


RURAL HEALTHCARE DATA ANALYSIS

DATA LAYERS AND THEIR RELEVANCE


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PROBLEM STATEMENT

- 
- Rural healthcare systems often lack accurate geospatial data for decision-making.
 - **Objective:** To create data layers that identify healthcare gaps, infrastructure, and access issues.
 - **Approach:** Use Google Earth Engine to extract relevant data layers.



SOURCE AND LAYERS

| <u>DATA LAYER</u> | <u>CATEGORY</u> | <u>RESOLUTION/SCALE</u> | <u>CHARACTERISTICS</u> | <u>METHOD TO OBTAIN</u> |
|----------------------------|-----------------|-------------------------|---|---|
| Population Density | Raster | 100m - 1km | High-resolution grid, number of people per unit area. | WorldPop, GPW, or integrate Census of India data with shapefiles. |
| Health Facilities | Vector | Point locations | Locations of hospitals, clinics, PHCs. | MoHFW, Bhuvan, or manually digitizing from local data. |
| Road Networks | Vector | Scale: 1:50,000 | Major roads, minor roads, and pathways for connectivity analysis. | OpenStreetMap, Bhuvan, or survey data. |
| Elevation (DEM) | Raster | 30m or finer | Terrain height, slope analysis (physical barriers). | Access SRTM (Google Earth Engine), CartoDEM (Bhuvan), or USGS Earth Explorer. |
| Land Use/Land Cover (LULC) | Raster | 10m - 30m | Categories: agriculture, forests, barren land, etc. | ESA WorldCover or Bhuvan LULC datasets. |





SOURCE AND LAYERS

| | | | | |
|---------------------------|--------|------------------------|---|---|
| Seismic Hazard Zones | Vector | Scale: 1:250,000 | Earthquake risk areas for healthcare planning. | Geological Survey of India (GSI) or Bhuvan seismic hazard layers. |
| Administrative Boundaries | Vector | Village/District level | Boundaries for analysis and aggregation of data. | shapefiles from GADM, Bhuvan, or Census of India portals. |
| Public Transport Routes | Vector | Scale: 1:100,000 | Bus and train routes, stops for rural areas. | State Transport Departments, OpenStreetMap, or digitizing from survey data. |
| Electricity Grid | Vector | Scale: 1:100,000 | Power grid lines, transformers, substations. | Bhuvan, State Electricity Boards, or manual digitization. |
| Air Quality | Raster | 1km | PM2.5, PM10 concentrations, health risk analysis. | Sentinel-5P (Google Earth Engine) or CPCB air quality monitoring data. |





SOURCE AND LAYERS

| | | | | |
|-------------------------|--------|------------------------|--|---|
| Water Quality | Vector | Point locations | Data on drinking water sources and quality. | CGWB, Bhuvan Water Layers, or digitize survey data. |
| Disease Incidence | Vector | Point/Polygon level | Locations with high incidence of diseases (e.g., malaria, dengue). | MoHFW, NFHS, or state-specific health reports. |
| Rainfall Patterns | Raster | 5km - 25km | Monthly and annual rainfall grids. | IMD, CHIRPS, or Bhuvan rainfall layers. |
| Temperature Variability | Raster | 1km | Seasonal temperature extremes. | MODIS (Google Earth Engine) or IMD datasets. |
| Disaster Response Zones | Vector | Point locations | Locations of disaster management centers. | NDMA, Bhuvan, or local disaster management reports. |
| Poverty Index | Vector | Village/District level | Economic vulnerability for healthcare prioritization. | Socio-Economic Caste Census (SECC) or NFHS. |





CONCLUSION AND WAY FORWARD

- Layers collectively address the problem of rural healthcare mapping.
- Insights support evidence-based decision-making for rural development.
- Future work: Refine methods and validate data with field surveys.



THANK YOU



LAYERS INTO CONSIDERATION

01

HEALTH FACILITIES

02

ROADS AND TRANSPORT

03

ADMINISTRATIVE
BOUNDARIES

04

RIVERS AND NATURAL
BARRIERS

05

ELEVATION DATA

06

MEDICAL SHOPS





LAYERS INTO CONSIDERATION

07

AGE DISTRIBUTION

08

AIR QUALITY

09

WATER QUALITY

10

AMBULANCE NETWORK

11

TEMPERATURE VARIABILITY

12

DISEASE INCIDENCE DATA



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LAYERS INTO CONSIDERATION

13

POVERTY AND ECONOMIC DATA

16

EDUCATION LEVELS

14

POPULATION DENSITY

15

LAND COVER/USE





SOURCE

SPATIAL RESOLUTION : 30M-100M

01

GOOGLE EARTH ENGINE

02

BHUVAN

03

USGS EARTH EXPLORER

04

DATA.GOV.IN

05

OPENSTREETMAP

06

EARTH EXPLORER





SOURCE

SPATIAL RESOLUTION : 30M-100M

07

CENSUS OF INDIA
([HTTPS://CENSUSINDIA.GOV.IN](https://censusindia.gov.in))

08

WORLDPOP INDIA
([HTTPS://WWW.WORLDPop.ORG/](https://www.worldpop.org/))

09

([HTTPS://SEDAC.CIESIN.COLUMBIA
.EDU/DATA/COLLECTION/GPW-V4](https://sedac.ciesin.columbia.edu/data/collection/gpw-v4))

10

INDIA DATA PORTAL
([HTTPS://INDIADATAPORTAL.COM/](https://indiadataportal.com/)):

11

OPENLAYERS

12

HYDROSHEDS





SOURCE

SPATIAL RESOLUTION : 30M-100M

13

WORLDPOP, GPW

14

SRTM, ASTER DEM

15

MODIS, ESA WORLDCOVER

16

CHIRPS, ERA5

17

OSM, TIGER

18

GADM, TIGER





LAND COVER/USE

Data Layer 3

01

SOURCE

landsat or Sentinel-2 data,
classified using GEE.

02


UTILITY

- Differentiates between urban and rural areas.
- Identifies suitable locations for healthcare facilities based on land use.

03

METHOD

Perform supervised
classification of satellite
imagery.





ROAD NETWORKS

Data Layer 4

01

SOURCE

OpenStreetMap (OSM)
integration in GEE.

02


UTILITY

- Maps accessibility to healthcare facilities.
- Identifies remote areas with poor connectivity.

03

METHOD

Download vector data from OSM and overlay on the base map.





LAYER INTEGRATION FOR ANALYSIS



ACCESSIBILITY MAPPING

- Use road network data and elevation models to perform a least-cost path analysis, identifying regions with poor accessibility to healthcare centers.
- Generate travel time surfaces to measure how long it takes to reach the nearest facility.

SERVICE GAP IDENTIFICATION

- Combine population density and healthcare facility data to calculate healthcare coverage areas (buffer zones).
- Detect underserved areas by spatial clustering of high population density outside coverage zones.

OPTIMAL SITE SELECTION FOR NEW FACILITIES

- Perform suitability analysis by weighting criteria like population demand, accessibility, and land availability.
- Use a weighted overlay model for prioritizing high-need locations.





ELEVATION DATA

Data Layer 5

01

SOURCE

SRTM DEM (Shuttle Radar Topography Mission) in GEE.

02


UTILITY

- Analyzes terrain for planning healthcare infrastructure.
- Identifies hard-to-reach areas due to elevation changes.

03

METHOD

Use GEE to extract elevation data and integrate it into analysis.



POPULATION DENSITY

Data Layer 6

01

SOURCE

- <https://www.worldpop.org/>
- <https://indiadataportal.com/>

02

UTILITY

- Efficient allocation of health centers and infrastructure.
- Supports government and NGOs in formulating rural development plans.

03

METHOD

- Satellite Imagery and GIS

HEALTHCARE FACILITY LOCATIONS

Data Layer 6

01

SOURCE

Direct source (government health department datasets or NGOs).

02

UTILITY

- Provides current healthcare infrastructure locations.
- Identifies gaps in rural healthcare service areas.

03

METHOD

Geocode facility locations and overlay on maps.



ELEVATION

Data Layer 6

01

SOURCE

- <https://www.worldpop.org/>
- <https://indiadataportal.com/>

02

UTILITY

- Efficient allocation of health centers and infrastructure.
- Supports government and NGOs in formulating rural development plans.

03

METHOD

- Satellite Imagery and GIS
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