Reviewer's report

Title: Spatial variation in the management and outcomes of survivors from an acute coronary syndrome

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Reviewer: Brahmajee Nallamothu

Reviewer's report:

General

The manuscript by Vanasse et al. is an analysis of spatial variation in three clinical outcomes associated with an admission for acute coronary syndromes: 1) the use of invasive cardiovascular procedures (ICP), 2) length of stay (LoS), and 3) rates of early readmission (ER). In addition to exploring patterns of spatial variation, the authors attempt to partially account for this variation through factors such as proximity to a specialized cardiology center using multivariate regression models. The analysis is based on administrative data from the Quebec hospital discharge registry in 2000. The manuscript is innovative. The analysis appears appropriate. The tables and figures generally complement the manuscript text. I have three major compulsory revisions that should be addressed and minor comments.

Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

1) Outcomes evaluated. Did the authors consider evaluating outcomes related to death such as in-hospital and 30-day mortality rates? It would be important to see whether death rates also vary across geographic regions and if this variation is due to spatially-related factors. Of course, the latter (i.e., 30-day mortality rate) may be unavailable in the registry, but these outcomes are very meaningful. At the very least, the authors need to comment on why they did or did not evaluate death as a clinical outcome.

2) Additional covariates in model and residual confounding. I am concerned that the multivariate models, which primarily adjusted for age and gender, have a substantial amount of residual confounding that needs to be addressed. One problem might have been that age was only modestly adjusted for using a dichotomous category. Geographic proximity was also only evaluated using a dichotomous category in the models that included it. Were other potential relationships between age (e.g., <50, 50 to 65, 65 to 75, etc.) or distance and clinical outcomes explored? It is easy to imagine that an individual who live only 1 km from a cardiovascular center may be considerably different from someone living 30 kilometers away.

Also, a number of additional factors that can impact on these clinical outcomes were not adjusted for at all in the multivariate models. These include co-morbidities (which may be limited by the use of administrative data) and urgency of admission. The fact that urgent readmissions cannot be differentiated from elective readmissions is a particularly major concern. High early readmission rates in the remote regions may simply have been due to discharge after stabilization at a remote hospital and then elective readmission at a specialized cardiology center two weeks later for a scheduled procedure like coronary angiography. This would be very appropriate. The authors seem to recognize this limitation in their discussion, but that does not prevent it from being a major obstacle to interpreting their findings. Finally, socioeconomic variables, such as the median income levels for the ZIP code, may be available by linking to census information and could provide...
additional insights. The authors should comment on their inclusion or exclusion of these factors.

3) Policy impact. The authors describe a substantial amount of spatial variation in the three clinical outcomes. But geographic variation in utilization and outcomes has been well-described before in other geographic regions. It is therefore not surprising, and it may not be the most important contribution of this manuscript (although the authors may argue differently). I believe the manuscript’s ability to comment on the relationship between spatial issues like the importance of proximity to a specialized cardiology center to outcomes is inherently more interesting from a policy perspective. However, its ability to do so is substantially limited due to residual confounding. I am unclear as to what their final message should be: do their findings support opening up additional specialized cardiovascular centers? Or perhaps better systems for centralizing care at existing centers are needed? The authors should comment on the policy implications, if any, of their findings to expand its interest to a larger audience.

Minors Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

1) Was the 35-km catchment area obtained using “as the crow flies” distances or road network distances?
2) The authors should describe exactly how they calculated their standardized rates for ICP and early readmission. I’m assuming that they simply compared observed to expected rates of events to create standardized ratios. If so, they should state this directly and avoid using the term “SMR” since it refers specifically to standardized mortality ratios and is a little confusing.
3) Could the authors expand on hierarchical agglomeration and why it is superior to the other methods that were noted to “bring in the notion of ‘distance’”?
4) The figure titles and legends use minor variations in terms: for example, early readmission is alternatively referred to as readmission and EHR and ICP is referred to as PCI.

Discretionary Revisions (which the author can choose to ignore)

1) The geographically weighted regression (GWR) analysis shows evidence of spatial non-stationarity (i.e., regression coefficients vary significantly depending upon their location) for key coefficients in the multivariate analyses of LoS and early readmission. Did the authors map out differences in local estimates of these coefficients and were any geographic patterns noted? Note: the application of GWR is non-trivial and beyond my immediate expertise. It may require independent statistical review.
2) I would eliminate the use of the abbreviation ER – it overlaps too much with the concept of emergency room. These were early readmissions and it is unclear if they were urgent or elective.
3) Figure 2 may be better represented using a table.

What next?: Unable to decide on acceptance or rejection until the authors have responded to the major compulsory revisions

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: Yes

Declaration of competing interests:
I declare that I have no competing interests.