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Spatial Analysis of Geographic Access to Public Healthcare Facilities in Côte d'Ivoire

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Background

~1.3 billion people do not have access to effective and affordable health care, leading to a wide array of negative health outcomes.
In Côte d'Ivoire, many communities lack good access to healthcare facilities; the landscape is complex geographically and travel capacity can vary seasonally - all impacting access to health care.

Aims

- Map geographic accessibility to public healthcare facilities across the nation.
- Analyze spatial autocorrelation of poor access using the global Moran's I statistic and Anselin's local indicator of spatial autocorrelation.
- Quantify and analyze the proportion of the population that have poor access to timely health care (≥ 4 hours travel time).

Data Source

Land Cover/Land Use (LC/LU) from GLC 2000
Water Bodies (Polygons and Lines) from OpenStreetMap's.
Major roads (Primary, Secondary and Tertiary) from OpenStreetMap's.
Population distribution from World Pop.
Digital Elevation Map (DEM) from SRTM.
Ivorian Health Facilities list from Human Data Exchange.
Travel capacity data from previous study.
We validated our data sources using satellite imagery.

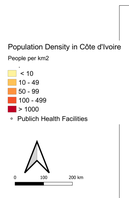

Figure 1

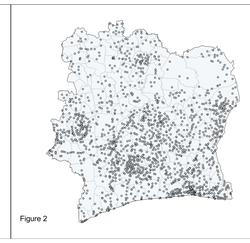

Figure 2

Methods

Accessibility analysis

Model travel times to the nearest facility based on least cost path algorithm with AccessMod software (version 5.6.3).

Modelled sequentially from simplistic model of travel times to a complexity model that mimics the reality. The first model assumed complete isotropy.

Then added transport barriers and included transport network. The third model included elevation to better account for bicycling and walking speeds uphill and downhill and assuming anisotropy.

Travel scenarios were based on assumed travel capacity (best-case scenario).

Geographic patterns in spatial accessibility

For each subprefecture (subnational unit used for health planning), we estimated the population coverage outside of various times of a health facility. (Figure 3A)

Then, we analyzed spatial autocorrelation of poor access using the global Moran's I statistic and Anselin's local indicator of spatial autocorrelation. (Figure 3B)

Results

- **67% of the total population is within one hour** (60 min) of the nearest healthcare facility at the country level. (Figure 3A)
- Approximately **6% were outside 4 hours catchment of any facility**.
- At the subprefecture level **population coverage outside 1, 2, 3, 4 hours was heterogonous** ranging from **27% < 1%**. (Figure 3A)
- Marginalized subprefectures with poor access were clustered in the north based on Moran's I spatial clustering. (Figure 3B)

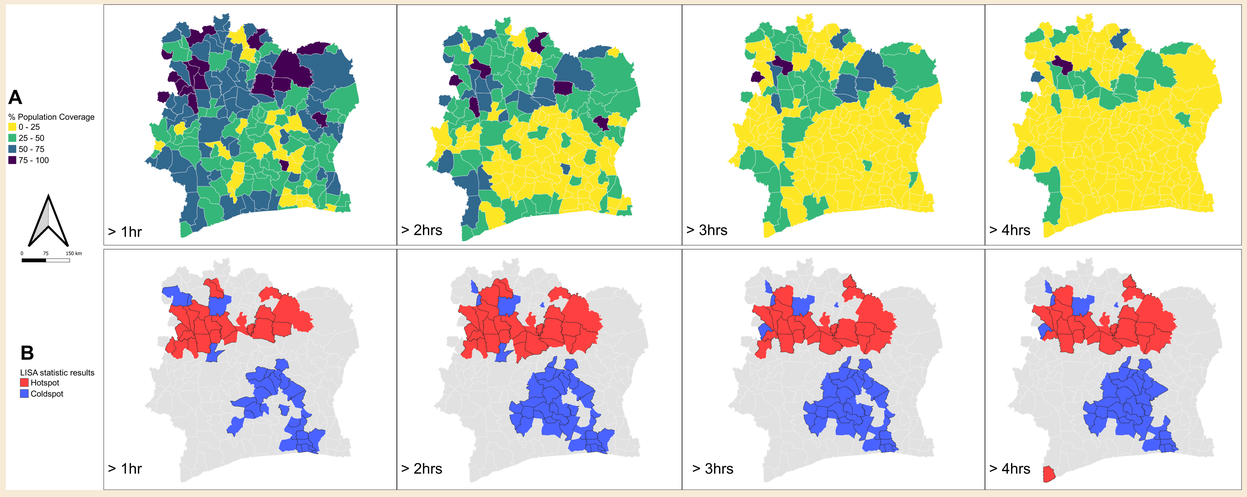

Figure 3. Geographic patterns in spatial accessibility, Cote d'Ivoire, West Africa. A) Percentage of population coverage in each sub-prefectures. B)Results from test of statistical clustering (based on LISA statistics). LISA, local indicators of spatial autocorrelation. Moran's I values range from 0.342 to 0.399 (p-value <0.001).

CONCLUSION

Geographic inequalities and access to health care persists in Côte d'Ivoire. The most marginalized in the north should be targeted to improve spatial access to health care reduce health inequalities.

References

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