Author's response to reviews

Title: Effects of neighborhood geodemographic profiles on healthcare service utilization: A case study on cardiac care

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Responses to Reviewers’ Comments

Manuscript submitted to *BMC Health Services Research*:

Title: “Effects of Neighborhood Geodemographic Profiles on Healthcare Service Utilization: A Case Study on Cardiac Care”

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Dear Editor-in-Chief and Handling Editor

We would like to thank all reviewers for their constructive comments and suggestions. We have taken great care to ensure that their concerns have been adequately addressed in our second revision.

In what follows, we provide detailed responses to the reviewers’ comments and describe the related changes.

Sincerely,

Prof. Jiming Liu

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Reviewer #1

We thank you for your thoughtful and valuable comments, and present our responses below.

Comment 1

“(1) The term patient arrival is used to represent the use of hospital services. The term is still quite confusing to me. For example, in Background the authors wrote “Although the literature has associated neighborhood geodemographic factors with patient arrivals, little is known about how such factors (e.g., population size, age profile, service accessibility, and educational profile) interact to influence healthcare service characteristics (e.g., arrival, capacity, supply, and wait time). Do the two arrivals have the same meaning?

(2) I also suggest to improve the clarity of the sentence and minimize the use of brackets here and throughout the paper, which makes it hard to read.”

[Our response]

Thank you for the feedback. Our responses to the above enumerated points are as follows:

(1) To clarify the terms “patient arrivals” and “arrival”, in this version, we have changed the key term “arrival” to “service utilization” as the name of the latent variable. The term “patient arrivals” is used to operationalize “service utilization”. Please refer to the first paragraph in the Abstract on page 1, as an example to illustrate our revisions.

(2) We have minimized the use of brackets throughout the manuscript. Please refer to the first paragraph in the Background section on page 2, as an example of our revisions.

Comment 2

“The maps originally included in the first draft were removed. Why?”

[Our response]

Thank you for the feedback. We have removed the maps included in the first version (i.e., the Figures 2 and 3 in the first manuscript) for the following reasons:
(1) The original Figure 2 illustrates the distribution of our selected cities/towns. As we have stated in the text, we have selected cities/towns with populations above 40,000 according to the 2006 Canadian census data (the second paragraph of the Methods section on page 6 in this version). Readers who are interested in the cities/towns selected can readily find information about them on the Statistics Canada website. Given that the illustration in Figure 2 simply repeats statements made in the text, we have removed it to avoid redundancy.

(2) The original Figure 3 illustrates the distribution of our focal 11 hospitals providing cardiac surgery services. As Table 2 in our manuscript has detailed the hospital names, interested readers can find further information about the hospitals from the website of Cardiac Care Network of Ontario (http://www.ccn.on.ca/ccn_public/FormsPartner/lhin_hospitals.aspx). Therefore, we also removed Figure 3 to avoid redundancy.

Comment 3

“The number of hypotheses made does seem to be quite high for the length of the paper.”

[Our response]

Thank you for the helpful comment. In this version, we have focused on investigating the potential moderating effects of service accessibility and educational profile on the relationship between population size and service utilization and that between age profile and service utilization. All the hypotheses kept in this version are closely related to this research focus.

The original hypotheses related to the relationships among arrival (service utilization in this version), capacity, supply, and wait time have been removed in this version because they have, more or less, been discussed in the literature [1,2], and validated by our previous work [3].

Please refer to the Literature review and research hypotheses subsection on pages 3-6 and Figure 1 in this revision for changes made.

Comment 4

“...How was city/town represented when getting the travel time in Google? Centre point? What are the pros and cons of using Google Maps instead of using a GIS for obtaining more accurate calculations?”
[Our response]

Thank you for the valuable comments. In Google Maps, a city/town is represented as the centre point of its polygonal geographic area [4].

In our study, Google Maps is utilized to estimate the average driving time from a selected city/town to any of the hospitals. Google Maps, compared to a GIS, may provide relatively more realistic driving time since Google Maps considers the actual traffic conditions on roads, whereas the driving time obtained from a GIS, to some extent, may provide a theoretically estimated driving time calculated based on the lengths of roads and road speed limits [5,6].

Please refer to the fourth paragraph in Data subsection on page 7 to find the justification for utilizing Google Maps to estimate the driving time in this study.

Comment 5

“...there are still places that lack of clarity and need to be fixed, for example, “Another limitation is in regard to with the data” on p13.”

[Our response]

Thank you for the feedback. We have further improved the writing in this revision. Please refer to the Future research subsection on page 12 in this version to see our revisions.

Comment 6

“p. 4, “...to investigate the potential effects of geodemographic profiles on cardiac surgery characteristics”.

(1) It is unclear what cardiac surgery characteristics.
(2) The assumption of a causal effect relationship is problematic. The authors should revise this argument throughout the paper.”

[Our response]

Thank you for the valuable comments. Our responses to the abovementioned points are as follows.

(1) In the previous version, cardiac surgery characteristics denote the number of patient arrivals, operating room capacity, physician supply, and wait time for cardiac surgery services. In this version, as we have decided to focus on
investigating the relationships between geodemographic profiles and service utilization, the term “service characteristics” has been removed.

(2) In our manuscript, the term “effect” or “effects” does not suggest cause-effect relationships. Instead, it denotes interrelationships among the variables of interest. In this version, we have kept the term but improved some of the statements throughout the manuscript to avoid misleading readers to infer causal relationships.
Reviewer #2

We thank you for your attentive and beneficial comments, and present our responses below.

Comment 1
“The authors did a great job commenting on all of the reviews. While I do not agree with all of their responses, they have made great strides in making this a more presentable piece.

[Our response]
Thank you very much for the encouragement.

Comment 2
“One item that I am having difficulty with is their insistence on using the LHIN’s as proxy measures of neighbourhoods. This is, in my opinion, unacceptable and cannot be substantiated.’’

[Our response]
Thank you for the feedback. The province of Ontario has been divided into 14 regions or LHINs. Each LHIN is responsible for planning, funding, and integrating healthcare services for its corresponding area.

LHINs, which represent the spatial partitions of the geographic area of Ontario, vary in their geodemographics and healthcare service distributions. For instance, as shown in Table 1 in this version, the proportion of seniors (aged 50 and above) varies from 27.54% in Mississauga Hamilton LHIN to 37.32% in North East LHIN, and the proportion of educational profile (with above high school education) varies from 61.25% in Hamilton Niagara Haldimand Brant LHIN to 74.16% in Champlain LHIN.

Operationalizing the LHIN as the neighborhood in our study will enable us to better understand the relationships between LHINs’ geodemographic profiles and the corresponding healthcare service utilization (specific discussions are presented in the second and fourth paragraphs in Discussion Section on pages 10-11 in this version). Our findings can also provide valuable information for LHIN administrators to consider in their planning and/or managing healthcare service resources. For instance,
our findings suggest that in order to improve the service performance (e.g., wait time), it is necessary to consider the interaction effects of geodemographic factors (e.g., service accessibility and education) in its neighborhood, as well as the geographic distribution of the same service in neighboring areas.

Comment 3

“(1) The paper also suffers from a lack of context to help direct the results.

(2) As it is currently written, the manuscript is really heavy on the methodology and results. I suggested in my last review that there are way too many hypothesis for one manuscript. I am puzzled as to why they have not chosen to simplify their piece (e.g. 1 hypothesis) and expand on how the methodology is relevant, how decision makers should interpret this, and what other areas it is relevant for. All of this information is there, but its rather hidden.”

[Our response]

Thank you very much for the valuable comments and suggestions.

(1) Our research context is cardiac surgery services in Ontario, Canada. LHINs are the concerned neighborhoods. In this study, we have found that service accessibility has a moderating effect on the relationship between population size and service utilization, and educational profile has moderating effects on both the relationship between population size and service utilization, and the relationship between age profile and service utilization. To interpret our findings in this research context, we have taken specific LHINs to describe what the moderating effects of service accessibility and educational profile imply for these LHINs with respect to their varied geodemographic profiles. Please refer to the second and the fourth paragraphs in Discussion section on pages 10-11 in this version to see these context-based discussions.

(2) We have removed a number of earlier hypotheses and have now specifically focused our study on the relationships among service utilization, operating room capacity, physician supply, and wait time. In accordance with the comments, we also have improved the sections of Methods, Results, and Discussion in presenting our study and findings. Please refer to the Literature review and research hypotheses subsection, Data subsection, and the sections of Results and Discussion to see the revisions.
Comment 4

“The authors revert back to their study being a 'contextual' study as opposed to a 'compositional' analysis - I disagree.”

[Our response]

Thank you for the feedback. A contextual study emphasizes the influence of social context (e.g., neighborhood geodemographic factors) on the focal dependent variables [7]. It usually utilizes aggregate data, such as the population socioeconomic characteristics aggregated for countries, regions, cities, etc. In contrast, a compositional analysis is usually utilized to examine the effects of individual characteristics, rather than environmental factors, on focal dependent variables (e.g., certain patient behavior) [7]. As “neighborhood or contextual effects will themselves be contextual, and that both the factors themselves and the magnitude of their effects will context dependent” [8, p.111], our study, which aims to investigate the direct and moderating effects of certain geodemographic factors on healthcare service utilization, should be a contextual study.

Comment 5

“(1) It does not appear that the authors are actually using arrival data from each of the cities within the LHINs - just using the hospital data to measure use and then inferring that demand is equally distributed within the cities based on population size and demographics.

(2) There is no mention of other factors that dictate demand (e.g. co-morbidities). This limitation needs to be made clearer.”

[Our response]

Thank you very much for the valuable suggestion.

(1) The arrival data has been utilized to measure the variable, service utilization (arrival in the previous version) in this paper. Specifically, we first estimated the average driving time for patients living in each selected city/town to any of the focal hospitals using Google Maps. Then, we derived the proportion of population within 30-minute driving time to hospitals providing cardiac surgery services for each LHIN (i.e., the measurement for service utilization) based on the population sizes of its contained cities/towns and the average driving time from these cities/towns to their nearest hospital(s).

(2) In this study, in order to investigate how certain neighborhood geodemographic factors interact to influence service utilization, four geodemographic factors, i.e., population size, age profile, service accessibility, and educational profile, have been
modeled as predictors of service utilization. Future research may extend this study by considering other impact factors in healthcare service utilization. For instance, the distribution of risk factors for cardiovascular disease (e.g., co-morbidity of diabetes [9]) may affect the patient population size, and hence exert effects on cardiac surgery service utilization. We may further investigate how the spatial distribution of risk factors for cardiovascular disease, in addition to our currently identified geodemographic profiles, influences the cardiac surgery service utilization.

We have highlighted this promising direction for our future work in this version. Please refer to the first paragraph in the Future research subsection (Limitation and future research subsection in the previous version) on page 12 in this revision.

**Comment 6**

“The last sentence in the first paragraph of the discussion “Further, as LHINs are the only organizations in Ontario to plan and allocate healthcare resources ...” is circular.”

[Our response]

Thank you for this helpful comment. We have improved this sentence. Please refer to the first paragraph in the Discussion section on page 10 in this revision.
References


- End of responses -