

Developing a GIS Dashboard Tool to Inform Non-Profit Hospitals of Community Health Needs at the Neighborhood Level

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Abstract

The objective of this paper is to describe the methods used to develop geographic information systems (GIS) dashboard tool and explain how it can assist nonprofit hospitals to identify priority neighborhoods. Multiple data sources from the 500 Cities Project databases were analyzed, and two online dashboards were created. The first dashboard is a hospital-specific composite dashboard, and the second is a comparison dashboard of health outcomes identified by both the hospital and the county's community health needs assessment focused on neighborhood-level disparities. Hospital-specific health outcomes were Stroke, Diabetes, and Coronary Heart Disease. County-specific health outcomes were Obesity, Dental, and Mental Health. All of the six health outcomes were standardized, rescaled, and weighted within the final composite score. Tableau was used for developing the dashboards and geographically mapping the analyzed data. The maps were developed specifically for a large hospital in Florida; however, this methodology can be utilized by other hospitals across the US. City-specific data is essential to ensure the accuracy of community health needs. The development of an interactive, comprehensive map using Tableau is a useful tool for visualizing target neighborhoods for community health outreach. The integration of community needs assessment findings into the development of composite scores allows hospitals in the US to use this tool to inform community health outreach strategy adequately.

Keywords: GIS, Dashboards, Data Science, Decision-Making, Health Outcomes, Community Health.

1. INTRODUCTION

In 2011, nonprofit hospitals saved approximately \$24.6 billion due to tax exemptions (Rosenbaum, Kindig, Bao, Byrnes, & Colin O'Laughlin, 2015). To regulate the use of this money and to justify the continued usage of tax-exempt status, the 2010 Patient Protection and Affordable Care Act (ACA) implemented stricter criteria for nonprofit hospitals to demonstrate community benefits. Nonprofit hospitals must not only conduct a Community Health Needs Assessment (CHNA) every three years but also provide evidence that they are addressing these needs within the target community (IRS, 2013). As a result, hospitals must gather data and develop strategies that can address community health outcomes (IRS, 2013). As such, this study describes the process by which a hospital can articulate and depict neighborhood-level health needs to allow hospitals to meet the needs of the communities they serve.

Studies that report on nonprofit hospitals progress in meeting federal CHNA requirements are substantially lacking in the literature. However, one recent national cross-sectional study attempted to address this gap by examining the progress of tax-exempt hospitals across the US in meeting four CHNA implementation activities: "strategy formulation to address identified needs, participation in the development of community-wide plans, planning for the provision of community benefits, and budget development to address identified needs." The authors found that only a minority, $n = 574$ (36%) of hospitals met all four actions (Cramer, Singh,

Flaherty, & Young, 2017). This staggering finding indicates that there are many barriers associated with CHNA activities.

ACA legislation requires that hospitals collaborate with local health professionals and organizations (Pennel, Burdine, Prochaska, & McLeroy, 2017). While the collaborative activities in and of themselves may not pose a barrier, the areas in which hospital administrators should pursue and spend limited hospital resources are not always clear. Conducting a needs assessment, and defining population needs requires both quantitative and qualitative data at various population levels. However, while state, city, and county data sources are often available, neighborhood-level data are often lacking or unavailable altogether. While there is currently one data-driven tool available to hospitals to use (Community Commons) (Chow, Jaffee, & Snowden, 2003), the tool doesn't allow hospitals a macro -view of local health outcomes based on CHNA and hospital identified health needs. The usage of localized data can guide the CHNA and ultimately inform hospital-sponsored outreach in a more targeted way that better meets community needs and is a better utilization of hospital resources.

In this paper, we describe two geographic information systems (GIS) dashboards developed to assist a large hospital in the State of Florida in viewing health outcomes of different neighborhoods in Duval County. The nonprofit hospital intends to use the GIS dashboards to select communities to implement its WellnessRx program created in response to CHNA needs.

2. DESIGN SCIENCE RESEARCH METHODOLOGY

Design science is a problem-solving paradigm involving the creation, analysis, and evaluation of artifacts designed as a solution to real-world problems. Design science research (DSR) methodology can be effective when creating an innovative information-based artifact strategically and holistically. The study reported in this paper uses design science research methodology to govern the design, development, and evaluation of the GIS dashboard.

We describe our adoption of the design science research methodology following the framework described in Peffers et al. (2007).

Problem Identification

A fundamental guideline for practicing design science research is the creation of an artifact that addresses an important and unresolved real-world problem (Hevner, March, Park, & Ram, 2004). In this paper, we address the problem of selecting a neighborhood to implement public health initiatives using a data-driven approach as opposed to gut-driven decisions. Section 3 discusses the problem identification step of the DSR methodology.

Define the Objectives of a Solution

The objective of this study is to develop a GIS Dashboard that addresses the identified wicked problem. The goals of the artifact are discussed in section 3. An important aspect of defining the objectives of a solution is identifying key ingredients that are needed to design the artifact. In regards to our study, those key ingredients are the relevant data sources. We worked along with the stakeholders to identify data sources pertinent to develop the GIS dashboard, as discussed in section 4.

Design & Development

Creation of an innovative artifact is central to the DSR outcome. Hevner et al. (2004) have described several forms a DSR artifact can take. In this study, we developed composite scoring methods to assign community health indicators to neighborhoods to assist with the decision-making process. We implemented the composite scoring methods along with other relevant information in a GIS dashboard tool. The dashboard tool was developed in five iterations with each iteration being a two weeks sprint. Section 5 discusses the composite scoring methods, and section 6 provides an overview of the GIS dashboard. GIS dashboard can be accessed from the URL: <http://bit.ly/17fldssgmayotableau>

Demonstration

Demonstrating how to the use of the artifact to solve the identified problem is an essential step of the DSR process. Demonstration steps help in ensuring the stakeholders have required resources to solve the problem using the designed artifacts. In regards to this study, we demonstrated the artifacts to the stakeholders during the three-month development period. We also created a YouTube video to show how to use the GIS dashboard to select a neighborhood based on community health indicators. The demonstration video can be accessed from <https://www.youtube.com/watch?v=cIIBj9jCQ6w>.

Evaluation

Assessing the utility of the artifact in regards to solving the problem is a required activity of DSR methodology. Hevner et al. (2004) have described multiple forms of evaluating DSR artifacts. In this paper, we performed a summative and interpretive form of evaluation. We used software walkthrough technique to illustrate the utility of the GIS dashboard to the stakeholders as well as identify anomalies and defects with the dashboard product. Results of the walkthrough are discussed in section 6.

Communication

Disseminating the importance of the problem and innovativeness of the solution to an appropriate audience is the final set of actions of a design science research. We have presented the problem and GIS dashboard in the open to the public forum to the stakeholder and community at large in the northeast Florida region. Publication of this paper is a valid form of diffusing the resulting knowledge gained from this study.

3. DECISION-MAKING SUPPORT NEED

Mayo Clinic in Florida is a non-profit hospital that served over 1.3 million people. In response to their 2016 CHNA, Mayo Clinic Florida launched Wellness Rx in collaboration with New Town Success Zone (NTSZ), a grassroots community neighborhood initiative focused on connecting families with available community resources within the New Town community in Jacksonville, FL. Wellness Rx is a community-led wellness program designed to empower and educate New Town residents with information to improve their overall health. Through civic participation, the NTSZ has created a model of engagement that encourages self-responsibility, accountability, and community-driven action around health and wellness priorities.

Mayo Clinic wanted to expand the Wellness Rx program to other community neighborhoods. However, the identification of the target area posed limitations because there was no health outcomes data available that could help identify a community based upon neighborhood geography. Thus, Mayo Clinic did not have any reliable means to make decisions on which neighborhoods to implement Wellness Rx programs. Therefore, Mayo Clinic formed a partnership with The Florida Data Science for Social Good (FL-DSSG) program to develop a data tool to address this need.

The Florida DSSG (<https://dssg.unf.edu/>) program was founded in 2017 and was created to provide students at the University of North Florida with hands-on opportunities to develop data-driven solutions for local public sector organizations, including nonprofits and government agencies. The FL-DSSG offers a summer internship that recruits students from diverse disciplines to work alongside community partners on social good projects that blend data science and technology design.

The overall goal of the Wellness Rx and DSSG project was to create a Geographic Information Systems (GIS) based dashboard tool to visually represent health outcomes data at a neighborhood level which could then be used to identify and evaluate other neighborhoods for future interventions. Given that few repositories provide hospital administrators ability to develop data maps of community health needs, this paper focuses on describing the resultant GIS dashboard utilized at Mayo Clinic Jacksonville to help identify community needs at the neighborhood level.

4. DASHBOARD DATA SOURCES

Data for this study was obtained from multiple sources. First, we used the 500 Cities Project databases developed by the Centers for Disease Control and Prevention (CDC) and the Robert Wood Johnson Foundation (CDC-500Cities, 2016). The 500 Cities Project data recorded health outcomes in 500 cities around the United States at the Census Tract level, for the year 2014. The City of Jacksonville was one of the 500 cities that participated in the project. However, only 164 out of the total 173 census tracts for Duval County were available. The absent census tracts include tracts 139.02, 139.05, 140.01, 140.02, 141.01, 141.02, 142.02, 142.03, and 142.04. The data is open-source, but was prepared and provided to the research team by the Florida Department of Health in Duval County. The 500 Cities project provided 28 variables within three broad categories (see Appendix A),

each consisting of multiple variables (k), namely: Health Outcomes (k = 13), Prevention Measures (k = 10), and Unhealthy Behaviors (k = 5).

Second, to build the maps, we used data from:

- The University of Florida GeoPlan Center supplied Brownfield maps, as well as community service centers.
- The Florida Department of Environmental Protection: yielded additional Brownfield maps.
- City of Jacksonville Property Appraiser: added average housing values by census tract.
- Zillow: provided neighborhood-name correlates for census tracts.
- American Community Survey (ACS): census demographics (education level, household income, and ethnicity)
- Behavioral Risk Factor Surveillance System (BRFSS): health indicators (binge-drinking, asthma, and smoking rates).

The resultant maps were built using geographical data layered into Tableau. Google Code™ Application Programming Interfaces (APIs) provided the base map of the city as well as an interactive Google Street View™ that allows the user to pick a census track and virtually travel around the area.

5. COMMUNITY HEALTH INDICATOR COMPOSITE SCORES

In this study, we developed two community health indicators using composite scoring mechanism. We used a total of 6 health variables to create two composite scores. First, the Wellness Rx program identified three variables of interest, Stroke, Diabetes, and Coronary Heart Disease. These three primary community health variables served as the foundation for a "Mayo Composite" to identify the health of the community. Second, the Community Health Needs Assessment (CHNA) for Duval County identified three other variables as "Targeted Negative Health Outcomes": Obesity, Poor Mental Health, and No Dental Visit in the Past Year. These variables were added to the Mayo Composite measures to create an overall "CHNA Composite."

To create composite scores, standardization, rescaling, and weighting was necessary. Our first step to compare data was to standardize each outcome. Standardization was done to allow for comparison between the different health outcomes. This process allowed us to combine different outcomes into a single index or composite score. We converted each of the health variables into standardized values (z-scores). We

then rescaled the values on a scale of 0-10 to allow easy comparison across variables and neighborhoods using the formula listed in Equation 1.

$$\text{Rescaled Value} = (X1 - \text{MIN}([a,b])) / (\text{MAX}([a,b]) - \text{MIN}([a,b])) * (11-1)$$

Equation 1. Rescaling Formula for All Variables

"X1" represents the value to be rescaled in the original metric and [a,b] represents the total range of the data whereby $X1 | a \leq x \leq b$. The "(11-1)" portion of the equation set the largest scale value as 10. The automatic low-end of the rescale will always be "0" with this formula. After the variables were standardized and rescaled, they were combined to create the Mayo composite and the CHNA composite. These composite scores were used to gain an overview view perspective of a group of relevant health disparities, presented by Census Tract.

Initially, there were five separate composites, but after running a Pearson Correlation (r) analysis in SPSS 24, we opted to keep only two of them, as they all were highly correlated to each other ($r > .800, p < .001$). The decision was made to keep composites that would be useful for Mayo Clinic and their partnering organizations.

The last step was to weight the composites. Combining the outcomes would create equally weighted composites. For the Mayo Composite, the three health outcomes would have 33.3% weight in the composite, making them equal. To highlight the community's needs, we wanted to present the three other variables within the CHNA Composite properly. To do this, we ran a Pearson Correlation between Stroke, Coronary Heart Disease, Diabetes, Obesity, Dental, and Poor Mental Health, with the Mayo Composite. Table 1 shows the weightages used for the CHNA Composite.

These weights are then inserted into the composite formulas to reflect the data. Equation 2 shows the formula used for calculating the weighted composite scores. These were the final composites that were used to display community health indicators for the selected neighborhood in the Tableau dashboards.

Variables	Correlation	Equation	Weight
Diabetes	.970	.970/5.145	18.85%
Stroke	.948	.948/5.145	18.43%
Heart Disease	.929	.929/5.145	18.06%
Obesity	.867	.867/5.145	16.85%
Dental	.748	.748/5.145	14.54%
Mental Health	.683	.683/5.145	13.28%
Total	5.145		100%

Table 1. CHNA Weighting Methodology

Weighted Mayo Composite: Heart Disease(.3333) + Stroke(.3333) + Diabetes(.3333)

Weighted CHNA Composite: Diabetes(.1885) + Stroke(.1843) + Heart Disease(.1806) + Obesity(.1685) + Dental(.1454) + Poor Mental Health(.1328)

Equation 2. Weighted Composite Scores

6. GIS DASHBOARD

Several programs were used for data analyses to build the actual repository of information contained in the dashboard. All of the data was stored and maintained in Microsoft Excel. For statistical data analyses, we used the Statistical Package for Social Sciences, version 24 (IBM, 2016), and to display the results in series of maps geographically, we used Tableau 10 (Tableau, 2018).

The completed GIS tool has two dashboards (Appendix B), the first a composite and the second a comparison. To distinguish between health outcome severity, shading is used in both dashboards with darker shading representing higher composite scores or worse health outcomes. Each dashboard contains different additional features. In the composite dashboard, health outcomes can be viewed individually or combined. The dashboards were successful at providing visual data regarding the specific health outcomes that were most prevalent in each census tract. There is also a street view feature providing a virtual walk-through of a census tract. Census demographics (education level, household income, and ethnicity) and health indicators (binge-drinking, asthma, smoking rates, etc.) are listed to the right of the composite map. The GIS tool aims to help nonprofit hospitals identify information regarding a particular health indicator at the census tract level.

GIS dashboards offer an interactive feature whereby, if the mouse is placed over an area,

census tract number, neighborhood name and numeric representation of composite score are displayed. Lastly, community resources available within each health tract are provided. The comparison dashboard allows you to select multiple census tracts at once and compare them by shaded color, composite, and outcome scores. Along with the selected comparison, a summary table will be produced, providing a comparison of the highest negative health outcomes. Screenshots of the final tableau dashboard tool can be found in Appendix B.

7. WALKTHROUGH OF THE GIS DASHBOARD

A walkthrough is an informal software inspection method used for evaluating as well as educating a software product to an audience. Software inspection methods, including walkthrough, are described in the IEEE 1028-2008 - Standard for Software Reviews and Audits (IEEE-1028, 2008). Following the walkthrough purposes described in the IEEE 1028-2008 standard, we used walkthrough technique to evaluate conformance to stakeholder expectations and evaluate the usability of the dashboard.

Walkthrough technique adopts a step-by-step narrative use of the artifact (Light, Burgess, & Duguay, 2018). Walkthroughs reveal the user engagement process with the artifact to the intended goals. User walkthroughs can help designers identify users' departure from intended procedures or engagement process (Light et al., 2018). Tweaking the user interface and potentially functional design in response to identified user engagement departures can help in improving the user experience of the artifact. To facilitate the walkthrough procedures, we demonstrated both composite and comparison dashboards to key stakeholders from Mayo Clinic. The step-by-step illustrated use of the dashboards is shown in Appendix B. In this section; we discuss the results of the walkthrough.

After the walkthrough demonstrations, stakeholders stated that both dashboards conform with their need of viewing health outcomes for neighborhoods and selecting neighborhoods to implement Wellness Rx program. During the demonstration, stakeholders used the dashboard for a variety of scenarios, and outcome & composite index options. Stakeholders identified that data for two neighborhoods did not fit with their knowledge of the community. When we investigated the dataset, discovered an issue with the merging process. We rectified the error, and rerun the merging process, and subsequently, the dashboard data source was

updated. Some stakeholders stated the dashboard did not work in the Internet Explorer and Edge browsers. Since the dashboard utilizes Google Maps and other related tools; we recommended stakeholders to use Chrome and Firefox browsers.

8. DISCUSSION

Many tax-exempt hospitals are faced with the perennial issue of determining how to develop a CHNA implementation strategy that aligns with priority community health needs. The complexity of deciding where to begin, what stakeholders to engage, and what data to use can stymie the process. However, localized data represented visually via a GIS dashboard tool can maximize nonprofit hospitals investment in community benefit through a targeted approach (Newbold, 2018). In this paper, we described how Mayo Clinic Jacksonville, partnered with FL-DSSG supported by the University of North Florida, developed an online data dashboard that aids hospital administrators' decision-making in the CHNA pre-planning process. Hospitals around the nation can use a similar tool as a means to start conversations with their CHNA implementation teams and to analyze health disparities at the neighborhood level.

There are some limitations to the GIS dashboard. For instance, the 500 cities data is not available each year; therefore, the dashboard only serves as a snapshot of a particular point in time. To assess the success of any interventions, it is suggested that there be a pre and post-test given to program participants in each census tract. The data cannot be relied on to show change over time. The dashboard primarily relies on 500 cities data from 2014. It can be argued that trends have already changed prior to interventions. Despite these challenges, we were able to develop a GIS dashboard that provides neighborhood-level community health data that was otherwise not readily.

Practical Implications

The GIS dashboard described in this paper provides a more localized understanding of Jacksonville neighborhoods and details current health outcomes and resources. Knowing which resources are available within a census tract helps health workers know what support they may have within an area and what they need to focus on developing. When identifying where to take health programs, this data tool provides a faster approach to identifying target communities and is based solely on health data. Basing decisions on health data alone removes a lot of the subjectivity

humans bring to decision-making. This can enable nonprofit hospitals to coordinate efforts to improve population health. This dashboard can be updated with new census data each year, providing consistency in available health data and the opportunity to track progress within an area. It allows hospitals to evaluate the impact of their community outreach efforts.

The tool proved to be useful for Mayo Clinic Wellness Rx program, and overall fills a void for available neighborhood-level data in the Jacksonville area. This tool is publicly available and may be used by other non-profit hospitals and health organizations in the Jacksonville area. Additionally, the methodology is provided so that other health organizations and hospitals across the U.S. can replicate this dashboard for their city.

In conclusion, this paper addresses one of the CHNA needs of hospitals in the U.S. by developing a GIS dashboard containing community health outcomes and capability to filter neighborhoods based on composite scores of the health variables. We developed the dashboard following the design science research methodology. In the paper, we describe the composite scoring method included within the dashboard. We use walkthrough technique to confirm that the dashboard meets the expectations of the stakeholders. Results of the walkthrough reveal some issues which were addressed to satisfactorily meets all of the stated needs of the stakeholder.

9. ACKNOWLEDGMENTS

Research work described in the paper was supported by the Nonprofit Center for Northeast Florida.

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Appendix A

Below table provides a listing of the 500 Cities project measures obtained from the Behavioral Risk Factor Surveillance System (BRFSS).

Category	Measures
Unhealthy Behaviors	Binge drinking among adults aged ≥ 18 years
	Current smoking among adults aged ≥ 18 years
	No leisure-time physical activity among adults aged ≥ 18 years
	Obesity among adults aged ≥ 18 years
	Sleeping less than 7 hours among adults aged ≥ 18 years
Health Outcomes	Arthritis among adults aged ≥ 18 years
	Current asthma among adults aged ≥ 18 years
	High blood pressure among adults aged ≥ 18 years
	Cancer (excluding skin cancer) among adults aged ≥ 18 years
	High cholesterol among adults aged ≥ 18 years who have been screened in the past 5 years
	Chronic kidney disease among adults aged ≥ 18 years
	Chronic obstructive pulmonary disease among adults aged ≥ 18 years
	Coronary heart disease among adults aged ≥ 18 years
	Diagnosed diabetes among adults aged ≥ 18 years
	Mental health not good for ≥ 14 days among adults aged ≥ 18 years
	Physical health not good for ≥ 14 days among adults aged ≥ 18 years
	All teeth lost among adults aged ≥ 65 years
	Stroke among adults aged ≥ 18 years
Prevention	Current lack of health insurance among adults aged 18-64 years
	Visits to doctor for a routine checkup within the past year among adults aged ≥ 18 years
	Visits to dentist or dental clinic among adults aged ≥ 18 years
	Taking medicine for high blood pressure control among adults aged ≥ 18 years with high blood pressure
	Cholesterol screening among adults aged ≥ 18 years
	Mammography use among women aged 50-74 years
	Papanicolaou smear use among adult women aged 21-65 years
	Fecal occult blood test, sigmoidoscopy, or colonoscopy among adults aged 50-75 years
	Older adults aged ≥ 65 years who are up to date on a core set of clinical preventive services by age and sex

Table 2. Variables from the 500 Cities Project

Appendix B

WALKTHROUGH OF COMPOSITE DASHBOARD

User task: Browse and select a neighborhood based on composite and health indicator interests.

Step 1: Open the Composite Dashboard in the Browser

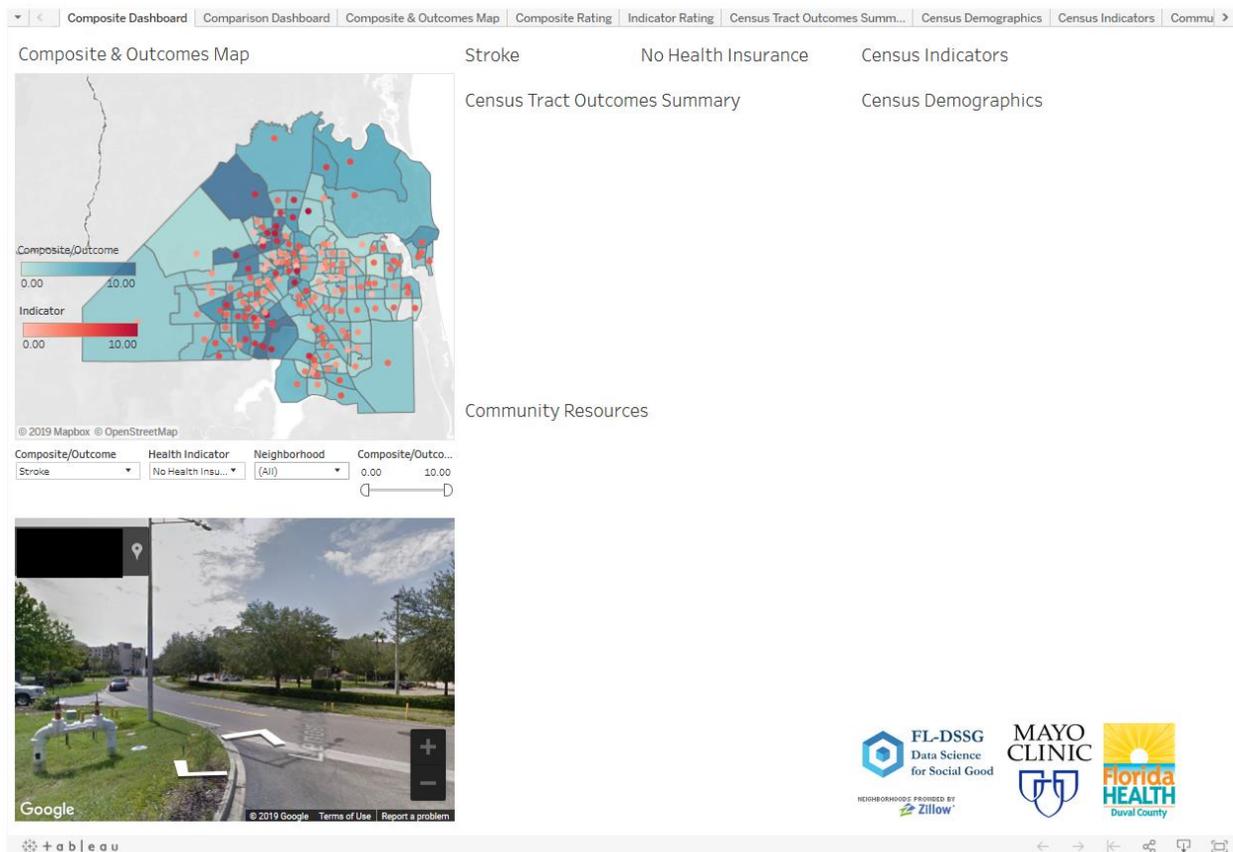


Figure 1. Composite Dashboard Landing Screen

Users can access the composite dashboard by visiting the URL, <http://bit.ly/17fldssgmayotableau> in the browser. We recommend users to use Firefox version 60 or above or Chrome version 60 or above browsers. Upon visiting the URL, the composite dashboard will be loaded. The left top portion of the composite dashboard shows a map of neighborhoods in the Duval county with options to select composite indexes, health indicators, neighborhood, and composite score ranges. Bottom left portion displays the Google street view of a selected neighborhood. Right top portion displays community health data available for the selected neighborhood, while bottom right portion displays community resources available for the selected neighborhood. Figure 1 shows the landing screen for the composite dashboard.

Step 2: Adjusting Composite and Outcome Options

Below the Composite & Outcomes Map in the top left section of the dashboard, users have options to select a composite index, a health indicator, a neighborhood, or a composite/outcome filter range of interest. Suggested sequence of actions is selecting a composite index, then a health indicator, and then the range for the composite filter. Figure 2 shows composite & outcomes map when Mayo Composite index is selected, figure 3 shows the map when families with children below the poverty level are selected as the health indicator, and figure 4 shows the map when the composite score range is filtered

between 7 and 10. Figure 5 shows the composite dashboard for the above-specified selections. Figure 6 shows the composite dashboard for CHNA index as the composite index, no health insurance as a health indicator, and 7 and 10 as the composite filter values. After selecting a neighborhood, users can browse and view census indicators, health summary data for the census tract selected neighborhood resides, census demographics, and listing of community resources. Thus, the composite dashboard can be used for selecting and viewing data available for a neighborhood.

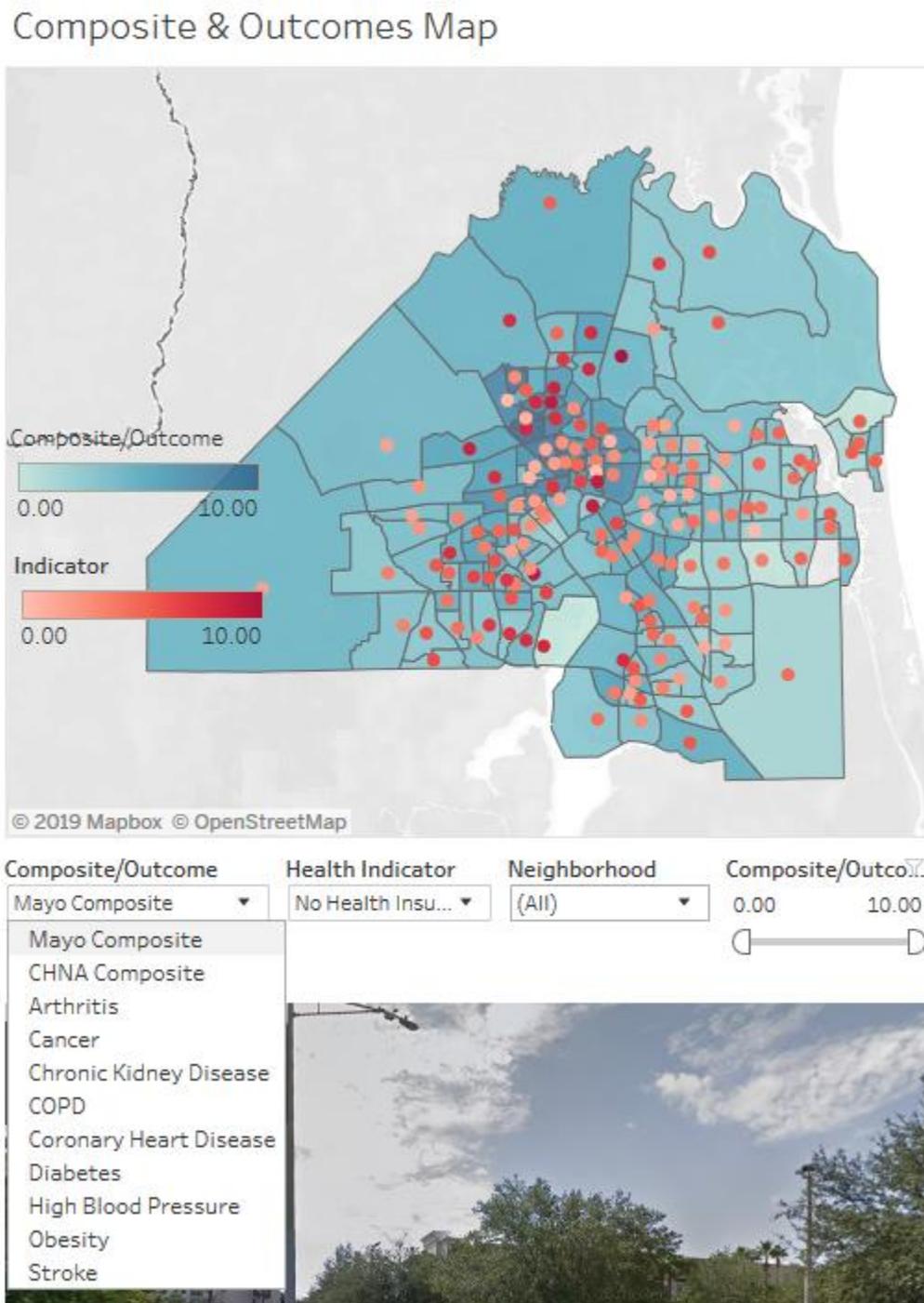


Figure 2: Composite & Outcome Index Options

Composite & Outcomes Map

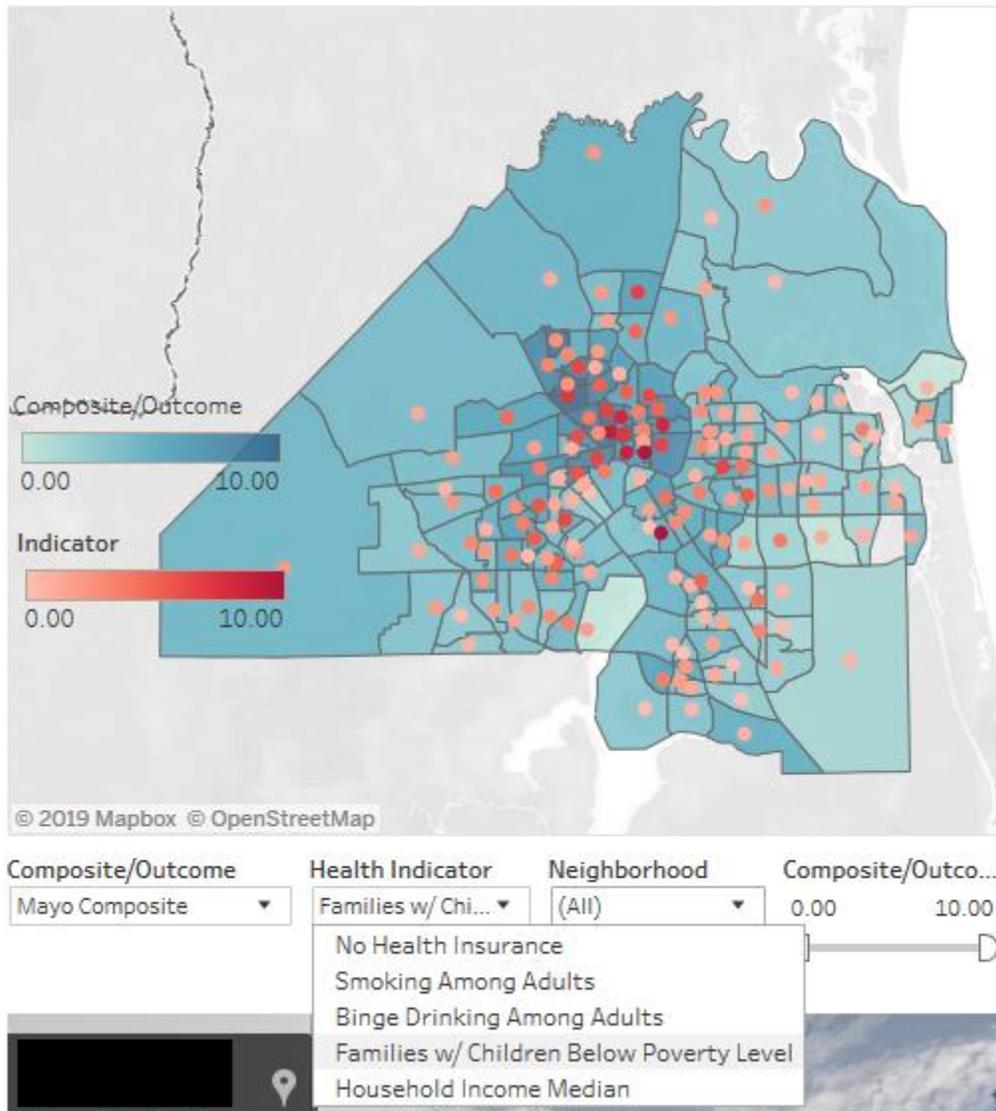


Figure 3: Health Indicator Options

Composite & Outcomes Map

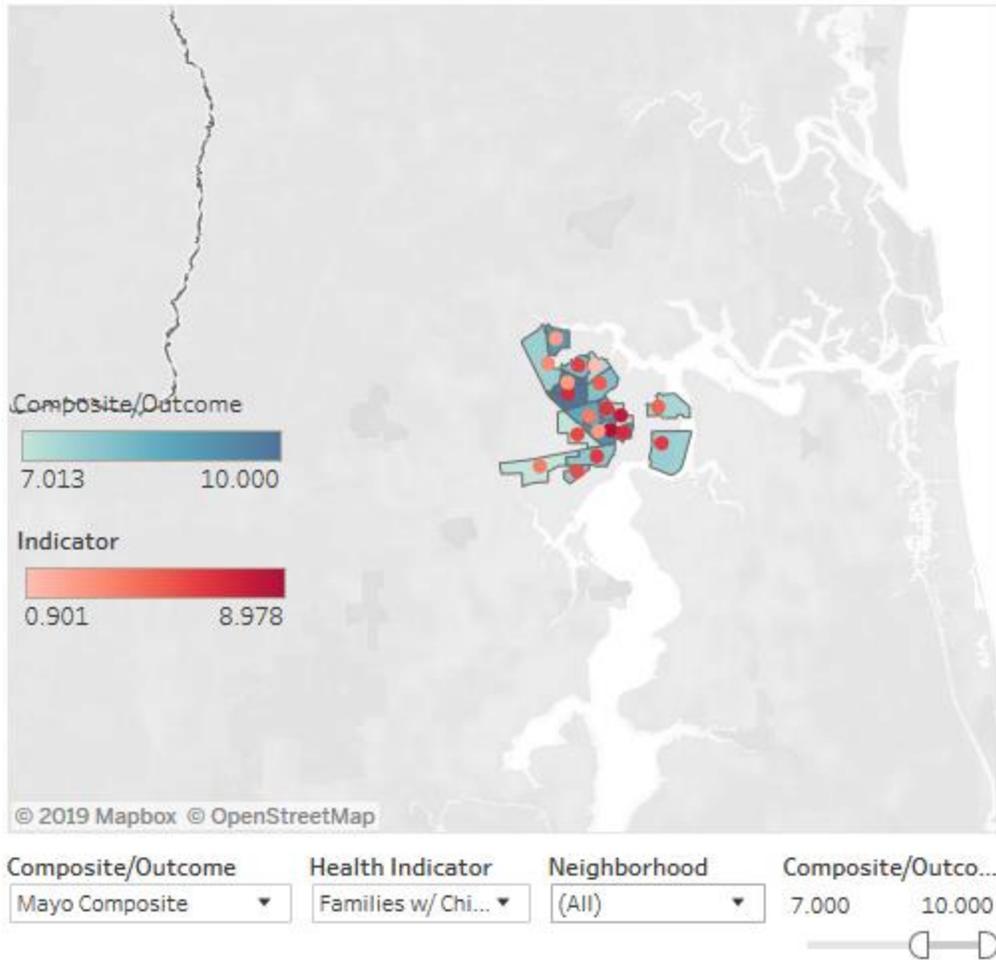


Figure 4: Composite & Outcome Filter

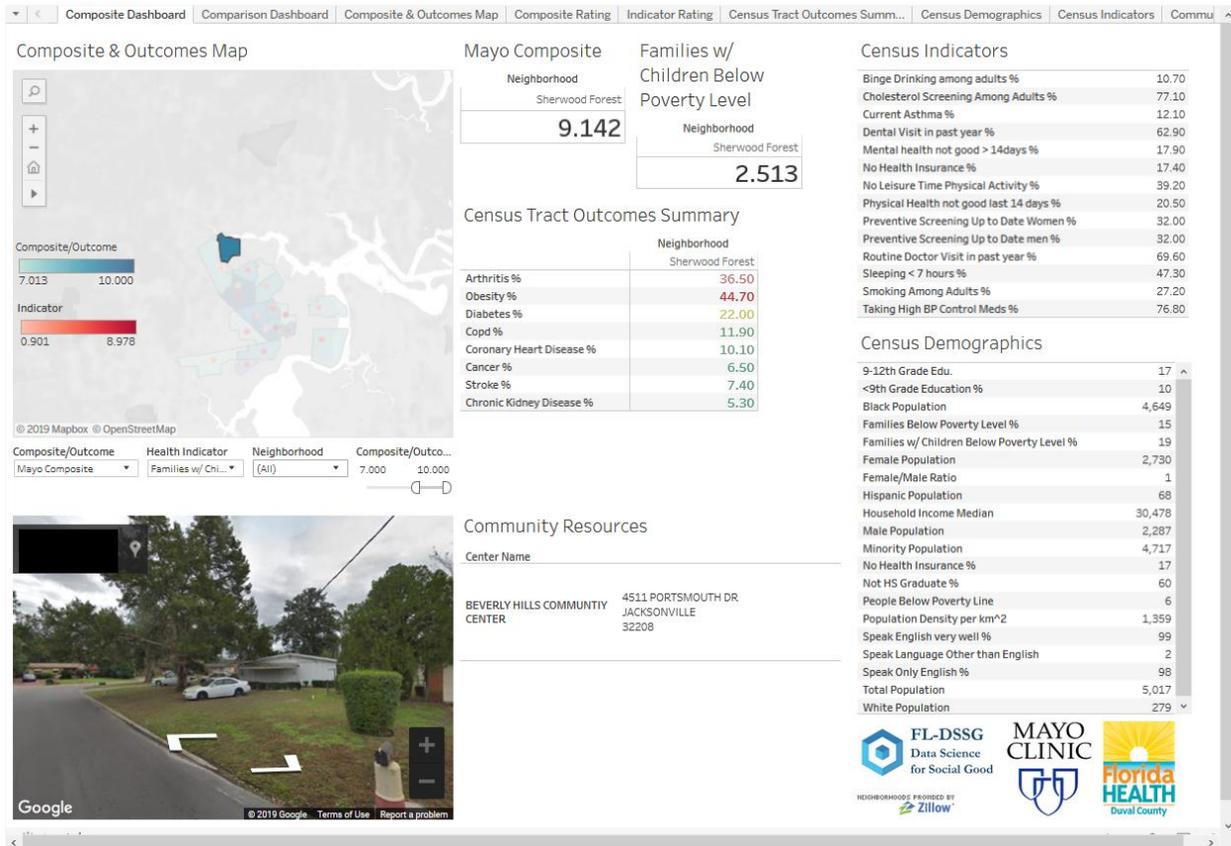


Figure 5. Composite Dashboard with Community Health Data and Resources available for a Selected Neighborhood based on Mayo Composite Index

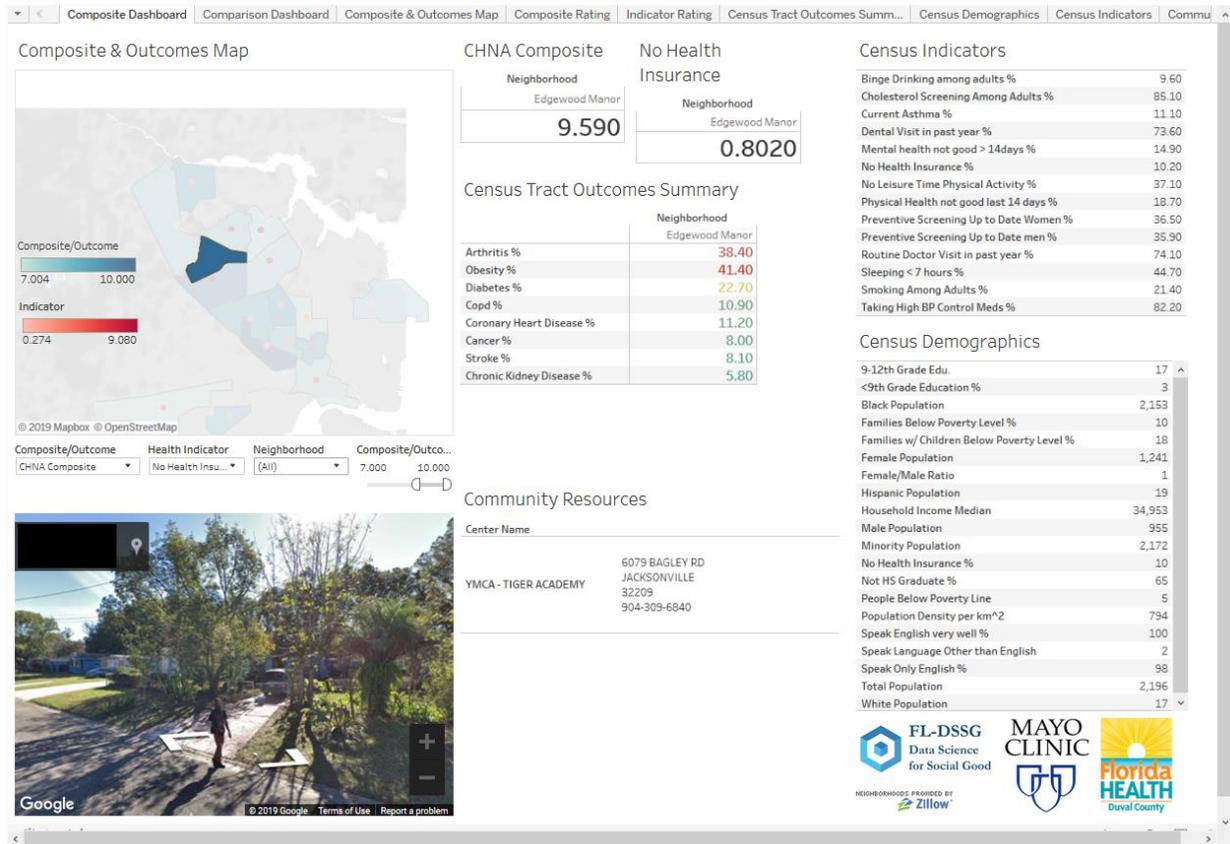


Figure 6. Composite Dashboard with Community Health Data and Resources available for a Selected Neighborhood based on CHNA Composite Index

WALKTHROUGH OF COMPARISON DASHBOARD

User task: Browse and select two or more neighborhoods for comparing based on the community health outcomes

Step 1: Open the Comparison Dashboard in the Browser

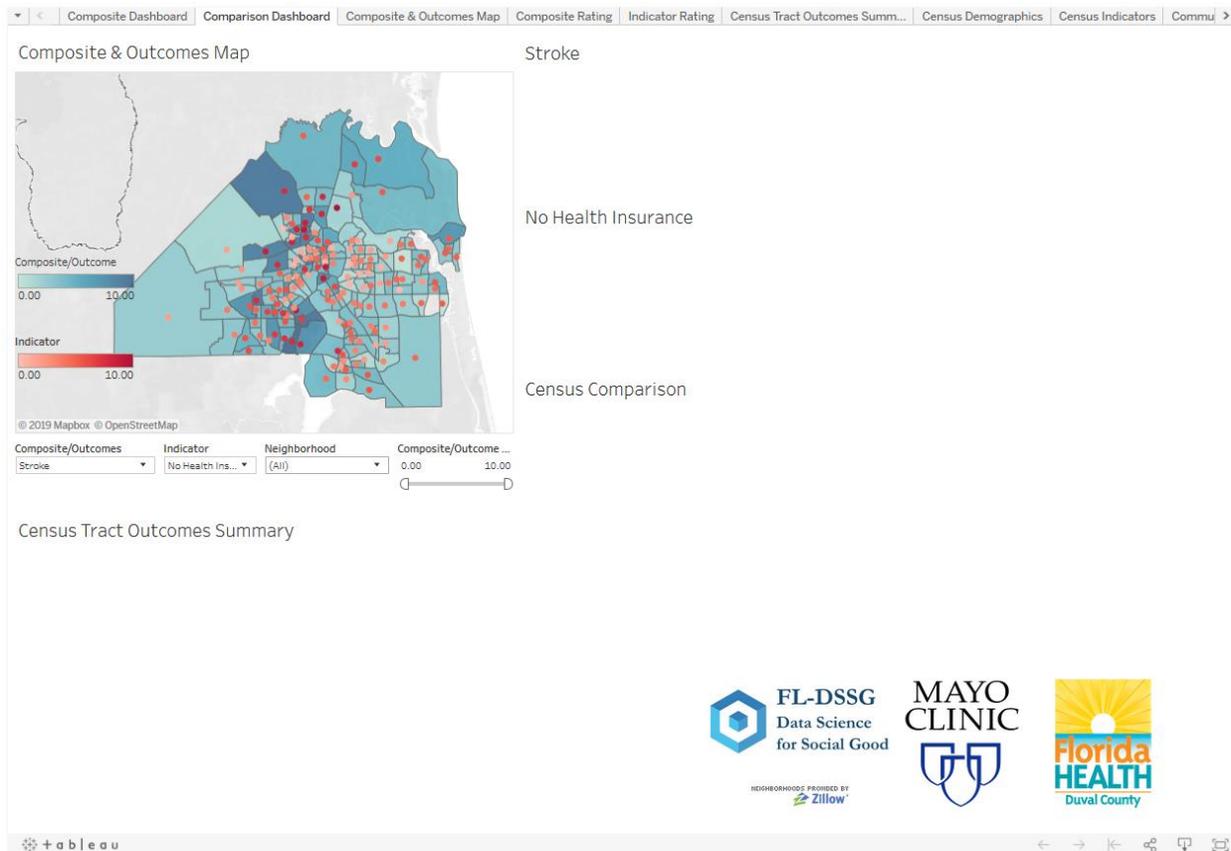


Figure 7. Comparison Dashboard Landing Screen

Users can access the comparison dashboard by visiting the URL, <http://bit.ly/17fldssgmayotableau> in the browser. We recommend users to use Firefox version 60 or above or Chrome version 60 or above browsers. Upon visiting the URL, the users will have to click on the comparison dashboard to load the comparison dashboard. Similar to the composite dashboard, left top portion of the comparison dashboard shows a map of neighborhoods in the Duval county with options to select composite indexes, health indicators, neighborhood, and composite score ranges. Bottom left portion displays census tract outcomes summary for the selected neighborhoods. The right portion of the dashboard displays selected composite outcomes, health indicators, and census comparison data for the selected neighborhoods. Figure 7 shows the landing screen for the comparison dashboard.

Step 2: Selecting neighborhoods for comparison

Similar to the composite dashboard, users can filter neighborhoods of interest by adjusting composite indexes, health indicators, and composite outcome options. Users can select a neighborhood by clicking on a shaded neighborhood area and can select multiple neighborhoods by pressing control and clicking on neighborhoods. Figure 8 shows an example of three neighborhoods selected for comparison.

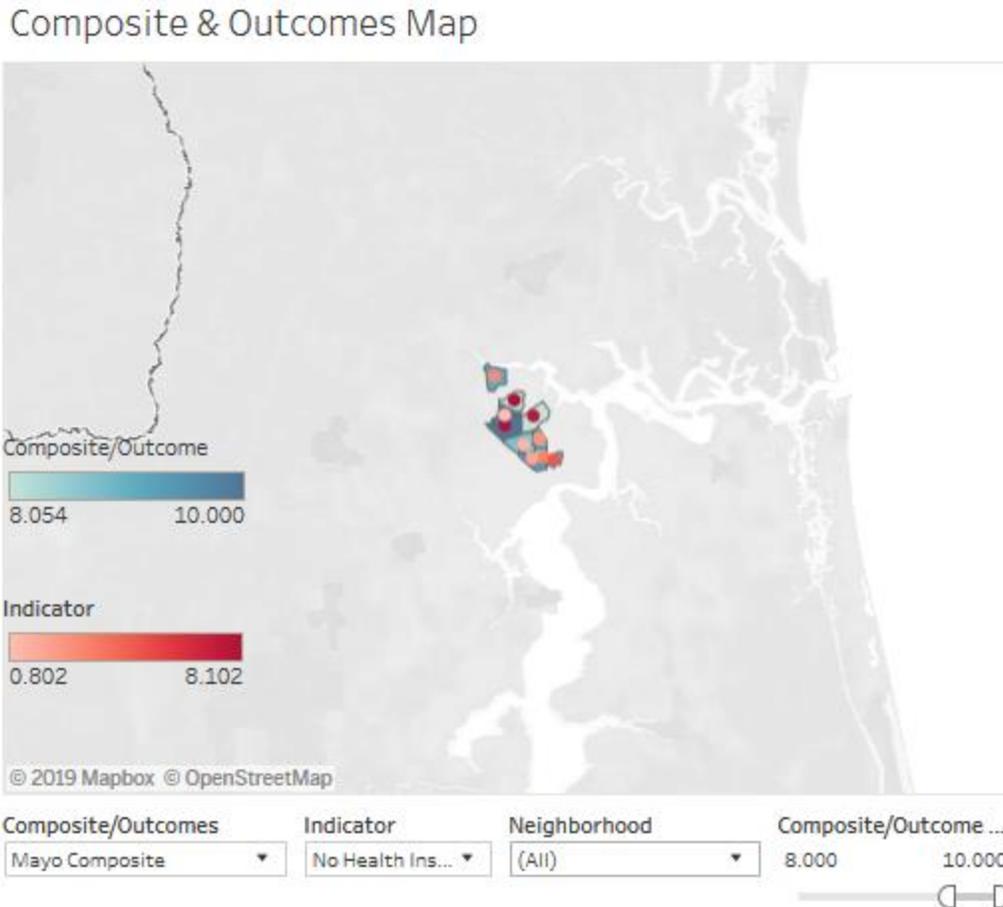


Figure 8. Neighborhoods Selected for Comparison

Step 3: Determining a neighborhood to implement Wellness Rx program

Given that mayo composite index, no insurance as a health indicator and composite scores in the range of 8 and 10 as the manipulation values, 10 neighborhoods were filtered matching the provided options. Three neighborhoods of interest were selected for comparison. For easier selection of neighborhoods, the map can be zoomed and panned using options available on the map as shown in figure 9. Figure 10 shows a zoomed map of neighborhoods matching the filtering criteria. Users can hover the mouse over to see neighborhood name and composite score value for the selected index, as shown in figure 11. For this illustration, three neighborhoods were selected for comparison, and the resulting dashboard is displayed in figure 12. As the Wellness Rx program focusses on heart diseases, diabetes, and stroke, two of three selected neighborhood seems to be ideal for implementing the program.

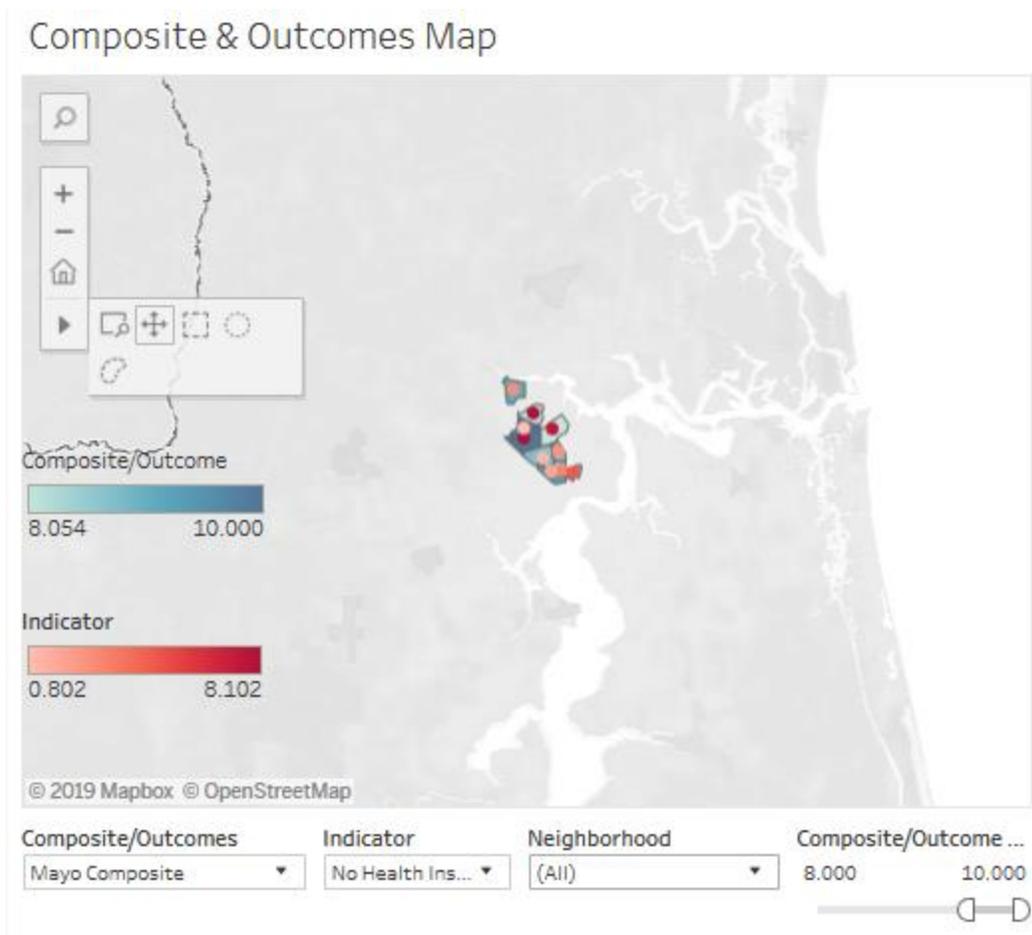


Figure 9. Options to Pan and Zoom the Neighborhood Map

Composite & Outcomes Map

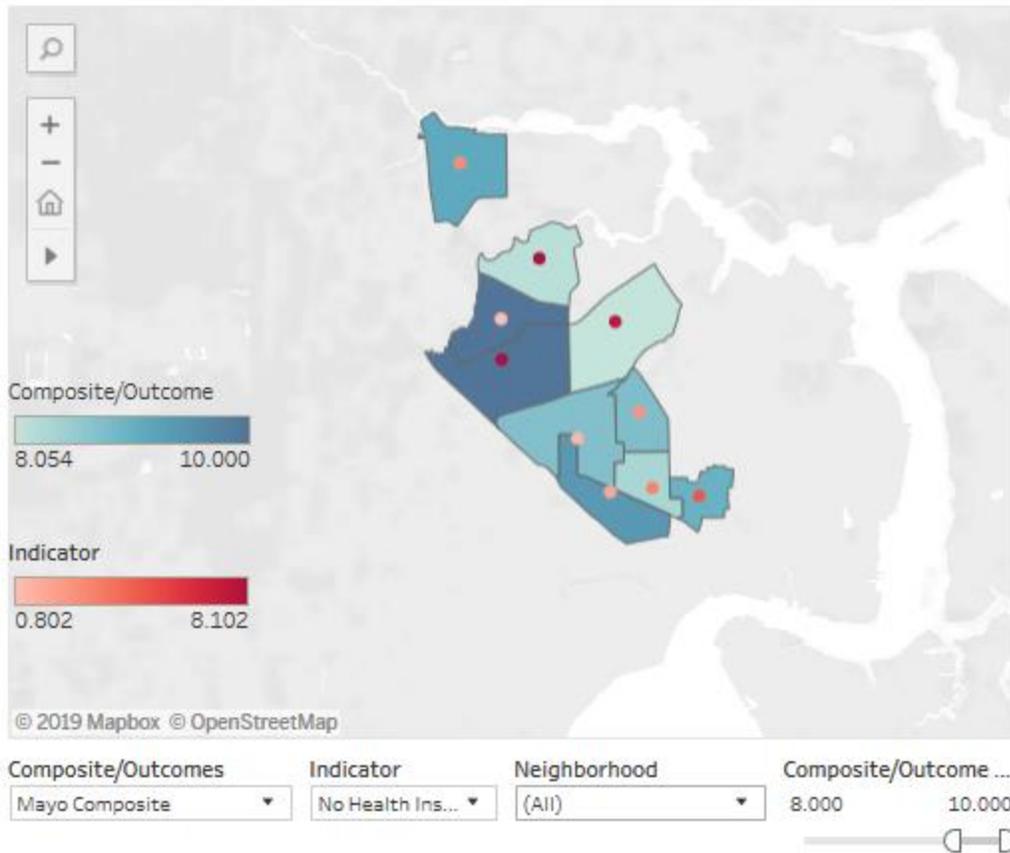


Figure 10. Zoomed view of the Neighborhood Map

Composite & Outcomes Map

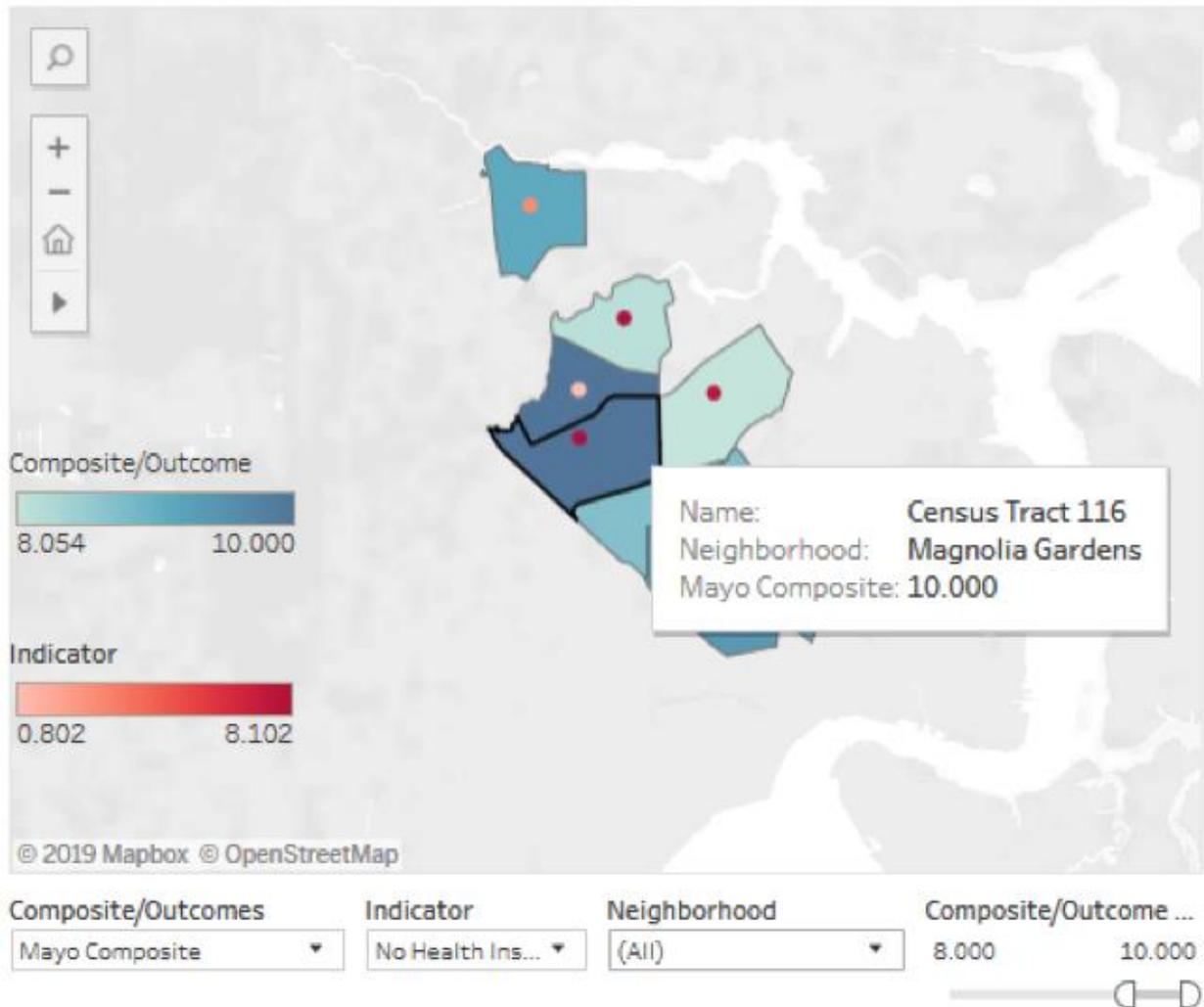


Figure 11. Neighborhood Information Presented when Mouse Hovering

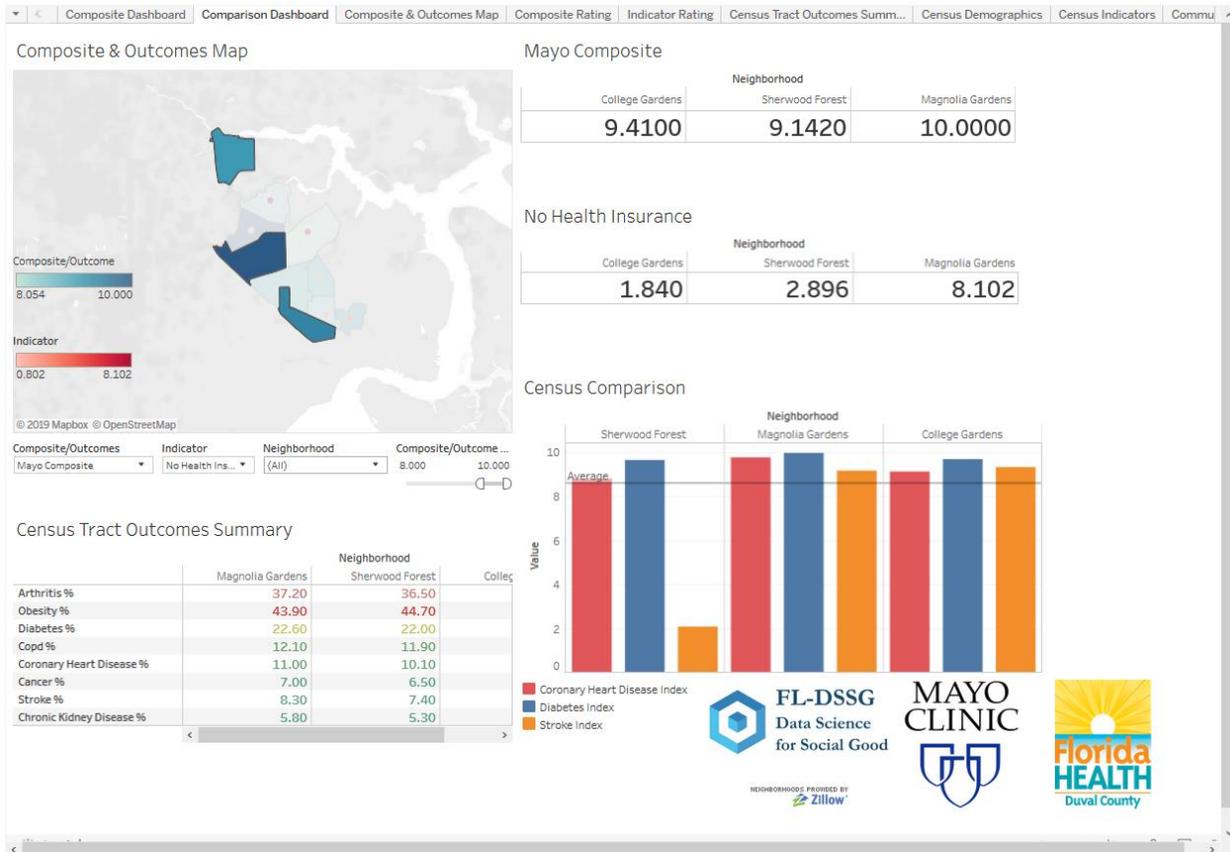


Figure 12. Comparison of Selected Neighborhoods