Referee #3

This empirical study investigates the impact of inclement weather on the time emergency medical response (EMS) time intervals for the city of Beijing. It is broken into two stages. Firstly, to explore the impact of inclement weather (i.e., precipitation) on traffic and EMS accessibility to come with the worst-case scenarios of the year 2029 (i.e., days including different times per day). Secondly, to evaluate EMS accessibility under the identified worst-case scenario and evaluate the distribution of EMS with particular focus on the difference in population and road network distribution between urban and suburban areas. The study can be useful to identify the scenarios needing improvement to ensure more fair access to EMSs for populated cities. The paper is generally well-written and easy to read but can be improve in terms of clarity.

1. The abstract. It seems to overlook a key impact that seems important from the results: The day of snowfall seems to have more significant impact that the days of rainfall (among the worst-case scenario considered). Can the authors add a mention about this fact somewhere in the abstract.

Response: We thank for reviewer's comment. We added one sentence in abstract in Lines 31, Page 2:

And snowfall has a greater impact on the accessibility of EMS than rainfall.

2. The introduction. In Line 107, Please be specific on what is meant by "The latter". It can be more effectively used to also introduce to lay reader some common terms that will be occurring later, such as "coverage area" and "waterlogging".

Response: We thank for reviewer's comment. We revised the whole paragraph in Lines 73-105, Page 4-5:

The spatial accessibility of EMSs is defined by the travel impedance (distance or time) between service locations and the scene (Guagliardo, 2004). A large body of research on spatial accessibility is concerned with access to hospitals (Luo and Wang, 2003; Mao and Nekorchuk, 2013; Pan et al., 2018; Yang et al., 2020; Yin et al., 2021) and first-aid stations (Hashtarkhani et al., 2020; Jones and Bentham, 1995; Shin and Lee, 2018). To measure the EMSs accessibility, the two-step floating catchment area (2SFCA) method is one of the common methods (Chen and Jia, 2019; Kanuganti et al., 2016; Li et al., 2021; Luo and Qi, 2009). The 2SFCA method considers accessibility to be mediated by not only the distance decay but also the interactions between supply and demand (Chen and Jia, 2019), which is more suitable for normal scenarios. While for studies focusing on the influence of inclement weather on EMSs, people concern more about the transportation situation, instead of the interaction between supply and demand. The coverage analysis method (Coles et al., 2017; Green et al., 2017; Yu et al., 2020) or shortest path analysis method(Albano et al., 2014; Andersson and Stålhult, 2014) are more widely used. These methods could better characterize the reduction of accessibility caused by the road service degradation. For example, Yu et al. (2020) analyzed the accessibility of emergency service in England and identified vulnerability hotspots by *quantifying the EMSs coverage of area and population within different time radii under different flood scenarios; Coles et al. (2017) measured the travel time and service area coverage of EMSs in York, UK under flood scenarios by using FloodMap-HydroInundation2D to model flood inundation; Yin et al. (2021) assessed the vulnerability of EMSs to surface water flooding in Shanghai, China by quantifying accessibility in terms of service area, response time, and population coverage, considering four temporal scenarios (nighttime, evening, daytime, and morning–evening peak) of average drive speeds based on a real-time traffic analysis from GPS big data; Andersson and Stålhult (2014) used network analysis methods to generate the shortest paths from hospitals to various administrative areas in Manila, Philippines, and evaluated the impact of different flood events on these paths. Most of these studies assumed that roads are impassable or traffic speed has a certain degree of reduction when the flooded water depth reaches a specific depth, and further evaluated the impact of rainstorm on EMSs accessibility. Due to insufficient recorded traffic data, relatively few studies have been performed to analyze the impact of road access capacity on EMSs accessibility according to actual traffic speed variation.*

3. What platform was used to "Combining the topology road network with medical facility locations and the distribution of the population, we could further analyze the spatial accessibility to EMSs." Was this work GIS based? What was the tool employed?

Response: We thank for reviewer's comment. In this study, we used ArcGIS 10.8 to run the analysis. We added that in the method section in Lines 185-186, page 9:
Both service area analysis and OD Cost Matrix analysis are GIS-based, and was done in ArcGIS 10.8.

3. Line 162: the sub-section numbering here down to line 189 is missing a third digit. I suppose it should be 2.2.1, 2.2.2, 2.2.3 and 2.2.4.

Response: We thank for reviewer's comment. We apologize for the mistake in the section labels, and it was corrected in revision.

Methodology.

1. As in any study, there should some assumption made by the authors and aspects that were not addressed. A mention of these would be useful.

Response: We thank for reviewer's comment. In this study, we have these assumptions in lines 187-195, page 9:

1. *The ambulances move at the average speed all the time and would always take the shortest path in space.*
2. *In network analysis, the location of facilities is approximately considered to be on the nearest road point vertically.*
3. *In OD analysis, we use the centroid as the origin point to represent the whole grid, and the*

shortest path to hospital is the same within the grid.

4. *The prehospital EMSs is divided into two parts: the ambulances depart from the first-aid station to the scene and from the scene to the nearest hospital. The case where patients transfer directly from the scene to an EMS facility via private transportation will not be considered in this study.*

2. Line 232: Is there any citation that you can use to justify the choice of the 15-minute arrival time?

Response: We thank for reviewer's comment. In previous study, considering various response time targets, three service zones lying within 8-, 12-, and 15-minute travel are specified for each individual EMS station. And the coverage areas all decreased under the impact of flood. So, we chose 15-minute arrival time. In the revised manuscript, we added the reference：

Yin, J., Yu, D., and Liao, B.: A city-scale assessment of emergency response accessibility to vulnerable populations and facilities under normal and pluvial flood conditions for shanghai, china, ENVIRON PLAN B-URBAN, 48, 2239-2253, http://doi.org/10.1177/2399808320971304, 2021

5. Line 255: please define OD. Does it stand for Origin-Destination?

Response: We thank for reviewer's comment. Yes, "OD" refers to origin-destination, and we added it in Lines 250-251, Page12:

The shortest transfer time is calculated by the OD (Origin-destination) cost matrix analysis method.

6. Line 258-259: More discussions on the calculation cost is welcome so one can justify the rationale behind increasing the resolution from 100 and 1000 m. How much would this impact the predictions vs. reduce the cost for the analysis?

Response: We thank for reviewer's comment. The choice of roads to the nearest hospital won't be greatly impact because the distance to the nearest to the nearest hospital is normally more than 1km in most areas, so increasing the resolution would not affect the overall pattern of spatial difference of accessibility, but would the cost of calculation would reduce to 1/100, because every grid needs to calculate the shortest route and transfer time to every hospital. After the aggregation of population grids, there are about 25,000 origin points, and we need to calculate the shortest travel path between every origin point and hospital and select a closest hospital for each origin point. The calculation can be done in about 10~15 minutes for each scenario. If we don't do the aggregation, the number origin points would be about 2,500,000, so the calculation would be more than 1000 minutes.

7. Line 265: there is always a mention of a grid. Should this be meaning that the analysis was GIS based?

Response: We thank for reviewer's comment. The analysis is GIS based. We have added this information in Lines 184-185, Page 9:

Both service area analysis and OD Cost Matrix analysis are GIS-based, and was done in ArcGIS

10.8.

6. Line 306: Figure 4 deserves a discussion as such in 4.1.1 before moving to 4.1.2 and quoting it there. I guess it was used to support further the choice for the days considered as worst-case scenario.

Response: We thank for reviewer's comment. We add some elaboration in lines 296-299, page 14:

Figure 4 illustrates the spatial difference of traffic speed reduction and distribution of precipitation on precipitation days. A large number of red roads (with traffic speed reduction over 10 km/h) can be observed in the 4 days mentioned above. By comparing the distribution of precipitation and traffic speed reduction on different dates in Figure 4, it can be found that the precipitation in the four days with the most severe speed reduction was moderate, and the precipitation distribution of the whole city was relatively uniform. Compared with other rain days, although the precipitation on July 5, August 9 and September 19 was larger and concentrated in the inner city, the traffic speed reduction of the whole city was not as serious as the four days mentioned above, which may be caused by the decrease of people's willingness to travel with the increase of rain.

7. Line 331: "The results demonstrate …" what results? Any figures I should be looking at? Or, from which equation? Are you talking about the "coverage rates". Please specify.

Response: We thank for reviewer's comment. The results refer to the spatial difference of population coverage. We added a new figure to illustrate it better. The new figure has 2 rows, using the first row minus the second row is the variation that Figure 6 (the order number becomes Figure 7 now) shows, as can be found in Page 17:

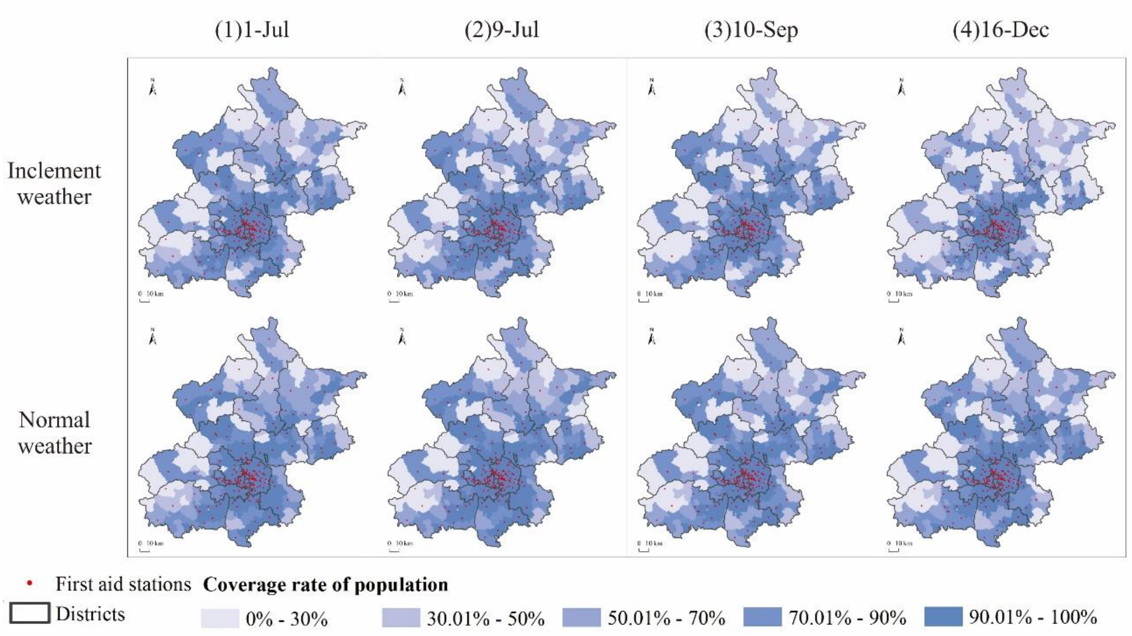
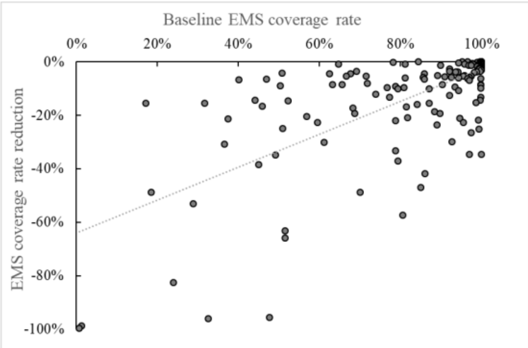


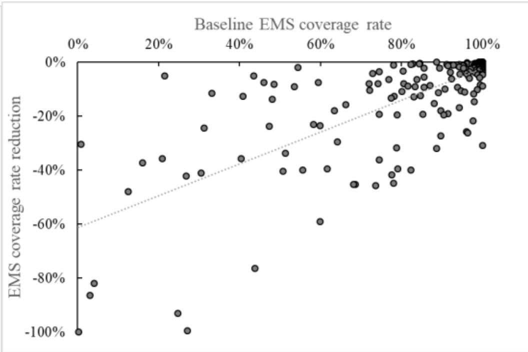
Figure 6. The EMSs coverage rate of population in townships under the inclement weather condition and normal weather condition on 1st July, 9th July, 10th September and 16th December

8. Line 359: The clarity of the sub-figures in Figure 7 can be significantly improved. Same for Figure 8.

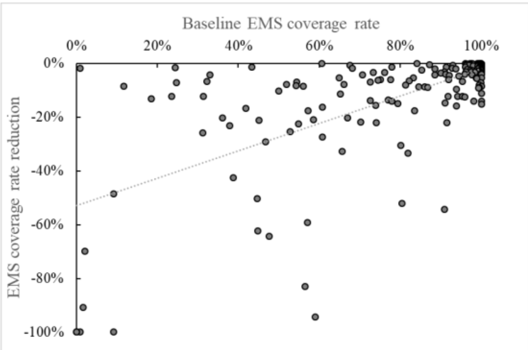
Response: We thank for reviewer's comment. We have enlarged the font in the figures to make it clearer. The figure number changed in the revision of manuscript.



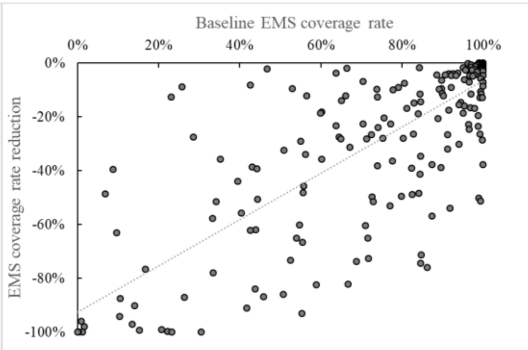
(a)



(b)

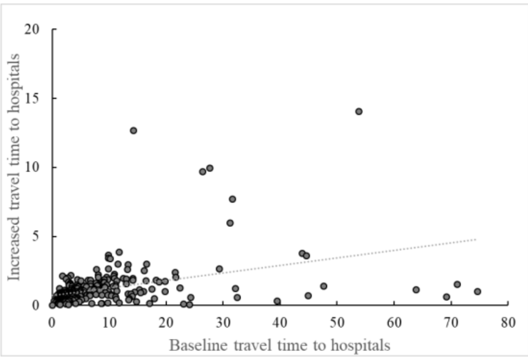


(c)

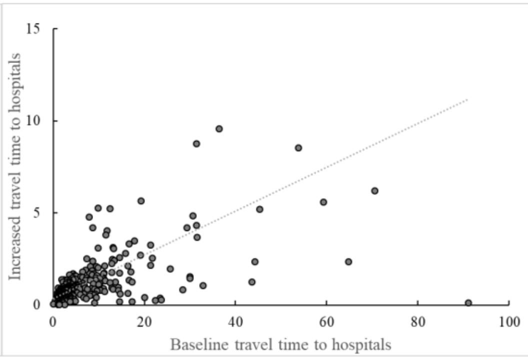


(d)

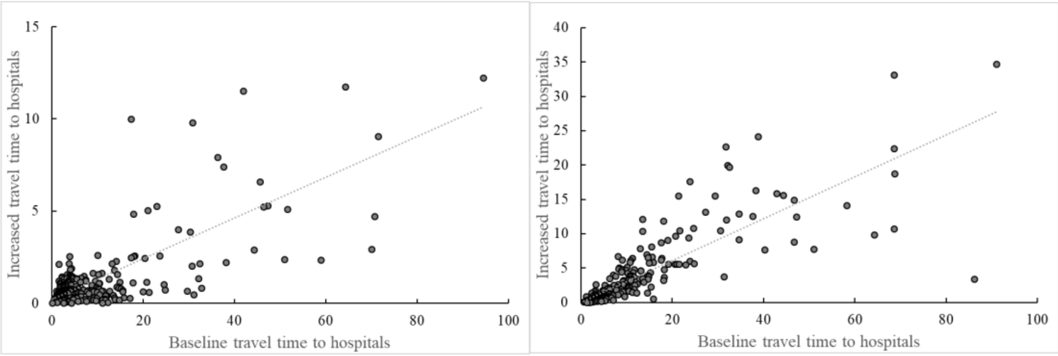
Figure 8. The correlation between the baseline EMS coverage rate of population and its reduction percentage in inclement weather. (a) 1st July, (b) 9th July, (c) 10th September, and (d) 16th December



(a)



(b)



(c) (d)

Figure 10. The correlation between the baseline transfer time to hospitals and the increased transfer time in inclement weather. (a) 1st July, (b) 9th July, (c) 10th September, and (d) 16th December

9. Overall, the snowfall seems to have the greatest impact and it useful to highlight in key locations including the abstract and conclusions. This could be hinting at the fact that such a study is more of relevance to cities affected by snowfall.

Response: We thank for reviewer's comment. We have added that in abstract and conclusions in Lines 31-32, page 2 and Lines 460-461, page 24:

And snowfall has a greater impact on the accessibility of EMSs than rainfall.
Besides, snowfall has a greater impact on EMSs accessibility than rainfall.