# HealthDashboard: A Urban Public Health Geospatial Visualization Platform

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#### University of São Paulo, Brazil

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#### **Motivation**

- Smart Cities
  - Use of technology to achieve efficient usage of urban resources
    - Urban information
    - Evidence-based policymaking
- InterSCity project
  - A collaborative research project from the National Science and Technology Institute (INCT) of the Future Internet for Smart Cities

#### Context

- Significant growth in healthcare data from health facilities
  - Information helpful to **public managers**
- Large collections of heterogeneous data
  - Hard to analyze without **proper visualization tools**
- Collaboration with a Municipal Health Secretariat to develop a large-scale data visualization platform

#### Dataset

- Brazilian National Health System (SUS): ~190 million users
- Hospital Information System (**SIH-SUS**) (hospitalization dataset)
- Covers around **70% of hospitalizations** in Brazil
  - 285 million since its creation
- SIH-SUS contains:
  - **Administrative** information
  - **Patient** information (age, gender, race, residence, ...)
  - Health facility where the patient was admitted
  - Health logs about the **hospitalization** (specialty, diagnosis, duration, ...)

#### **Initial Testing Dataset**

- 1-year SIH-SUS dataset from the city of São Paulo
  - Over 500K hospitalization records
  - Dataset enriched with geolocation
  - Uses the census tract for the patient residency, not the exact patient address (for geo-anonymization)
  - Census tract enable us to get sociodemographic data from the census

### **Development Approach**

- Government-Academia collaboration
  - Practices from **Open Source Software** communities and **Agile Methods**
- Partnership based on constant feedback
  - Requirement specifications and discussions via Gitlab Issue Tracker
  - Frequent meetings
  - Health officials' validation in a homologation environment

## **Technical Overview**

- Web application
  - Advanced Geo-Search
  - General Data

- Built using Ruby on Rails framework
  - Model-View-Controller architecture
- PostgreSQL database
  - Using Redis as a cache server



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**Clustering options:** 

Heatmap options:

· Opacity: 1

Facilities options:

• City



Filters
Health Facility
Procedure
Patient data
Heatmap by hospitalization rate
Search
Map options
Clustering
Heatmap
Administrative limits
Facilities
Legends
State Municipal

#### Export

PDF CSV



Health Facility		
Procedure		
Main diagnosis (ICD-10	)	
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**Health Facility** 

Procedure

Patient data

Nothing Selected

Nothing Selected

Nothing Selected

Nothing Selected

Nothing Selected



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Health Facility	
Procedure	
Patient data	
Distanc <mark>20</mark> avelled (Km)	84.5
Age group	
Nothing Selected	*
Race/Color	
Nothing Selected	
Education level	
Nothing Selected	×
Sex	
Nothing Selected	
Administrative sector	
Nothing Selected	*



Health Facility	
Procedure	
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Health Facility		
Procedure		
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Competence (aaaamm)

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· 2078015 - Hospital Das Clinicas Hc/Fmusp

• 2089777 - Hosp Nipo Brasileiro

**Health Facility** 

2 selected items

Selected facilities

Nothing Selected

Nothing Selected

Nothing Selected

Nothing Selected

Nothing Selected



Data Characterization and Applied Filters	.↓ (i)
Database	
Source: Sistema de Internações Hospitalares SUS - SMS/SP	
Total records: 554202	
Territory/Unit of analysis: Município de São Paulo	
Selected Data (based on filters)	
Total records: 788	
Main diagnosis (ICD-10): I21 - Infarto agudo do miocárdio	
Travelled Distance (Km) between: 20 - 84.5	
Rankings	
Historic Series	
Specialties	
Facilities	
Facilities Distances' by Specialty	
Distances and Displacement	
Hospitalizations / Patients	
Territory and Administrative Regions	





#### **Future Work**

- Update 2015 dataset to 2018 and 2019
  - 1,142,966 hospitalization records
- Benchmarks and performance oriented improvements
- Official release and wide publicity to public health managers
  - More feedback to evolve the platform
- Spread to other Brazilian cities
  - e.g. Rio de Janeiro
  - uniform open data format across the country helps







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### https://interscity.org/software/healthdashboard





