District level correlates of COVID-19 pandemic in India

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Wittgenstein Centre Conference 2020
“Demographic aspects of the COVID-19 pandemic and its consequences”
30 November - 1 December, 2020
COVID-19 situation in India (30th November 2020)

- Total Population: **1.38 Billion**
- Total Cases: **9.1 million**
- Active Cases: **0.446 million**
- Recovered Cases: **8.8 million (93.78%)**
- Deceased Cases: **1,37,187 (1.46%)**
- Total Number of tested: **140 million**
- Test Positivity Rate: **average 6.5 percent**
- Recovery Rate: **above 90 percent**
• India is reported as the world’s second-largest hotspot of COVID-19 cases.

• Number of patients with coronavirus infection (COVID-19) is huge!
Objective

- To identify the district level correlates the COVID-19 infection ratio in India during Mar-July 2020
Data

- COVID-19 India dashboard
- National Family Health Survey of India 2015-16 (NFHS-4).
- Census of India 2011.
- Period of study **March to July 2020**
Methods

• **Spatial Analysis**
  LISA MAP and MORAN – I Value
  GeoDa software

• **Statistical Analysis (STATA Software)**
  MULTIPLE REGRESSION - ADJUSTED and UNDAJUSTED MODELS
  OUTCOME: COVID-19 Infection Ratio (IR) at district level
  Independent variables: Demographic, socio-economic, Infrastructure and Health related variables
Results

Figure 1- Trend of number of total confirmed cases by no. of days in India 14 March-July 30, 2020

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Total Cases

Days
Figure 2 - Bi-weekly average new, infected, recovered, deceased cases in India (March 14 - July 31, 2020)

Average new cases (per day) bi-weekly

Average infected cases (per day) bi-weekly

Average recovered cases (per day) bi-weekly

Average deceased cases (per day) bi-weekly
Figure 3 - State-wise Infection Ratio (per lakh) above national average (INDIA = 42.38) , till July 31, 2020

State-wise Infection Ratio (per 100,000) till 31 July, 2020
Figure 4 - District-level variations in COVID-19 on July 31, India 2020

Panel A: Number of positive (absolute values) COVID-19 cases in districts as of July 31, 2020

Panel B: District level infection ratio (IR), defined as the number of confirmed cases per 100,000 population by July 31, 2020
Figure 5 - Moran’s I and LISA cluster maps for district’s infection ratio of COVID-19 in India till July 31, 2020

**Moran’s I – Value**

Moran’s I: 0.333 (isolates in weights are removed)

**LISA clusters map**

- IR: Not Significant (564)
- High-High (27)
- Low-Low (115)
- Low-High (7)
- High-Low (8)
- Neighborless (4)
- Undefined (2)
### Description - Total 22 Exploratory Variables

#### Demographic variables
- Percent of 60 years and above population
- Percent of women whose husbands are away for the last six months
- Population density

#### Socio- Economic variables
- Percent of literate population
- Percent of SC population
- Percent of ST population
- Percent of Hindu population
- Percent of Urban population
- Avg persons sleeping in a room

#### Infrastructure variables
- Percent of households with soap availability
- Percent of households with water availability within the premise
- Percent of households with Toilet facility within the premise

#### Health-related variables
- Percent of women with Diabetes (Glucose>140mg)
- Percent of women (among age 18+) who reported having Cancer Disease
- Percent of 18- aged women consuming Tobacco
- Testing ratio per 100 thousand
- Under-5 mortality rate
- Percent of institutional births
- Percent of full immunization among children aged 23-36 months
- Percent of women reporting anemia among women aged 18+
- Percent of children with stunting
- Percent of children with wasting

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**Outcome Variable:** Where, 
\[ C_i = \text{the number of confirmed cases in } i^{\text{th}} \text{ district and } P_i = \text{total projected population in the } i^{\text{th}} \text{ district on July 31, 2020.} \]

**Infection Ratio (IR)**
\[ \frac{C_i}{P_i} \times 100,000 \]
## RESULTS – MODEL STATISTICS

| Regression Models | Unadjusted model | | | | Adjusted model | | |
|------------------|------------------|------------------|------------------|------------------|
|                   | B-Coeff. | p-value | 95% CI | B-Coeff. | p-value | 95% CI |
| **Demographic variables** | | | | | | |
| percent of 60 years and above population | -1.42 | 0.84 | (-15.58, -12.74) | -7.28 | 0.5 | (-28.31, -13.75) |
| Percent of women whose husbands are away for the last 6 months | -13.08** | 0 | (-18.15, -8.01) | 1.48 | 0.65 | (-5.02, -7.99) |
| Population density | 0.06** | 0 | (0.06, 0.07) | 0.05** | 0 | (0.04, 0.06) |
| **Socio-economic variables** | | | | | | |
| Percent of literate population | 7.15** | 0 | (4.44, 9.85) | 2 | 0.4 | (2.63, 6.62) |
| Percent of SC population | 0.43 | 0.79 | (-2.76, -3.62) | 3.92* | 0.04 | (0.12, 7.72) |
| Percent of ST population | -1.22* | 0.03 | (-2.29, -0.14) | 0.32 | 0.7 | (-1.34, 1.99) |
| Percent of Hindu population | -0.09 | 0.87 | (-1.18, -1.0) | 0.29 | 0.71 | (-1.24, 1.83) |
| Percent of Urban population | 7.27** | 0 | (6.01, 8.53) | 3.08** | 0 | (1.05, 5.11) |
| Avg persons sleeping in a room | -28.21 | 0.3 | (-81.04, -24.62) | -1.7 | 0.97 | (-79.56, 76.16) |
| **Infrastructure variables** | | | | | | |
| Percent of households with soap availability | 3.50** | 0 | (2.04, 4.96) | -0.03 | 0.98 | (-2.24, 2.19) |
| Percent of households with water availability within the premise | -0.17 | 0.75 | (-1.27, -0.92) | -0.53 | 0.37 | (-1.71, 0.64) |
| Percent of households with Toilet facility within the premise | 2.41** | 0 | (1.38, 3.45) | 0.42 | 0.7 | (-1.73, 2.57) |
| **Health-related variables** | | | | | | |
| Percent of women with Diabetes (Glucose>140mg) | 21.05** | 0 | (8.06, 34.05) | 3 | 0.66 | (-10.57, 16.58) |
| Percent of women (among age18+) who reported having Cancer Disease | 25.6 | 0.44 | (-39.49, -90.68) | 23.65 | 0.41 | (-32.26, 79.56) |
| Percent of 18+aged women consuming Tobacco | -2.68* | 0.02 | (-4.87, -0.49) | 0.34 | 0.8 | (-2.27, 2.96) |
| Testing ratio per 100 thousand | 0.03** | 0 | (0.02, 0.04) | 0.03** | 0 | (0.01, 0.04) |
| Under-5 mortality rate | -2.59** | 0 | (-3.84, -1.33) | -1.16 | 0.14 | (-2.71, -0.38) |
| Percent of institutional births | 2.94** | 0 | (1.28, 4.6) | 0.13 | 0.92 | (-2.33, 2.59) |
| Percent of full immunization among children aged 23-36 months | 0.81 | 0.34 | (-0.86, -2.48) | -1.26 | 0.17 | (-3.07, -0.55) |
| Percent of women reporting anemia among women aged18+ | 0.39 | 0.75 | (-1.98, -2.77) | 0.98 | 0.79 | (-1.46, 3.42) |
| Percent of children with stunting | -4.58** | 0 | (-7.49, -1.67) | 3.05 | 0.18 | (-1.37, 7.47) |
| Percent of children with wasting | -1.26 | 0.55 | (-4.87, -1.38) | 0.28 | 0.75 | (-3.42, 0.03) |
Key Findings

✓ Huge variation across districts

✓ Infection Ratio (IR) in India is 42.38 per 100 hundred thousand population and 15 states are above from national averages.

✓ 80% of the new patients, and 90% of the deaths are concentrated in nine Indian states.

✓ Six high-risk COVID-19 infected cities (Mumbai, Chennai, Thane, Pune, Bengaluru, and Hyderabad) in India.

✓ COVID-19 infection ratio is found to be higher in the districts with higher level of population density, higher percent of urban population, higher percent of deprived castes and with the higher level of testing ratio.
Strengths and limitation of the study

Strengths

Studies identifying COVID-19 Vulnerability based on strict assumptions
Study is based on what has been experienced

Limitations

Possibility of under-reporting
Thank you for Your Attention!!!

PLEASE WEAR A MASK