

Reviewer: 2

Comments to the Author

- In the introduction section, it would be desirable to mention (and reference) some of the previous scientific studies and articles, published in prestigious journals, which show the importance of mobility data in modeling the spread of an epidemic. This point is even mentioned in the section "Lessons Learned" page 14: "Recent research indicate that mobility data can play..." This is not in fact a "recent" finding for pandemic analysis as the research in this topic has been carried out since many years ago. Obviously the specific references to the modeling of the COVID19 epidemic are recent. We suggest authors to use a reference (amongst many available) published in a prestigious journal (peer review) such as this <https://www.nature.com/articles/s41598-020-68230-9>

We have updated the introduction section with references to relevant articles from prestigious journals, and thank you for suggesting the specific paper from Nature. The manuscript was in fact referencing the preprinted version of the same. We have updated the reference to the final peer reviewed version in Nature.

- Authors make various external references using the footer annotation format. I consider more appropriate to use a bibliographic references section for this purpose. This would also avoid duplicated footnotes: reference links 1,2,3 are the same that appear in the 11, 12 and 13 references.

We have updated the manuscript to make use of bibliographic reference now following the APA 6th edition style recommended by the journal for references and citations.

- In the methodological section, an extrapolation procedure is mentioned to produce absolute mobility estimates of the entire population from the operator's mobile lines count. It would be interesting to provide some additional details on how this procedure is carried out with some external reference or short explanation. Usually this is done by using census data although there might be different criteria (for example, the exclusion of people under <18 or >80 years old).

Good suggestion. The extrapolation method is indeed based on census data, and we have added an overview of how it works on page 5 & 6.

- In the manuscript, the importance of monitoring mobility during vacation periods is mentioned at the end of section 1. Were the movements of the native population going abroad or the movement of people between Nordic countries quantified at this time? Was there an anonymized monitoring of the presence of international travellers from other in Sweden?

International travelling was not examined during the collaboration described in the paper. However, Telia has provided anonymous and aggregated insights on international travelers to the municipality of Oslo by request of the Oslo Emergency Planning Agency.

- Regarding the use of the tool provided by Telia, it refers to monitoring the adherence of the population to the mobility recommendations provided by the authorities. This constitutes “a posteriori” descriptive analysis. Was the tool used for prescriptive purposes? That is, was PHAS able to use the tool to adjust future mobility recommendations (based for example on trends), anticipate expected dates for peaks of contagion or to estimate the demand for hospital beds?

Foremost the tool has been used to evaluate and reaffirm officials at PHAS that recommendations had sought-after effects; it was not used for prescriptive purposes. The Telia data has recently been used at Sahlgrenska University Hospital to predict the number of admitted COVID-19 patients. <https://www.teliacompany.com/sv/nyhetsrum/news-articles/20212/telia-ericsson-and-sahlgrenska-university-hospital-in-sweden-use-ai-to-help-improve-covid-19-planning/>

- Regarding the charts, I would suggest some improvements for better readability. In Figure 5, it would be convenient to provide the labels for the months along the X-axis and / or add vertical grid lines to each week number label. In addition, the question arises regarding the reference week (10). Was the seasonal effect of mobility taken into account throughout the year? Probably in a normal year (without a pandemic) the relative mobility between the month of March and the month of June is not the same, but higher, so the % reduction in these circumstances could be even greater. In Figure 6, the colour legend that assigns each line in the graph to a country is missing.

Figure 5 has been updated with vertical grid lines. We did not find a satisfactory visualization that also included the months that improved readability. The x-axis represents the week of the year which do not align perfectly with the month as a week may belong to two months.

Great question about the seasonal effects. As explained in the figure text, weeks 24-32 represent the summer period in Sweden with a large part of the population are on holiday. This period was thus removed from the graph. The same pattern existed for week 44 which is why it was removed as well. While it is fully correct that the relative mobility between March and June is not the same, Figure 5 shows the estimated number of people at their work location which does not vary as much as overall mobility. As such we believe the simple reference week comparison is suitable as it also makes for an easy to understand, simplified figure.

Thank you for pointing out that the legend was missing for Figure 6. The legend has now been added.

- Regarding privacy, Were Telia clients given the opportunity to opt-out on this project? Was there a legal framework in Sweden that allows Telia to use this data without permission from customers? (although with all the security/privacy guarantees) It would be interesting to clarify this point.

The data is fully anonymous and as such no permission is required. Data is anonymized and aggregated in accordance with GDPR and ePrivacy requirements.

- Finally, section 4 talks about the importance of keeping these processes and tools operational to promote a rapid response to potential epidemiological crises in the future. Could you clarify if in the case of PHAS there is a plan to create such infrastructure for the medium/long term? Will PHAS use mobility data beyond responding to the current crisis? In this sense, for Telia, has this experience modified the functional roadmap of the Crowd Insights tool?

Anonymised telecom mobility data has proven to add important information for PHAS during the COVID-19 pandemic. To secure long-term access to these data, PHAS conducted a public procurement during the spring of 2021. The contract was awarded to Telia and the agreement came into force on May 1st 2021. PHAS will therefore be able to further look into the potential and usability of these data once the pandemic has abated, also in terms of other diseases than COVID-19.

For Telia, the experience has indeed modified the functional roadmap. Several learnings from the collaboration with PHAS led to improvements in the different Crowd Insights products. This has been clarified on page 12 and also a reference to municipality of Malmö who started using their “Crowd Insights for Municipalities” product for analyzing travel patterns and informing the public as part of their weekly pandemic reporting.