

LETTER TO THE EDITOR

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# Letter to the editor regarding “spatiotemporal association of low birth weight with Cs-137 deposition at the prefecture level in Japan after the Fukushima nuclear power plant accidents”

Sani Rachman Soleman<sup>1,2</sup>, Tomoko Fujitani<sup>1</sup> and Kouji H. Harada<sup>1\*</sup> 

## Abstract

In the previous report, association between increased low birth weight prevalence and radiocesium deposition after 2011 Fukushima nuclear disaster was found. However, the statistical analyses therein raised several questions. First, ecological variables are not justified enough to adjust potential confounding. Second, the spatiotemporal regression model does not consider temporal reduction in radiation dose rate. Third, dose-response plot between dose rates and odds ratios overestimates  $R^2$  and underestimates  $p$  value.

**Keywords:** Low birth weight, Radiation, Epidemiology, Statistics, Ecological study, Fukushima nuclear disaster

## Dear Editor

Regarding with a recent study on Cs-137 exposure with low birth weight (LBW) in infants in Japan by Scherb and Hayashi [1], we express concerns on data analyses, particularly in Figures 4 and 5 of the article.

Firstly, LBW can be influenced by various individual factors such as body weight change of mothers during pregnancy, smoking, etc. The authors included spatiotemporal effects in logistic

regression model (but details of modeling were not provided), and analyzed data without individual factors. Authors included ecological variables, but they are not enough to control individual variations for LBW. How can annual population, number of physicians adjust the potential risk factors for LBW? In addition, if triple disasters affected those background factors, OR jump could be observed. Hence, individual risk factors are essential for the analysis because the observed OR for Cs-137 is relatively small and easily influenced by confounding.

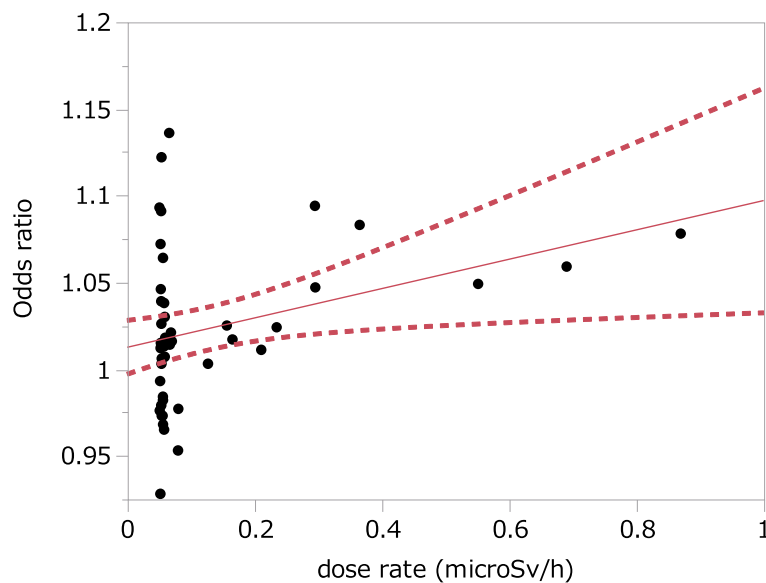
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\* Correspondence: [kharada-hes@umin.ac.jp](mailto:kharada-hes@umin.ac.jp)

<sup>1</sup>Department of Health and Environmental Sciences, Kyoto University Graduate School of Medicine, Yoshida Konoe, Sakyo, Kyoto 6068501, Japan  
Full list of author information is available at the end of the article



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**Fig. 1** Unrestricted linear regression analysis between dose rates and odds ratios in 47 prefectures in Japan shown in the report [1]. Red line showed regression line with 95% confidence intervals (dotted lines).  $R^2 = 0.108$  and  $p = 0.0239$  for slope factor

Secondly, Figure 4 of the article claimed ionizing radiation increased the prevalence of LBW. The logistic model assumed the level-shift after 2011 persists to 2018 at same magnitudes. According to previously study [2], air radiation dose rate from deposited fallout was highest at initial time of deposition, but the dose decreased to less than 40% only by physical decay until 2016. Further, migration of radionuclide in soil reduced the dose rate to 20% of initial rate [2]. Thus, it is unlikely that the effect on Cs-137 persisted for years without any attenuation. In other words, observed OR jump can be attributable to other factors in triple disasters or regional trends.

Thirdly, we found an overestimation of  $R^2$  and underestimation of  $p$  value of the regression in Figure 5 of the article. Authors mixed data of 37 prefectures into one point, and made variations of them small. As shown in Tables 2 and 3 of the article, even in non-contaminated regions showed high odds ratios over 1.1. Furthermore, authors analyzed them with restricted linear regression model (intercept was fixed to 1), but we examined them in unrestricted regression that showed  $R^2$  of 0.37 and  $p = 0.046$ . The  $R^2$  was further decreased to 0.11 in the analysis of original 47 records (Fig. 1 in this letter). Authors intended to ‘avoid an overly scattered picture’, but the manipulation caused overestimation of  $R^2$ . In addition, there was no rationale to employ restricted linear regression analysis.

According to explanations above, we suggest that authors will clarify the assumptions and rationale in the study.

#### Authors' contributions

SRS and KHH drafted the initial manuscript and TF reviewed the manuscript. All of them has approved the final form of this letter.

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#### Availability of data and materials

Data and material sharing are not applicable to this letter.

#### Ethics approval and consent to participate

Not applicable.

#### Consent for publication

Not applicable.

#### Competing interests

All authors declare that they have no competing interests.

#### Author details

<sup>1</sup>Department of Health and Environmental Sciences, Kyoto University Graduate School of Medicine, Yoshida Konoe, Sakyo, Kyoto 6068501, Japan.

<sup>2</sup>Department of Public Health, Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta 55584, Indonesia.

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