Comments on the investigation reports by Fukushima Medical University and the University of Tokyo on allegations regarding papers on radiation dose estimates in Date City

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Abstract

There are serious concerns with the investigations carried out by Fukushima Medical University and the University of Tokyo on allegations regarding two papers by Makoto Miyazaki and Ryugo Hayano (i.e. Miyazaki-Hayano Papers 1 and 2) [1, 2]. These investigations fail to address several important issues raised in the allegations. In particular, some discrepancies among the main Figures in Paper 2 [2] remain unexplained, and the claimed absence of underestimation of lifetime doses is illogical.

1 Introduction

1.1 Background

Miyazaki-Hayano Papers 1 and 2 [1, 2], written by Makoto Miyazaki (Fukushima Medical University, herein FMU) and Ryugo Hayano (the University of Tokyo, herein UT), study individual external doses of citizens in Date City, Fukushima Prefecture, based on the radiation dose data collected from individual dosimeters distributed to the residents between 2011 and 2015 after the Fukushima Dai-ichi Nuclear Power Plant accident.*1 After the publication of the papers, Akemi Shima, a resident of Date City, and one of the authors, Shin-ichi Kurokawa, found numerous potential violations of the Ethical Guidelines for Medical and Health Research Involving Human Subjects (herein, Ethical Guidelines) established by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Health, Labour and Welfare of Japan. These violations include the unconsented use of personal information and the failure to comply with the research protocol, among others. Furthermore, Kurokawa had previously raised concerns [3] on the technical aspects of Paper 2 [2].

Shima submitted letters of allegations, asking FMU (in January 2019) and UT (in December 2018) to conduct a formal investigation on research misconduct. FMU, whose Ethics Committee had approved the research protocol, concluded on July 19, 2019 that despite the unconsented use of personal information including radiation exposure doses and the deviations from the research protocol, Miyazaki (and Hayano as a co-researcher) could not be held in violation of the Ethical Guidelines. (Note that here FMU clears Hayano of violation of Ethical Guidelines for conducting research before the approval by the Ethics Committee, despite the fact that Miyazaki was the sole subject of their investigation.) Further, one mistake was acknowledged in Paper 2 [2] but deemed unintentional and not fabrication ("either willful or due to gross neglect of the basic duty of care expected of a researcher" as specified by MEXT [6]*2), and Miyazaki was cleared of research misconduct.

The Committee on the Code of Conduct for Re-

*1—In addition to being cited in multiple papers and presented at RICOMET 2017, Miyazaki-Hayano Papers were originally included (and later deleted pending investigations) as references in a report on radiation standards by the Radiation Council of the Japanese government.

search at the University of Tokyo (herein, the UT Committee), in its July 19, 2019 report, declined to investigate the alleged violations of the Ethical Guidelines which are considered outside its jurisdiction on research misconduct. The UT Committee concluded that the mistakes in Paper 2 were unintentional and not "due to gross neglect of the basic duty of care expected of a researcher," hence clearing Hayano of research misconduct.

1.2 Issues with the investigation reports

There is an inconsistency in the investigation report by FMU, and some of the important technical issues raised in the allegation were never addressed by FMU or the UT Committee, rendering the investigations inadequate. In this letter, we point out these issues with the investigations. We refer to [7] for further errors and inconsistencies in Paper 2 and [8] for the ethical problems of Papers 1 and 2.

In Paper 2 [2], the authors collect the dose rate data of individual dosimeters from various zones in Date City (zones A, B and C), fit the data with a reduction function, and estimate cumulative doses in a longer period. In Fig. 6, a box-and-whisker plot is shown for radiation dose rates of individuals in zone A whose houses were subject to decontamination between October and December 2013 (425 residents) and a reduction function is given, adjusted by the ambient dose rates. (The authors state that they used the values 2.1 Sv h^{-1} (Sv/h) at t=0.65y and a "coefficient" c^{A}=0.1, obtained in [1], but the curve in Fig. 6 actually passes through 0.33 μSv/h which is larger than derived from those values.) In Fig. 7, a box-and-whisker plot is shown for cumulative doses of the individuals in Fig. 6 and the *supposed curve* is given by integrating the reduction function in Fig. 6. In Fig. 5-1 (herein, Fig. 5A), a box-and-whisker plot of cumulative doses of individuals in zone A (476 residents, regardless of the decontamination status) and an integrated curve are shown.

One of the main concerns raised in [3] is that, when one sums the dose rates in Fig. 6 multiplied by the corresponding time period, one does not obtain the cumulative doses in Fig. 7. The same holds for the reduction function in Fig. 6 and the integrated curve in Fig. 7. Furthermore, in [2], the outliers of the box-and-whisker plots are defined as those lower than or higher than the 1st percentile or 99th percentile, respectively. Yet, in Figs. 5A and Fig. 7 (including 476 and 425 residents, respectively), there are evidently more than 10 outliers above each upper whisker.

Although the investigations find and explain the discrepancy between dose rates and cumulative doses in Figs. 6 and 7, they fail to do so for the reduction function and the integrated curve. Furthermore, FMU claims that the estimated cumulative dose is not underestimated, although the corrected integrated curve shows otherwise. Outliers are not mentioned at all in the reports by either FMU or the UT Committee.

2 The allegation and the response: Fukushima Medical University

2.1 The allegation to FMU

The allegation contains various claims including those on violations of the Ethical Guidelines and deletion of the dose data, but we only cite the parts where Figs. 5A, 6, and 7 are concerned (translated by us)*3.

> Fig. 7 is the integral of Fig. 6, but the actual computation from Fig. 6 shows that the cumulative doses in Fig. 7 are only half of the supposed values. Similarly, the values obtained from Slide 2 and Fig. 5A by subtracting the initial dose of 1.4 mSv from the first 4 months are only half of the values obtained by integrating Fig. 6. As the vertical axis of Slide 1 is shown in "mSv per 3 months," the operation to compute the cumulative dose is just a simple summation. It is extremely unusual for two authors to overlook such simple mistakes for more than two and a half years, suggestive of either fabrication or remissness comparable to fabrication. Furthermore, Slide 2 and Fig. 5A show more than 10 outliers above the 99th percentile. Because the number of corresponding residents is 476, the number of outliers would have to be 5 or less. This is exceedingly incomprehensible.

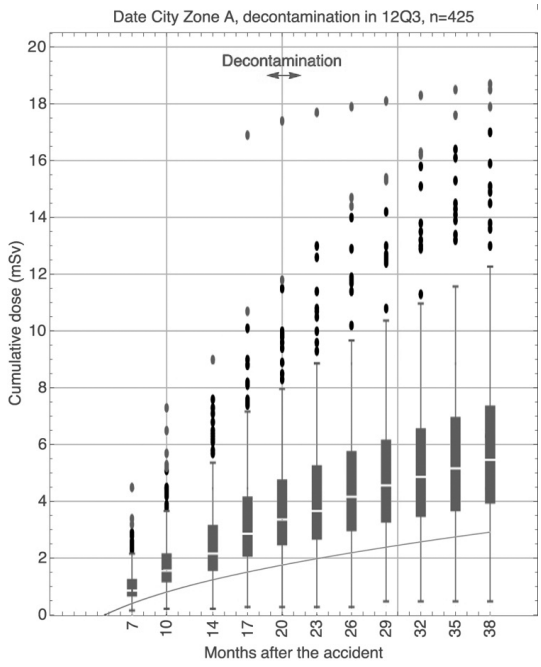
2.2 The response by FMU

The following is the only paragraph in the report by FMU [4] referring to Figs. 6 and 7 (and never mentioning Fig. 5).

> In comparing the claims of the alleger and the

*2—MEXT defines research misconduct as the "fabrication, falsification or plagiarism of data or research findings, etc. in a submitted research paper or other published research results, either willfully or due to gross neglect of the basic duty of care expected of a researcher."

*3—The "Slides" are from a presentation by Hayano at the ICRP Dialogue Seminar, as seen in this video, https://www.youtube.com/watch?v=dq9lsd3b5nw



Figure—Cumulative doses from Fig. 7 of [2] multiplied by 1/0.455, shown as the box-and-whisker plots with outliers, with the original integral curve (starting at $t = 0.39$ y). The latter does not pass through the corrected medians (white bars in the box-and-whisker plots) at all.

alleged, the following was determined.

(1) Review of Paper 2 shows that the error pointed out by the alleger corresponds to Fig. 7.

(2) When creating Fig. 7, the authors converted the individual dosimeter data from the 3-month cumulative dose to the dose rate per hour (/3/24/30.5＊1000(=0.455)) just as they did in Fig. 6, even though the conversion was unnecessary for Fig. 7.

(3) The value of the estimated lifetime doses shown in the conclusion of Paper 2 is reasonable, and there is no underestimation of individual radiation doses as claimed by the alleger.

There are at least three problems with this conclusion.

- We pointed out [7] that the integrated curve in Fig. 7 is smaller than the summation of the reduction function in Fig. 6 by a factor of about 0.58 which differs from 0.455, the coefficient used to convert the cumulative doses to the dose rate. FMU clearly fails to address this discrepancy. Similar issues with Fig. 5A were not addressed, although we pointed out that the factors here have different values (0.55 and 0.7, as explained in Section 4).
- The issue of the outliers is ignored.
- The integrated curve in Fig. 7 (as is, before the correction) approximately passes through the medians of the actual cumulative doses. If the cumulative doses are to be multiplied by 2.2 (= 1/0.455) as a corrective measure, so is the integrated curve: If not, the integrated curve would not fit the corrected data as in Figure. Accordingly, the estimated cumulative doses for 70 years should also be multiplied by 2.2.The conclusion that there is no underestimation of individual radiation doses is illogical.

3 The allegation and the response: The University of Tokyo

3.1 The allegation to the UT Committee on Code of Conduct for Research

Shima sent a letter of the allegation to the UT Committee on December 10, 2018, revising it on December 17 (first revision) to clarify her allegation at the request of the UT Committee, stating that Slide 2 corresponded to Fig. 5. Another revision was sent on December 18 (second revision) to clarify that Slide 2 actually corresponded to Fig. 7. The UT Committee officially accepted the second revision on December 19. She sent another revision (third revision) on December 22, stating that Slide 2 actually corresponded to Fig 5A, not Fig 7. The UT Committee responded that the December 22 revision would be considered a supplementary material rather than replacing the officially accepted December 19 (second) revision. The original letter of the allegation and the subsequent revisions are all dated December 10, 2019. Below is the relevant part of the third revision submitted on December 22.

> The presentation at the ICRP Dialogue Seminar, (1)-①, and Paper 2, (1)-③, contain numerous aberrant issues. Slides 1 and 2 from the former, in Attachment 2, correspond to Figs. 6 and 5 for zone A in Paper 2. Despite the similarity of the contents and distributions, the only difference between the slides and the figures is the scale of the vertical axis. There is another issue. The integration of the graph in Slide 1 should yield the graph in Slide 2, and the integration of Fig. 6 should yield Fig. 5A, yet their resultant values are not consistent. Slide 2 and Fig. 5A are the graphs from which the lifetime cumulative doses of the research subjects are to be derived, thus fabrication to underestimate the cumulative doses is suspected. I request that the University of Tokyo recover and verify the data.

3. 2 The response by the UT Committee

The UT Committee published only a very brief summary of the conclusions [5]. Below is the only section referring to Fig. 6.

> Concerning the discrepancy between the slides from the seminar (cited as ① in Appendix) and the paper (cited as ③), because the vertical axis in the slides was intended to show the individual dose rate (Sv/h), the values obtained from the raw data (cumulative doses in 3 months in mSv) should have been multiplied by 0.455 (/3 (months) /30.5 (days) /24 (hours) ＊1000). But we confirmed that this was not done. We further confirmed that this conversion was done for the values of the vertical axis in the Fig. 6 in the paper cited as ③ in Appendix.
>
> As for the discrepancies among data in the paper cited as ③ in Appendix, the values of the vertical axis in Fig. 7 represent Cumulative Dose [sic] (mSv) and they should have been multiplied by 2.2, which is the inverse of 0.455 mentioned above. We confirmed that the alleged researcher forgot this multiplication when conducting computations from Fig. 6.

We note the following.

- Even though the final revision of the allegation submitted on December 22 correctly specifies Fig. 5A, UT investigates only Fig. 7 which was erroneously mentioned in the second revision officially accepted. The discrepancy between Figs. 6 and 5A, not the expected 0.455, hence remains unexplained.
- While the allegation talks about the *integration* of the graphs, the report refers only to the cumulative doses of the data, which can be obtained by *summation*. In other words, the discrepancy between the reduction curve in Fig. 6 and the integrated curve in Fig. 7 is ignored. This discrepancy, not the expected 0.455, hence remains unexplained.
- Most critically, the UT Committee fails to address suspicion of fabrication for underestimating the lifetime doses to be derived from the integrated curve, as raised in the letter of allegation.

4 Unexplained discrepancies

Below is the summary of the discrepancies claimed in the allegation which the investigations failed to address or resolve.

- The discrepancy between the reduction curve in Fig. 6 and the integrated curve in Fig. 7 is 0.58 as computed in [7], not 0.455 as expected. (The value of the curve at the 38th month (m) is 2.87 mSv, while the integral of the reduction function from t=0.39＊12 m to 38 m (without the initial dose, as in Fig. 7) gives 4.93 mSv, and their ratio is 0.58.)
- The discrepancy between the reduction curve in Fig. 6 and the integrated curve in Fig. 5A is 0.70 as computed in [7], not 0.455 as expected.
- The discrepancy between the dose rates in Fig. 6 and the cumulative doses in Fig. 5A is 0.55 as computed in [7], not 0.455 as expected.
- The plots of the outliers in Fig. 5A and Fig. 7 must be wrong.
- In order to fit the integrated curve to the cumulative doses, the former must be corrected. This effectively invalidates the conclusion of FMU that there is no underestimation.

We further point out that one of the alleged researchers, Hayano, published a note on January 8, 2019 [9] stating that, when reviewing the data analysis program written by himself, he found that the error in Paper 2 [2] was due to his forgetting to multiply the value of the 3-month individual dose shown as the value of the central month by 3 for the "3-month intervals." Hence, he claimed that the cumulative dose was underestimated to be 1/3 of the actual value, and that the estimated lifetime doses should have been tripled accordingly. But this "claimed" discrepancy by 1/3 is evidently wrong. On July 19, 2019 [10], after UT released its report, he "retracted" the January 8 note and admitted that the error was actually 0.445, without offering any further explanation about the first claim of underestimation by 1/3. Instead he claimed that there was no underestimation of the lifetime doses (not even by a factor of 0.455), in accordance with the report by FMU [11]. This bizarre series of events leaves us no choice but to conclude that the source codes of their analytical program should be published in order to bring light to the truth.

As has been demonstrated, many discrepancies and inconsistencies raised in the letters of the allegations are left unexplained by the investigations by FMU and the UT Committee, rendering both investigations inadequate.

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