

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Balancing the risk of the evacuation and sheltering-in-place options: a survival study following Japan's 2011 Fukushima nuclear incident
AUTHORS	Shimada, Yuki; Nomura, Shuhei; Ozaki, Akihiko; Higuchi, Asaka; Hori, Arinobu; Sonoda, Yuki; Yamamoto, Kana; Yoshida, Izumi; Tsubokura, Masaharu

VERSION 1 – REVIEW

REVIEWER	Hailong Li CDC in China
REVIEW RETURNED	14-Jan-2018

GENERAL COMMENTS	<p>Review</p> <p>(1)The data of total suffered people victim is absent, I think, it is very critical because the data produced from the present article might be not enough to support the conclusion. The data of total suffered people located 22 km south of the Fukushima Daiichi nuclear power plant should be provided at least.</p> <p>(2) Among these hospital patients who were admitted to Takano Hospital between 1 January 2008 and 31 December 2016, are they volunteer or compulsory or randomly? What is the standard of admitting?</p> <p>(3) Whether did the hospital cost influence the caring or treating? Some death case, if so, might be due to the expensive cost. So, whether the factor of cost was considered in this research?</p> <p>Anyway, it is a useful research. And I am glad to accept the conclusion of this research if the data is sufficient. It can be reference for NBC incidence rescue operation.</p>
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REVIEWER	C. Norman Coleman, MD Radiation Research Program, National Cancer Institute, Bethesda, MD USA
REVIEW RETURNED	23-Jan-2018

GENERAL COMMENTS	The information is valuable for planning and responding to future catastrophes. The severity of the shortages for shelter-in-place were
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	<p>quite severe, as you noted. Two points are worth amplifying. The ADL rating was quite low. I am not familiar with that scale but it is worth commenting on in greater detail in particular is that what one expects in hospitals in general in Japan? The second point is the mortality which seemed to be worse in cardiovascular disease and other category. Can you conclude that any particular disease should not shelter in place for advising future situations.</p> <p>Lastly, is it possible to use a few other hospitals where evacuees went and others at a distance to see if the shelter-in-place was truly worse. This may be beyond what you can readily do so it is not a requirement for a revision but if possible it would serve as additional comparisons.</p>
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REVIEWER	Kristian Krieger Universite catholique de Louvain, ISPOLE, Belgium
REVIEW RETURNED	26-Jan-2018

GENERAL COMMENTS	<p>The paper addresses a very important question in the field of disaster management, namely the health implications of sheltering-in-place for vulnerable populations, for which limited empirical research has undertaken.</p> <p>I have two minor comments for the authors: First, it would be good to define what you mean by well-planned evacuation. On p.12 you suggest it refers to "appropriate transport and places to evacuate safely". Does this mean that the patients are allocated to institutions with similar care levels as pre-incident? Please clarify because the destination of the patients certainly affects mortality rates. Secondly, when reading the 'methods' section, I would have liked to read more on how the incident has affected the care services, as you do on page 11. The advantage would be to provide context for the question of evacuation versus non-evacuation earlier.</p>
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VERSION 1 – AUTHOR RESPONSE

RESPONSE TO REVIEWERS

We would like to thank the reviewers for their helpful comments. Our responses to the comments from reviewers #1, #2, and #3 are given beneath each comment. The added/revised text is double-quoted in our response for ease of reference, with line and page numbers provided where necessary.

Response to Reviewer #1

Comment #1.

The data of total suffered people victim is absent, I think, it is very critical because the data produced from the present article might be not enough to support the conclusion. The data of total suffered people located 22 km south of the Fukushima Daiichi nuclear power plant should be provided at least.

Response #1.

We completely agree with your view that the inclusion of the data of the total number of affected individuals located 22km south would result in a more robust conclusion. However, we are unable to obtain this critical data for the following reasons. Before the 2011 Fukushima nuclear incident, there were five additional hospitals in Futaba District in which Takano Hospital is located. Three hospitals were located within a radius of five km around the Fukushima Daiichi nuclear power plant within the difficult-to-return zone, in which lodging is prohibited now (March 2018), and were therefore forced to close. Although they were located outside of the difficult-to-return zone, the other two hospitals were also closed because of the incident. For these reasons, we were not able to collect data from the

other five hospitals in the district. In accordance with your concern, our results may simply not be generalisable. However, the statistical methods used in this study increased the generalisability of the study. We included adjustments for the important patient-specific health elements in the study, such as age, primary disease, and medical condition; thus, it is likely that other risk factors (i.e., experience of sheltering-in-place) for mortality that we identified are generalisable beyond the specific hospital studied. To provide additional clarity on this particular point, we edited the text as follows:

“Second, although there were six hospitals in Futaba District before the incident, we were only able to obtain data from Takano Hospital. Three of the other five hospitals were located within a radius of five km around the Fukushima nuclear power plant, which was within the difficult-to-return zone, in which lodging is prohibited as of March 2018; thus, they were forced to close. Although the other two hospitals were located outside the difficult-to-return zone, they were also closed because of the incident. For these reasons, we were not able to collect data from these five hospitals in the district. Thus, our results may simply not be generalisable. However, the statistical methods we used increase the generalisability of the study. We employed a Bayesian approach to analyse survival in this study, which included adjustments for the patient-specific elements in the study (such as age, primary disease, and condition); therefore, it is likely that the potential mechanism which explains the significant differences in mortality risk between the study groups is generalisable beyond this specific hospital study.” (page 10, line 33, Discussion section)

Comment #2.

Among these hospital patients who were admitted to Takano Hospital between 1 January 2008 and 31 December 2016, are they volunteer or compulsory or randomly? What is the standard of admitting?

Response #2.

The internal department of the hospital not only admits patients on a voluntary basis but also accepts those referred by other acute hospitals outside Futaba District. The psychiatric department of the hospital admits patients on a voluntary basis, while for some cases in which the patients may pose a danger to themselves or to others the department commits patients involuntarily. These are the standard patient admission policies across Japan. To clarify, we have edited the text as follows:

“It was established in 1980 as a hospital that provides long-term internal and psychiatric care to those whose nursing and medical care needs cannot be met in nursing homes. The internal department of the hospital not only admits patients on a voluntary basis but also accepts those on referral from other hospitals with a focus on emergency care outside Futaba District. The psychiatric department of the hospital admits patients on a voluntary basis, while for some cases in which patients may pose a danger to themselves or others the department commits patients involuntarily. As such, Takano Hospital has played a central role in maintaining the welfare of residents not only in town but also across Futaba District, as the only hospital in operation since the Fukushima nuclear incident on 11 March 2011.” (page 5, line 4, Methods section)

Comment #3.

Whether did the hospital cost influence the caring or treating? Some death case, if so, might be due to the expensive cost. So, whether the factor of cost was considered in this research?

Response #3.

We understand your point. Most of the hospital costs are covered by the national health insurance system in Japan. Therefore, it is not likely that the high cost significantly affects the care or treatment. To clarify this point, we have edited the text as follows:

"It should be noted that it was unlikely that the high cost significantly affected the mortality rate after the incident because most hospital costs are covered by Japan's national health insurance system." (page 8, line 34, Results section)

Response to Reviewer #2
Comment #1.

The ADL rating was quite low. I am not familiar with that scale but it is worth commenting on in greater detail in particular is that what one expects in hospitals in general in Japan?

Response #1.

Thank you for your careful reviews and very helpful comments. According to the All Japan Hospital Association, 66.4% of hospital patients in Japan scored over 23 points on the ADL (out of 24) in 2013.[1] Meanwhile, 66.1% of our study participants (in the internal department) scored over 23 points. Because the distribution of the total ADL score of internal patients was inflated to 23-24 points, we edited Table 1 and the supplementary table by presenting their distribution using a median and interquartile range instead of the mean and standard deviation. We also edited the text as follows:

"Their characteristics are shown in Table 1 by department. Age distributions at the endpoint were substantially different between the departments, with the psychiatry department admitting younger patients (median: 86.0 years [interquartile range: 8.5] for the internal department and 61.0 [27.5] for the psychiatry department). The median ADL score at admission for internal patients was 23 (out of 24) with an interquartile range of 11. The percentage of those with a medical condition at 3 was 28.7%. Note that these distributions of the ADL and medical conditions within the group of study patients were similar to those of patients nationwide.[1]" (page 8, line 5, Results section)

According to the edited text above, we included the median of the ADL score in Table 1 and the supplementary table. Please check the revised manuscript and the attached supplementary table.

Comment #2.

The second point is the mortality which seemed to be worse in cardiovascular disease and other category. Can you conclude that any particular disease should not shelter in place for advising future situations?

Response #2.

We understand that consideration of disease-specific mortality risk would be helpful. However, given the small sample size in the study, unfortunately, the statistical ability to conduct analyses by primary disease was limited.

Comment #3.

Lastly, is it possible to use a few other hospitals where evacuees went and others at a distance to see if the shelter-in-place was truly worse. This may be beyond what you can readily do so it is not a requirement for a revision but if possible it would serve as additional comparisons.

Response #3.

We completely agree with your view. However, unfortunately this is impossible for the following reasons. Before the 2011 Fukushima nuclear incident, there were five other hospitals in Futaba District in which Takano Hospital is located. Three of the other hospitals were located within a radius of five km around the Fukushima Daiichi nuclear power plant within the no-entry zone, and were therefore forced to close. Although the other two hospitals were located outside the no-entry zone, they were also closed because of the incident. For these reasons, we were not able to collect data from these five hospitals in the district. In accordance with your concern, our results may simply not be generalisable. However, the statistical methods used in this study increased the generalisability of

the study. We included adjustments for the important patient-specific health elements in the study, such as age, primary disease, and medical condition; thus, it is likely that the other risk factors (i.e., experience of sheltering-in-place) for mortality that we identified are generalisable beyond the specific hospital studied. To clarify, we edited the text as follows:

“Second, although there were six hospitals in Futaba District before the incident, we were only able to obtain data from Takano Hospital. Three of the other five hospitals were located within a radius of five km around the Fukushima nuclear power plant, which was within the no-entry zone; thus, they were forced to close. Although the other two hospitals were located outside the no-entry zone, they were also closed because of the incident. For these reasons, we were not able to collect data from these five hospitals in the district. Thus, our results may simply not be generalisable. However, the statistical methods we used increase the generalisability of the study. We employed a Bayesian approach to analyse survival in this study, which included adjustments for the patient-specific elements in the study (such as age, primary disease, and condition); therefore, it is likely that the potential mechanism which explains the significant differences in mortality risk between the study groups (discussed below) is generalisable beyond this specific hospital study.” (page 10, line 33, Discussion section)

Response to Reviewer #3

Comment #1.

First, it would be good to define what you mean by well-planned evacuation. On p.12 you suggest it refers to "appropriate transport and places to evacuate safely". Does this mean that the patients are allocated to institutions with similar care levels as pre-incident? Please clarify because the destination of the patients certainly affects mortality rates.

Response #1.

We agree with your critical point. However, it is difficult to establish a clear definition of appropriate protocol for evacuation. The protocol may vary depending on the post-disaster situation, as the preferred response is not always available or feasible during the disaster. To clarify, we edited the text as follows:

“Therefore, if sheltering-in-place and sufficient resources are not guaranteed, evacuation could be a reasonable option and might save more lives of vulnerable people if it is executed in a well-planned manner for appropriate transportation and safe evacuation locations; ideally, this can happen at least at the level expected during ordinary (non-emergency) times.” (page 13, line 24, Discussion section)

Comment #2.

Secondly, when reading the 'methods' section, I would have liked to read more on how the incident has affected the care services, as you do on page 11. The advantage would be to provide context for the question of evacuation versus non-evacuation earlier.

Response #2.

We edited the text accordingly, as follows:

“Takano Hospital employed 86 full and part-time staff before the incident, including two full-time physicians (including the hospital director), and nurses and care workers. However, after the incident on 11 March 2011, as of 15 March, most staff had evacuated; the only remaining staff consisted of four nurses and two care workers in the internal department and five nurses and two care workers (and the hospital director) in the psychiatry department. One day later, two more internal nurses evacuated. Lack of trained staff might hamper basic (mostly nursing) care delivery, including perineal care, postural change, oral care, meal feeding assistance, and suctioning of secretions. At that point, because of poor resources and high workloads, the hospital director decided to evacuate some

patients who were likely to survive among the remaining staff rather than radiation concerns.” (page 12, line 32, Discussion section)

Bibliography

1. All Japan Hospital Association. Interdisciplinary research project on the actual conditions of the elderly with medical needs [Japanese]. 2014. https://www.ajha.or.jp/voice/pdf/other/140414_6.pdf (accessed 13 March 2018).

VERSION 2 – REVIEW

REVIEWER	C. Norman Coleman National Cancer Institute, USA
REVIEW RETURNED	30-Mar-2018
GENERAL COMMENTS	This is a very useful study. The only 2 things I might suggest are 1) data on the cause of death (may not be readily findable, and 2) did the people shelter-in-place or in a communal shelter (important)
REVIEWER	Kristian Krieger Visiting Fellow, Catholic University of Louvain, Belgium
REVIEW RETURNED	03-Apr-2018
GENERAL COMMENTS	I would like to thank the authors for effectively addressing the comments/issues raised in the course of the first round of review.
REVIEWER	Hai-long Li CDC in China
REVIEW RETURNED	15-Apr-2018
GENERAL COMMENTS	I don't think the research can provide reference to the other country for nuclear incidence rescue. As well known to all, the three basic principles of protection against nuclear incidence are time, distance and sheltering. And the present article is no more than to elaborate the principles with data, and has no novel result. Therefore, I reject it.

VERSION 2 – AUTHOR RESPONSE

RESPONSE TO REVIEWERS

We would like to thank the reviewers for their helpful comments. Our responses to the comments from the editors and reviewer #1, #2, and #3 are given beneath each comment. The added/revised text is double-quoted in our response for ease of reference, with line and page numbers provided where necessary.

Response to Editors

Comment:

Please revise the title of your manuscript to include the research question, study design and setting. This is the preferred format of the journal. We do not accept manuscripts with declarative titles.

Response:

Thank you for your careful inspection. We have changed the study title into the proper format to include the research question, study design, and setting as follows.

“Balancing the risk of the evacuation and sheltering-in-place options: a survival study following Japan’s 2011 Fukushima nuclear incident” (page 1, line 1, Title)

Response to Reviewer #1

Comment:

I don't think the research can provide reference to the other country for nuclear incidence rescue. As well known to all, the three basic principles of protection against nuclear incidence are time, distance and sheltering. And the present article is no more than to elaborate the principles with data and has no novel result. Therefore, I reject it.

Response:

We would like to express our sincere appreciation to you for the careful review of the manuscript and its revision and many constructive suggestions for improving the them. We acknowledge and understand the fundamental principles of human protection following a nuclear incident, but are not able to fully address them due to limited data. Nonetheless, given the paucity of information on safe emergency response for vulnerable people post-nuclear incidence, we and many others in the field see considerable value in such data on informing future policy.

Response to Reviewer #2

Comment:

The only 2 things I might suggest are (1) data on the cause of death (may not be readily findable), and (2) did the people shelter-in-place or in a communal shelter (important).

Response (1):

First of all, we would like to express our gratitude to you for the careful review of the manuscript and its revision and useful and constructive recommendations on them. We understand that consideration of the cause of death would be very helpful. However, we unfortunately cannot access data on cause of death, which is located at several different hospitals as patients died in different locations. We edited the text to clarify this reason as follows:

“Data on causes of death were not available because such data is located at several different hospitals, due to patients dying in different locations.” (page 5, line 156, Methods section)

Response (2):

All of those who did not evacuate stayed on-site at the hospital. To clarify, we have edited the text as follows:

“Post-incident periods were separately measured for those who evacuated after the incident, those who did not evacuate but sheltered-in-place (stayed on-site at the hospital), and those newly admitted to the hospital after the incident. Therefore, our study considered the mortality rates per person-days for the baseline pre-incident and three groups post-incident: evacuees, non-evacuees (our major interest), and new admittees.” (page 6, line 171, Methods section)

Response to Reviewer #3

Comment:

I would like to thank the authors for effectively addressing the comments/issues raised in the course of the first round of review.

Response:

We would like to offer our special thanks to you for kindly focusing your energies on the careful review of the manuscript and its revision. Our manuscript was revised according to your useful and constructive recommendations.