CASE STUDY REPORT
April 2019

Next-Generation Health and Human Services Infrastructure: A Process & Platform

The University of Chicago Center for Spatial Data Science (CSDS) and School of Social Service Administration (SSA) with the Chicago Department of Public Health (CDPH)

INNOVATION CHARACTERISTICS

Open source technology	Collaborative	New or creative	Replicable

This project sought to develop a process and platform that uses publicly available data to present a system-wide picture of whether public funds are appropriately matched to identified community health needs. This information can help planners and policymakers analyze their financial investments and inform decisions about ongoing spending in a larger context. The project is a partnership between the Chicago Department of Public Health (CDPH) and researchers at the University of Chicago's Center for Spatial Data Science (CSDS) and School of Social Service Administration (SSA). It analyzes the distribution of public funds for health and health-related human services within the City of Chicago. The project focused on developing: 1) a process that helps government agencies identify which data elements are needed for conducting such analyses, and which data elements are missing, and 2) a diagnostic tool for assessing data quality, for internal use by public agencies. This project was implemented with funding and support from the Robert Wood Johnson Foundation (RWJF) through the Public Health National Center for Innovations (PHNCI) Public Health Innovations Implementation Grant Program.

Background

Health planners are often familiar with data on community health needs, risks, and other factors, such as the types of health and health-related human services available to community residents – information that is commonly available

through a community health assessment. However, they are typically less familiar with the specific locations of financial investments in services within their community. While federal, state, and local governments frequently dedicate public funding for health and health-related human services through contracts with local service providers, they rarely track these funds in a manner that allows them to understand the location of service delivery. This makes it difficult for health planners to assess whether public funding is going to priority issues and locations within the community.

Prior research on health and health-related human services contracts in New York City, conducted by Nicole Marwell, PhD, Associate Professor at the University of Chicago's SSA, has established that there is limited knowledge about the spatial match of public funds to need.[i] The CSDS/SSA team defined three key questions that are particularly difficult to address with existing contracts data: 1) where are publicly funded health and health-related human services delivered within a city?, 2) what is the spatial proximity of residents with specific needs to these services?, and 3) what is the mix of services that residents can reach?

⚓ INNOVATION FOCUS

Topic Areas
Health equity, social determinants of health, spatial access to health and health-related human services

Summary
The CSDS/SSA team developed a process and open source platform that public health agencies and other government agencies can use to assess whether public funds are spatially matched to community health needs.

Location Served
Chicago, Illinois

Partners
Chicago Department of Public Health (CDPH)

Key Characteristics
- Open source technology
- Spatial analytics

Target Audience
Leadership and staff, such as planners and policy makers, within public health departments and other government agencies

To help answer these three questions, the CSDS/SSA team sought to develop a process and platform that health planners and others could use to understand where public funds for health and health-related human services were located, and that could also provide a system-level perspective on whether financial investments are appropriately matched to community health needs. They were inspired to build upon longer-term data infrastructure projects being implemented within the City of Chicago, in addition to the recent trends of web-based data visualization and open data portals for administrative data within the city. In particular, CSDS staff recognized that they could leverage existing frameworks and partners within the City of Chicago to develop the platform. For example, the Chicago Health Atlas is an existing tool that maps health services, businesses, and other resources.[ii] The CSDS/SSA team also realized that this type of data analytics could help CDPH to address two key strategies of their Healthy Chicago 2.0 Initiative—a plan for maximizing the health and wellbeing of city residents—including: 1) analyze geographic access to health and health-related human services and address gaps in care; and 2) increase capacity and availability of health and health-related human services by maximizing the impact of existing resources.

To further refine their idea, the CSDS/SSA team had numerous conversations with CDPH staff and other stakeholders, including an initial weekend design sprint. The design sprint was a two-day meeting, led by the CSDS/SSA team, involving design professionals and students from the Chicago Art Institute who applied their design and research skills to the project. The meeting and conversations enabled the team to fully explore the concept of a process and platform that could provide a system-level perspective on funding for health and health-related human services across levels of government, as well as open-data analytics opportunities and limitations. Through these conversations, and analyses of the data on health and human service funding, it became clear that the data were missing too many elements to inform actual decisions on spending. One major obstacle was that the data from the open data portal listed addresses for contractor headquarter sites but lacked addresses for satellite service locations; without an accurate address for every provider site, the output of the spatial analysis would not be correct. The CSDS/SSA team realized that there

was a need for a process and diagnostic tool that agencies could use to assess the quality of open data, including identifying missing data elements, before open data – particularly contracts data – can be analyzed and used to inform real-world decision making.

Next-Generation Health and Human Services Infrastructure: A Process and Platform

The CSDS/SSA team developed a process and platform to help public health agencies assess whether public funds are appropriately matched to the spatial distribution of community need. Designed to enable a system-wide perspective on public funding allocations for health and health-related human services within the City of Chicago, it provides a replicable framework that other types of services and jurisdictions beyond Chicago can use.

The process for assessing the spatial match of public funds to need begins with the project questions and identifies simple spatial analytic methods to address the questions and the data elements needed. To illustrate how data on public funding is produced by government agencies, and what specific data elements are missing that are required for accurate spatial analysis, the CSDS/SSA team created a data production diagram. This diagram clarified the incompleteness of available public spending data, helping to see what could be done with more complete data and ultimately helping CDPH to change its contracting process to collect key missing data. CSDS also developed open source code for cleaning and merging existing contracts data from multiple levels of government – including city, county, and state – using data from resource directories. The CSDS/SSA team used these data to illustrate the insights that could be gained if accurate data were available, thus underscoring the importance of having complete contracts data for assessing the spatial match of funds to need. However, an analysis of the currently available data revealed that they were not accurate enough to inform decision making.

To explore the spatial gap between needs and services, and to conduct additional assessments of data quality, CSDS also created a suite of maps and graphs, for internal use by CDPH, using an online mapping platform. The online mapping platform enables CDPH to determine: 1) the fixed location of headquarters and satellite offices that provide health and health-related human services to clients, 2) how much funding they receive, and 3) the funding they receive by service type. The platform displays this information for selected geographic units, such as wards, community areas, or Census tracts. The maps also identify potential spatial access gaps to services in relation to need (see Figure 1 for an example). The mapping platform provides these answers by analyzing publicly available needs data in relation to two sets of contracts data: CDPH's newly collected data and data assembled across governmental levels for headquarters that were merged with resource directory data to estimate service delivery locations. The data on needs were informed by CDPH's Healthy Chicago 2.0 indicators. Beyond the online mapping platform for internal use by CDPH, CSDS developed an open source package of tools that enable anyone to identify spatial access gaps for health and health-related human services; the open source package is described in the "results" section.

Implementation Experiences

Implementation experiences for developing the Next-Generation Health and Human Services Infrastructure process and platform included:

Identifying a set of analytic methods to address the question. The central question for this project is: does the money from government contracts for health and health-related human services go to where community need priorities are located? To address this question, CSDS set out to identify an appropriate set of analytic methods and addressed the key challenge of developing an efficient computational solution to implement these methods at scale. CSDS also conducted the data analysis for this project.

Acquiring and processing existing data. The CSDS/SSA team knew they wanted to leverage financial data on city, county, and state contracts from open data portals to answer their questions of interest. A critical challenge for the team was

determining the best way to clean and prepare the data for conducting the desired analysis, in order to ensure that the results of the analysis were correct. To rectify this, the CSDS/SSA team spent extensive time working with CDPH to review and verify the service addresses of government contractors. CSDS mapped the results using data obtained directly from the open data portal and then compared those to results using new data from CDPH; the new data provided substantially more accurate results, alleviating CDPH's concerns. The CSDS/SSA team reported that cleaning and processing the data was much more labor and time intensive than anticipated.

Supporting changes to government contracting processes. The collaborative work to improve data quality and accuracy resulted in a revised data collection process for contracts data at CDPH. CDPH updated its contracting process by introducing a new form that collects, by contract, the addresses for both headquarters and satellite locations, which sites receive funding, and which services are delivered. A similar process change would have to be implemented across other city, county, and state agencies in order to produce contracts data that would allow for accurate analysis of the multiple sources of public funds that support the city's health and health-related human services infrastructure.

Engaging partners and stakeholders in the process. The CSDS/SSA team conducted this work with CDPH as its sole governmental agency partner. CDPH and CSDS have a history of collaboration and partnership, so trust was a foundational component of this project. Throughout the project, the CSDS/SSA team maintained regular communication with CDPH, communicating regularly to discuss progress and resolve questions. They noted that the PHNCI grant helped to support this higher level of collaboration. The team also drew on longstanding relationships with other stakeholders, such as elected officials and nonprofit service providers, to refine their own understanding of government funding processes. This helped to inform next steps for improving the quality of the data from the open data portal.

Collaborative thinking to address problems. The two CSDS/SSA team members responsible for conceptualizing and implementing this work come from very different backgrounds, with distinct trainings and expertise. One has technical expertise in spatial methods and distributions, while the other is an ethnographer who studies low-income communities and the organizations that serve them. These two individuals, with different experiences but complementary perspectives, worked together to ideate and expand their critical thinking to identify unique approaches to addressing the problem.

Organizational supports for innovation. CSDS at the University of Chicago was described by staff as a center "defined by academic freedom." Having a director that supports critical thinking and collaboration sets the tone for innovation. Staff described having adequate time and space to conduct background research, pursue processes for addressing the problem, and engage in discussion with colleagues who serve as sounding boards for new ideas. Similarly, SSA at the University of Chicago was described as an interdisciplinary school of social work and social welfare, where working across intellectual boundaries to solve pressing social issues is embedded in the organizational culture. Together, these environments provided the types of supports that foster innovative projects.

Considerations for Replication, Adaption, and Adoption

The CSDS/SSA team's vision for the Next-Generation Health and Human Services Infrastructure Process and Platform project is that other cities and counties will be able to access the process and free, open source platform that allows them to analyze their health and health-related human services spending in a larger context. According to the CSDS/SSA team, anyone who wants to replicate the project could follow a very similar process as was used in Chicago. The CSDS/SSA team deliberately defined the process and platform in a manner that allows it to be easily adopted by other jurisdictions. While it was designed using contracts data for health and health-related human services, they note that it can also be applied to other types of contracts and in other contexts since the platform is broadly designed to assess spatial access for any amenity.

CSDS has also released code for data cleaning and formatting. This will help others to improve the quality of and prepare financial contract data for analysis. The project team emphasized that even if data are available on an open data portal, extensive work may be required to clean and prepare contract data for use in spatial analysis.

The CSDS/SSA team identified several important considerations for others seeking to address the same questions. These include:

- Determining if there are existing data of sufficient accuracy that can feed into the platform;

- Involving individuals with some level of technical expertise, such as data analytics and programming experience;

- Involving individuals with significant domain knowledge of the health and health-related human services space;

- Tolerating complexity, as the funding system for health and health-related human services is complicated;

- Remaining persistent in the face of opposition, as efforts to track public funding can be controversial; and

- Identifying a champion(s) at the government partner who is dedicated to the work and motivated to achieve the results - this individual should be able to present a clear and powerful explanation of the importance of the results.

Results

Public health agencies can use the Next-Generation Health and Human Services Infrastructure process and platform to analyze and improve the targeting of public investments in health and health-related human services. It can also be used by other government agencies beyond public health. CSDS developed an open source package that enables anyone to identify spatial access gaps for health and health-related human services. The open source package is designed to calculate three measures that identify spatial gaps at the neighborhood level: 1) travel time to nearest provider, 2) number of providers within travel range, and 3) a Health and Human Services Access Score. In order to generate these results, CSDS developed a tool, which is part of the same package, to efficiently compute travel times for walking, biking, and driving. The tool computes travel times at unprecedented scales – billions of travel times within minutes, which usually takes weeks. The code, with extensive documentation and tutorials (Jupyter notebooks), as well as application programming interface (API), is available on GitHub so that others can implement the spatial access results.

As a result of the project, the CSDS/SSA team influenced broader systems changes in the contracting and data collection process within CDPH, who has implemented the new contracting and data collection process for all new contracts going forward. The team is implementing a strategy to encourage other government agencies in the City of Chicago to do the same.

Further, this project has contributed to the body of work examining the opportunities for and challenges of using government open data to answer questions related to health and funding and how those can influence social determinants. The project also has contributed to new

RESOURCES

Information about the project and process

► Nicole P. Marwell and Julia Koschinsky. (2018). "Two Classes of Problems for Data-Driven Governance in Cities." University of Chicago Working Paper.

► Julia Koschinsky and Nicole Marwell. (2018). "Does Human Service Money Go to Where the Need is? A Roadmap." University of Chicago Working Paper

Code and API to compute travel times and calculate spatial access metrics

► https://pypi.org/project/spatial-access/

Code to clean and merge data on headquarters with satellites from service directories

► https://github.com/GeoDaCenter/contracts_cleaning

thinking, among CSDS/SSA project partners and others, regarding the problem of matching funding to community need, and also provides tools to support a system-wide perspective on public investments.

Next Steps

The CSDS/SSA team envisions that in the long term, others will be able to use the process and platform to assess the allocation of public funds in relation to community priorities for health and health-related human service needs. For example, beyond government officials, they expect interest from nonprofit service providers, government partner organizations, advocacy groups, and community residents. The process and platform may be applied to assessing spatial access to other goods or services – such as primary care in rural areas, public WiFi hotspots, or recycling stations – in order to inform decisions of whether additional amenities are needed within a specified jurisdiction.

The CSDS/SSA team is finalizing additional materials for disseminating the Next-Generation Health and Human Services Infrastructure process and platform. These materials include: two academic papers about the background, process, and system-level analytic potential of the project, and an online roadmap, in non-technical language, that guides project implementation. CSDS has been approached by others, outside of the University, who are interested in the technical aspects of the platform and expects that these individuals will help to support, refine, and enhance the platform further in the future.

For More Information about the Next-Generation Health and Human Services Infrastructure process and platform:

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Figure 1. Comparison of Service Need, Spending and Spatial Access in a Target Area

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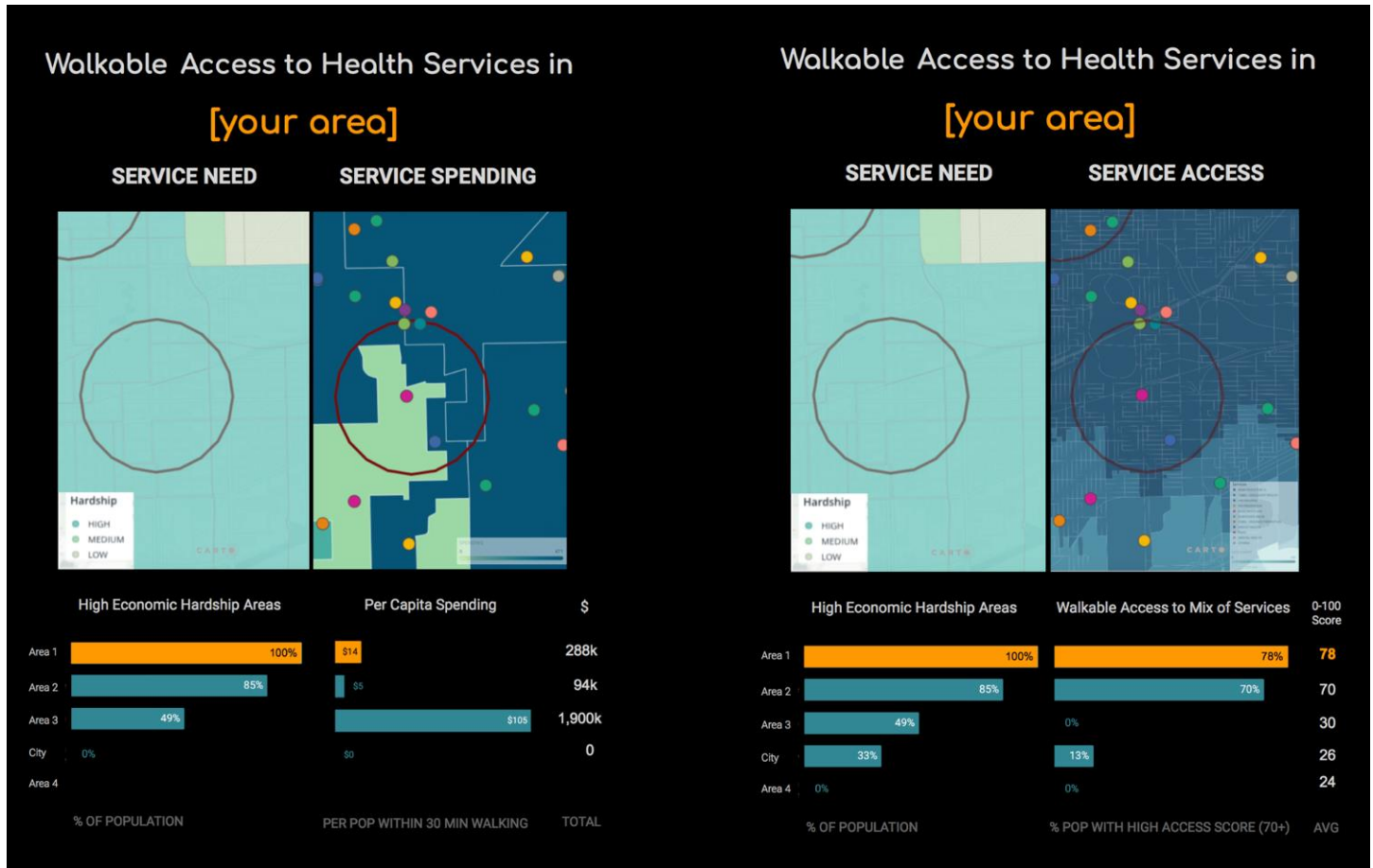
[i] Marwell NP and Gullickson A. 2013. "Inequality in the Spatial Allocation of Social Services: Government Contracts to Nonprofit Organizations in New York City." *Social Service Review* 87: 319-353.

[ii] Chicago Health Atlas. Retrieved from https://www.chicagohealthatlas.org/.