Healthy Access, Healthy Regions: An Open Spatial Data Science Application and Systems Framework for Place-Based Decision-Making in Public Health

Marynia Kolak | Center for Spatial Data Science, University of Chicago

Overview

While surveillance of diseases and injuries is routine in public health strategies in the U.S., simultaneous real-time monitoring of associated built environment features remains rare. There is an increasingly urgent need to create "distributed, interoperable spatial data infrastructures to integrate health research data across and within disparate health research programs," for generating hypotheses, detecting spatial patterns, and responding to health threats (Richardson et al. 2013).

Our goal is to address this need so that spatial analytic results update automatically as new data are added – in a community and analyst-friendly web environment.

HOW CAN WE BETTER INTEGRATE DATA & ANALYSIS IN A FLEXIBLE TECHNOLOGICAL FRAMEWORK TO *CONTINUOUSLY* ASSESS HEALTH PROGRAMS AND OUTCOMES?

The "Healthy Access, Healthy Regions" Explorer is a civic tech web application being developed in response to this challenge as a cross-sector collaboration with the Chicago Department of Public Health (CDPH), University of Chicago's Center for Spatial Data Science, Arizona State University, and community-based organizations.

Research Objectives

The goals of this public informatics decision-support tool are to:

(1) Generate interactive asset maps that support needs assessments,
(2) Dynamically identify areas for treatment based on risk scores,
(3) Ultimately assist in the evaluation of policies and interventions.

A core objective is to provide a place of integration, visualization and exploration of multiple datasets needed for well-rounded community health surveillance.

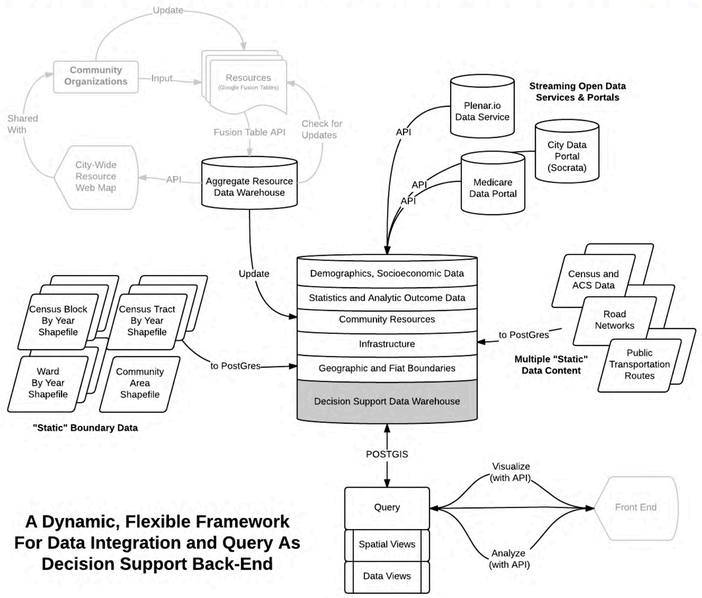
INTEGRATE
VISUALIZE
EXPLORE

Better engage both public and in-house analyst users with linked and dynamic web maps, visualization, and ultimately dynamic analysis.

Solution Framework

A Hybrid Architecture for Flexible Back-End

A robust framework with hybrid architecture can be scaled and updated in the future with further contributions. This allows for service-driven visualization and analytics in the final environment. Location (and time) are used as keys for joining data in most cases. Processing and pre-calculations are done on the warehouse when possible, with caching enabled, to increase efficiency on the frontend. Datasets captured in dynamic workflows from multiple public and in-house data portals, including the newly developed Open Community Data Collective. In many cases, data were migrated from static spreadsheets to dynamic versions on the web. We leverage PostGres, POSTGIS, and python.

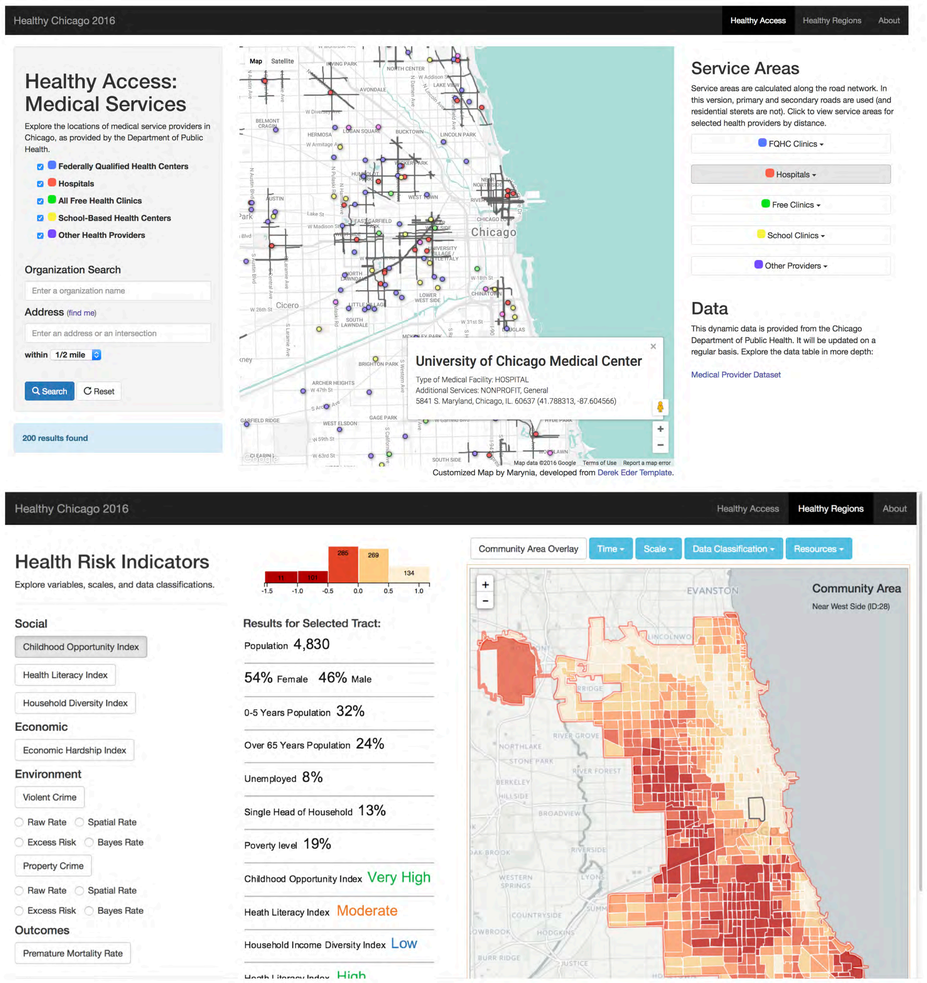


A Light, Open, and Efficient Front-End

Users can choose and overlay variables of interest at different geographic scales (census tract, zip code, or community area). As the user explores the map, additional attributes of demographic and socioeconomic characteristics are updated live as data visualizations. Results of an analysis (such as service area calculation or cluster analysis) can be clicked on for further exploration. The front-end uses JavaScript, HTML/CSS, jQuery, with libraries from Leaflet, Carto, Google Maps and Fusion Table APIs, and more.

Relevance to Policy

By improving how data is accessed, cleaned, and shared in a dynamic environment, analysis and understanding are also improved. Data and the resulting explorations, visualizations, and analysis are more easily shared, validated, confirmed or challenged, and ultimately improved in a transparent, open process.



(Top) Working prototype visualizing dynamic health provider data, and calculated 1-mile service areas. (Bottom) Wireframe of final dashboard environment. Resources can be additionally layered as needed.

The Team

Core team members are Marynia Kolak (ASU PhD Candidate, Staff at Center for Spatial Data Science, and CDPH Intern), Raed Mansour (CDPH), Sheri Cohen (CDPH) and Nik Prachand (CDPH). Additional contributions and guidance come from Luc Anselin (U Chicago), Julia Koschinsky (U Chicago), Ross Maciejewski (ASU), Michael Steptoe (ASU), Feng Wang (ASU) and Tamara Freihat (Chicago State University). The original prototype for community data was developed with volunteers at the West Humboldt Park Community Development Council and the Community office Northwestern Memorial Hospital. Marynia is funded by the Agency for Healthcare Research and Quality & the Center for Spatial Data Science at University of Chicago.

HEALTHY CHICAGO
CHICAGO DEPARTMENT OF PUBLIC HEALTH

THE CENTER FOR SPATIAL DATA SCIENCE
THE UNIVERSITY OF CHICAGO

ASU

*Richardson, D. B., Volkow, N. D., Kwan, M. P., Kaplan, R. M., Goodchild, M. F., & Croyle, R. T. (2013). Spatial Turn in Health Research. *Science*, 339(6126), 1390–1392.

mkolak@uchicago.edu