PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	An Exploratory Spatial Analysis of Overweight and Obesity among Children and Adolescents in Shandong, China
AUTHORS	Qin, Wenzhe; Wang, Lu; Xu, Lingzhong; Sun, Long; Li, Jiajia; Zhang, Jiao; Shao, Hui

VERSION 1 – REVIEW

REVIEWER	Martha Paisi University of Plymouth United Kingdom
REVIEW RETURNED	21-Jan-2019

GENERAL COMMENTS	Thank you for the opportunity to review this work. This is an interesting paper demonstrating the need for geographically focused interventions targeting childhood obesity in Shandong, China. The paper would be scientifically strengthened if the significance of several area-level characteristics on the observed spatial patterns of overweight/obesity was examined (e.g. distribution of fast food outlets) and/or if the authors made the paper more internationally appealing. Abstract: Line 24: If applicable, the authors could revise the sentence to indicate that this work involved secondary analysis of data e.g. 'Data on 6,216,076 children and adolescents aged 7-18 years from the Children and Adolescent Physical Examination Database for Shandong Province were used in this study" Line 34: Please use full stop rather than comma at the end of the sentence Strengths and Limitations Page3- line 3: Please could the authors clarify whether this was a secondary analysis of data or whether the CAPE study was conducted as part of this work? At present, it is as if its the latter. Page3- lines 12-18- Could be revised and broken down into two sentences Introduction Page 3- Line 32: 'was' should be 'has been' Page3- Line 55: 'What's more' could be replaced by another word Page 4-lines 21-25: Could be revised Page 4-line 43: Please revise 'which has caught up with developed countries' The authors could describe somewhere in the introduction: a) the use/value of geographic information systems in improving population's health b) other studies that used spatial analysis to explore the spatial patterns of overweight/obesity. The introduction could be strengthened by adding a theoretical concept on how the build environment may influence the spatial patterns of overweight/obesity

	Methods Please could the authors justify the use of the particular area level? Page 5-line 36: Obesity should be defined as BMI ≥95th percentile and not ≤ 95th percentile In Table 1, the authors could use asterisks after the p values to indicate the significant in results Page 5-lines 57-59: As this is something that comes up frequently during the paper, please could the authors clarify whether this was secondary analysis of data or whether the census study was conducted especially for the purpose of this study? If possible to explore the impact of area deprivation on the identified spatial patterns, it would strengthen the paper significantly. Discussion Page 10-first paragraph: the paragraph could be strengthened by adding more plausible explanations for the observed difference of overweight/obesity between boys and girls. Page 10-second paragraph: The paragraph could be strengthened by drawing evidence form studies that conducted analysis of the association between neighbourhood characteristics and overweight/obesity levels. Some recommendations for future research should also be added. Page 10-lines 41-43: The authors state that 'SES is the most important factors responsible for the geographic differences in the prevalence of childhood obesity'. However, as this was not examined in the present study, it would be better if the authors revised the text above accordingly. The authors explain well how the results will guide the allocation of resources at the local setting. However, they should expand on the implication to the international level and provide some recommendations for future research e.g. exploring the underlying mechanism for the increased levels of overweight/obesity in some areas, investigating the impact of area level characteristics on the spatial patterns identified etc. Page 12-lines 6-17: Please could you revise the text in terms of language. Thank you

REVIEWER	Di Fang University of Arkansas USA
REVIEW RETURNED	15-Apr-2019

GENERAL COMMENTS	The article aims to identify the spatial patterns of childhood overweight/obesity in Shandong province in China. As the authors mentioned, the contrition is that they use a unique datasheet that contains administrative data of children's BMI. Hence, there is value to this research. However, I have the following concerns: 1. The literature review was not thorough. Firstly, the issue of childhood obesity has been studied extensively in the US and in China. The authors should cite references that pertain to their study group as well the driving factors of overweight and obesity. Secondly, the use of spatial econometric in health studies is vast. There are often many recent developments in the methodology that the author should acknowledge. 2. The authors need to justify the use of said method. Moran's I is often considered a first -step test in spatial analysis, which is often followed by a more complicated spatial econometric method, e.g.

	spatial lag model. The authors should explain why Moran's I and LISA alone is enough to answer their research question. 3. The key contribution of this article is the dataset. Therefore the authors should spend more time explaining the mandatory physical examination among children in China, include descriptive statistics, and include a thorough discussion. I find it hard to believe that the reporting rate is 100%. This just doesn't happen in observation studies. 4. The logical link between results and conclusion is unconvincing. Moran's I can also test if there is spatial correlation in the errors of two spatial polygons. As to whether or not such a correlation should be explained as a cluster or a spillover of obesity is up for debate. As the authors pointed out, there are many factors, e.g. food environment , urban/rural difference, income, etc, that can contribute to the observed significant Moran's I. Without a careful discussion of how these are addressed and controlled for, the conclusion is hard sale. 5. It is good to see that BMI is age-standardized, but it is not clear how this is done. Again, a descriptive stats table would help. Why not use BMI z-score, which is more accepted measurement of BMI for children. Also, the data has wide age range and 7 year-old have different metabolism than 18-year old. It might be interesting to study sub-groups by age categories. 6. The objective is to study how resource should be allocated based on this research. This is not clearly addressed. Some minor suggestions: 1. Spatial polygon is not clearly defined in the article. The authors should discuss how school districts and residential districts differ for children. 2. A clear mathematical definition of Moran's I will be nice. 3. In terms of results, what is the difference between high-low and low-high areas?

VERSION 1 – AUTHOR RESPONSE

Reviewer 1:
Dear Prof. Paisi
Thanks a lot for your kind comments and hard work to improve the quality of our paper. We have studied comments carefully and have responded to these suggestions point-by-point, and revised the manuscript accordingly. What we are most grateful to is that your article ‘Obesity and Dental Caries in Children in Plymouth’ gave us a lot of inspiration and very helpful for revising and improving our paper. Thanks again for your kind help. The main corrections and the responds to the comments are as follows.

Abstract:
Line 24: If applicable, the authors could revise the sentence to indicate that this work involved secondary analysis of data e.g. ‘Data on 6,216,076 children and adolescents aged 7-18 years from the Children and Adolescent Physical Examination Database for Shandong Province were used in this study”
Line 34: Please use full stop rather than comma at the end of the sentence.

Responds: Thanks for your careful work, we have revised the sentence as suggested.

Strengths and Limitations
Page3- line 3: Please could the authors clarify whether this was a secondary analysis of data or whether the CAPE study was conducted as part of this work? At present, it is as if the latter.
Page3- lines 12-18- Could be revised and broken down into two sentences
Responds:
a): We have clarified in the article that this was a secondary analysis of the Primary and Secondary Schoolchildren Physical Examination Database.
b): The sentence has been broken down into two sentences.

Introduction
Page 3- Line 32: 'was' should be 'has been'
Page3- Line 55: 'What's more' could be replaced by another word
Page 4-lines 21-25: Could be revised
Page 4-line 43: Please revise 'which has caught up with developed countries'
The authors could describe somewhere in the introduction: a) the use/value of geographic information systems in improving population's health b) other studies that used spatial analysis to explore the spatial patterns of overweight/obesity.
The introduction could be strengthened by adding a theoretical concept on how the build environment may influence the spatial patterns of overweight/obesity
Responds:
a): We have revised the sentence as suggested.
b): 'What's more' has been replaced by 'Even worse'.
c): The sentences have been revised.
d): The sentence 'which has caught up with developed countries' has been changed to 'which has caught up the prevalence of childhood OW/OB in developed countries.'
e): In the introduction, we have described the use/value of GIS in improving population's health and other studies that used spatial analysis to explore the spatial patterns of overweight/obesity in the third paragraph of 'introduction'.
f): We have added the theoretical concept on how the build environment may influence the spatial patterns of overweight/obesity in the second paragraph of 'introduction'.

Methods
Please could the authors justify the use of the particular area level?
Page 5-line 36: Obesity should be defined as BMI ≥95th percentile and not ≤ 95th percentile
In Table 1, the authors could use asterisks after the p values to indicate the significant in results
Page 5-lines 57-59: As this is something that comes up frequently during the paper, please could the authors clarify whether this was secondary analysis of data or whether the census study was conducted especially for the purpose of this study?
If possible, to explore the impact of area deprivation on the identified spatial patterns, it would strengthen the paper significantly.
Responds:
a): In the fourth paragraph in 'method', we have justified the use of the particular area level.
b): We have revised the article as suggested above.
c): We have clarified that this was a secondary analysis of data in the article.
d): It is a good suggestion to explore the impact of area deprivation on the identified spatial patterns. We have carefully studied the literature on the association between deprivation and childhood obesity (Paisi M, Kay E, Kaimi I, et al. Obesity and dental caries in young children in Plymouth, United Kingdom: A spatial analysis. 2018.). Unfortunately, our database does not contain any data about area deprivation, so we are currently unable to study the impact of area deprivation, which will be the focus of our future research.

Discussion
Page 10-first paragraph: the paragraph could be strengthened by adding more plausible explanations for the observed difference of overweight/obesity between boys and girls.
Page 10-second paragraph: The paragraph could be strengthened by drawing evidence from studies that conducted analysis of the association between neighborhood characteristics and overweight/obesity levels. Some recommendations for future research should also be added.
Page 10-lines 41-43: The authors state that 'SES is the most important factors responsible for the geographic differences in the prevalence of childhood obesity'. However, as this was not examined in the present study, it would be better if the authors revised the text above accordingly.
The authors explain well how the results will guide the allocation of resources at the local setting. However, they should expand on the implication to the international level and provide some recommendations for future research e.g. exploring the underlying mechanism for the increased levels of overweight/obesity in some areas, investigating the impact of area level characteristics on the spatial patterns identified etc.
Page 12-lines 6-17: Please could you revise the text in terms of language.
Responds:
a): We have added more plausible explanations from literature for the observed difference of overweight/obesity between boys and girls in third paragraph of the 'discussion'.
b): We have drawn evidence from studies that conducted analysis of the association between neighborhood characteristics and overweight/obesity levels, and some recommendations for future research also be added. The revised text has shown in the fourth paragraph of 'discussion'.
c): We have revised the sentence to that 'the regional SES might be the influenced factor responsible for the geographic differences in the prevalence of childhood obesity'.
d): Based on the above recommendations, we have expanded on the implication to the international level and provide some recommendations for future research in the sixth paragraph of 'discussion'.
e): We have made language revision.

Reviewer 2:
Dear Prof. Fang:
Thanks a lot for your careful review and precious comments to improve the quality of our paper. These comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have responded to these suggestions point-by-point, and revised the manuscript accordingly. In the process of literature review, we found that there are some similarities in our research direction, and we have learned a lot from your work and hope to communicate more in the future. The main corrections and the responds to the comments are as follows.

1. The literature review was not thorough. Firstly, the issue of childhood obesity has been studied extensively in the US and in China. The authors should cite references that pertain to their study group as well the driving factors of overweight and obesity. Secondly, the use of spatial econometric in health studies is vast. There are often many recent developments in the methodology that the author should acknowledge.
Responds:
(1): We have cited references that pertain to our study as well the driving factors of overweight and obesity in the first and second paragraph of 'introduction'.
(2): We have added other studies that used spatial analysis to explore the spatial patterns of overweight/obesity in the third paragraph of 'introduction'.

2. The authors need to justify the use of said method. Moran's I is often considered a first -step test in spatial analysis, which is often followed by a more complicated spatial econometric method, e.g. spatial lag model. The authors should explain why Moran's I and LISA alone is enough to answer their research question.
Responds:
The study applied Moran's I and LISA to conduct a descriptive analysis of sex-specific spatial patterns of childhood overweight/obesity as well as the presence of spatial clusters. Due to data available, the data did not include other detailed information at the individual level, which prevent us to use a more complicated spatial method, e.g. spatial lag model, to analyze the factor of above spatial patterns. Future research should include a comprehensive, spatial analysis including determinants of both diet and physical activity measures aiming to disentangle the complex role that place plays in the health of communities.

3. The key contribution of this article is the dataset. Therefore, the authors should spend more time explaining the mandatory physical examination among children in China, include descriptive statistics, and include a thorough discussion. I find it hard to believe that the reporting rate is 100%. This just doesn't happen in observation studies.
Responds:
(1): A detailed description of the Primary and Secondary Schoolchildren Physical Examination in Shandong Province was as follows and also shown in the second paragraph of 'method'.
(2): a thorough discussion has added in the second paragraph of the 'discussion'.
(3): With regards to the reporting rate, three initiatives were implemented to ensure the 100% reporting rate. First, all measurements were performed by well-trained health professionals in each of the 140 counties using the same type of apparatus and followed the same procedures and the uniform date. Second, the physical examination data was directly entered into the Student Health Checkup Management System in Shandong Province. Each student receiving a physical examination has a unique code. Third, a special policy document has been issued to regulate the medical examination process, and a special quality control team is available to supervise the physical examination work.

4. The logical link between results and conclusion is unconvincing. Moran's I can also test if there is spatial correlation in the errors of two spatial polygons. As to whether or not such a correlation should be explained as a cluster or a spillover of obesity is up for debate. As the authors pointed out, there are many factors, e.g. food environment, urban/rural difference, income, etc., that can contribute to the observed significant Moran's I. Without a careful discussion of how these are addressed and controlled for, the conclusion is hard sale.
Responds: A careful discussion has added in the fourth and fifth paragraphs of 'discussion'.

5. It is good to see that BMI is age-standardized, but it is not clear how this is done. Again, a descriptive stats table would help. Why not use BMI z-score, which is more accepted measurement of BMI for children? Also, the data has wide age range and 7-year-old have different metabolism than 18-year old. It might be interesting to study sub-groups by age categories
Responds:
(1): Using demographic data from the 2010 census as the standard population, we applied the direct method to calculate the age-standardized rates of overweight/obesity. The calculation process and formula are as follows.

Age	Standard population (Ni)	Observed incidence rate (Pi)	Expected incidence case (Ni*Pi)
7	N_1	P_1	N_1*P_1
8	N_2	P_2	N_2*P_2
9	…	…	…
10	…	…	…
11	…	…	…
12	…	…	…
13	…	…	…
14	…	…	…
15	…	…	…
16	…	…	…
17	…	…	…
18	N_i	P_i	N_i*P_i
Total	N		$\sum(N_i*P_i)$

Age-standardized rate (P') $=\frac{\sum(N_i*P_i)}{N}$

(2): The standard for overweight and obesity among school children and adolescents in our study is developed by Working Group for Obesity in China (WGOC). Considering the differences in body composition across different ethnic groups, the WGOC organized by International Life Science Institute Focal Point in China conducted an analysis on BMI of children and adolescents aged 7–18 years, the age-, sex specific BMI 85th and 95th percentiles were developed, respectively, by using the B-spline curve to adjust the curves passing through a BMI of 24 and 28 kg/m^2 (the cutoff points used for Chinese adults to define overweight and obesity, respectively) at 18 years of age, and a new BMI classification reference was recommended by WGOC in 2004. This standard is the most appropriate one and has been applied extensively in recent years in China. In 2018, National Health Commission of China updated above standard. BMI Z score is also a widely adopted measurement for childhood overweight/obesity. In our study, we applied BMI Z score to screen the outliers in BMI.

(3): We are very appreciated with the important suggestion to study sub-groups by age categories. Before this article, we have tried to study the age-difference, however, we faced two problems: If every age group is compared with each other, it may not make much sense; we also tried to divide the age into 3-4 sub-groups, but authoritative grouping criteria was not found in the literatures. Considering the particularity of schoolchildren's growth and development, it is unscientific to classify children according to adult grouping criteria. In addition, most of the findings on childhood obesity focus on gender differences. Gender is a powerful influence on many health-related behaviors and exposures across the life course. Furthermore, the topic in our study is the gender-difference, adding information about age-difference will reduce the emphasis on gender differences, and the 'introduction' and 'discussion' need to be adjusted greatly. Therefore, the age-difference in schoolchildren' overweight/obesity will be a research focus for us in the future.

6. The objective is to study how resource should be allocated based on this research. This is not clearly addressed.

Responds:

For the hot spots of childhood overweight/obesity, resource allocation is mainly concentrated in three aspects. First, through the health education of parents, they are encouraged to establish a healthy lifestyle, which in turn affects children's cognition and diet behavior; In addition, the schools should develop appropriate health strategies, including education on nutrition knowledge, increased physical activity, and encourage children to establish health behaviors; Furthermore, government should provide more interventions for hot spots of childhood overweight/obesity, including developing dietary guidelines, increasing community exercise facilities, and conducting health education.

7. Spatial polygon is not clearly defined in the article. The authors should discuss how school districts and residential districts differ for children.
Responds:
Primary and junior middle school admission is according to the admission dicing system based on proximity principle. There is no big difference between the school districts and residence districts. Although few high school students need to go to school far away from their residential areas, these students are difficult to distinguish. This study included 'county' as spatial units, both the school district and the residential area are in one county. This greatly avoids the difference in childhood obesity rates due to differences between school districts and residential areas.
8. A clear mathematical definition of Moran's I will be nice.
Responds: We have added a clear mathematical definition of Moran's I in the 'method'.

9. In terms of results, what is the difference between high-low and low-high areas?
Responds: 'low–high' indicates that low values are adjacent to high values, in other words, the low value is surrounded by high values. 'high-low' indicates that the high value is surrounded by low values.

VERSION 2 – REVIEW

REVIEWER	Di Fang The University of Arkansas at Fayetteville, USA
REVIEW RETURNED	24-May-2019

GENERAL COMMENTS	The authors have greatly improved the manuscript since the last review. The response to the review is thorough. I suggest the authors consider using some of the explanation to the reviewer in the manuscript. This manuscript may also benefit from hiring a technical writer.

VERSION 2 – AUTHOR RESPONSE

Reviewer 2:
Dear Prof. Fang:

We want to express our sincere thanks to you! Your valuable suggestions on our manuscript really do great help and make us feel warm indeed though in a hot summer.

We have used some of the explanation in the manuscript, for example, the difference between school districts and residential districts, and the difference between high-low and low-high areas.

Moreover, we have asked a native English-speaking colleague to assist us to improve the quality of the English throughout our manuscript.