PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf**) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Spatial barriers and the bypassing of nearby dental clinics for dental services: a secondary data analysis in Korea
AUTHORS	Shin, Hosung; Cho, Han-A

VERSION 1 – REVIEW

REVIEWER	Yasuaki Saijo Asahikawa Medical University, Japan
REVIEW RETURNED	23-May-2018

GENERAL COMMENTS	Major The statistics and table 3 were not understandable. In statistics, the authors describe “The travel distance was skewed positively; therefore, we log-transformed the dependent variables in preparation for GEE regression analysis.” It said that the betas in tables should be log (distance) per one unit change (target category vs. reference category). Therefore, I think, in abstract, “traveled 1.27 times and 1.17 times farther ($p < 0.01$)” should be “traveled 1.27 km and 1.17 km farther ($p < 0.01$), ” etc. P10: “Bypass rates were not significantly different by geographical region ($p = 0.183$).” Please describe the statistical method analyzing this p value. P5: “Within the distance threshold, the difference was insignificant for dental use because it included the radius of daily activity and shared market area. [14]” Can the reference be adopted to South Korea? Minor P5L3: “Korea Health Panel” should be “Korea Health Panel (KHP).” Table 2: The 95%CIs should be converted to exponential values to the exp(beta)s dimension.

REVIEWER	Rita Santos Centre for Health Economics, University of York, United Kingdom
REVIEW RETURNED	30-Jun-2018

GENERAL COMMENTS	Thank you for submitting this paper. Your study is quite interesting and I hope that my comments will help you to improve it. In the paper, you analyse the factors that explain the distance travelled by patients to dental clinics and the bypassing distance.

	My first comment is on your bypassing distance definition. You define bypassing as the distance between the nearest and the used dental clinic. However, if the nearest was on the left-hand side of the patient household and the used of the right-hand side you bypassing distance would be larger than the distance between the patient and the used practice. I suggest you do your analysis using a bypassing distance the difference between the used dental clinic and the distance the to nearest. You should also define clearly spatial barrier. Your methods section should explain more clearly the GEE approach, identifying the family and link function you used and the coefficient transformation you have included in table 2. Since you are using repeated observations you should also explain why you do not do a multilevel approach. The weakness of your study in on your explanatory variables. You conclude that older, more educated, with higher income, from rural areas that need more specify dental treatments. However, those just characterised the population that used the service. What you want is to understand the dental clinic choice and why patients are travelling to certain dental clinics, i.e., the characteristics of the dental clinics. You need to include in your models the characteristics of the chosen clinics, their quality, their prices, their availability of services, and all the factors that will explain the patient choice. Since some of the services need to be paid by patients, including prices and modelling those services separately would give you insight to how different patient choices are (or not) once they have to pay for the services.

VERSION 1 – AUTHOR RESPONSE

Reviewers' Comments to Author:

Reviewer: 1

Reviewer Name: Yasuaki Saijo

Institution and Country: Asahikawa Medical University, Japan

Competing Interests: None.

Major

The statistics and table 3 were not understandable. In statistics, the authors describe “The travel distance was skewed positively; therefore, we log-transformed the dependent variables in preparation

for GEE regression analysis." It said that the betas in tables should be log (distance) per one unit change (target category vs. reference category). Therefore, I think, in abstract, "traveled 1.27 times and 1.17 times farther ($p < 0.01$)" should be "traveled 1.27 km and 1.17 km farther ($p < 0.01$), " etc.

→ Thank you for your valuable comment. We calculated the distances from a dental service user's residence to the dental clinic they actually utilized. At this point we have log-transformed the values of the two points to calculate the difference. In the logarithmic calculation, the subtraction is a ratio, so interpretation of the ratio is 'times', not 'km'. In addition, when authors employed GEE module for regression analysis, we used 'Gaussian" as link function

P10: "Bypass rates were not significantly different by geographical region ($p = 0.183$)."
Please describe the statistical method analyzing this p value.

→ Authors conducted binomial proportion test for bypass rates of three regions

P5: “Within the distance threshold, the difference was insignificant for dental use because it included the radius of daily activity and shared market area. [14]”

Can the reference be adopted to South Korea?

→ Authors could not find the reference of health care field including dentistry in Korea, but criteria for the threshold of daily activity cited in other academic fields are as follows.

1) The Ministry of Land, Infrastructure and Transport in South Korea mentioned that there was a tendency to travel to destinations using transportation other than walking at distances of over 500 meters .

2) According to a study using Household Travel Survey Data, small-sized living zone that was a spatial range accessible on foot without using transportation was estimated to range from 500 m to 1.3km.

Reference

1. http://www.molit.go.kr/USR/I0204/m_45/dtl.jsp?idx=7360

2. Ha J. Lee S. A Study on the Designation of Living Zones by Its Spatial Hierarchy Using OD Data and Community Detection Technique : Focused on the 2010 Household Travel Survey Data of the Seoul Metropolitan Area. Journal of Korea Planning Association. 2016;51(6):79-98.

DOI: https://doi.org/10.17208/jkpa.2016.11.51.6.79

In addition, since about 18,000 dental clinics in South Korea were located in narrow commercial districts, we thought that the threshold of 500 meters was applicable to Korea.

Minor

P5L3: “Korea Health Panel” should be “Korea Health Panel (KHP).”

→ Authors changed it as your suggestion

Table 2: The 95%CIs should be converted to exponential values to the exp(beta)s dimension.

→ Authors changed Table 2 according to your suggestion as following:

Variables	Travel distance			Bypass distance		
	Exp (β)	*P-value*	95% CI	Exp (β)	*P-value*	95% CI

Bypass	9.63	0.000	(8.71, 10.64)			
Age group (y)						
45–65	1.26	0.006	(1.07, 1.49)	1.71	0.032	(1.05, 2.79)
> 65	1.37	0.003	(1.11, 1.69)	2.08	0.021	(1.11, 3.87)
Sex						
Female	1.09	0.352	(0.91, 1.31)	1.54	0.133	(0.88, 2.72)
Education						
< Elementary school	1.04	0.659	(0.86, 1.26)	0.50	0.022	(0.28, 0.91)
> College	1.27	0.009	(1.06, 1.52)	1.88	0.027	(1.07, 3.28)
Trisection of equivalent income						
T2	0.95	0.344	(0.86, 1.05)	0.47	0.000	(0.36, 0.62)
T3	0.99	0.916	(0.88, 1.12)	0.42	0.000	(0.31, 0.59)
Geographical region						
Small cities	1.25	0.003	(1.08, 1.45)	0.40	0.000	(0.26, 0.63)
Rural county	1.98	0.000	(1.55, 2.54)	0.63	0.233	(0.29, 1.35)
Type of dental treatment						
Implant/orthodontics	1.17	0.002	(1.06, 1.28)	1.53	0.001	(1.20, 1.95)
Prosthesis	1.07	0.076	(0.99, 1.15)	0.97	0.754	(0.81, 1.17)
Temporal trend						
Year 2009	1.00	0.988	(0.92, 1.08)	2.06	0.000	(1.69, 2.51)
Year 2010	1.22	0.000	(1.12, 1.32)	2.29	0.000	(1.86, 2.83)

Year 2011	1.19	0.000	(1.09, 1.29)	1.42	0.001	(1.15, 1.77)

Reviewer: 2

Reviewer Name: Rita Santos

Institution and Country: Centre for Health Economics, University of York, United Kingdom

Competing Interests: None declared

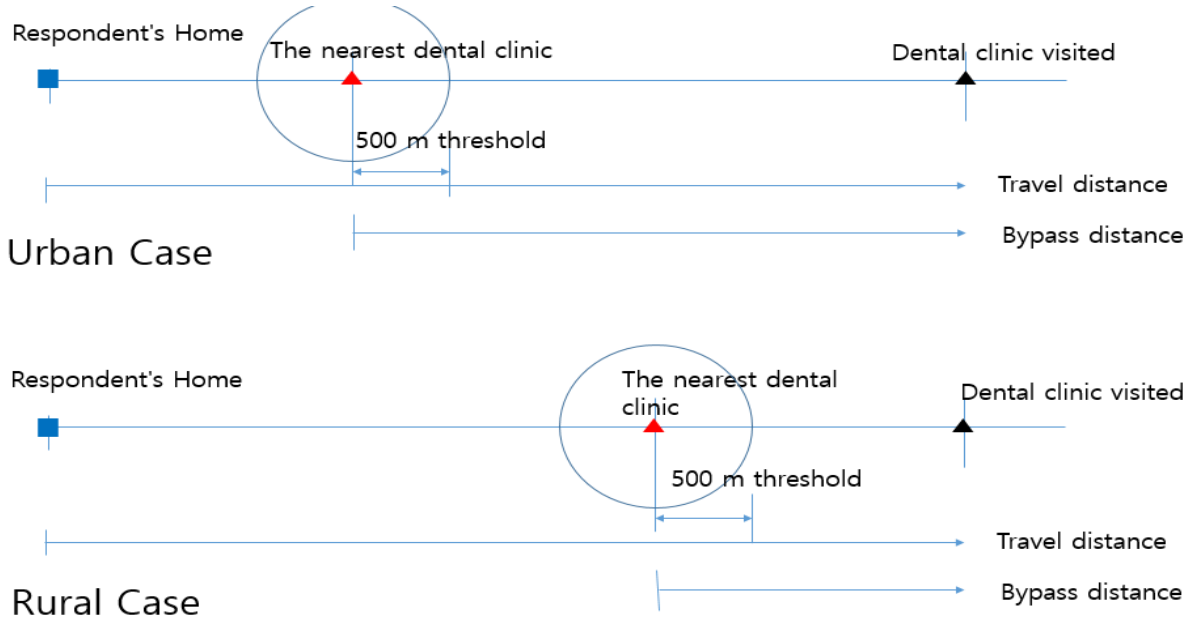
Dear authors,

Thank you for submitting this paper. Your study is quite interesting and I hope that my comments will help you to improve it.

In the paper, you analyse the factors that explain the distance travelled by patients to dental clinics and the bypassing distance.

My first comment is on your bypassing distance definition. You define bypassing as the distance between the nearest and the used dental clinic. However, if the nearest was on the left-hand side of the patient household and the used of the right-hand side you bypassing distance would be larger than the distance between the patient and the used practice. I suggest you do your analysis using a bypassing distance the difference between the used dental clinic and the distance the to nearest.

→ Thank you for your critical comments. Our definition of bypass was shown in the following figure.



As shown in the figure, the nearest dental clinic in the urban is located close to the respondent's house, while the actual visiting dental clinic was located relatively far away. On the contrary, the nearest dental clinic in rural areas tended to be located far from the respondent's home, but the bypass distance was relatively smaller than in the urban areas. Based on those ideas, authors measured bypass distance. However, in order to make it clear, we have modified it as you have suggested.

To obtain the distance measurement, the patient's residence and the dental clinic address were geocoded and the distances were measured by combining the geocodes through network analysis based on digital geographic maps and traffic network maps. “Bypass distance” was the distance from the nearest dental clinic to the utilized dental clinic. In this case, the bypass distance was defined as the distance between two dental clinics exceeding a 500 m threshold.

You should also define clearly spatial barrier.

Spatial barriers to healthcare utilization imply limited geographic accessibility due to an imbalance of the spatial distribution of healthcare institutions. Spatial barriers are often measured in travel distance

[19, 5], transportation availability [19], and time traveled [19, 5]. In this study, we chose to measure the travel distance to evaluate spatial barriers to dental care utilization.

Reference

19. Syed, S. T., Gerber, B. S., & Sharp, L. K. (2013). Traveling towards disease: transportation barriers to health care access. *Journal of community health*, *38*(5), 976-993.

5. Probst JC, Laditka SB, Wang JY, Johnson AO. Effects of residence and race on burden of travel for care: Cross sectional analysis of the 2001 US national household travel survey. BMC Health Services Research. 2007;7:40.

Your methods section should explain more clearly the GEE approach, identifying the family and link function you used and the coefficient transformation you have included in table 2. Since you are using repeated observations you should also explain why you do not do a multilevel approach.

→ We described why the authors employed population-averaged GEE in the statistical analysis part.

In this study, we employed the population-averaged GEE method, which identifies the average variation of dependent variables in a population rather than the individual's level of change. [24] The travel distance was skewed positively; we log-transformed the dependent variables in preparation for GEE regression analysis, and employed identity as the link function and Gaussian as the family in the GEE. The coefficients of GEE regression represent logged values and were exponentially transformed for readability in Table 2.

The weakness of your study in on your explanatory variables. You conclude that older, more educated, with higher income, from rural areas that need more specify dental treatments. However, those just characterised the population that used the service. What you want is to understand the dental clinic choice and why patients are travelling to certain dental clinics, i.e., the characteristics of the dental clinics.

You need to include in your models the characteristics of the chosen clinics, their quality, their prices, their availability of services, and all the factors that will explain the patient choice. Since some of the services need to be paid by patients, including prices and modelling those services separately would give you insight to how different patient choices are (or not) once they have to pay for the services.

→ We completely agree with what you mentioned.
Of the KHP data we used, provider's characteristics available to KHP was type of dental treatment. So this study could not reflect the characteristics of the chosen clinics, their quality, their prices, their availability of services, and all the factors that will explain the patient choice.

As an alternative, authors included those as one of our study limitations.

Lastly, since the KHP data only listed the type of dental care provided, we could not include detailed information regarding the characteristics of the chosen dental clinics, such as their quality, prices, availability of services, or other factors that might explain the patient's choice of dental clinic.

VERSION 2 – REVIEW

REVIEWER	Yasuaki Saijo Asahikawa Medical University
REVIEW RETURNED	24-Aug-2018

GENERAL COMMENTS	In statistics, the detail of the dependent variable, log-transformed values of the two points difference, should be described.

REVIEWER	Rita Santos Centre for Health Economics, University of York, United Kingdom
REVIEW RETURNED	02-Oct-2018

GENERAL COMMENTS	The paper reads better but there are still some strange phrases as in the abstract: "We included users of dental care services who received from 2008 to 2011". The paper also needs to have a discussion on the policy implications of your results. It is essential for the reader to understand why this is an important study and which policies would address and improve the conditions for patients.

VERSION 2 – AUTHOR RESPONSE

Reviewers' Comments to Author:

Reviewer: 1

Reviewer Name: Yasuaki Saijo

Institution and Country: Asahikawa Medical University, Japan

Please state any competing interests or state ‘None declared’: None

Minor

In statistics, the detail of the dependent variable, log-transformed values of the two points difference, should be described.

→ Revised as following:

For descriptive statistics of distance of travel to dental clinics and bypassing distance displayed in Table 1, the unit of measures is meter. In Table 2 which showed GEE regression results, dependent variable was log-transformed because of right skewness of distance and bypassing measures. Authors described this information in the method sections in detail. However, to emphasize reviewer’s comment, authors included short description in note of Table 2.

Note: The dependent variable was log-transformed.

Reviewer: 2

Reviewer Name: Rita Santos

Institution and Country: Centre for Health Economics, University of York, United Kingdom

Please state any competing interests or state ‘None declared’: None declared.

The paper reads better but there are still some strange phrases as in the abstract:

"We included users of dental care services who received from 2008 to 2011".

→ Revised as following:

We included users of dental care services from 2008 to 2011

The paper also needs to have a discussion on the policy implications of your results. It is essential for the reader to understand why this is an important study and which policies would address and improve the conditions for patients.

→ Revised as following:

Bypassing is costly and inefficient for the individuals and the health system [36] and is seen as a powerful expression of a patient's preference, lack of service variety, obsolete equipment, and perceived poor quality [37]. To ensure that patients receive timely and accessible high-quality services, the health system provides relevant information to help them seek healthcare institutions and professionals. Governmental policies that provide incentives for dentists to set up clinics in areas where dental resources are lacking are also required. Then, dentists can consider providing practical benefits to patients with large bypass distances, for example, by ensuring that the appointment time is strictly adhered to and by providing support for transportation costs based on the time and distance traveled.