

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Examining changes in the equity of physician distribution in Japan: a specialty-specific longitudinal study
AUTHORS	Hara, Koji; Kunisawa, Susumu; Sasaki, Noriko; Imanaka, Yuichi

VERSION 1 – REVIEW

REVIEWER	matthew muffy stanford university medical center Stanford, USA
REVIEW RETURNED	30-Jul-2017

GENERAL COMMENTS	<p>Dear Authors,</p> <p>Thank you for submitting your manuscript “Failure to improve the inequitable geographic distribution of physicians in Japan: a specialty-specific longitudinal study.”</p> <p>The manuscript reads very well, it has a clear and concise message, and the tables and figures are well done. I do have a few suggestions and questions that came to mind when reading the paper that I hope you find helpful.</p> <p>L1 The title: “Failure to improve the inequitable geographic distribution of physicians in Japan: a specialty-specific longitudinal study” implies (to me, at least) that an intervention was attempted to decrease the inequitable distribution. There were some policy changes between 2000-2014 that would increase and decrease the equity of physician distribution, but these were not the focus of the study. Would suggest shortening the title to “The inequitable geographic distribution of physicians in Japan: a specialty-specific longitudinal study.”</p> <p>L95-97 I like the introduction, but think you should mention that the longitudinal study takes place from 2000-2014.</p> <p>L111 What was the rationale for including these physician subgroups?</p> <p>L141 The statement that “Health expenditure per capita is indicative of the general workload of healthcare providers” may be inaccurate (at least in the US). Would consider rewording to “is likely indicative” or something that acknowledges the potential uncertainty here.</p>
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L145-151 Like that you used Gini coefficients and Lorenz curves. Would state that you also calculated the Gini coefficients for each specialty in each year from 2000 and 2014.

L155-156

It seems strange to me that the definition of a rural SMA is a population below the median population density of all SMAs (and conversely for urban SMAs). Clearly, the lowest SMA population density is quite different from the population density of SMAs just below the median value. When you use this methodology, you may lose some interesting and important information about the SMAs with the lowest population densities.

Some would classify a geographic area as rural if the population is below a designated threshold. Or, perhaps further subdivide the SMAs into quartiles of population density and evaluate the trends in the upper and lower quartiles. You may want to consider doing something like this, or at least provide some rationale for the methodology that you used.

L190-191

The increase in anesthesiologists seems dramatic. Can you explain a few things:

1. Why there are 1/5 the number of anesthesiologists in Japan as surgeons
2. Why you think there was such a large increase in anesthesiologists (was there a change in the way that anesthesia care was administered?)

L197

When you state that "inequity had worsened" this confers a value judgement about equitable distribution being "better" and inequitable distribution being "worse." While I happen to agree, it may be better to stick with terms that do not confer this value judgement. For example, would consider stating: "inequity had increased."

L253 Think that "must" sounds too strong. Consider stating "We (or some authors) believe that improvements should be made to the working environment."

L287-292 This is interesting. Could you briefly explain the rationale for this change in policy?

L325 Consider rewording to state that "the inequities of geographic distribution of physicians in Japan have not decreased" or something to that effect (avoids the word improves/worsened).

L328 "Urgent measures" sounds a bit too strong to me.

REVIEWER	Arturo J. Rios-Diaz, MD Thomas Jefferson University Hospital, Thomas Jefferson University. Philadelphia, PA, USA.
REVIEW RETURNED	20-Aug-2017

GENERAL COMMENTS	<p>The authors have assessed changes in geographic distribution of physicians according to healthcare demand in Japan at a population level in a longitudinal fashion. There was a decrease in the number of physicians per demand-adjusted population in internal medicine, surgery, orthopedics and OB/GYN. Conversely, pediatrics and anesthesiology had an increase in the number of physicians. Subanalysis revealed that rural areas had the highest decrease and urban areas had the lowest decrease in physicians per demand-adjusted population.</p> <p>This tremendous work by the authors should be acknowledged and applauded as the literature lacks of population-level data on geographic disparities. There are some minor revisions that before it can be considered for publication as shown below.</p> <p>MAJOR</p> <ul style="list-style-type: none"> - Line 169: While the adjustment coefficients of healthcare demand for the different age strata and sex were key in this study to calculate the demand-adjusted population, these results are not necessarily useful to the reader or at least is not clear from the paper. The authors could either move all this paragraph and Figure 1 to an appendix, or explain and comment in the discussion why it is useful to have these results in the manuscript, or this paragraph can be entirely removed. - Table 4 is merely a count of physicians per 100,000 population. It should contain under parenthesis the percentage of increase/decrease in the 2014 columns so the reader can easily identify the proportion of change. - There are a few grammar issues. Specially when talking in past tense the authors tend to use past perfect (Line 197 "had worsened" instead of "worsened", same for line 226, 230, 265, 272, etc.). Please, revise this along the entire manuscript. - Methods: primary and secondary outcomes need to be clearly defined - Conclusion: I would be more careful with the phrasing of the conclusion. There is definitively a disparity in rural/urban supply in all specialties, but there was an increase in demand-adjusted population for the number of physicians in two specialties. <p>MINOR</p> <ul style="list-style-type: none"> - Line 101: "Surveys of Physicians, Dentists, and Pharmacists" should read as "the Survey of Physicians, Dentists, and Pharmacists" and a brief explanation of what this survey is would be beneficial to the reader. - Line 134: It is not clear why data from 2012 was used to ascertain the number of SMAs, please explain. - Line 182: This paragraph repeats all the results in Table 2. It would read better. Consider leaving the first 3 lines and then referring to the table for trends according to specific specialty. - Line 208. Would read better as "...in the number of physicians by clinical specialty in each group of SMAs" - Line 219: Every time the authors state "lowest increase (or the highest decrease)" they refer to different specialties and it gets confusing.
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	Since there were just two specialties in which there was an increase, it may be better to say for which specialties this was the case (i.e. “highest decrease for internal medicine, surgery, orthopedics and OBG/GYN or lowest increase for anesthesiology and pediatrics”
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VERSION 1 – AUTHOR RESPONSE

Reviewer 1

#3 L1 The title: “Failure to improve the inequitable geographic distribution of physicians in Japan: a specialty-specific longitudinal study” implies (to me, at least) that an intervention was attempted to decrease the inequitable distribution. There were some policy changes between 2000-2014 that would increase and decrease the equity of physician distribution, but these were not the focus of the study. Would suggest shortening the title to “The inequitable geographic distribution of physicians in Japan: a specialty-specific longitudinal study.”

Response: Thank you for the suggestion. In accordance with the reviewer’s comment, we have revised the title as follows (the title has been further modified to be non-declarative as instructed by the editor):

“Examining changes in the equity of physician distribution in Japan: a specialty-specific longitudinal study”

#4 L95-97 I like the introduction, but think you should mention that the longitudinal study takes place from 2000-2014.

Response: As suggested, we have added the study period to the study’s objective (Page 7, Line 98), and thank the reviewer for their advice.

#5

L111 What was the rationale for including these physician subgroups?

Response: Thank you for this question. Internal medicine, surgery, and orthopedics were selected because these departments generally employ more physicians than other departments. Next, geographic disparities in the number of physicians in pediatrics, OB/GYN, and anesthesiology have been previously documented in Japan (described in Page 6, Lines 82-83). Accordingly, these subgroups were also targeted for analysis. We have added a description of this rationale to the Methods (Page 8, Lines 118-121).

#6 L141 The statement that “Health expenditure per capita is indicative of the general workload of healthcare providers” may be inaccurate (at least in the US). Would consider rewording to “is likely indicative” or something that acknowledges the potential uncertainty here.

Response: As suggested, we have reworded the phrase to “is likely indicative” (Page 10, Line 152), and thank the reviewer for pointing this out.

#7 L145-151 Like that you used Gini coefficients and Lorenz curves. Would state that you also calculated the Gini coefficients for each specialty in each year from 2000 and 2014.

Response: Thank you for the comment. As advised, we have revised the manuscript to state that we calculated the Gini coefficients for each specialty every two years from 2000 to 2014. This sentence was added to the Methods (Page 10, Lines 158-159).

#8 L155-156

It seems strange to me that the definition of a rural SMA is a population below the median population density of all SMAs (and conversely for urban SMAs). Clearly, the lowest SMA population density is quite different from the population density of SMAs just below the median value. When you use this methodology, you may lose some interesting and important information about the SMAs with the lowest population densities.

Some would classify a geographic area as rural if the population is below a designated threshold. Or, perhaps further subdivide the SMAs into quartiles of population density and evaluate the trends in the upper and lower quartiles. You may want to consider doing something like this, or at least provide some rationale for the methodology that you used.

Response: Thank you for the comment. As pointed out, the population densities would be quite different between the lowest SMA and the SMAs just below the median value. However, the definition used in this study is—we believe—intuitively easy to understand and was used in a previous study,¹ which performed a principal component analysis that divided SMAs into four groups according to the principal components (urban-rural classification and initial healthcare service supply). In addition, even if we were to compare the areas with the lowest and highest population densities, the difference between those regions is likely to be larger than those in our study. As a consequence, while our urban-rural classification using the population density median may lead to an underestimation of the results, we do not think that further subdividing the classification would change the direction of the outcomes. However, we do agree that downstream analyses should verify these findings using other urban-rural classifications.

1. Sasaki H, Otsubo T, Imanaka Y. Widening disparity in the geographic distribution of pediatricians in Japan. *Hum Resour Health* 2013;11:59.

#9 L190-191

The increase in anesthesiologists seems dramatic. Can you explain a few things:

1. Why there are 1/5 the number of anesthesiologists in Japan as surgeons

Although the exact reason is unknown, a possible explanation is the relatively late introduction of anesthesiology departments in Japan. While the American Surgical Association and the American Society of Anesthesiologists were established in 1880 and 1905, respectively, the Japan Surgical Society and the Japanese Society of Anesthesiologists were established in 1899 and 1954, respectively. This may explain the relatively low ratio of anesthesiologists to surgeons at present in Japan. However, this is supposition on our part, and not based on any hard data or previous studies. Response: We have therefore refrained from adding this explanation to the manuscript.

2. Why you think there was such a large increase in anesthesiologists (was there a change in the way that anesthesia care was administered?)

Response: There is an increasing need for anesthesiologists in Japan resulting from the rising number of surgeries conducted, the increasing complexity of surgery owing to advances in surgical techniques and the overall aging of patients, as well as growing social expectations for safety in anesthesia. Because of the initial shortage of anesthesiologists, the increased demand for these specialists may have led to higher salaries, thereby attracting more physicians. In addition, the increase in anesthesiologists may also have been influenced by an overall increase in female physicians. Anesthesiologists generally do not have their own patients or on-call duties, and this specialty may therefore be more compatible with raising families. In fact, the proportion of female anesthesiologists rose substantially from 26.7% to 37.6% during the study period, which supports this theory. We have added these explanations in the manuscript (Page 16, Lines 255-264), and thank the reviewer for pointing this out.

#10 L197

When you state that “inequity had worsened” this confers a value judgement about equitable distribution being “better” and inequitable distribution being “worse.” While I happen to agree, it may be better to stick with terms that do not confer this value judgement. For example, would consider stating: “inequity had increased.”

Response: Thank you for the suggestion. As advised, we have reworded the phrase to “inequity increased” here (Page 13, Line 200) and throughout the manuscript.

#11 L253 Think that “must” sounds too strong. Consider stating “We (or some authors) believe that improvements should be made to the working environment.”

Response: We have changed the phrase as advised (Page 16, Line 253).

#12 L287-292 This is interesting. Could you briefly explain the rationale for this change in policy?

Response: Thank you for your question. Prior to 2004, clinical training was not mandatory or standardized. Accordingly, few medical graduates were able to acquire a wide range of medical skills through comprehensive and systematic training. In addition, training assessments were not adequately performed under the Ikyoku system.² In order to improve the overall quality of clinical training in Japan, the Ministry of Health, Labour and Welfare mandated a standardized 2-year training program in 2004. Under the new program, trainees were required to rotate through all the basic specialties (internal, surgery, and emergency medicine) and compulsory secondary specialties (pediatrics, OB/GYN, psychiatry, and community health).³ The introduction of this new program therefore diminished the role of the Ikyoku system. The number of non-university training hospitals increased from 476 in 2001 to 852 in 2004, and medical graduates were now given a greater number of options for training hospitals to attend.³ As a consequence, graduates tended to choose non-university hospitals in urban areas.⁴ In 2003, 72.5% of graduates worked at university hospitals. However, the implementation of the new program saw this percentage drop to 55.8% in 2004 and to 49.2% in 2005.

We have added an explanation of the rationale for this change in policy to the Discussion (Pages 18-19, Lines 299-306).

2. Ministry of Health, Labour and Welfare, A history of post-graduate clinical training system [in Japanese] 2017 [Available from: <http://www.mhlw.go.jp/topics/bukyoku/isei/rinsyo/hensen/> accessed 1 Sep. 2017].

3. Koike S, Ide H, Yasunaga H, et al. Postgraduate training and career choices: an analysis of the National Physicians Survey in Japan. *Med Educ* 2010;44(3):289-97. doi: 10.1111/j.1365-2923.2009.03582.x [published Online First: 2010/05/07]

4. Sakai R, Tamura H, Goto R, et al. Evaluating the effect of Japan's 2004 postgraduate training programme on the spatial distribution of physicians. *Hum Resour Health* 2015;13:5. doi: 10.1186/1478-4491-13-5 [published Online First: 2015/01/27]

#13 L325 Consider rewording to state that “the inequities of geographic distribution of physicians in Japan have not decreased” or something to that effect (avoids the word improves/worsened).

Response: Thank you for the suggestion. We have revised the conclusion to remove the words “improved” and “worsened” here (Pages 20-21, Line 349-340) and throughout the manuscript.

#14

L328 "Urgent measures" sounds a bit too strong to me.

Response: Thank you for the comment. We have changed "urgent" to "additional" (Page 21, Line 342), and hope this is acceptable.

Reviewer 2

MAJOR

#15 Line 169: While the adjustment coefficients of healthcare demand for the different age strata and sex were key in this study to calculate the demand-adjusted population, these results are not necessarily useful to the reader or at least is not clear from the paper. The authors could either move all this paragraph and Figure 1 to an appendix, or explain and comment in the discussion why it is useful to have these results in the manuscript, or this paragraph can be entirely removed.

Response: Thank you for the comment. As requested, we have moved Figure 1 and its associated paragraph to the Appendix. We feel this improves the overall flow of the manuscript, and thank the reviewer for the suggestion.

#16 Table 4 is merely a count of physicians per 100,000 population. It should contain under parenthesis the percentage of increase/decrease in the 2014 columns so the reader can easily identify the proportion of change.

Response: Thank you for the advice. In accordance with the reviewer's comment, we have added the percentages of increase/decrease between 2000 and 2014 to Table 4.

#17 There are a few grammar issues. Specially when talking in past tense the authors tend to use past perfect (Line 197 "had worsened" instead of "worsened", same for line 226, 230, 265, 272, etc.). Please, revise this along the entire manuscript.

Response: We apologize for the errors. The manuscript has been professionally edited for grammatical issues, and the inappropriate use of past perfect tense has been removed.

#18 Methods: primary and secondary outcomes need to be clearly defined

Response: The primary outcomes were the overall number of physicians per 100,000 population and the trends in Gini coefficients for each specialty from 2000 to 2014. The secondary outcomes were the changes in physician numbers between 2000 and 2014 for subgroups that were categorized according to regional characteristics. We have added this explanation to the Methods as advised (Page 10, Lines 144-149).

#19 Conclusion: I would be more careful with the phrasing of the conclusion. There is definitively a disparity in rural/urban supply in all specialties, but there was an increase in demand-adjusted population for the number of physicians in two specialties.

Response: As pointed out, the number of physicians per demand-adjusted population increased in pediatrics and anesthesiology. In addition, the urban-rural disparity in the number of pediatricians per demand-adjusted population decreased. We have revised the conclusions to include these exceptions (Pages 20-21, Lines 339-343).

MINOR

#20 Line 101: "Surveys of Physicians, Dentists, and Pharmacists" should read as "the Survey of Physicians, Dentists, and Pharmacists" and a brief explanation of what this survey is would be beneficial to the reader.

Response: Thank you for the suggestion. We have revised the sentence and added a brief explanation of the survey. Physicians in Japan are required to participate in this survey, which includes information on each physician's specialty and the type and location (municipality) of their workplace (Pages 7-8, Lines 103-106).

#21 Line 134: It is not clear why data from 2012 was used to ascertain the number of SMAs, please explain.

Response: Because the numbers of SMAs and their constituent municipalities fluctuated slightly through the research period, we had to choose a specific year for analysis. We previously conducted a study (the precursor of the present study) that used SMA boundaries from 2012.5. We adopted the same boundaries in this study for the sake of consistency. Furthermore, there were no major changes in the number of SMAs during the study period (354 in 2000 and 344 in 2014). Therefore, even if data from other years had been used to ascertain the number of SMAs, we would not expect these small changes to affect our findings and conclusions.

5. Hara K, Otsubo T, Kunisawa S, et al. Examining sufficiency and equity in the geographic distribution of physicians in Japan: a longitudinal study. *BMJ Open* 2017;7(3):e013922. doi: 10.1136/bmjopen-2016-013922 [published Online First: 2017/03/16]

#22 Line 182: This paragraph repeats all the results in Table 2. It would read better. Consider leaving the first 3 lines and then referring to the table for trends according to specific specialty.

Response: As suggested, we have revised the paragraph to focus on the notable decreases in surgeons and OB/GYN specialists, and the increases in pediatricians and anesthesiologists (Pages 12-13, Lines 192-196).

#23 Line 208. Would read better as "...in the number of physicians by clinical specialty in each group of SMAs"

Response: Thank you for the suggestion. We have revised the sentence (Page 13, Line 209-210) as recommended.

#24 Line 219: Every time the authors state "lowest increase (or the highest decrease)" they refer to different specialties and it gets confusing. Since there were just two specialties in which there was an increase, it may be better to say for which specialties this was the case (i.e. "highest decrease for internal medicine, surgery, orthopedics and OBG/GYN or lowest increase for anesthesiology and pediatrics")

Response: Thank you for pointing this out. This phrasing may indeed confuse the readers. We have revised the relevant sentences to improve readability (Page 4, Lines 42-43; Page 14, Line 220-221; Page 15, Line 234).

VERSION 2 – REVIEW

REVIEWER	Matthew Muffly Stanford University Medical Center
REVIEW RETURNED	19-Sep-2017

GENERAL COMMENTS	Thank you for making these changes. I have no further recommendations.
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REVIEWER	Arturo J. Rios-Diaz, MD Thomas Jefferson University Hospital. Philadelphia, USA
REVIEW RETURNED	21-Oct-2017

GENERAL COMMENTS	<p>The authors have assessed changes in geographic distribution of physicians according to healthcare demand in Japan at a population level in a longitudinal fashion. There was a decrease in the number of physicians per demand-adjusted population in internal medicine, surgery, orthopedics and OB/GYN. Conversely, pediatrics and anesthesiology had an increase in the number of physicians. Subanalysis revealed that rural areas had the highest decrease and urban areas had the lowest decrease in physicians per demand-adjusted population. This tremendous work by the authors should be acknowledged and applauded as the literature lacks of population-level data on geographic disparities.</p> <p>I thank the authors for addressing all the comments I made previously. The revisions were not done over the file that was originally submitted, which makes difficult to assess all the changes made in the revised “marked copy” version. I would encourage to avoid this for future revisions.</p> <p>The manuscript still has a few minor revisions that should be made prior to publication:</p> <ul style="list-style-type: none">- Abstract Results: please include the decrease according to specialty for all the specialists assessed and not just for surgery (internist, surgeons, orthopedists, OB/GYN specialists) as this information is the crux of the paper.- Abstract: Consider an abbreviation for “physicians per 100 000 demand-adjusted population”. for the abstract, it may improve readability and leave.- Abstract Conclusions, manuscript conclusions and rest of manuscript: avoid saying “decreased in all specialties except pediatrics and anesthesiology” as it reads as if all the medical specialties were assessed in this study, which is not the case. It would be more accurate and appropriate to state “in all specialties assessed” or something along those lines.- Selection of specialties (Line 118): I would encourage to have some sort of data to back this selection as this could have introduced selection bias in the study (other specialties may have not experienced the same geographic disparity), please comment on this in your limitations- Discussion: authors should be extremely careful with their speculations in the discussion. It is acceptable to make speculations based on observations but I would try to find more data that goes along your speculations.
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	<p>- Line 260: The sentence “Because anesthesiologists generally do not have their own patients or on-call duties, this specialty may be more compatible with raising families” right after stating that the number of female physicians increased is extremely sexist and inappropriate. It should be deleted as it adds nothing to the discussion.</p>
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VERSION 2 – AUTHOR RESPONSE

#1 Abstract Results: please include the decrease according to specialty for all the specialists assessed and not just for surgery (internist, surgeons, orthopedists, OB/GYN specialists) as this information is the crux of the paper.

Response: Thank you for the suggestion. In accordance with the reviewer’s comment, we have added the decreases for all the specialties assessed. (Pages 3-4, Lines 39-40)

#2 Abstract: Consider an abbreviation for “physicians per 100 000 demand-adjusted population”. for the abstract, it may improve readability and leave.

Response: As suggested, we have abbreviated “demand-adjusted population” to “DAP” to improve readability, and thank the reviewer for their advice. (Pages 3-4)

#3 Abstract Conclusions, manuscript conclusions and rest of manuscript: avoid saying “decreased in all specialties except pediatrics and anesthesiology” as it reads as if all the medical specialties were assessed in this study, which is not the case. It would be more accurate and appropriate to state “in all specialties assessed” or something along those lines.

Response: Thank you for the comment. As advised, we have reworded the phrase to “all specialties assessed” throughout the manuscript. (Pages 3-4; Page 21, Lines 341-342)

#4 Selection of specialties (Line 118): I would encourage to have some sort of data to back this selection as this could have introduced selection bias in the study (other specialties may have not experienced the same geographic disparity), please comment on this in your limitations

Response: As suggested, we have added a limitation addressing this possible bias (Page 20, Lines 331-334), and thank the reviewer for pointing this out.

#5 Discussion: authors should be extremely careful with their speculations in the discussion. It is acceptable to make speculations based on observations but I would try to find more data that goes along your speculations.

Response: Thank you for the comment. We have carefully looked through the Discussion, and decided to delete the sentence “Due to the initial shortage of anesthesiologists, the offering of higher salaries may have contributed to attracting more specialists.” from the third paragraph as we lack data to back it up.

In addition, analysis, we calculated the Gini coefficients for general internal medicine and its subspecialties in order to verify our speculation that the increase in geographic disparity may be related to an increasing tendency toward physician specialization in Japan. The results confirmed that the coefficient in the subspecialties was more than twice that of general internal medicine (General internal medicine: 0.173 in 2000 to 0.149 in 2014, Internal subspecialties: 0.386 in 2000 to 0.390 in 2014). We have added these results to the Discussion. (Page 17, Lines 279-283)

#6 Line 260: The sentence “Because anesthesiologists generally do not have their own patients or on-call duties, this specialty may be more compatible with raising families” right after stating that the number of female physicians increased is extremely sexist and inappropriate. It should be deleted as it adds nothing to the discussion.

Response: We apologize for the inappropriate sentence, and have deleted it as advised. (Page 16, Lines 259)

VERSION 3 – REVIEW

REVIEWER	Arturo J Rios-Diaz Thomas Jefferson University Hospital. Philadelphia, PA. USA
REVIEW RETURNED	18-Nov-2017
GENERAL COMMENTS	Thank your efforts addressing all the comments I made. I have no further recommendations.