The Global Open Healthcare Access Map

Improving Access to Healthcare Facilities through Open Geoinformation

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HeiGIT gGmbH: Heidelberg Institute for Geoinformation Technology

Smart Mobility

Location-based Services & Navigation
- Emergency Routing / Navigation
- Healthy / Pleasant Routing
- Specialized Wheelchair Routing
- POI service

Geoinformation for Humanitarian Aid

Supporting Disaster Management & Sustainability
- Disaster Routing / Logistics
- Improving OSM data
- Damage assessment / Exposure Modeling
- Healthcare Access
- Mobile Crowdsourcing (MapSwipe)

Big Spatial Data Analytics

Data Mining & Machine Learning using open GI
- OSM data quality (analysis & improvement)
- Data products via machine learning
- Predictive Analytics
- Maps (e.g. climate protection map)
openrouteservice API & Ecosystem

APIs
/directions
/isochrones
/matrix
/geocoding
/poi
/maps
/optimization

openrouteservice.org
Sign up for free!

Clients / libs
openrouteservice-py
openrouteservice-r
QGIS: ORS Tools
JavaScript
VROOM
Disaster Routing
maps.openrouteservice.org

Covid-19 accessibility to healthcare in SS Africa

Access of **Population 60+** to primary healthcare facilities

- Healthsites.io
- OSM street network
- Statistics for each country

Global Open Healthcare Access Map

https://apps.heigit.org/healthcare_access

- Access to health facilities / share of population
  - Primary healthcare / secondary / both types
- Different scales & units
  1. Country
  2. First admin level (State, district)
  3. Second admin level (district, province) some countries only
  4. Hexagons (ISEA3H, zoom level 8)

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The Open Healthcare Access Map is a proof of concept implementation. For further information, please refer to the 'About' tab.

The map shows coverage by travel time across different regions.

- **Coverage by Travel Time**
  - **Pop share (%)**
    - 0-10: 25%
    - 10-20: 20%
    - 20-30: 15%
    - 30-40: 10%
    - 40-60: 5%
    - >60: 5%

- **Travel time (Min.)**
  - 0-10: 659,569,468 (46.88%)
  - 10-20: 853,117,495 (60.63%)
  - 20-30: 554,030,258 (39.37%)

- **People within travel time to the next facility**
  - **20 Min.**
    - 659,569,468 (46.88%)
  - **40 Min.**
    - 853,117,495 (60.63%)
  - **60 Min.**
    - 554,030,258 (39.37%)

HeiGIT (Heidelberg Institute for GeoInformation Technology) is responsible for this map.
767,684,017 (54.55%) people live within less than 30 minutes travel time (motorized) to the next facility.

958,809,843 (68.13%) live within less than 60 minutes travel time to the next facility.

448,335,866 (31.86%) live further away than 60 minutes travel time to the next facility.
Please note, this is a proof of concept implementation. For further information please refer to the about tab.
India

Layer Controls
Select the scale of interest
- National

Select the type of facilities
- Both types

Layer Opacity
Overlay Facilities

Coverage by Travel Time
- 30
- 25

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Open Healthcare Access Map

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Units (admin level 1)

Travel time in minutes
- Purple: >60
- Blue: 60
- Dark blue: 50
- Teal: 40
- Green: 30
- Light green: 20
- Yellow: 10

Within 30 minutes travel time, 18 / 36 unit(s) cover more than 50% of people.

Within 60 minutes, 26 / 36 unit(s) cover more than 50% of people. 10 unit(s) cover less.
Within 30 minutes travel time, 198 / 528 unit(s) cover more than 50% of people.

Within 60 minutes, 278 / 528 unit(s) cover more than 50% of people. 250 unit(s) cover less.

385 / 528 unit(s) cover more than 25% of people. 143 unit(s) cover less.

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Healthcare Accessibility COVID 19 temporal vaccination centers

- Travel time to closest COVID-19 vaccination center
  - per federal state (German rule)
  - ORS & OSM vaccination center sites

- Majority of population in less than 30 minutes driving time but regional differences
# OSM Data sources

Here is a list of all healthcare related tags used in this application:

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Relevant Tags</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary care</td>
<td>{amenity,healthcare}=doctors</td>
<td>Provision of ambulant, preventive care as well as monitoring and check-ups. E.g. health centers, general practitioners and clinics.</td>
</tr>
<tr>
<td></td>
<td>{amenity,healthcare}=clinic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>healthcare=midwife</td>
<td></td>
</tr>
<tr>
<td></td>
<td>healthcare=nurse healthcare=center</td>
<td></td>
</tr>
<tr>
<td></td>
<td>amenity=health_post</td>
<td></td>
</tr>
<tr>
<td>Secondary and tertiary care</td>
<td>amenity=hospital or healthcare=hospital</td>
<td>Provision of inpatient care.</td>
</tr>
<tr>
<td>COVID-19 Vaccination Centers</td>
<td>vaccination=covid19</td>
<td>(Temporary) medical facilities for mass vaccination against COVID-19</td>
</tr>
</tbody>
</table>
Completeness of Health Facilities in Sub-Saharan Africa

http://ohsome.org
heigit.org --- uni-heidelberg.de/gis
Example: Healthcare in Subsahara-Africa (hospitals with bed tag)

http://ohsome.org

November 2020 - before the campaign

December 2020 - after the campaign
Healthcare Accessibility after disasters

- **How resilient / vulnerable is the infrastructure in face of disaster?**

- **Example impact of 2013 flood event on road network connectivity & access to health sites** in Jakarta

- Analysis of effect of flood on
  - accessibility to hospitals & clinics
  - demand (population) & supply (bed capacity) relationship

- Accessibility assessment based on ORS

Covid-19 Vaccination Center Routing App

- OSM
- ORS
- Germany
- mobile client
Wheelchair routing in openrouteservice
USAID - Global Health Supply Chain

- Use ORS (Matrix API) in own Logistics-Software „Last Mile Optimization“
- Distribute goods (Medicine) von Frachtzentren zu recipient medical value ca. 120 Mio US$ p.a. in Sambia, to >1.800 clinics, health facilities
- Pilot Sambia: ZAMMSA Challenge: DATA

Summary Statistics

<table>
<thead>
<tr>
<th>Routes</th>
<th>Volume (m³)</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>131</td>
<td>92.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stops</th>
<th>Distance (KM)</th>
<th>Fuel (L)</th>
<th>Cost (ZK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>400</td>
<td>59</td>
<td>5,846</td>
</tr>
</tbody>
</table>

AIDS Health Care Foundation Chifundo (4.92 cubic meters)
Arakan Camp Hospital (0.69 cubic meters)
Bauleni Urban Health Center (4.58 cubic meters)
Bwafwano Home Based Care (0.47 cubic meters)
Chandra Urban Health Center (0.33 cubic meters)
Chaisa Health Centre (4.54 cubic meters)
Chazanga Urban Health Center (4.39 cubic meters)
Chelstone Urban Health Center (4.10 cubic meters)
Chest Diseases Laboratory (0.73 cubic meters)
Chilenje 1st Level Hospital (0.76 cubic meters)
Chimanga Clinic (4.08 cubic meters)
Chreso Ministries-Lusaka (3.13 cubic meters)
DisasterORS (Mozambique avoid flooded areas, Ahrtal, Copernicus)
Healthy routing with ORS

HEAL – Heat stress avoiding routes
Solar Radiation index of streets in Heidelberg

Model using **buildings only**

Model using **buildings + vegetation**

1. July, 12 pm

1. July, 12 pm
Shadow route versus shortest route (HD)

Shadow route vs. shortest route

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Thank you! Questions?

Feel free to share your needs & requirements.

Ideas for improvement welcome!

We love to collaborate!

Thank you!

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