IS HEALTHCARE SPATIALLY ACCESSIBLE?

A Gravity-Based Model Study of Automobiles and Transit in a Four County Region in Indiana

Bincy Mariam Koshy, Capstone Advisor - Prof. Bumsoo Lee, Client - Department of Urban + Regional Planning, University of Illinois at Urbana - Champaign

INTRODUCTION

Spatial accessibility to healthcare is one of the pre-requisites for equitable and quality healthcare services for all segments of population, urban and rural. It is important to assess spatial access to healthcare because health services, organizations and providers (supply) are spread out and account for huge variation in locations and thus result in large spatial nuances in healthcare. Accessibility models are usually based on gravity potential and the supply and demand analogy. In this study, a Hansen-type gravity model is used to calculate spatial accessibility to healthcare in Madison county, Hamilton county, Delaware county and Marion county.

GRAVITY-BASED MODEL

- Accessibility refers to reaching destinations. Places that are highly accessible are closer to activities and centers when compared to less accessible places that are farther away.
- In this context, a nearby healthcare provider is considered more accessible than a remote one based on gravity potential.
- In the study region, the analysis is conducted at the traffic analysis zone (TAZ) level.
- Using Hansen’s gravity model equation, the attractiveness of the origin TAZs to the hospitals are calculated using the resistance factor which is travel time for two modes, automobiles and transit.
- The following equation corresponding to the Hansen gravity model is used:

\[ A_{im} = \sum_j O_j \cdot C_{ijm}^{-2} \]

Where: \( A_{im} \) is accessibility at point 'i' to hospital at point 'j' using mode 'm', \( O_j \) is the opportunities (number of beds) at point 'j', \( C_{ijm} \) is the impedance (travel time) to travel between 'i' and 'j' using mode 'm'.

In order to retrieve transit travel time data, web scraping technique was used. A Google API key was used to gather data using a Python script.

OBSERVATIONS & CONCLUSION

Underserved Areas - Northern parts of Hamilton county, Madison county and majority of Delaware county
Transit access to healthcare - High in Marion county due to good transit access provided by IndyGo, high in central part of Delaware county due to MITS (Muncie Indiana Transit System) service; low in Madison county and Hamilton county due to lack of proper transit systems
Automobile access to healthcare - High in Marion county and southern part of Hamilton county due to more number of opportunities in Indianapolis and high dependency on automobiles in Hamilton county where transit does not exist; low in Delaware county and Madison county

Socio-Demographic and Healthcare Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Median Age</th>
<th>Population</th>
<th>Median Household Income</th>
<th>Poverty Rate</th>
<th>Primary Care Physicians for Every 100,000 People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marion County</td>
<td>34.3</td>
<td>941,229</td>
<td>$44,874</td>
<td>18.6%</td>
<td>81</td>
</tr>
<tr>
<td>Madison County</td>
<td>40</td>
<td>129,862</td>
<td>$44,795</td>
<td>16.8%</td>
<td>46</td>
</tr>
<tr>
<td>Hamilton County</td>
<td>36.9</td>
<td>316,373</td>
<td>$89,823</td>
<td>5.57%</td>
<td>140</td>
</tr>
<tr>
<td>Delaware County</td>
<td>35.1</td>
<td>116,463</td>
<td>$39,537</td>
<td>22%</td>
<td>100</td>
</tr>
</tbody>
</table>