

## **Title: Correlations of Rural-Urban Differences in Geographic Healthcare Access Coverage and other Access Measures: An Ecological Study of 128 Countries**

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**Conflicts of Interest:** None

### **Background:**

Inequities in healthcare access, influenced by adverse economic and geographic factors, between rural-urban regions is an important global issue. This study aims to find associations between country-level rural-urban estimates for geospatial access by walking and motorized transport to healthcare facilities and various other global indicators for rural-urban healthcare accessibility.

### **Methods:**

The binarized Urban-Rural Catchment Area (URCA) raster (1km<sup>2</sup>) gave rural (CA label > 7) and urban (CA label = 1 to 7) areas. Malaria Atlas Project (MAP) provided rasters for motorized and walking travel times to healthcare facilities (1 km<sup>2</sup>), while 1 km<sup>2</sup> resolution population counts came from WorldPop. Administrative boundaries of countries were taken from GADM-3.6. We defined healthcare access coverages (HAC) as the population proportions (%) within 60 minutes from their nearest healthcare facility by motorized (HAC-M<sub>60</sub>) and 30 minutes by walking (HAC-W<sub>30</sub>) modes of transport, respectively. The rural-urban values for HAC-W<sub>30</sub> and HAC-M<sub>60</sub> are denoted as RMU\_HAC-W<sub>30</sub> and RMU\_HAC-M<sub>60</sub>, respectively. The rural-urban values for the following health deficit indicators from the International Labour Office (ILO) dataset: legal health coverage deficit (LHCD, % of population without legal coverage), out-of-pocket expenditure (OPE, % of total health expenditure), financial deficit (FD, % population not covered due to financial resource deficit), staff access deficit (SAD, % population not covered due to health professional staff deficit), and maternal mortality ratio (MMR, maternal deaths per 10,000 live births). were calculated as RMU\_LHCD, RMU\_OPE, RMU\_FD, RMU\_SAD and RMU\_MMR respectively. We analyzed the correlations of rural-urban differences for ILO deficit indicators with the rural-urban differences in HAC-M<sub>60</sub> and HAC-W<sub>30</sub> using Spearman's Rank Correlation.

## Findings:

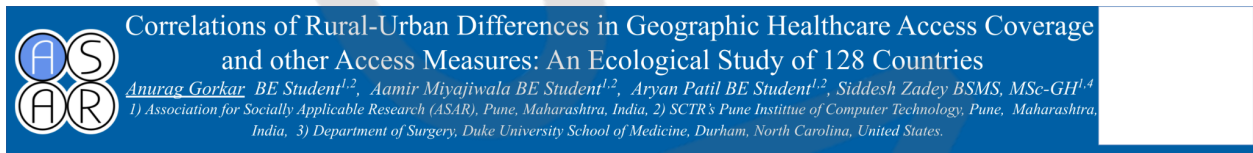
For 128 countries,  $RMU\_HAC-M_{60}$  correlated with  $RMU\_FD$  ( $r=0.31$ ,  $p<0.001$ ),  $RMU\_SAD$  ( $r=0.29$ ,  $p<0.001$ ),  $RMU\_MMR$  ( $r=0.28$ ,  $p<0.001$ ),  $RMU\_OPE$  ( $r=0.22$ ,  $p=0.0008$ ), and  $RMU\_LHCD$  ( $r=0.12$ ,  $p=0.035$ ).  $RMU\_HAC-M_{30}$  correlated with  $RMU\_MMR$  ( $r=0.23$ ,  $p=0.0008$ ) and  $RMU\_OPE$  ( $r=0.145$ ,  $p=0.0369$ ) but not with  $RMU\_LHCD$  ( $r=0.11056$ ,  $p=0.286$ ),  $RMU\_SAD$  ( $r=0.08$ ,  $p=0.165$ ),  $RMU\_FD$  ( $r=0.07$ ,  $p=0.1411$ ).

## Interpretation:

Our analysis depicts the inter-relationships between rural-urban disparities in geographic access to healthcare facilities and those in other indicators for health access. Our findings are limited by parent data sources. Future studies should investigate the associations between rural-urban disparity metrics.

## Source of Funding:

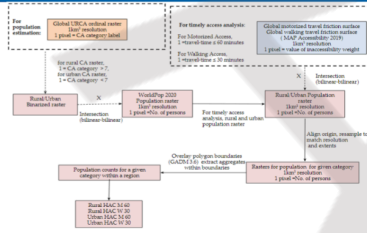
None



- ### Background
- Inequities in healthcare access between rural and urban areas influenced by adverse economic and geographic factors are a major global issue.
  - The objective of this study is to find associations between country-level rural-urban estimates for geospatial access to healthcare facilities by walking and motorized transport and various other global proxy indicators for rural-urban disparities in access to health-care services.

- ### Methodology
- #### Data Sources
- Urban Rural Catchment Areas (URCA) from Global mapping of urban-rural catchment areas reveals unequal access to services.
  - Motorized and Walking friction surface files from Malaria Atlas Project (MAP).
  - Administrative boundaries of countries were taken from GADM-3.6.
  - Global evidence on inequalities in rural health protection from International Labour Organization (ILO).

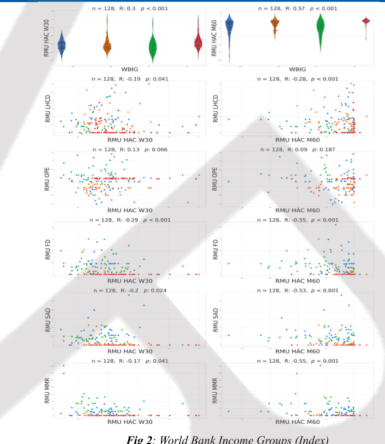
- #### Data Analysis
- For rural and urban areas globally health care access coverages (HAC) is defined as the population proportion (%) with access to the nearest healthcare facility within 60 minutes by motorized (HAC M60) and 30 minutes by walking (HAC W30) modes of transport, respectively (Fig 1).
  - The rural minus urban values for HAC M60 and HAC W30 are denoted as  $RMU\_HAC\_M60$  and  $RMU\_HAC\_W30$  respectively.
  - The rural minus urban values for the following health deficit indicators from the ILO dataset: legal health coverage deficit (LHCD, % of the population without legal coverage), out-of-pocket expenditure (OPE, % of total health expenditure), financial deficit (FD, % population not covered due to financial resource deficit), staff access deficit (SAD, % population not covered due to health professional staff deficit), and maternal mortality ratio (MMR, maternal deaths per 10,000 live births), were calculated as  $RMU\_LHCD$ ,  $RMU\_OPE$ ,  $RMU\_FD$ ,  $RMU\_SAD$ , and  $RMU\_MMR$  respectively.
  - Using Spearman's Rank Correlation, we evaluated the correlations between rural-urban disparities in ILO deficit indicators and rural-urban differences in  $HAC\_M60$  and  $HAC\_W30$ .
  - The p - values were corrected using Holm-Bonferroni Correction.



- ### Findings
- For 128 countries,  $RMU\_HAC\_M60$  correlated with  $RMU\_LHCD$  ( $r=-0.28$ ,  $p<0.001$ ),  $RMU\_FD$  ( $r=-0.55$ ,  $p<0.001$ ),  $RMU\_SAD$  ( $r=-0.53$ ,  $p<0.001$ ),  $RMU\_MMR$  ( $r=-0.55$ ,  $p<0.001$ ) but not with  $RMU\_OPE$  ( $r=0.09$ ,  $p=0.187$ ).
  - For 128 countries,  $RMU\_HAC\_M30$  correlated with  $RMU\_FD$  ( $r=-0.29$ ,  $p<0.001$ ), but not with  $RMU\_OPE$  ( $r=0.13$ ,  $p=0.066$ ),  $RMU\_LHCD$  ( $r=-0.19$ ,  $p=0.041$ ),  $RMU\_SAD$  ( $r=-0.2$ ,  $p=0.024$ ), and  $RMU\_MMR$  ( $r=-0.17$ ,  $p=0.041$ ).
  - Fig 2. Shows scatter plots for correlations between  $RMU\_HAC$  variables and  $RMU$  proxy indicators from ILO dataset by World Bank Income Groups.



- ### References
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**Fig 2: World Bank Income Groups (Index)**

- ### Conclusion
- Our analysis depicts the inter-relationships between rural-urban disparities in geographic access to healthcare facilities and those in other indicators for health access. Future studies should investigate the associations between rural-urban disparity metrics.