

# Transit in theory and in practice: Incorporating aspects of lived experience into measures of transit accessibility and justice

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## Introduction

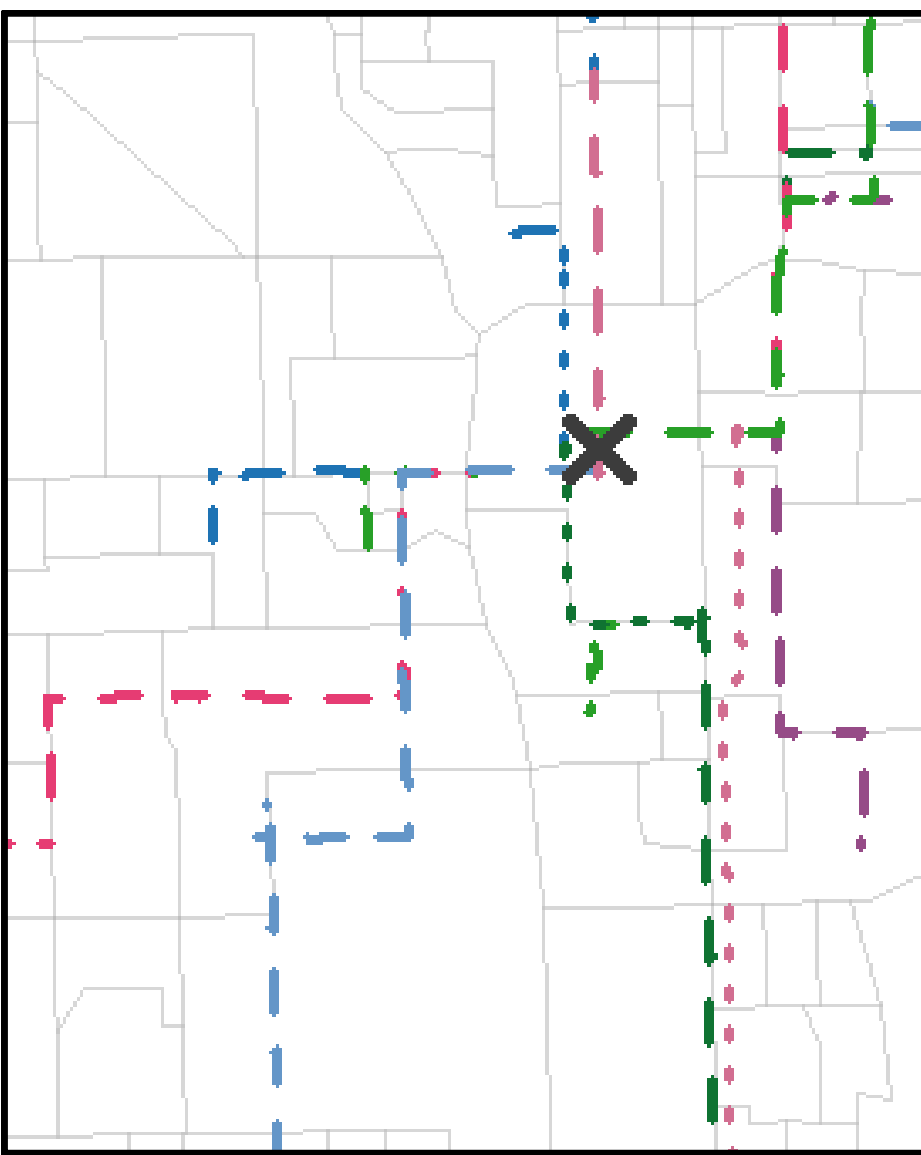
Studies on public transit access have taken two principal approaches:

- **Process-based:** measuring travel times to destinations based on schedule data
- **Outcome-based:** measuring impedances beyond travel time (eg. walkability)

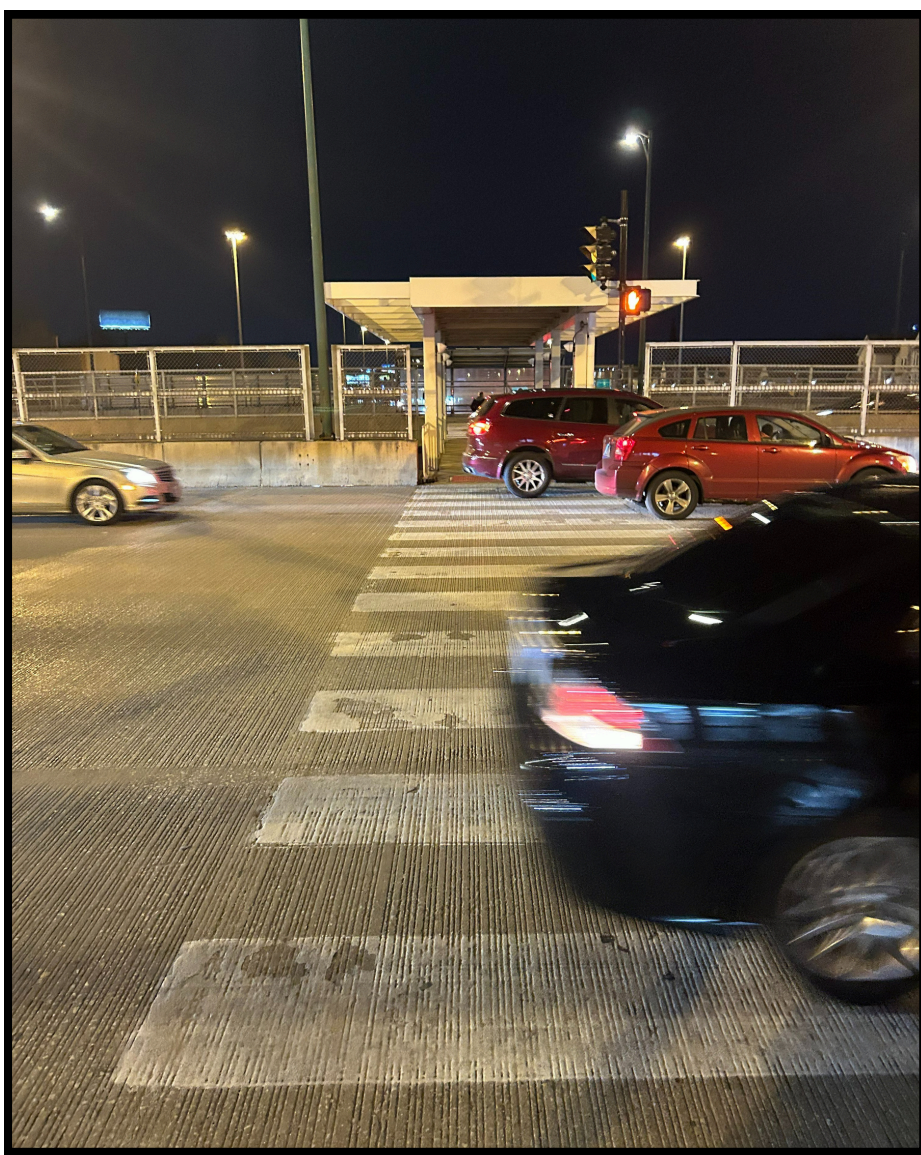
Few studies have managed to bridge the gap between these two paradigms.

Measures of access that accurately reflect both the system and the experiences of its users are necessary to advance:

- **Transit equity:** underserved communities being able to access opportunities
- **Transit justice:** dismantling the injustices and racism propagated by historical transit planning



**Process-based studies** measure access by theoretical travel time alone, which may not match user experiences



**Outcome-based studies** measure impedances beyond travel time, like needing to cross 10 lanes of busy traffic to reach a bus stop

## Objective

To create a proof of concept for a transit access metric that incorporates both **process** and **outcome** indicators to better identify issues of transit **equity** and **justice**.

## Literature

**Process-based studies:** While their use of system-wide schedule data does allow for a more rigorous evaluation of access [1, 2], they lack grounding in human experience. Some expand on this paradigm, accounting for competition, differing departure times, and route preferences [3, 4]; however, many transit **outcomes** remain unaddressed.

**Outcome-based studies:** Though not directly measuring access, these studies highlight the importance of **subjective impedances** such as perceived safety [5], walkability [5, 6], number of transfers [4], amenities and infrastructure [4], and wait time [7].

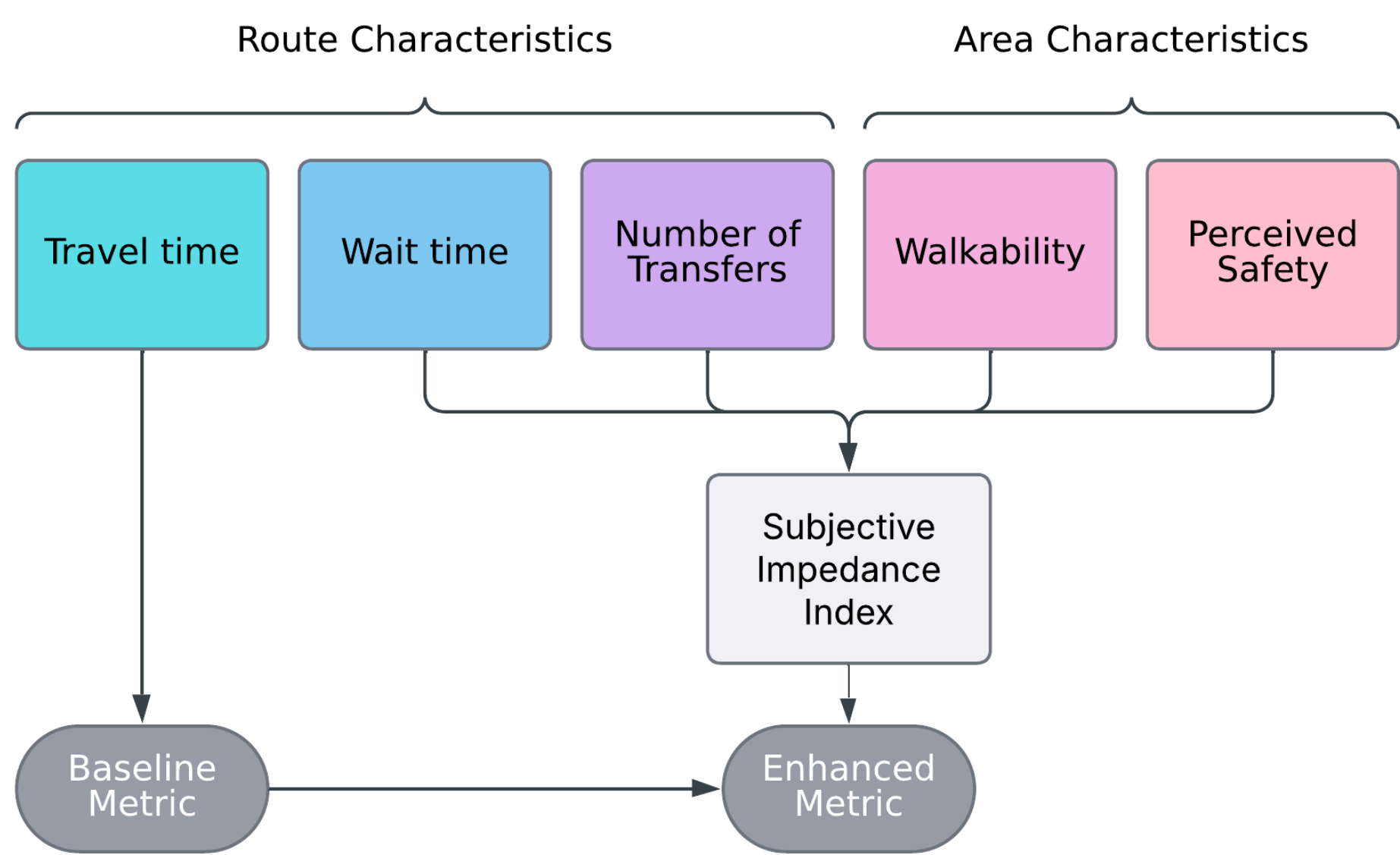
## Methods

A new (**Enhanced**) transit access metric is developed and compared to a traditional process-based (**Baseline**) metric, using Chicago as a case study.

- Both metrics rate Census Block Groups by:
1. Finding all jobs and points of interest that can be reached
  2. Weighting each by the travel time needed to reach it (using a “gravity” decay function)
  3. Taking the total of these weighted scores

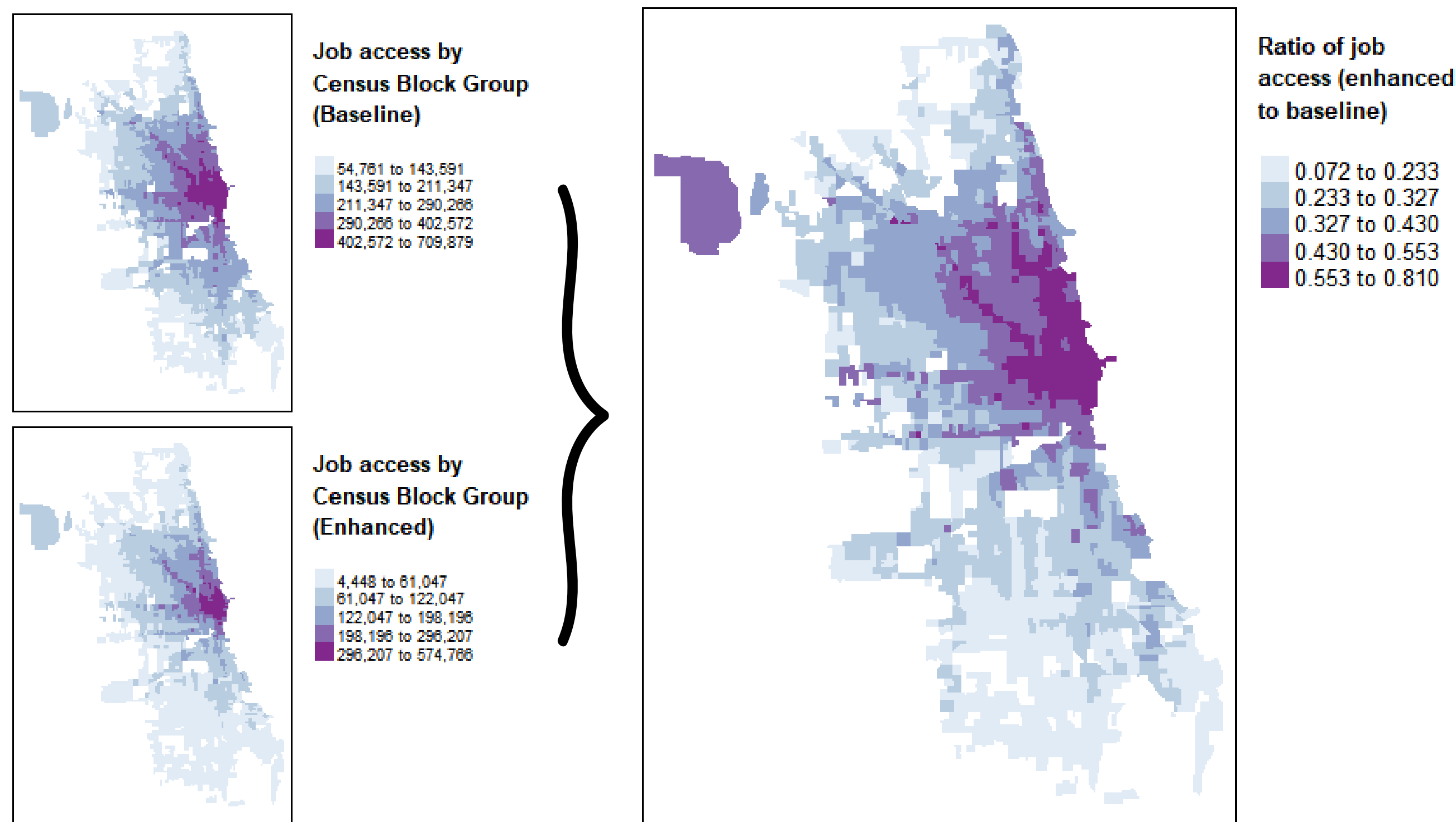
However, the **Enhanced** metric multiplies travel time by a **subjective impedance** index to address human experience (see chart below) and substitutes this value as the weight in step 2.

The ratio between the two metrics is used to identify areas where process-based methods may overestimate access. This distribution is compared to demographic variables to identify possible issues of equity and justice.



## Results

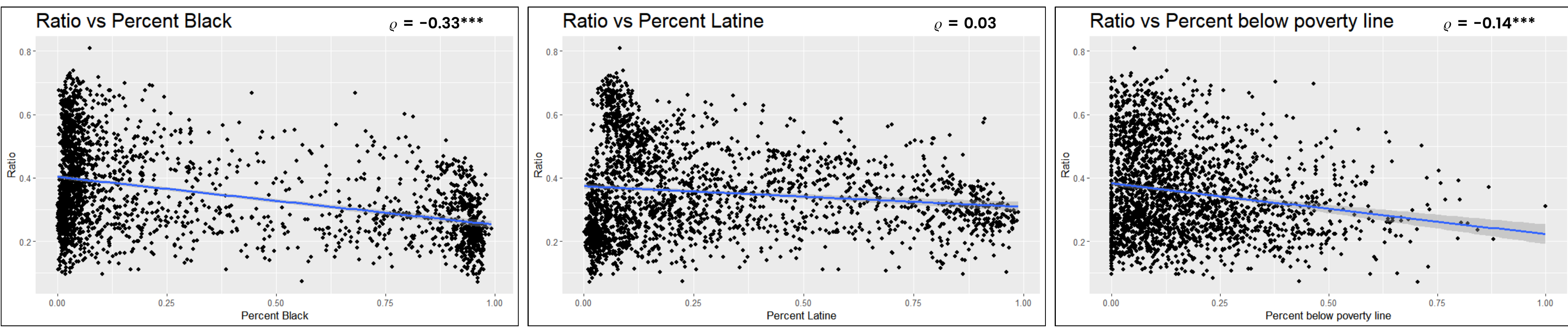
Only job access is shown, as results are similar for points of interest.



**A lower ratio indicates a wider gap between the metrics.**

The ratio between the metrics demonstrates that **process-based** metrics overestimate transit access, particularly on Chicago’s Southwest Side and periphery, by failing to account for **subjective impedances**. The gap between the metrics is smaller in the Loop (city center), Near North Side, and along CTA train lines.

The scatter plots below demonstrate that greater Black population and prevalence of poverty are significantly correlated with a lower ratio.



Test statistic  $\rho$  is Spearman’s rank correlation coefficient, used because the data are not not normally distributed.

\*\*\*Significant at  $p < 0.001$  level

## Conclusions

There is a strong and unevenly distributed gap between the **Baseline** and **Enhanced** metrics, illustrating the importance of **subjective impedances** for accurately measuring access.

Deep **inequities** already existing in transit access are compounded by the inability of **process-based** measures to account for them comprehensively.

Transit improvement initiatives should focus not only on reducing travel times, but on mitigating **subjective impedances** as well, especially in areas where the gap between the metrics is wide.

## References

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