said, the total number of thyroid cancer cases in the Fukushima children cohort is currently 197 (185 official cases from the screenings, one from the Age 25 Milestone Screening and 11 ‚unofficial' cases from Fukushima Medical University Hospital). The official number of suspected cases not yet operated on is currently 50, bringing the total number of patients with presumed thyroid cancer to at least 247 (see above).

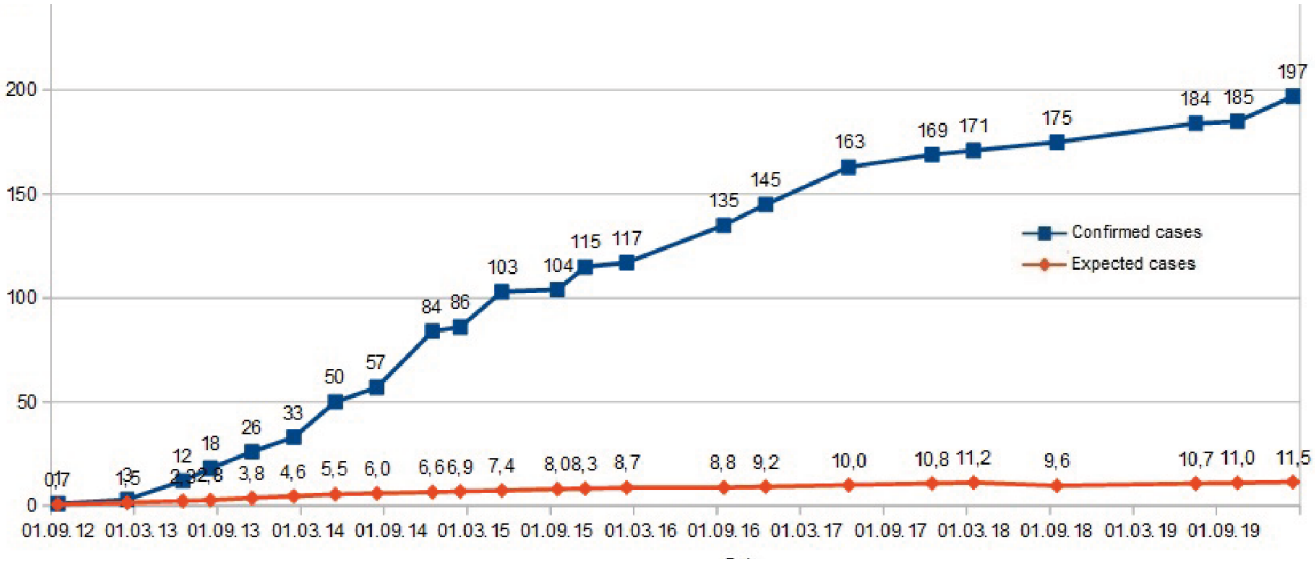
Of particular interest is the comparison of these figures with the baseline incidence rate of pediatric thyroid cancer in Japan. The official rate of new cases of thyroid cancer in children under 25 years of age in Japan in the ten years 2000-2009 was 0.59 per 100,000 per year. Today, nine years after the beginning of the nuclear catastrophe in the investigated population of about 218,000 patients, 11.5 thyroid cancer cases would have been expected.

However, the actual number of thyroid cancer cases in Fukushima is significantly higher: the 197 diagnosed cases in the study cohort represent an increase by a factor of 17 compared to the expected number of cases (197:11.5). Only considering the 96 cases that were diagnosed after the initial examination, which cannot be explained by any kind of screening effect, the factor is even higher: during this time from 2014-2020, the expected number of cancer cases would have just been 4.1, so that the actual number of cases represent an increase by a factor of 23 (96:4.1).

The following graph compares the actual number of cases of thyroid cancer (in blue) with the calculated number of cases expected in the study cohort (in orange). It becomes apparent that the number of cases increased continuously during the first screening examination, but also beyond that. The continuing increase in the number of cases during the years 2014-2020 cannot be explained by a screening effect.

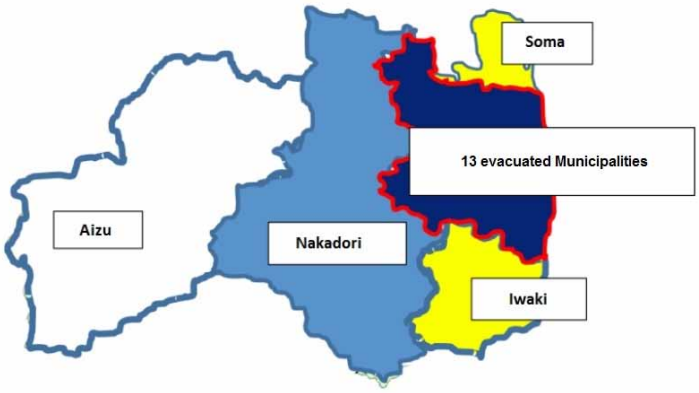
The decrease in the number of expected cases is caused by the study participants lost to follow-up, whose potential cancer cases may go unnoticed, since they are no longer participating in the study. As the number of participants in the screenings decreases from 300,000 to 218,000 during the years 2016-2020, so does the number of expected cancer cases.

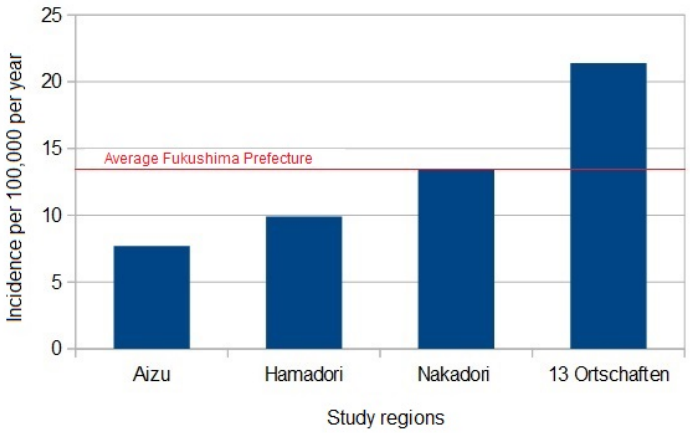
Rates of pediatric thyroid cancer in Fukushima, 2012-2020



In 2017, it became clear that the geographical distribution of thyroid cancer rates showed a distinct correlation to the rate of radioactive contamination. Fukushima Prefecture consists of three administrative districts: western Aizu, central Nakadori and eastern Hamadori, where Fukushima Dai-ichi nuclear power plant is located. The Prefecture was divided by FMU into four investigation regions for the thyroid study: the “13 municipalities” around the nuclear power plant received the highest amount of radioactive fallout and form a separate investigation region. The regions around the city of Soma in the north and the city of Iwaki in the south were designated by FMU as “Hamadori”. Radioactive contamination here was supposedly still relatively low compared to parts of the central district of Nakadori. The contamination was lowest in Aizu in the west of the prefecture.

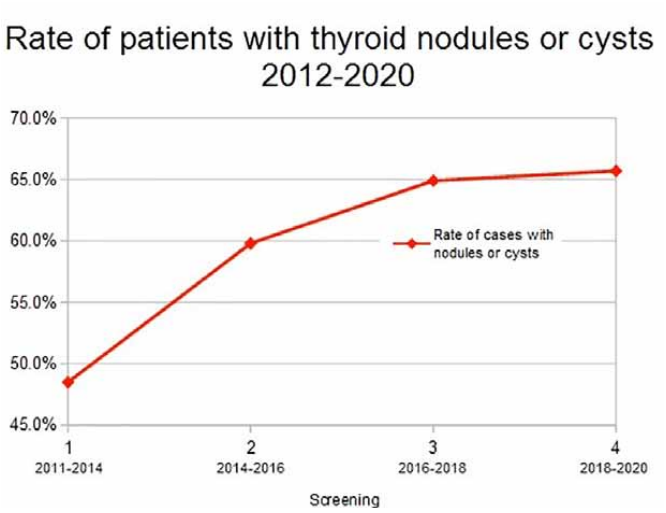
The investigation regions ordered by decreasing degree of radioactive contamination are as follows: the 13 municipalities around the Fukushima Dai-ichi NPP, followed by Nakadori, Hamadori and finally Aizu. Looking at the incidence of thyroid cancer in children, the 13 municipalities in the eastern part of Fukushima Prefecture showed the highest rates of new cases, while the regions of Nakadori, Hamadori (Soma and Iwaki) and Aizu showed significantly lower rates, depending on their location (as of June 2017):





Trend 2: Rising rates at nodes and cysts

As in the previous rounds of screening, the researchers again found an increasing rates of nodules and cysts in the childrens' thyroid glands. While the rate of cases with nodules and cysts was 48.5 % in the first screening, it rose to 59.8 % in the second screening, to 64.9 % in the third screening and to 65.7 % in the current fourth screening, although it must be said that in this latest round, results are currently only available for only 43 % of the study cohort (see below).

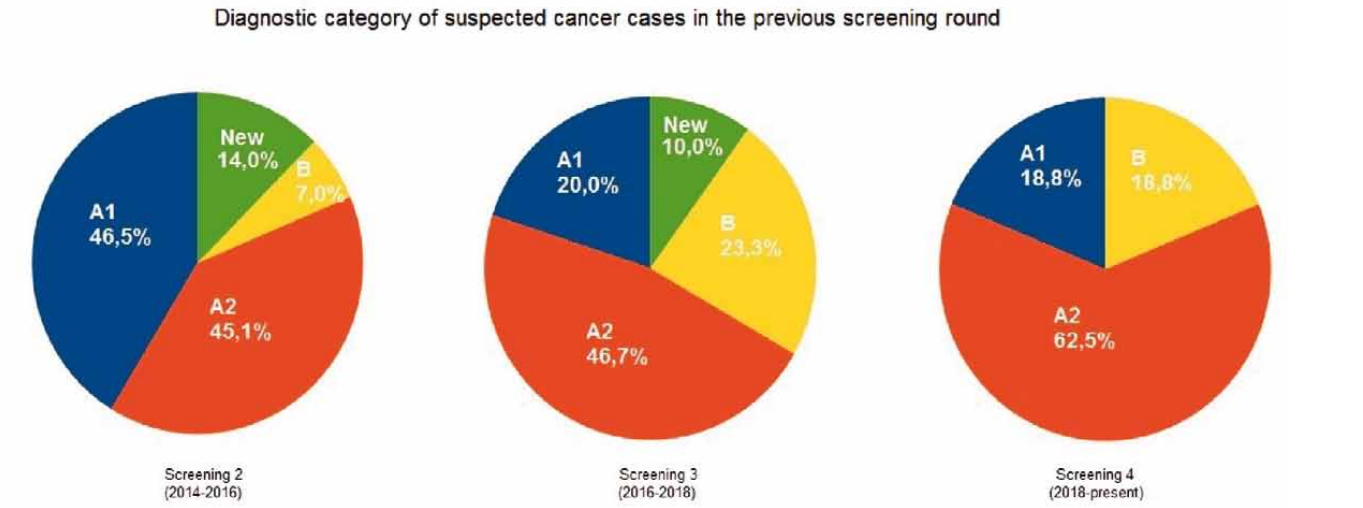


So far, each screening round has shown that new cancer cases had been classified as harmless in the previous round, so that they must have developed into malignant tumors during the time between the screening examinations. In the second examination, 42,436 patients were found to have cysts and nodules that had not been present in the initial examination. In the third examination, cysts or nodules previously described as inconspicuous were found in a further 22,115 patients from the cohort, and in the fourth examination, cysts or nodules were found in a further 9,209 patients. Each screening examination also included several hundred patients which previously had seemingly harmless cysts or nodules (category A2), which turned into conspicuously large lesions (category B) in later rounds. Currently, for example, this is the case in 346 patients in the fourth screening examination.

At its meeting in February of 2020, the Oversight Committee also presented the results of preceding examinations in confirmed or suspected cancer cases: In the second screening round, 33 of the 71 suspected cancer cases (46.5 %) had been completely unremarkable in the initial examination (category A1). In 32 cases (45.1 %) a category A2 with small cysts or nodules was present in the initial examination. Only in five cases (7.0 %) was category B with noticeably large cysts or nodules present at the initial examination, one case (1.4 %) had not been examined at all during the initial examination.

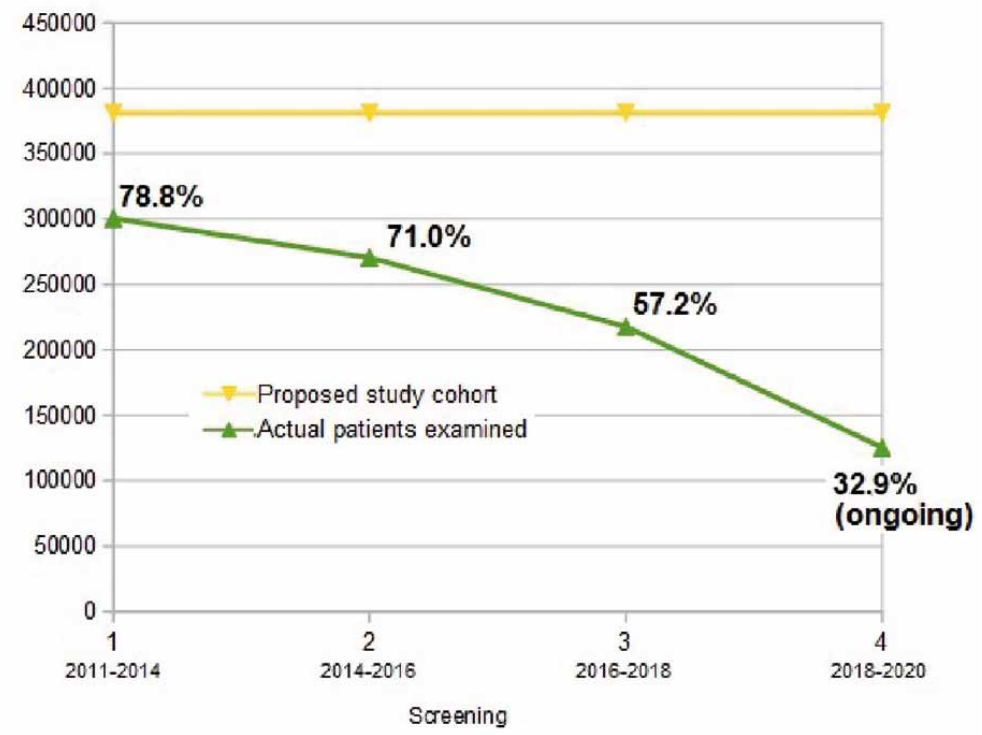
In the third screening round, six of the 30 suspected cancer cases (20 %) had been completely unremarkable in the previous examination (category A1). In 14 cases (46.7 %) a category A2 with small cysts or nodules was present in the previous examination. Only in seven cases (23.3 %) was category B with conspicuously large cysts or nodules present in the previous examination, three cases (10 %) had not been examined in the previous examination

In the currently ongoing fourth screening round, three of the 16 suspected cancer cases (18.8 %) were completely unremarkable in the previous examination (category A1). In 10 cases (62.5 %) a category A2 with small cysts or nodules was present in the previous examination. Only in three cases (18.8 %) a category B with conspicuously large cysts or nodules was present in the previous examination.



It is therefore clear that in the majority of suspected cancer cases, relatively inconspicuous findings rather than conspicuous precancerous lesions were found in previous examinations, and cancer development must have taken place in the period between the screening examinations (see p. 4 below).

Screening participation rate, 2012-2020



A large part of this decline in participation is certainly due to the exclusion of the 25 year olds from the main study. In the cohort of Age 25 Milestone Screening, the participation rate in thyroid examinations is a mere 9.6 %. While many clinical studies have drop-out rates, in Fukushima this seems to be a systematic problem: Fukushima Medical University, which is in charge of the thyroid study, has been sending staff to schools for several years now in order to educate children about their "right not to participate" and their "right not to know". The examination forms now also include an "opt-out" option, i.e. the possibility of being removed from the screening.

Trend 3: Declining number of participants

The number of children examined in the thyroid screenings has been falling for years. While in the initial examination from 2011-2014 there were about 300,000 children whose thyroid glands were examined, this number fell by 10 % to about 270,000 in the second examination from 2014-2016 and by a further 10 % in the third examination from 2016-2018. The number in the current fourth round is just under 218,000. So far, only about 125,000 children have been examined in the fourth examination. Expressed in relative numbers, the percentage of children examined in Fukushima has fallen from an initial 78.8 % in the first screening to 71.0 % in the second screening, 57.2 % in the third screening and currently in the ongoing fourth screening to 32.9 %.

Fukushima Medical University is quite deliberately accepting and even encouraging for children to leave the study. Is FMU concerned that the worrying trend of increasing numbers of thyroid cancer cases will continue? Are they uncomfortable with the data, which contradicts the government's claim that the nuclear catastrophe would not lead to any additional cancer cases? Who is behind these measures, which increasingly threaten the integrity and validity of the study? Is it the government in Tokyo that is promoting a renaissance of nuclear energy in Japan? Or is it the IAEA, which "supports" Fukushima Medical University financially and logistically in conducting the study? Unfortunately, these and other unpleasant questions did not come up at this latest meeting of the Oversight Committee.

Conclusions

We continue to see a significant increase in new cases of thyroid cancer in children and adolescents in Fukushima. Currently, the ratio of diagnosed cases of thyroid cancer to expected cases is 23:1. Due to the developments outlined in this paper, these figures are likely to be a systematic underestimation, as became apparent by the newly published thyroid cancer cases diagnosed outside the study protocol.

In addition, an increase in other types of cancer and other diseases that are triggered or affected by ionizing radiation is also expected in the population affected by radioactive contamination – well beyond the borders of Fukushima Prefecture. The FMU's thyroid examination is the only scientific screening study that can provide any relevant information about the health consequences of the Fukushima nuclear disaster. And it currently runs the risk of being undermined by the advocates of nuclear energy.

The inhabitants of Fukushima and the people of Japan have an inalienable right to health and to life in a healthy environment. The examination of children's thyroid glands benefits not only the patients themselves, whose cancers can be detected and treated early, but also the entire population affected by radioactivity as well as future generations. The scientifically correct continuation of thyroid screenings is therefore in the public interest and must not be thwarted by political or economic motives. It is important to continue to critically monitor these developments from outside.

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