We’d like to sincerely thank the editor for the opportunity to revise and re-submit our manuscript now titled “Exploring Mobility of Care with measures of Accessibility”: We would also like to thank the reviewers for their insightful feedback on the manuscript. The revised manuscript has been extensively edited to incorporate all suggestions, which we believe has improved the clarity of the paper’s objective, methods, results, and discussion. The following points are a summary of the changes you’ll notice throughout the revised manuscript, and the next three sections provide detailed replies to each comment from each reviewer. Reviewers’ original text is in black and our replies are in blue. Again, thank you for your dedication in providing feedback.

* The title of the manuscript has been changed from “Exploring mobility of care with measures of access: a case for gender-mainstreaming accessibility analysis”, to “Exploring mobility of care with measures of accessibility”.
  + The gender-mainstreaming perspective provided by Mobility of Care is now explained in text, therefore we were able to shorten the title to enhance clarity.
* The Introduction, Methods (where population data is detailed), and the Discussion and Conclusion sections now all mention the importance of considering low-income status in Mobility of Care research.
* The paper’s objectives are clearly stated at the end of the last paragraph in the Introduction section.
* A short multimodal accessibility review section is added, following the Introduction section. This is to clarify the destination and mode focus of multimodal accessibility measures (both cumulative and accessibility measures that consider competition) and demonstrate how the consideration of multimodal access to Mobility of Care destinations is novel and the consideration of competition effects is complimentary to accessibility interpretation.
* We added more information about transit, walk, and bike infrastructure in Hamilton – in the Background section (particularly, see the enhanced Figure 1 which now includes the density of bus stops as well as bike/walk infrastructure).
* Added additional context on how care destination categories were decided on in the Destination Dataset subsection of the Background section.
* Added additional explanation on why LICO and All Populations are relevant to Mobility of Care to the Background section in Population subsection.
* Separated the accessibility methods from the original Background and Methods section. Now, the literature on Accessibility Measures (section) is reviewed, then Background on Hamilton (section) data is explained, then the Accessibility Measures (section) used are detailed.
* Removed the care category weighting scheme and its associated description in the methods and added a short discussion on how weights could be added based on a Mobility of Care travel survey to the Discussion and Conclusions section.
* Reshaped and largely rewrote the Results section – see the new and improved Figures within, e.g., Figure 5 now demonstrates both measures for all four modes and 15-minute and 30-minute travel thresholds.
* Reshaped the Discussion and Conclusions section to make the discussion of the results and the paper’s contribution clearer. Also added a ‘Limitations’ subsection to separate the results, discussions, and paper conclusions from the study’s limitations.

# Reviewer #1:

This is an interesting manuscript on care accessibility. The author(s) intends to contribute in the field of mobility of care as a gender-mainstreaming analysis with empirical focus on Hamilton, a Canadian City. I regard the topic approached as important for the Journal of Transport Geography. However, there are various confusing parts in the text, while some key pieces of information are missing. I suggest the author(s) to address the following in a revised version:

1. Overall, the main issue of this manuscript is how it is framed. It is said that the manuscript´s main aim is to perform a "gender-mainstreaming accessibility analysis". The resulting analysis is, however, far more modest. The author(s) perform an analysis of care accessibility in Hamilton; they did not bring any gender-related analysis. The author(s) rely on the trip purpose to link the analysis to a gendered perspective. The fact that more women perform care trips does not mean that analyzing care trips include analyzing gendered trips. Especially, the use of the term "gender-mainstreaming" accessibility confuses me in the title; before reading the manuscript, I had the expectation to find a gender-related analysis. Nevertheless, it is fair to say that author(s) may have come to the scope of analysis motivated by gendered results from the literature. I believe that this needs to be re-defined.

Thank you for this raising this important point on the gendered framing of the manuscript. Indeed, you are right to point out that our analysis is more ‘gender-motivated’ than a ‘gendered analysis’ as we adopt the Mobility of Care concept. We were happy to reframe our analysis more accurately. To ward off misperceptions - first and foremost, the term “Gender-Mainstreaming”[[1]](#footnote-1) should have been explicitly defined, so we’ve renamed the manuscript, now “Exploring mobility of care with measures of accessibility”.

Further, though we believe our manuscript offers an approach that can be part of gender-mainstreaming policies in transportation planning, we understand there are many dimensions to transportation planning that accessibility analysis is outside the scope of. Often accessibility analysis is not observed or forecasted travel, its about *potential* travel to some destinations: the trip purpose. “How many **jobs** opportunities can one reach within a given time period?” is a question accessibility analysis can estimate, and usually has. But our paper asks, why the focus on jobs? While jobs can be important for all people, they are not the only destination that can be important for all people. In fact, care trips (i.e., travel to destinations that are non-paid and essential for household maintenance) make up a significant destination purpose in people’s daily lives. This is particularly the case for women, and lower-income women (Ravensbergen, 2022). We argue this myopic focus on employment destinations rooted in a masculinist tradition in planning, such as the data that is available (i.e., what is chosen to be collected) is often employment focused allowing the proliferation of the status quo – this is part of this story. Since care destinations are relatively understudied (compared to employment destinations), and absent from the accessibility literature, this manuscript aims to provide a case for this ‘gender-mainstreamed’ accessibility analysis.

In addition to the title-change, we’ve made this more nuanced framing clearer throughout the manuscript, we’ve replaced “Gender-Mainstreaming” with “Gender-Aware”, as the Mobility of Care framework is just that: gender-aware. As defined by Ines Sanchez de Madariaga, “*The umbrella concept "mobility of care" provides a framework for recognizing, measuring, making visible, valuing and properly accounting for all the travel associated to those caring and home related tasks needed for the reproduction of life. While these daily tasks continue to be mostly performed by women around the world, as men increase their participation in care activities, gender approaches to transport planning will become more and more significant for individuals of both sexes. The aim is to build a better knowledge base of mobility patterns, behaviors and needs on which to develop more equitable transport policies that provide a better response to gender needs to the benefit of both men and women*.”[[2]](#footnote-2). Part of Sanchez de Madariaga’s proposals for addressing the issue are to explain the concept and demonstrate measurement methods. This manuscript answers this call in the flavour of an accessibility measure: a comparison between a commonly used accessibility measure (cumulative opportunities) by researchers and practitioners alike and a new accessibility measure that considers competition. The comparison of the measures is useful, but we believe it is particularly impactful as the comparison foregrounds care destinations, their neglect in the literature, and the potential impact on those who reside in lower accessibility neighbourhoods.

Given this, we’ve reworked the abstract and manuscript to hopefully ward off misperceptions and more accurately capture the manuscript’s contributions. Again, thank you for raising this important point regarding the framing!

2. In the first line of the conclusion, the author(s) claim to have conducted the first "exploratory feminist accessibility analysis of care destinations". The author(s) mention "feminist" without first introducing (not to mention discussing) the term. The information that women perform more care-related trips is far from the conclusion that analyzing care trips is a feminist-oriented solution. Feminism is a much complex theme that would need more space to be addressed. Moreover, the manuscript dos not discuss the gendered participation in care responsibilities, or the female travel pattern discussed in the literature.

Thank you for raising another great point. In line with your first comment, our scope was motivated by Gender Equality – specifically within the Mobility of Care framework which our Introduction section introduces. This topic is inherently linked to feminist approaches. However, you’re completely correct – feminism is a complex topic. We do not have space (within the word limit) to sufficiently address it along with the paper’s objective. Therefore, we’ve removed mentions of ‘feminist’ and replaced it with ‘gender-sensitive’. This is also a more accurate framing of what was done, and we thank you for noting this. The first line of the Conclusion section also now reads:

*“This paper is the first to conduct an exploratory multimodal accessibility analysis of Mobility of Care destinations – one that counters the current literature’s emphasis on employment-related destinations, a travel purpose more significant for men, and especially wealthy and educated men”.*

Together with the first comment, we’ve re-worked the Introduction and Discussion and Conclusions sections to further clarify this point. We hope the revised manuscript addresses these concerns.

3. Interestingly, the manuscript includes a socioeconomic information in the analysis, with income data of the neighborhoods. For me, however, this was a surprise during the text, once socioeconomic aspects do not appear sufficiently in the introduction, and should do. Especially for this perspective, the manuscript should inform if all schools were considered equally, both public and private ones. Same for hospitals, health-related destinations, recreation centers, senior centers, and so on. Can they be used by all socioeconomic range, or are there limitations for low-income inhabitants?

Topics that are missing in the introduction to support and enrich this perspective are listed below:  
a. An intersectional perspective, especially between gender and socioeconomic status;  
b. A gendered modal division, regarding socioeconomic perspective, such as the ownership of a car.

Excellent points regarding how the intersection between low-income and 1) destination type and 2) mode-use, should be further clarified.

**Regarding 3.a.,** we added this perspective to the Introduction section, Background on Hamilton Section, and Discussion and Conclusions.

* The Introduction now introduces a few more references discussing the intersection of low-income status and gender. This discussion was present in the original version, but perhaps insufficiently. Thank you for this comment, see the revised text:

*Further, the current under-reporting of mobility of care in research and planning has important equity considerations. Not only are mobility of care trips completed predominantly by women, this gendered discrepancy is greater in low-income households [Murillo, 2023; Sanchez de Madariaga, 2013; Ravensbergen, 2022]. For instance, in lower income households in the city of Montréal, women complete 50% more care trips than men [Ravensbergen, 2022]. The power of the Mobility of Care concept lies in its ability to highlight the masculinist bias in transport research – travel for care appears insignificant because travel surveys are not written to capture it [Sanchez de Madariaga, 2013].*

* We also added mention that all destinations are public, with exception to some of the senior centers, to the “Care destination dataset” subsection in “Background on Hamilton” section”:

*The majority of destinations included can be publicly accessed (e.g., only public schools, grocery stores, clinics, community centres). However, certain destinations may require a fee that could be prohibitive for lower-income households (e.g., all long-term care homes, whether publicly subsided or private are included).*

* In the Discussion and Conclusions “Study Limitations” subsection, regarding the absence of mobility of care travel behaviour for Hamilton, we add a disclosure on how the results should be interpreted. Of note: we removed the destination weighting scheme all together, as it is simpler and more accurate to keep the destinations unweighted and leave room for accurately calibrated weighting that considers individual-level Mobility of Care travel behaviour, when that becomes available.

*“Absence of mobility of care travel behaviour, lack of capacities or attractiveness characteristics for destinations, and the mode used to access destinations in Hamilton presents limitations”* on how the results should be interpreted… *“In absence of this data, destinations are left unweighted, limiting result interpretation to the \_potential\_ to access all care destinations, instead of including the real individual socio-economic and intersectional characteristics that influence what destinations can be potentially accessed. In other words, each location is considered as simply one opportunity, e.g., a school, a clinic, a hospital, and a grocery store are all equal to one opportunity each.”*

Regarding 3.b, the Introduction, Discussion and Conclusion sections are enhanced with a refined focus of the gendered modal division in addition to sustainability.

Introduction: *“Care trips are also less likely to be completed by public transit or bicycle [Ravensbergen, 2022] and are more likely done by car or foot than the commute [Maciejewska, 2019; Ravensbergen, 2022]. One way to apply a gender-aware lens to accessibility analysis is by explicitly considering access to destinations involved in Mobility of Care by multiple modes. Reframing accessibility analysis in this way reinforces its importance as an instrument that supports the planning of sustainable and equitable travel and land-use in cities.”*

Discussion and Conclusion: *“Results demonstrate that the car offers all-round high access to care destinations in Hamilton, an expected result given the city's car-oriented design. However, previous research suggests that care trips are more frequently completed by car than by transit or bicycle [Ravensbergen, 2022]. Care trips tend to involve carrying things (e.g., groceries) or people (e.g., children), aligning with qualitative work that found many prefer travelling by car for this type of trip due to convenience and increased safety [Maciejewska, 2019; Carver, 2013]. Hence, targeted policy that reduces car accessibility or the spatial availability of car-users should be adopted from an equity perspective that considers preferences in care trips, especially those of lower-income households.”*

4. In the methodology, the author(s) present a comparison between unconstrained and constrained multimodal accessibility. The destinations were grouped into five care categories. Is there any reference from the literature to support this choice of groups? If not, please explain to better support your assumption. For the Health-centric category, the author(s) included both hospitals and clinics with pharmacies; In this group, a care service is mixed with a commercial distribution related to care. This combination can camouflage the results for the health care service accessibility. Furthermore, as I understood, a high-complexity hospital is counted equally to a small pharmacy, especially for the cumulative accessibility this is a concern; is this understanding correct? This issue must be addressed or explained.

Great points. We’ve addressed this comment in two ways, first by improving the explanation of how the categories were generated (In Care destination dataset subsection) and second by removing the weighting scheme (Accessibility methods section) and expanding the study’s limitation subsection in the Discussion and Conclusions.

**First**, the category explanation. We adapted categories based on the travel survey conducted by Sanchez and Zucchini (2019) (for Madrid), which is the only study that directly measures mobility of care. Specifically, they capture two main categories “childcare” and “Attention to other dependent individuals”:

|  |  |
| --- | --- |
| Childcare  • Escorting to:  1. School  2. Nursery  3. Other activity (social: e.g. Playground, …)  4. More frequently used services (Doctor, Pharmacy, …)  5. Other Services (Library, Shopping, ...)  6. Employment  7. Strolling  • Activity for children:  1. School  2. Shopping  3. Visit  4. Turn Around  5. Primary Services (Hospital, Pharmacy, ...)  6. Other activities (preparing meals, homework…) | Attention to other dependent individuals (e.g. parents, relatives or  someone else not a family member)  • Escorting to:  1. Shopping  2. Other activity (Social, Religious…)  3. Services (Hospital, Pharmacy, ...)  4. Strolling  5. Errand  • Activity performed for other individuals:  1. Visit  2. Shopping  3. Pick up/Drop off  4. Errand  5. More frequently used services (Doctor, Pharmacy, ...)  6. Other activities (preparing meals, house cleaning, ...) |

This survey emphasises trip purpose while our analysis is one of potential interactions with destination places outside the private sphere (i.e., the end point of a trip purpose in the public sphere). Trip purposes overlap with destinations, so we did our best to generate the care task categories we interpreted from Sanchez and Zucchini (2019) and tie them into distinct types of destinations. The care task categories are:

* Caring for children (most of the Childcare destination types resulting from Sanchez and Zucchini (2019). Called “Child-centric” in the study and relate to destinations like schools, daycares, and community centres, recreation centres, and parks),
* caring for elders (most of the Other Dependent destination types resulting from Sanchez and Zucchini (2019). Called “Elder-centric” in the study, includes destinations like Senior centres, long-term care homes, and retirement homes – namely, places that are not typically meant for children, that’s how this category was determined)
* caring for health (this could apply to caring for children or for elders, it also applies to ones on self maintenance. Called “Heath-centric” in the study, it includes Hospitals, pharmacies, clinics, and dentist offices).
* household maintenance: which includes grocery shopping and errands. Both tasks are important to the household but different, so we split this task into:
  + caring for household maintenance errand (“Errand-centric” including Libraries, post offices, and banks)
  + caring for household maintenance grocery (“Grocery-centric” including all locations that sell groceries)

To reiterate, destinations and trip purposes are not the same thing. Destinations often can receive multiple trip purposes, and a type of trip purpose can land you at different types of destinations. We tried our best to work from Sanchez and Zucchini (2019)’s categories to generate new categories that are more conceptually congruent for an accessibility analysis. We added a few sentences to the methods to clarify this thought process:

*“ To showcase the dataset, it is grouped by care destination category. These five categories were generated by the authors following the travel purpose categories created in the mobility of care research by (Sanchez de Madariaga, 2019). Notably: child-centric (destinations for "Childcare" escorting trips), elder-centric (common destinations for other escorting trips that are not childcare-focused), grocery-centric, health-centric, and errand-centric destinations.”*

**Second** the weighting scheme: In our original manuscript, we incorporated a generalized weighting classification that would make each destination within a category equal, and the category equal to all other categories. We did this assuming, theoretically, all categories are equally important. But in reality, we do not know if this is true; we would need a survey like the one conducted by Sanchez and Zucchini (2019) but for Hamilton, to calibrate the weights. However, it presented an opportunity to demonstrate how one *could* weight the destinations.

However, as you correctly point out, all types of destinations within a category are not equivalent (a healthcare clinic is not likely equal to a hospital), nor arguably are all categories equal to each other. For this reason, we’ve decided to take a simpler approach: we’ve revised the manuscript to exclude this weighting scheme all together. We’ve also added the important question of travel behaviour to destination types into the “Limitations” subsection of the Discussion and Conclusions:

*“Absence of mobility of care travel behaviour, lack of capacities or attractiveness characteristics for destinations, and the mode used to access destinations in Hamilton presents limitations as well. Accessibility literature has weighted destinations (amenities) using a variety of method such as estimated capacity of destinations [Li, 2024] or origin-destination flows from travel surveys indicating attractiveness of certain destination types [Graells, 2021; Cheng, 2019]. However, traditional 'capacities' like health care facilities have beds is not relevant for all care destinations, moreover, origin-destination flows to all care destinations also have not been counted within the region's travel survey (e.g., TTS [TTS, 2018]). In absence of this data, destinations are left unweighted, limiting result interpretation to the \_potential\_ to access all care destinations, instead of including the real individual socio-economic and intersectional characteristics that influence what destinations can be potentially accessed. In other words, each location is considered as simply one opportunity, e.g., a school, a clinic, a hospital, and a grocery store are all equal to one opportunity each. Furthermore, the aggregated mode choice for mobility of care trips in Hamilton is unknown and hampers interpretation of spatial availability results. In this study, mode choice is assumed to be equal to the work-commute mode selection, but this is may not be necessarily the case. These limitations present room for future work to incorporate context-specific Mobility of Care travel surveys into accessibility analysis to more accurately reflect care trip travel behaviour.”*

5. After grouping the care destinations, I had expectations to see the accessibility for each group. Instead of that, the author(s) presented only the accessibility for the groups together. Then I suggest the comparison of the accessibility for each group separately, in order to enrich the conclusions, and possible contributions to public policies.

This is a fantastic suggestion; however we’re concerned with implementing it due to the exploratory nature of this work – we do not know the population’s preferences for mode-choice for care destination type in the Hamilton context (we assume mode-choice to work for the spatial availability measure), so disaggregating results by care destination category may be misleading for the spatial availability measure. This paper is also framed by the Mobility of Care concept which argues that care trips should not be separated, as doing so can hide their significance in daily mobility (for instance, trips to grocery stores on their own are infrequent, but combined with all other care trips they make up almost a third of adults’ trips). Separating all these destinations out risks undermining the mobility of care concept. We have not added to the analysis, but we have made it clearer that these categories are used to showcase the data in the Care destination dataset subsection:

*“A novel geospatial dataset of care destinations for Hamilton was compiled using a variety of local sources and manually confirmed through Google Maps. As a way to showcase the dataset, it is grouped by care destination category.*

Further, if you still disagree, perhaps we can add these disaggregated analyses in an appendix in a future submission? We would be happy to do so, though hesitate for the reasons specified.

6. Regarding the transportation infrastructure of Hamilton, the following overall information is relevant and I think it should be added:

a. How is the public transportation system in Hamilton? What was considered as transit - Buses, only? Are there other systems included?

b. How is the bike infrastructure in Hamilton? Are there segregated Bike lanes? How was that considered for the accessibility: was cycling considered sharing space with motorized transport? Please, clarify this in the manuscript.

Excellent suggestion to provide more clarity to the transportation infrastructure of Hamilton. We’ve enhanced Figure 1 to now visualise the density of transit stops and walking and cycling infrastructure in Hamilton, with some additional details regarding the infrastructure. We hope we achieved a balance between detail and the Journal’s word limit.

Regarding 6.a public transportation system in Hamilton, and 6.b. bike infrastructure in Hamilton in the Background on Hamilton section:

“*Hamilton is divided into six regional communities (@fig-Fig1). Hamilton-Central is the most urbanized of the six, and the five periphery communities of Dundas, Ancaster, Flamborough, Glanbrook and Stoney Creek are significantly more suburbanized with the furthest periphery regions being undeveloped or rural owing to their inclusion in the region’s greenbelt [@Greenbelt Foundation, 2023]. These different urban forms and associated transport infrastructure play a key role in access to care destinations. Hamilton Street Railway (HSR) is the city's transit provider operating only buses at the current date. Notably, Hamilton-Central is the only community fully serviced by HSR and has the highest concentration of walking and bike infrastructure for mainstream use (e.g., Level of Traffic Stress 1 or 2 which indicates low-speed, low-volume streets, separated bicycle facilities, and dedicated lanes where cyclist must interact with traffic at formal crossings) [Conveyal, 2024] as identified in the OpenStreetMaps road network [Geofabrik, 2023] and the city's General Transit Feed Specification file [Transitfeeds, 2023].”*

7. Regarding the modal division, one finding of the manuscript is that access to care is "relatively high by bicycle", and "highlight the great potential of the bicycle for easily accessing care". The gendered modal split pattern, which can be found in the literature, can enrich this discussion. Wide literature has found that women cycle less than men, especially when the infrastructure is absent.

Excellent point. We had addressed the potential for cycling to be used for mobility of care in the Discussion and Conclusions:

*“However, this study also highlights that the high spatial availability of motorists results in disproportionately low spatial availability for sustainable mode users, even in Hamilton-Central. While sustainability policies should aim to re-balance the spatial availability away from motorists to users of sustainable modes, these policies should incorporate an equity perspective that considers existing preferences in care trips. This study provides the stepping stones for such an equity lens in @fig-Fig6, by presenting a cross-tabulation of areas with high LICO prevalence and low spatial availability per sustainable-mode that could be the focus of policy intervention. Consider the cycling plot in @fig-Fig6, a factor driving the higher quantity of yellow DAs is the low proportion of cyclists assumed. This assumption holds in other Canadian contexts, cycling as a mode for care trips is also uncommon as cycling is uncommon (Ravensbergen, Fournier, & El-Geniedy, 2022). Moreover, as care trips tend to be preformed by women, the low proportion of cycling for care trips has been put forth as a hypothesis to explain the gender-gap in cycling observed in low-cycling cities (like Hamilton) where only a third of cyclists are women (Prati, 2018; Ravensbergen, Buliung, & Laliberte, 2019). However, cycling as a mode has potential as it demonstrates high cumulative opportunities values. However, that potential is not being realized in part due to the low proportion of cyclists and the higher spatial availability values of motorists. Future research could examine what barriers those who conduct care trips are facing in regards to cycling, particularly focusing on the yellow areas indicated @fig-Fig6.”*

# Reviewer #2:

Author has collected dataset regarding care trips,and did an interesting analysis. The outcomes of this investigation seems valid and useful.

Review findings:

1. The background and literature section is appropriate.

Thank you!

2. The objectives should be stated more clearly in the introduction section.

Great organization point. We’ve amended the last paragraph of the Introduction section to state the study’s objectives more clearly.

*“Taken together, this study's objective is to contribute to the transport planning literature through the demonstration of a multimodal accessibility analysis of Mobility of Care destinations. Two accessibility measures are used: the cumulative opportunity measure and the singly-constrained spatial availability measure. The measures are applied on a care destination dataset with novel Mobility of Care classifications for the city of Hamilton, Canada. The potential access to Mobility of Care destinations for walking, transit, bike, and on foot is calculated for 15- and 30-minute travel time thresholds. Results are compared across the two measures and four modes, and the overlap between low accessibility areas and high low-income prevalence is presented. Implications of the results are discussed along with study conclusions.”*

3. The methods are explained with details in the Section, "Background and methods." However, the tools and techniques used in the investigation should be reflected in the Abstract also.

Great point. The abstract has been modified to highlight what methods and techniques were used in the manuscript. We believe the revised abstract is clearer on this matter.

*“Accessibility, the ease of interacting with potential opportunities, is an increasingly important tool amongst transport planners aiming to foster equitable and sustainable cities. However, in accessibility research there is a historical focus on employment destinations that is shaped by a masculinist transportation planning tradition. This paper aims to counter this gendered bias by connecting the Mobility of Care framework, a gender-aware transport planning conceptualisation to an empirical accessibility analysis of care destinations in the City of Hamilton, Canada. Care destinations are all the places one must visit to sustain household needs such shopping, errands, and caring for others (children and other dependents). Through the creation of a novel care destination dataset, this paper considers access to care across different modes of transport at two travel time thresholds (trips shorter than 15-minutes and 30-minutes). The methods include using a routinely used accessibility measure (cumulative opportunity) and a novel competitive and singly-constrained accessibility measure (spatial availability). Results indicate that accessibility to care destinations by car is exceptionally high, and access by public transit, cycling and by foot is low across the city with some exceptions in the inner city. Notably, there are distinctions between both methods: cumulative opportunities illustrate a more optimistic potential interaction landscape for non-car modes, while the spatial availability measure demonstrates a theoretically more realistic spatial distribution of care destination availability of potential interaction. Neighbourhoods with both low spatial availability to care and a high proportion of low-income households are also identified as areas in need of intervention. The manuscript and analysis are computationally reproducible and openly available. The analysis presented demonstrates methods planners can use to apply a gender-aware lens to accessibility analysis. Further, results can inform policies aiming to encourage sustainable mobility.”*

4. Author may add the validation of finding using statistical methods.

Good point, however, unfortunately the analysis is descriptive and exploratory in nature: it represents the potential care opportunities that *could* be accessed and are spatially available to the mode-using populations. However, it does not include travel behaviour characteristics that reflect individual’s travel to care destinations as this data is not typically collected within traditional travel surveys. Furthermore, validating access to all care destinations – as their diversity of uses are numerous – is challenging with limited data. E.g., even if we did have neighbourhood level school enrollment data and we demonstrate a significant relationship to accessibility, this does not represent \_all\_ care destinations. From this perspective then, we limit our scope to be exploratory and descriptive in nature: we do not demonstrate that our accessibility maps relate to actual mobility of care travel behaviour, we instead demonstrate the potential interaction with care destinations (of which actual interaction is a subset). Hopefully this answer addresses this general comment, but please let us know if you had specific ideas in mind that fit within the objective and scope of the manuscript.

# Reviewer #3:

The article proposes and applies a methodology to measure the accessibility of strategic 'mobility of care' points to avoid some masculinity biases in common accessibility studies. The study topic is timely and worth investigating, but it needs to be reviewed and improved for publication.

First, the writing needs revision. Check typos and English; in some parts, it is difficult to read from the initial state of the art. This section is difficult to follow.

Thank you for this comment. We’ve heavily revised the manuscript, particularly focusing on clarity. We believe the revised manuscript has been largely improved.

I think the structure of the paper needs to be revised to make the flow clearer. For example, I suggest separating the background and method first by making the method stand out from the application. You can use a diagram or flow chart at the beginning to clarify the procedure and help readers understand the content; then, afterwards, describe the case study. The structure now is too confusing. I also suggest splitting the discussion and conclusions. The latter should be shorter and include the main findings and implications.

Thank you for this excellent suggestion. Indeed, we’ve incorporated your ideas and believe the manuscript’s flow has been greatly improved. Specifically, we added a short overview of accessibility methods (a short Literature Review, given the word limitations of the journal) after the Introduction section to bridge accessibility from the Intro to the third section in lieu of your suggestion to add a flow chart. We believe this addition is conceptually similar to your suggestion but may add more value to readers.

We then detail the case study in the third section, a “Data” section, with clear sub-headings. Then, we take your suggestion and include a stand alone Methods section as Section 4; detailing the cumulative opportunity measure first and then the spatial availability measure.

We chose to keep the Discussion and Conclusions section as is, due to the word limit of the Journal, but reorganized the text for clarity. The section starts with a short summary of the paper and follows with discussion points and a subsection titled “Study limitations” to bound the interpretation of the results and shed light on future research avenues.

Thank you for this crucial points, we believe the manuscript’s flow has greatly improved.

Evaluate the position of figures that interrupt the reading too often. Furthermore, is it possible to find a representation to compare fig 5 and 6 without having to scroll back and forth in the text?

Excellent suggestion: see the Figure 5 which now displays the old Figure 5 and 6 in one single figure. Thank you for this, we believe it is now easier for readers to compare the two measures.

Other comments:

\* Line 70 is unclear: destinations or multiple modes?

Good catch. This should be *“In this spirit, this study foregrounds the theoretical mobility of care concept by calculating the accessibility to care destinations ~~or~~ and multiple modes in an empirical case study of Hamilton, Canada.”* We’ve corrected this in the revised manuscript.

\* 74-80 rewrite because it is unclear, especially the description of spatial availability

Fair point, thank you. We’ve actually removed mention of competition effects in the introduction and now save that for Section 2 (the literature review). The study’s objective (as stated at the end of the Introduction) now reads:

*“Taken together, this study's objective is to contribute to the transport planning literature through the demonstration of a multimodal accessibility analysis of Mobility of Care destinations. Two accessibility measures are used: the cumulative opportunity measure and the singly-constrained spatial availability measure. The measures are applied on a care destination dataset with novel Mobility of Care classifications for the city of Hamilton, Canada. The potential access to Mobility of Care destinations for walking, transit, bike, and on foot is calculated for 15- and 30-minute travel time thresholds. Results are compared across the two measures and four modes, and the overlap between low accessibility areas and high low-income prevalence is presented. Implications of the results are discussed along with study conclusions.”*

And that sentence, now in Section 2, now simply reads: *“A critique leveled at cumulative opportunity measures (and other non-competitive accessibility measures) is its omission of competition-for-opportunities effects.”*

\* 82-85 Why use two different sources to describe Hamilton's population? Use more recent data

Hamilton is a city within the GTHA; the additional data sources are used to demonstrate the population size of the GTHA which is not in the Hamilton Population data citation. However, we’ve streamlined the citations to make this clearer. The text now reads:

*“This paper focuses on Hamilton as a case study, a mid-size city of approximately 500,000 residents that lies within the urban and suburban Greater Toronto and Hamilton Area and is home to seven million people, or approximately 20% of the Canadian population [City of Toronto, 2022].*

*Hamilton is divided into six regional communities (@fig-Fig1). Hamilton-Central is the most urbanized of the six, and the five periphery communities of Dundas, Ancaster, Flamborough, Glanbrook and Stoney Creek are significantly more suburbanized with the furthest periphery regions being undeveloped or rural owing to their inclusion in the region’s greenbelt [Greenbelt Foundation, 2023]. These different urban forms and associated transport infrastructure play a key role in access to care destinations….”*

\* point locations of origins is not clear to me what they are and how they were identified.

It is mentioned in the manuscript that the point locations of origins are the geometric centroids of the DA. We enhance the clarity in explanation in the text. Subsection in “Background on Hamilton” related to Travel times now reads:

*“As empirical travel behaviour to care-oriented destinations is uncounted and thus travel time is unavailable, travel time is approximated. Travel times by walking, cycling, transit and car is calculated for the geometric centroids of the DAs to the geometric centroids of the care destination location using the 'travel\_time\_matrix()' function from the {r5r} package [Pereira, 2021]. Inputs are point locations of DA centroids (origins), care destinations centroids, an OpenStreetMap road network including bike, transit and vehicle infrastructure [Geofabrik, 2023], and city GTFS transit routes/schedules [Transitfeeds, 2023].”*

For additional clarity in the Method, when describing the variables of Equation (1), $i$ is defined as *“a set of origin locations (e.g., DA centroids)”.*

Furthermore, the use of geometric centroids of DAs as origins is discussed as a study limitation in the Discussion and Conclusions section:

*“Third, the geometric centroids of DAs (origins) and destinations (all care destinations) were used as inputs for travel time calculations. This is a limitation as DAs were created for the purpose of the statistic census: they vary in area and their centroids may not necessarily align with where that population may begin their journey to care destinations. This methodological decision presents limitations on how the travel time estimates can be interpreted to reflect actual travel times to care destinations..”*

\* Line 206: is this an error 20.45, or is it correct? And \* Lines 199-212 confusing

Nice catch, it was an error and this paragraph was rewritten. These sentences are now is included in the “Travel impedance function” subsection and reads:

*“This selection is informed by a scan of the literature. Typically, literature considers travel to one type of care category (e.g., health, or school, or grocery stores) and each destination type is associated with different travel impedance behaviour (e.g., grocery shopping trips are on average 15 minutes [Hamrick and Hopkins, 2012], trips to receive cancer treatments are on average 20 minutes [Segel and Lengerich, 2020]. In other care-related accessibility analyses, travel time thresholds of include 10 mins (for daycares) [Fransen, 2015] and 30 mins to 1 hr (for hospitals) [Schuurman, l2006] are selected. Of the one study to-date that has calculated the average travel times to all different categories of care destinations, travel times to each care category differ by mode e.g., 16 minutes by car and 36 minutes by public transport [Ravensbergen, 2022]. To broadly reflect this past research: 15 and 30 minutes are selected.”*

\* Line 258 "Consider cycling: the access" re-write without ":"

This section was re-organized, and the use of the colon has been removed from this sentence. The full paragraph now reads:

*“The cumulative opportunity access is insightful in illustrating the range in which opportunities can be accessed by each mode based on their travel speed (on available infrastructure), a summary of each origins' modal opportunity isochrone. However, the cumulative opportunity measure does not account for competition effects. Namely, what proportion of the modal opportunity range is \_spatially available\_ to a mode-user at a given location when competing for those same opportunities with other mode-users. Considering competition in this way conjures richer conclusions that reflects the mode-using population. For instance, consider cycling, a mode that offers a relatively high range but still smaller than the car. The cumulative opportunity values in @fig-Fig5 reflects this intuition: Q3 and Q4 cumulative opportunity values are present for cycling in Hamilton-Central, offering the second-best cumulative opportunity access after the car. However, bike spatial availability values depict a more complex story of opportunity accessibility: it reflects the mode's opportunity range as well as proportion of mode-using population and how their range relatively compares to all other modes. The bike-using population is small (2% of the population), with many DAs having no or low proportions of bike-users. Meaning DAs with no bike-users are proportionally allocated no access to opportunities (zero spatial availability) and DAs with a small proportion of cyclists have relatively slow travel speeds compared to the car-using population. Though bike mode offers a relatively high opportunity range (cumulative opportunities), because of the low proportion of cyclist and their opportunity range compared to the \_many\_ other mode-users, they receive low spatial availability values.*

\* Lines 301-303 fewer repetitions! Section 3.3 is difficult to follow

Thank you for pointing out this repletion. Thank you for your comments, we’ve largely revised this subsection in the results. The opening sentence to this subsection now more clearly reads:

*“To draw insights on who may reside in DAs where populations are disadvantaged with low modal spatial availability and high low-income prevalence, a cross-tabulation is visualised in @fig-Fig6.”*

\* Add more description for the concept of "feminist accessibility analysis"

Thank you for your comment. Other reviewers also brought up this concern, so we’ve update the manuscript to more clearly define how we are using this concept in the manuscript. We’ve removed mentions of ‘feminist’ in the manuscript and now use the term ‘gender-aware’ when appropriate in the Introduction, and Discussion and Conclusions section in addition to changing the title of the manuscript to simply be “Exploring mobility of care with measures of accessibility”. Hopefully these changes more accurately reflects what the study achieves.

\* Error 393-395.

Thanks for catching this! We’ve removed this redundant heading.

1. As defined by the European institute for Gender Equality, gender-mainstreaming is a policymaking approach that accounts all gender’s interests and concerns to achieve gender equality. Source : <https://eige.europa.eu/gender-mainstreaming/what-is-gender-mainstreaming?language_content_entity=en#:~:text=Gender%20mainstreaming%20is%20not%20a,growth%2C%20employment%20and%20social%20cohesion>. [↑](#footnote-ref-1)
2. Source : <https://unhabitat.org/mobility-of-care-ines-sanchez-de-madariaga> [↑](#footnote-ref-2)