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Title: Emergency department utilization and hospitalizations for ambulatory care sensitive conditions among people seeking a primary care provider during COVID-19
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Reviewer 1: Brad Wright
Institution: Family Medicine, University of North Carolina at Chapel Hill School of Medicine,
General comments (author response in bold)

R1.1. Primary care seeking is unclear. The authors describe this as being derived from whether someone is on or off registry. I can understand that someone on the registry is primary care seeking, but someone who is off the registry could be off it because they have a PCP or because they don't and they're not seeking one. It is unclear how the authors distinguished this latter group, which is potentially quite different.
Please see our response to the first editor comment above (ED1) where we acknowledge room for improved clarity in presenting the topic of the paper. We have emphasized and clarified our dichotomous exposure of interest to be actively seeking (versus not actively seeking) a primary care provider by waitlist registration status as a relative marker of primary care need. We do not distinguish (nor can we) between those "off-registry" who have a provider and those "off-registry" without a provider not on the centralized waitlist formally seeking one. Nevertheless, we do feel that it is a reasonable assumption that an "on-registry" status would be strongly associated with higher primary care need relative to those "off-registry".

R1.2. The authors examine ED visits overall, but focus just on ACS hospitalizations. The rationale for this is unclear. If examining ED visits overall, why not focus on hospitalizations overall? Conversely, if the notion is the connection with primary care, then why not look at potentially-preventable or primary care treatable ED visits and ACS hospitalizations? Even as a sensitivity analysis this would make sense, but I think it would be best if the authors provide a justification motivated by theory.
Overall ED utilization has been used as an indicator of unmet primary care need, however, an ACSC case definition derived from physician billings administrative data diagnostic fields (the data source we used to enumerate ED contacts) has not been validated in the general population using ED services (while it has for inpatient hospitalizations – the case definition we used in this study). (In corroboration, see for example the 2017 study examining ACSC definitions for ED utilization, which concluded that ED-specific case definitions were warranted[1]). Using analogous ICD-9 coding to achieve a more specific definition may have resulted in excluding a large segment of the population who were using the ED to supplement primary care services. We do agree, however, that it would be interesting to assess ED utilization specifically among patients or individuals with ambulatory care sensitive chronic conditions as a more specific marker of primary care need and we are intending to do so in future work.

[1]**Frick J, Möckel M, Muller R, et al. Suitability of current definitions of ambulatory care sensitive conditions for research in emergency department patients: a secondary health data analysis. BMJ Open 2017;7:e016109**

R1.3. It is unclear why individuals were included if they were 5 years of age or older. Children's seeking of a PCP will be governed by parents, so this is different than examining adults. I would recommend the authors limit their sample to individuals age 18 and over or else provide a clear and strong justification for including some (but not all) children.
We restricted the study population to ages 5+ as it is our experience that, at least in Nova Scotia, young children, and especially neonatal children, are more likely to be attached to a primary care provider. We do agree that parents would be managing primary care provider access, but including older children would allow for the assessment of waitlist utilization among the 5-18 age group (as summarized in Table 1).

R1.4. Were there any missing data? If so, how were they handled?
Missing data are summarized in Table 1 and were limited to missing census-derived contextual data, effecting less than 3 percent of the study population. For multivariable rate ratio estimation summarized in Table 2, observations with these missing data were omitted.

R1.5. The fact that the outcomes were lower during COVID needs to account for the fact that health systems reduced elective services and other access to care, and that people also opted to avoid seeking care in an effort to avoid contracting COVID. Right now, the analysis does not account for this shock--or if it does, it is not very clear from the very abbreviate analysis section. The authors might do a better job of presenting their model specification. They do seem to address this a bit as a limitation--and rightly so--it is an important one.
The main objective of our study was to illustrate and compare relative utilization of health services outcomes (associated with primary care need) across those "on-registry" and "off-registry". As potential for this "shock" (e.g., dip in service utilization at the beginning of 1st wave) would be experienced by both "exposure" groups, we are unsure why this would need to be controlled for, or why it would be a serious limitation. Further, the primary goal of the analysis estimating the rate ratios summarized in Table 2 (i.e., comparing rates of service utilization, stratified by those "on-registry" and "off-registry") was precisely to demonstrate changes in service utilization (relative to the analogous prior year quarter) during calendar quarters overlapping with early COVID-19 waves, to which this "shock" contributed.

Reviewer 2: Paul Ronksley
Institution: Community Health Sciences, University of Calgary
General comments (author response in bold)

R2.1. Please state a hypothesis at the end of the introduction. Did the authors expect those on the waitlist to have higher rates of ACSCs in general (and this effect would be exacerbated during the first waves of the pandemic)?
The objective of this study was to describe changes in primary care need-associated service utilization across those "on-registry" and "off-registry". As such, we are not certain why an a priori hypothesis regarding how this service

would be expected to change would be required. Further, as analyses were conducted post onset of COVID-19, we are uncertain how a declaration of how we might have expected our service utilization outcomes to have changed would be useful. However, we are open to editorial advisement on this matter.

R2.2. I found the use of 'on' and 'off-registry' a bit confusing - maybe consider 'on' and 'off waitlist' - readers might get confused with 'on registry' referring to those that are registered with a primary care provider (which is not the case here).
We are open to editorial advisement on how to best and most clearly label our main comparison groups (i.e., dichotomous "exposure" categories).

R2.3. I struggled with the cohort timeframe and index date - why look back to 2017 if the paper is supposed to focus on the year pre and post COVID? (and the pandemic analysis only looks back to Q2 2019?) More importantly, what was cohort time zero for each patient? Was it the date they first entered the waitlist? If the authors had access to quarterly registry status, why use a simple dichotomy of ever/never as the exposure of interest. In my opinion, this is very problematic and a major weakness of this paper. More context is needed in terms of how long people remain on this waitlist. If the wait time is months to get a family doctor, then there is considerable misclassification in exposure status. However, if the authors can justify that residents remain on this list for years - then the use of a dichotomous exposure may be justified. Alternatively - if the authors did account for changes in exposure status (couldn't understand if this is what was meant by 'to accommodate participants contributing to both intervals comprising comparison) - why not use a more meaningful exposure such as 'length of time on wait list' (categorized into months). Showing a dose response or graded effect based on how long someone had to wait for attachment to primary care would be a really interesting analysis.
We agree that it may not have been necessary to begin the study period as far back as 2017. The beginning of 2017 marks period wherein the centralized primary provider waitlist began to receive substantive uptake (after being introduced in the second half of 2016). However, we felt that a longer period would provide additional transparency to assess ED utilization and ACSC hospitalizations prior to COVID-19 to allow a more credible assessment of how much discrepancies in ED utilization and ACSC hospitalizations between Nova Scotians "on-" vs "off-Registry" changed during the pandemic.
Please see our response to the second editorial comment (ED2) where we describe that we did, in fact, use a time-dependent "exposure" by calendar quarter.

R2.4. The linkage with the waitlist database is a real strength of this paper (i.e. novel and valuable linkage) - however, why did the authors link to physician billings to capture ED encounters (and not the National Ambulatory Care Reporting System (NACRS))? I'm sure the authors are aware that NACRS is the most commonly used administrative data source for ED utilization and would have provided additional insight into acuity (and the proportion of those ED visits that resulted in admission). I'm not familiar with the use of physician claims as a valid substitute for NACRS, and therefore the authors should provide more detail and justify the validity of using provider location within physician claims as a suitable alternative for this outcome.
We did not use NACRS to ascertain ED contacts as all ED departments in Nova Scotia do not report to NACRS. As we were only interested in enumeration of ED contacts, we felt that Physician billing data was more appropriate for a province-

wide study. We have added this information under the Key Measures subheading in Methods.

R2.5. The analysis section is sparse and should explain/justify the stratifications that are observed in the results section but are not mentioned in the methods. Why stratify by 65+ and sex only? Why not explore urban rural status? Level of comorbidity, deprivation? etc.
We limited stratified analysis to age and sex based on findings from other jurisdictions (summarized in Interpretation; second paragraph) that men, and particularly younger men, tend to seek and utilize primary care services less frequently. We agree that there may be other demographic or need-associated clinical characteristics (e.g., comorbidity/patient complexity) but feel that we did not necessarily have the ability to incorporate all the requisite sub-analyses into a single paper. Additionally, we feel that primary care need moderation by these other factors have been more thoroughly explored elsewhere.

R2.6-7. If the authors linked to physician claims data, why not report on the overall rate of GP use among those on and off the wait list registry? Was access to care different across these groups? It would be interesting to see if those that were on the wait list were simply using walk-in clinics and the ED more (as the authors alluded to in the introduction). This could be quantified using physician billing location. Similarly, adjusting for some measure of primary care use would be good to include in the multivariable regression analysis.

On the same lines - the authors likely recognize that the use of ACSC metrics are contentious and influenced by a number of patient, provider, and system level factors. While the authors have adjusted for a few key confounders, did they consider clinic continuity as a factor? While primary care continuity couldn't be measured in the waitlist group, it would still be possible to measure clinic continuity if people are going to the same location for care (which has been found to have a protective effect on admission for potentially preventable conditions).
We were unable to assess other factors related to access to care as suggested by the reviewer, such as walk-in clinic utilization (i.e., unable to identify contacts from walk-in clinics). We have no way to reliably identify practice location from the billing data to which we have access. We do agree that assessing provider continuity would be interesting, though this was not the goal of our research. Further, we did not think it plausible to measure primary care continuity among a population currently actively seeking a primary care provider that would capture material variation reflective of current continuity (as the majority would be expected to have low continuity). Finally, adjusting for such a continuity measure as a potential confounder might bias findings as provider continuity could be considered on the causal pathway in the association between actively seeking a primary care provider and utilization of health service outcomes reflective of primary care need.

R2.8. Include a sentence about ethical approval and the statistical software used for your analysis.
We have added a sentence indicating receipt of ethical approval at the end of the first paragraph in Methods; a sentence indicating statistical software used at end of paragraph under Analysis subheading in Methods.

R2.9. I found the amount of space devoted to the discussion of the authors parallel project (PUPPY) to be a bit distracting. It would have been nice to have more focus on the implications of these findings and potential reasons for these trends outside of what was identified so far in their CIHR-funded project. I think there was an inherent assumption that access to primary care changed during the study timeframe but the authors did not quantify rates of outpatient GP use within this study (which is possible using the physician claims database). Also a discussion about the absolute rate of ACSCs (which is low and a positive finding) is worth mentioning too.
We are open to removing, or paring down, discussion of the larger interprovincial work of which this study is a part. However, we feel that mention of the larger study provides the reader with useful insight on the high amount interest in this topic which is not only limited to Nova Scotia.
We did not have strong assumptions on how access to primary care would change per se, although we acknowledge that a dip in primary care in-office "GP" visits would be expected to parallel the decrease in ED contacts and ACSC hospitalizations at the onset of the pandemic as summarized in our findings. We felt that including a quantification of "GP" visits would not add materially to our study. Our main objective was to compare primary care need-associated utilization among individuals "off-registry" and "on-registry", two groups which would be expected to have characteristically different rates of in-office "GP" visits. We do agree that describing primary care access and utilization, of which in-office "GP" visits are a piece, across those actively seeking, and not actively seeking, a primary care provider, is interesting, and this is currently a focus of ongoing work. Therein, we stratify "GP" visits by in-office vs "virtual/remote" to ascertain how much the latter compensated for the former during the pandemic and whether this compensation differs by "off-registry" and "on-registry" status. However, we feel that this is beyond the scope of this paper.

R2.10. The second line in the interpretation section: ACSC hospitalizations were also higher for those 'off-Registry' for multiple quarters. Shouldn't this be 'on-registry'?
Yes. We thank the reviewer for catching this error. We have made the associated correction.

Reviewer 3: Amanda Martens
General comments (author response in bold)

R3.1. In my opinion, the authors do not touch on a crucial topic that impacts this study. It is important to understand how many primary care providers there are in Nova Scotia and Canada. This is valuable information that could either support the evidence and author's conclusion or weaken the author's argument (e.g., fewer primary care providers can explain why there are more patients on the centralized waitlists). This is also pertinent information to know when considering solutions (e.g., investing more in medical schools, nurse practitioners, etc.)
Assessing primary care provider need is a key consideration in explaining the quantity of Nova Scotians actively seeking a primary care provider. However, in our experience, this is more complicated than quantifying number of practitioners. First, there are many determinants of primary care provider supply beyond number registered to practice in the province. Some of these may include work culture, effectiveness of collaboration with non-physician practitioners (e.g., nurse practitioners – mentioned by the Reviewer or social workers), practice structure (e.g., single physician versus collaborative care team) and patient

rostering models. Second, in addition to provider supply, there is, first and foremost, population need, which is likely to be associated with multiple sociodemographic factors and other determinants. While we have, and are continuing to study, determinants of primary care need, we feel that this is outside of the scope of this paper.

R3.2. I would suggest that the authors present their results differently. While the findings appear to be sound, at times it was difficult to follow. I would advise improving the flow and readability of the text under the 'results' section. It may also be helpful to include the tables and graphs in the text so the reader can follow along, as opposed to at the end of the article.
We have made minor edits (not included in tracked changes) to the Results section (and the entirety of the manuscript document) to improve clarity. We are open to further suggestions on how to present our findings more clearly.

R3.3. In addition, the authors do not share any solutions or options to address the findings from this study. For example, how will this research support future health policy discussions? This gets touched upon in the future directions and conclusion paragraphs, but it would be helpful to understand how future PUPPY studies will support solutions to accessing primary care services.
As stated by the reviewer, we have dedicated a sizeable portion of Interpretation under Future directions to 1) explaining how PUPPY is leveraging a mixed methods design to provide context to the finding summarized in this manuscript and 2) providing an example of how PUPPY will include follow-up work evaluating solutions to primary care access by specifically studying pandemic-associated policy to increase primary care access via virtual care. We are open to specific suggestions of how description of other PUPPY work might enhance the interpretation of findings presented herein.

R3.4. Additional "minor suggestions":
- The introduction of this article makes the reader believe that challenges in accessing primary care is a new phenomenon. To mitigate this, I would suggest rephrasing the tone of the first few sentences in the introduction.

Response: We feel that the current state of primary care provider need/supply mismatch is most crucial and impactful to the introduction of this topic.
- I would also suggest including a few examples of the peer countries that were compared (underlined below). It is helpful for the reader to know which other countries were observed.
  - "Unfortunately, in 2020, roughly 10% of Canadians reported being "unattached" (i.e., not having a regular primary care provider or practice), which was among the worst when compared to peer countries".

We have included the associated reference and will add specific countries in the text under editorial advisement.
- Since you're writing this for an audience of general readers, it might be helpful to define some of these lesser-known terms like centralized waitlist or Registry. While the reader can assume what is meant by this, I think it is important to have a common understanding of these terms.

In our estimation, we have defined "on-registry" and "off-registry" status clearly insofar as signifying whether a publicly insured Nova Scotian was currently enrolled (i.e., seeking a primary care provider) on the Need a Family Practice

Registry centralized primary care provider waitlist. However, we are open to editorial advisement on how to further improve this aspect of our manuscript.

- In addition, there are many statistical terms used (e.g., chi-squared tests, negative bionomial regression, rate ratios) that the author is assuming the reader will know. I would suggest either defining these terms or putting in plain language, where appropriate.

We are willing to take editorial advisement on how to treat these terms.