Opportunities for Systemic Change

How Local Health Departments are Advancing Health Equity Through GIS

NACCHO
National Association of County & City Health Officials

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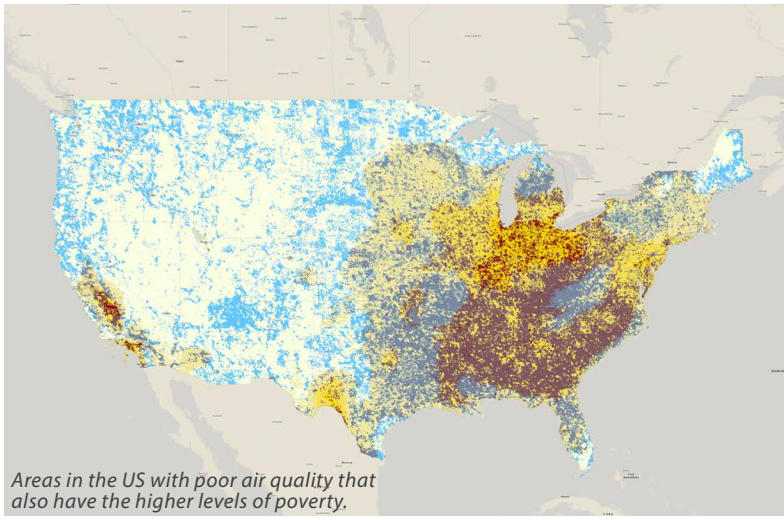
I. Introduction

Local health departments (LHDs) play a central role building better public health systems designed to increase access to health care and address the root causes of poor health. They are also effective conveners of community partnerships necessary to advance equitable public health systems.

As Community Chief Health Strategists, LHDs bring expertise in data collection, analysis, and evidence - based approaches to improving population health and health equity. While health inequity looks different across every jurisdiction, it is often rooted in structural racism which drives inequitable outcomes and unjust experiences within communities. Measuring inequity requires an examination of the social determinants of health (SDoH)[1] including social and economic factors, cultural norms and behaviors, the physical environment, and access to clinical care – measures that help us understand barriers people face accessing community resources.

Responses to ongoing crises including the COVID-19 pandemic, the opioid epidemic, increased prevalence of natural disasters due to climate change, and increased awareness of racial inequity magnified by police violence against Black men and women, all demonstrate the importance of solutions that highlight and respond to longstanding inequity. In response to growing inequity, some city and state governments in collaboration with health departments have declared racism a public health emergency.[2] These statements recognize the unjust treatment of Black, Indigenous, and People of Color and commits jurisdictions to addressing racial, economic, and social inequities through public policies and equitable practices.

A critical tool in advancing these efforts is the use of geographic information systems (GIS) to demonstrate the connection between SDoH, inequity, and geographic space from which health departments can make strategic, data-driven decisions supporting systematic change. When analyzing and communicating the state of health equity in a city or county, geospatial data can guide where more collaboration is needed and how to prioritize

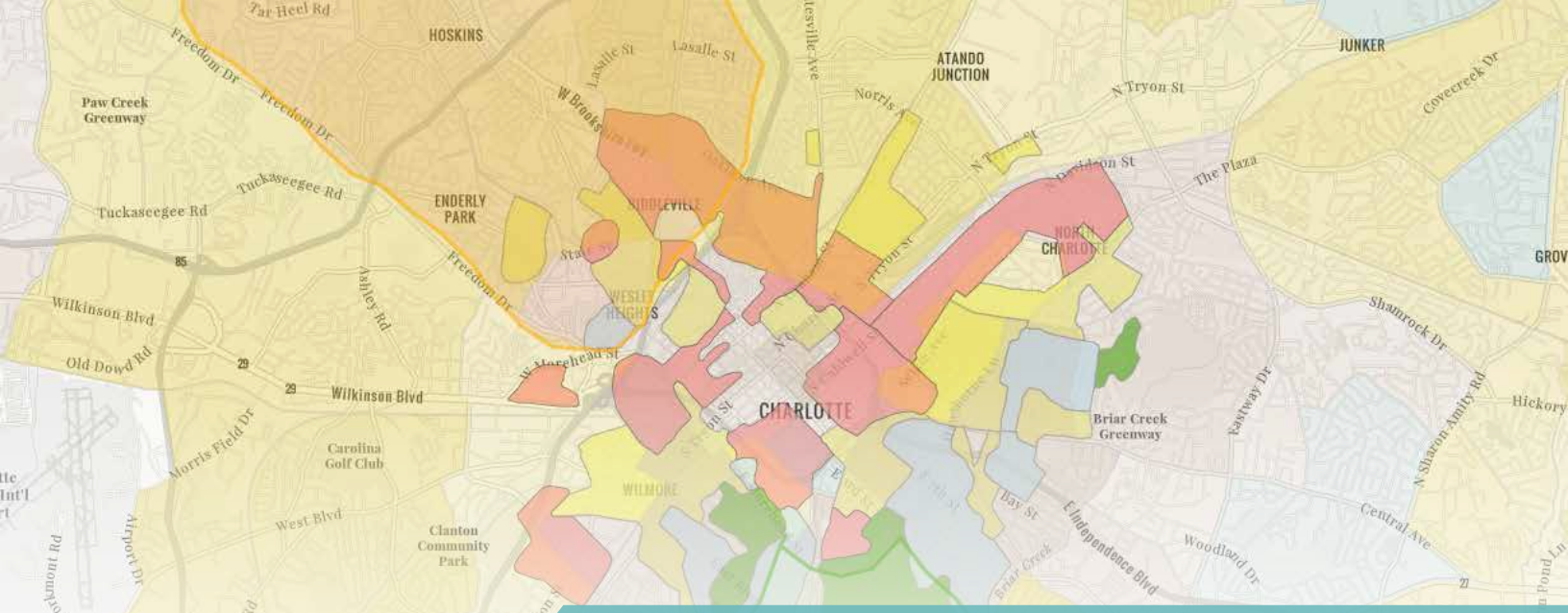


Areas in the US with poor air quality that also have the higher levels of poverty.

programs and policies to where they are needed most. GIS is more than a technology; it is a way of thinking about the spatial relationships that drive health inequities where people live, work, learn, and play.

GIS helps tell the story of inequities by demonstrating how the shadow of historical oppression and policies that unfairly distributed assets across the built and natural environments continues to drive poor health outcomes and population disparities along racial lines. Some of the opportunities to use geography to address inequity include:

- Prioritizing resource allocation according to hyper-local needs
- Designing and modeling communities that seek to rectify historical injustices (e.g., redlining), address structural drivers, improve economic opportunities, recreation, and access to essential services and resources
- Establishing storytelling mediums to better understand lived experiences and communicate findings to decision makers and the broader community
- Identifying partners to collaboratively share data and resources in a safe space
- Collecting new data in real-time to inform policy and program adjustments
- Monitoring health conditions block by block



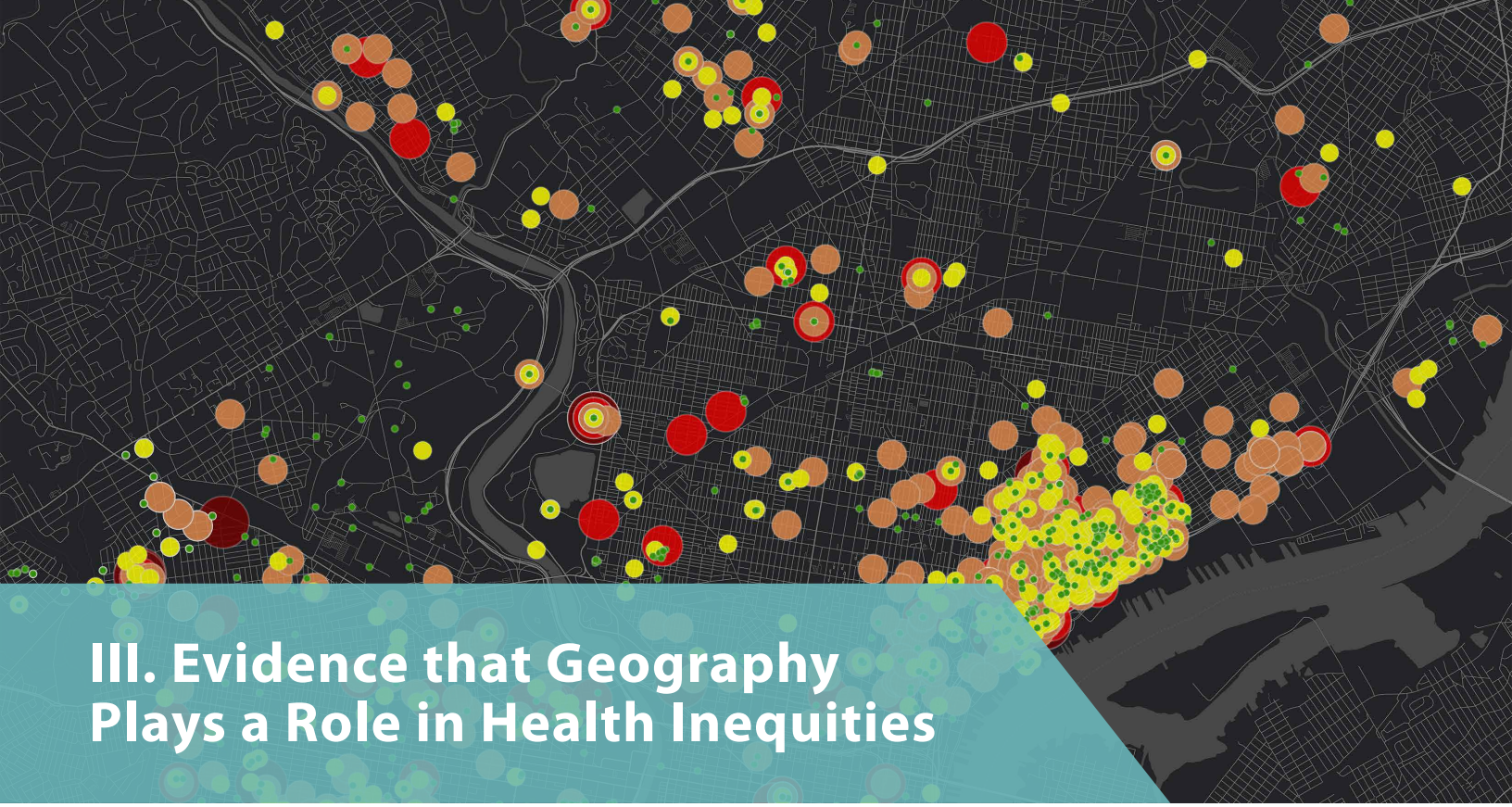
Historical HOLC redlining grades in Charlotte, NC [5]

II. What is Health Equity from a Geographic Perspective?

According to the Robert Wood Johnson Foundation (RWJF), **"Health equity means that everyone has a fair and just opportunity to be as healthy as possible."**[3] Achieving equity requires removing obstacles barring any person from attaining his or her full health potential. Many of those obstacles cluster geographically such as: inaccessibility to healthcare, discriminatory policies, toxic exposures, unsafe environments, and the absence of health promoting resources in a community.

Using a geographic perspective provides the background for where these issues occur and overlap to create undue burden on certain communities. For example, Clean Air Carolina (CAC), a non-profit out of Charlotte, NC, used geographic data to analyze the clustering of socio-economic, health, and environmental variables in the Historic West End community.[4] CAC used this geographic data, including real-time air quality data, to tell the story of the West End community – a predominantly Black community oppressed by years of housing discrimination, redlining, disenfranchisement, industrial zoning, highway construction, and disproportionately high exposures to air pollution.[5]

This data-driven community narrative led to community education, partnerships with local schools, distribution of air quality instruments, establishing an official air-monitoring station, and policy changes; notably, one high school student involved in the training program presented to school administrators resulting in a new bus idling policy at their school. As seen in West Charlotte, a geographic focus explicitly highlighted inequities and resource gaps, linked root causes to negative health outcomes, informed the design of solutions tailored to different communities, supported strategic resource allocation, and contributed to monitoring outcomes for remediation and improved equity.



III. Evidence that Geography Plays a Role in Health Inequities

Location Unveils Opportunities for Collaboration

Many health and human services professionals argue that healthcare is a fundamental right of all people, yet not all people have adequate access to healthcare and health-promoting resources. Addressing inequities requires removal of the barriers that hinder an individual's access to these programs and services that work in concert to generate positive health outcomes. For example, individuals living in rural areas served by only one public hospital can experience delays in preventative care and life-saving emergency services when travel time to receive treatment is excessive.

In other communities, access to grocery stores with fresh fruits and vegetables might be limited compared to a plethora of processed, high-calorie food options from convenience stores that contribute to higher rates of diabetes. Similarly, communities with fewer parks, green spaces, or walkable areas have fewer options for physical activity or social interactions among community members. In each scenario, an individual is constrained by what is or is not available in their community to support positive health outcomes.

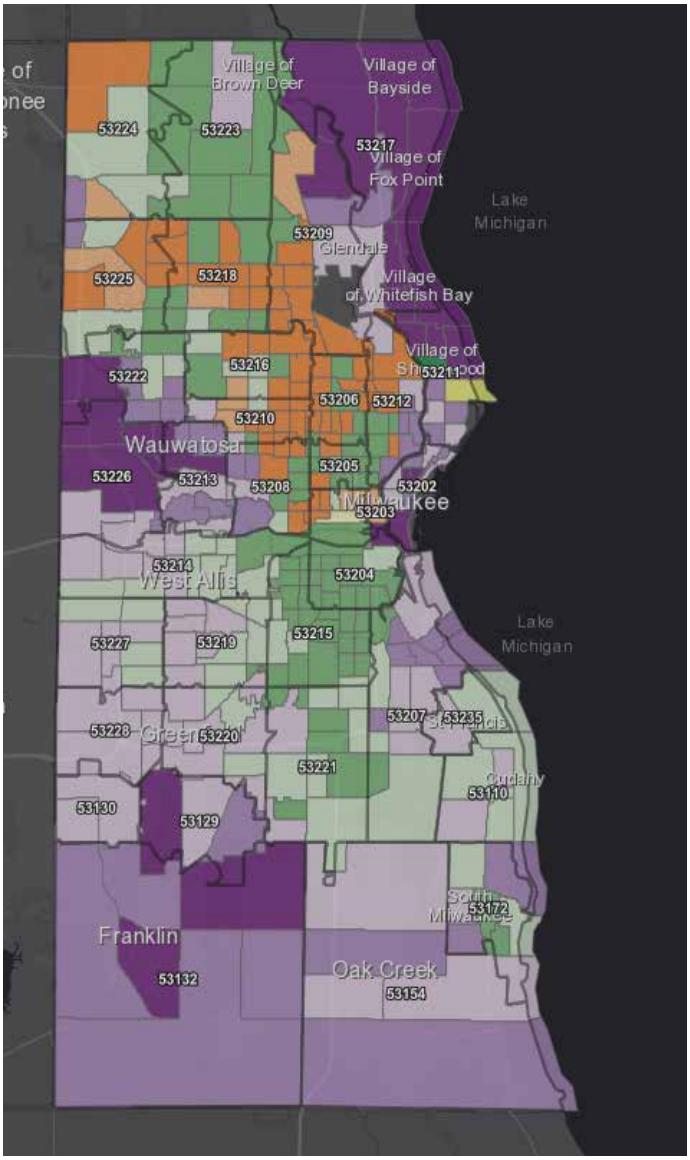
One could argue that ***where you live and work*** is the single most important factor for your health and well-being. But for an individual or family it may be difficult or near impossible to relocate from an under-resourced area into one with many accessible amenities. Public health departments, however, can help. Using geospatial data to visually represent the absence or presence of resources helps connect SDoH data from multiple sectors to their negative or positive health impacts and plan targeted actions to remediate problem areas. GIS can be the single, most effective tool to help health departments and other human services professionals identify disparities and understand their root causes neighborhood by neighborhood.

Health departments can also leverage geospatial thinking and methods to build collective will across community sectors to support data-driven policy agendas and action plans. Removing the barriers to health equity is the responsibility of all public serving entities in a community and cannot be achieved without partnership and a shared vision of success. Mobility and housing, economic development and revitalization, education and training, voting, law enforcement, safe water, and eradicating vector-borne diseases are examples of joint efforts among a cross-sector of collaborators.

Geographic data offers a key opportunity to integrate multi-sector perspectives and provide a foundation for collaborative approaches. For over a decade, the

Scott County Health Department (Iowa) has been using GIS to both promote environmental justice and health equity, and to identify community partners to support these efforts. One of the department's earlier mapping efforts was a project with Augustana College focused on childhood lead poisoning. The Scott County Health department used five factors to map the variable risk of lead exposure within neighborhoods across the county.

The map highlighted the stark environmental inequities that were known anecdotally using a visual representation of high-risk areas which predominantly clustered in African American communities. Being able to share the data in this way sparked a community-based coalition to seek federal funding that supported lead abatement programs. More recently, during the COVID-19 pandemic, the health department once again turned to GIS as a means of identifying and unifying community partners.



Milwaukee County uses the EVE Model to target areas of low vaccination and high vulnerability (orange)[7].

Using the CDC's Social Vulnerability Index (SVI) combined with additional data variables, the health department was able to target vaccine messaging and outreach efforts to their most vulnerable ZIP Codes by direct mailing tailored COVID-19 vaccine information to every address. They also identified strategic partnerships in those areas including Federally Qualified Health Centers (FQHCs), churches, hospitals, and the local Latin American Council to support vaccination messaging and uptake. Scott County Health Department Deputy Director, Brooke Barnes, noted that mapping has been a key driver in gaining buy-in from community organizations and residents for health equity initiatives in their community.

Place-Based Interventions

Health departments can apply geospatial knowledge to their strategic planning by focusing on places where resources have been stripped by disinvestment and unjust community planning practices, whether intentional or not. Place-based interventions offer the ability to look at overlapping factors contributing to inequities by using geography as the common denominator. This approach is already reshaping transparency, accountability, and equity by elevating neighborhood data and prioritizing interventions that produce measurable outcomes.

More than a year after being the first county to declare racism a public health crisis, Milwaukee County, Wisconsin applied their place-based approach to COVID-19 response efforts and vaccine allocation.[6] As the pandemic exacerbated health inequities across the world, Milwaukee County used Esri's technology and the CDC Social Vulnerability Index (SVI) to develop an **"Evaluating Vulnerability and Equity (EVE) Model"** tool to identify and support the most vulnerable populations in their county.[7] When vaccines first became available in the United States, this county used the EVE Model to identify the ten most vulnerable ZIP Codes, opening vaccine eligibility in those places first. As the vaccine rollout continued, door-to-door vaccination efforts and mobile vaccination units were strategically placed in neighborhoods based on continuously updated data in the EVE tool.

The positive impact of these ongoing and iterative efforts was realized as larger proportions of Black Milwaukee residents continued to get vaccinated in the fall of 2021. Using a place-based approach to planning and evaluation can also inform tough decisions about prioritizing emerging

needs alongside longstanding historical trends of disparate health outcomes. Place-based data can be examined over time to demonstrate the uniqueness of each neighborhood and the different assets and challenges from block to block, year to year. Health departments can use trend data to monitor effectiveness or harm of longstanding policies and adjust or balance policies that may only benefit part of their jurisdiction. This provides flexibility and agility in the allocation of programs and resources, ensuring that community members most in need receive the services essential to achieving optimal well-being.

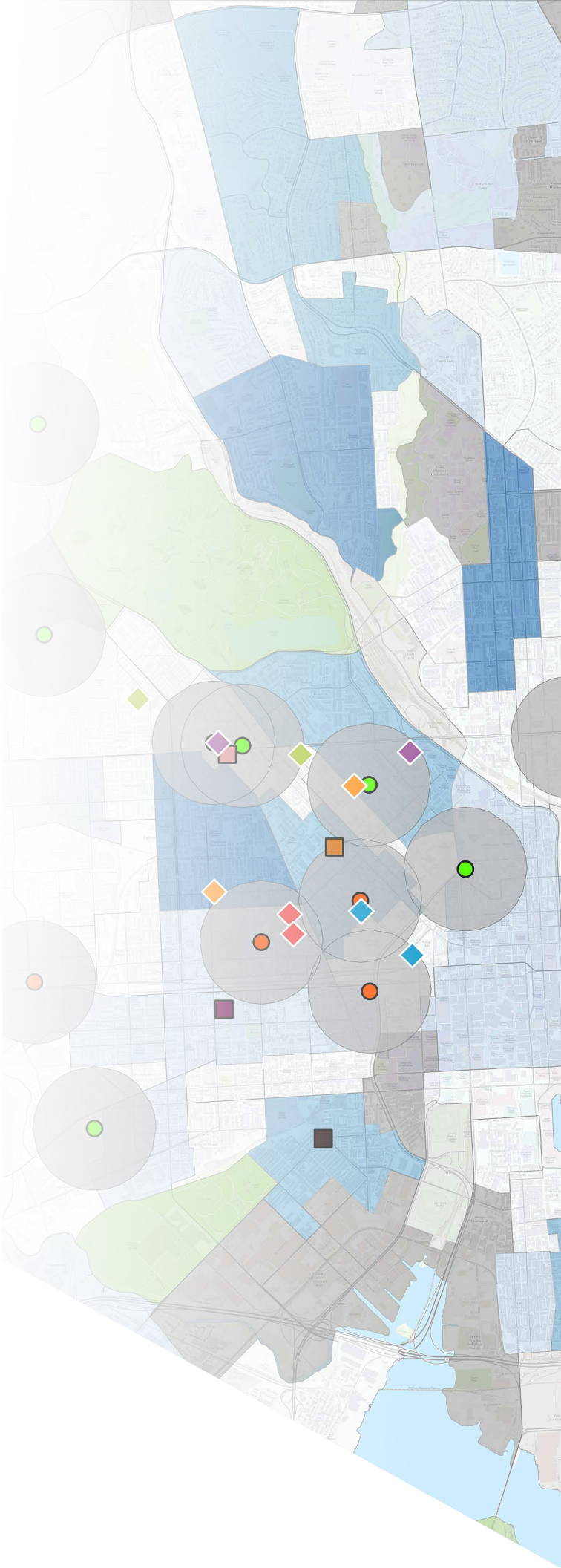
For example, Baltimore's approach is transforming transparency, accountability, and equity by highlighting neighborhood data and prioritizing the unique needs of each neighborhood.[8] Using CoDeMap, the City of Baltimore has been able to create a centralized data hub overlaying property information, socioeconomic data, and other key variables to better understand housing policies and take multi-level approaches to support the city's most vulnerable neighborhoods.[9]

The city has continued to enhance the tool for both internal and external purposes, allowing users to analyze data in all 270 of Baltimore's neighborhoods over the last five years to visualize the impact of their interventions and opportunities for innovative place-based solutions. Alice Kennedy, Baltimore City Department of Housing and Community Development Commissioner, noted that "GIS has given us the opportunity to bring all relevant data into the picture and to put a face to each neighborhood."

GIS Provides the System to Apply Place-Based Intervention

Acknowledging the value of geospatial data in your health department's strategy is the first step in establishing a place-based intervention approach. GIS provides the ability to organize and combine data on SDoH with other health and contextual data by using location as the means to link information together from various sectors and sources. The result is new insights that could not have been realized through standard data analysis or community outreach.

GIS technology expedites a health department's ability to monitor broad jurisdiction-wide trends as well as specific geographic trends within ZIP Codes, census tracts, neighborhood segments or custom areas of interest. GIS technology can streamline and improve community health needs assessment processes, create efficiencies in data collection and reporting, and enhance



the overall communication of data through easy to interpret interactive maps that are more compelling than standard reports.

GIS technology leverages the locational component in all data, whether collected from community members, authoritative agencies (e.g., CDC, HHS, NOAA), secondary data sources (e.g., Census or NHANES), administrative data, or other data curated by Esri (including demographics, income, education, purchasing patterns, locations of registered organizations and businesses, and much more) to realize and humanize the needs and characteristics of a community.

Connecting the issues through geospatial data provides insights into actions that can be taken today to correct historical injustices by identifying where disparities exist and the structures causing them. Highlighting disparities with geospatial data also facilitates conversations around why disparities exist and why they cluster in specific places or communities, and what can be done to support those communities experiencing disparate health outcomes. Our civic leaders can look at the interrelationships of factors creating an environment that does not support optimal health for every resident within their jurisdiction, and approach solutions in a new data-driven way with geospatial data.

IV. Get Started

Taking a geospatial approach to addressing health equity can help drive efficient, effective, and equitable outcomes, but where do you start? What do you or your organization need to have in place to take the appropriate steps toward understanding how "where" makes a difference in your decision process? How can you be sure that the decisions you make are based on accurate and authoritative information? What action needs to be taken to result in optimal outcomes? Finally, how do you know that the action taken had the intended results? In the past, these might have been daunting or even paralyzing questions, but with tried, tested, and proven processes for taking a geographic approach we can make measurable progress towards health equity.

1

The first question that needs to be addressed; who are the people that you serve? Where do they live, grow, learn, work, shop, eat, play, and receive services? You must understand these elements to take action and make a positive change. To meet this need you must build your foundational data infrastructure. The truth is, most jurisdictions have more data than is often realized. And, when data is not already in place, finding and accessing relevant data is easier now than ever. Authoritative data can be accessed and used from a number of resources including NACCHO,[10] Health Resources & Services Administration (HRSA),[11] Centers for Disease Control & Prevention (CDC),[12] Census Bureau,[13] ArcGIS Living Atlas of the World.[14]

2

Second, that authoritative data needs to be turned into actionable information. Through the power of GIS, seemingly unrelated data can be transformed into relevant information products that communicate patterns and trends across a community that would not be evident through traditional data analysis. Applying a geospatial approach to data analytics and visualization, understanding the population you serve, their challenges accessing critical goods and services, and addressing gaps to meet their needs becomes clear. With advances in geographic information systems (GIS), these capabilities are available to everyone from the executive who accesses common dashboards presenting key performance indicators of interest, to the program specialist using curated geospatial data from Esri's extensive data repository to perform an environmental scan of food banks in their jurisdiction.

Third, the best data and analytics available are useless unless a solution is taken. Along with any solution, the communication aspects are equally important. Effective and efficient communication prior, during, and after addressing the issue requires delivering the information through the appropriate channels, i.e., the channels upon which your audience depends and trusts (e.g., social media versus cable TV, newspapers, or other channels). GIS technology can help you achieve this by providing communication and collaboration tools like ArcGISHub and ArcGIS StoryMaps that help you present complex information in a clear and digestible format.

3

Finally, for any organization to understand the true impacts of action, whether short-term or long-term, ongoing monitoring and evaluation of the conditions needs to take place and be reported. The accuracy and timeliness of reporting is critical to make appropriate adjustments when necessary and to share short-term progress towards long-term goals. GIS supported dashboards have the ability to communicate real-time and near real-time data collected by staff, community members, or other partners and provide insights into important outcomes or key performance indicators, empowering decision makers to act quickly, effectively, and equitably.

4

Local public health professionals serve at the front lines, supporting the health and well-being needs of their communities. The greatest opportunities for positive change exist at those front lines, in consideration of each neighborhood and its unique characteristics. Solving for health inequities is a grand challenge and will require the best tools, the deepest insights, and the most thoughtful actions possible. Using GIS will give local public health departments those advantages and more.

NACCHO

The National Association of County and City Health Officials (NACCHO) represents the nation's nearly 3,000 local health departments. These city, county, metropolitan, district, and tribal departments work every day to protect and promote health and well being for all people in their communities.

For more information about NACCHO, **please visit** www.naccho.org.

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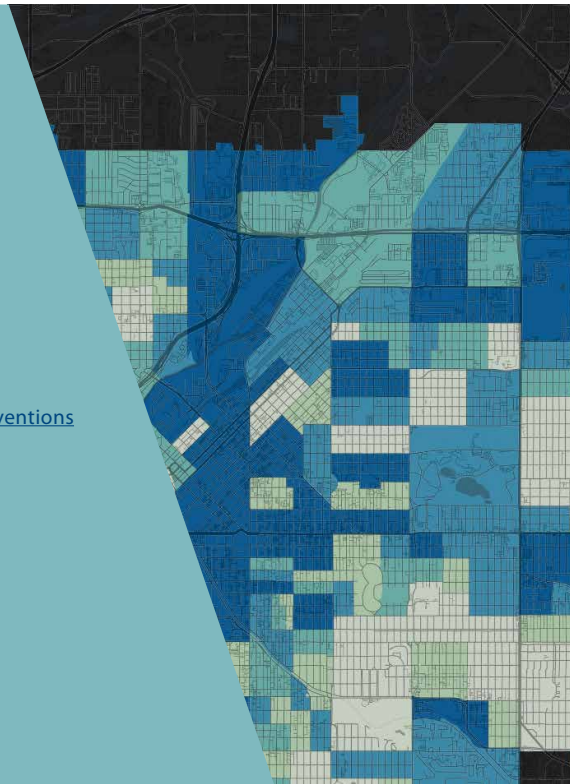
Esri

When Esri was founded in 1969, we realized even then that geographic information system (GIS) technology could make a difference in society. Working with others who shared this passion, we were encouraged by the vast possibilities of GIS.

Today our confidence in GIS for health applications is built on the belief that geography matters in people's lives - it connects our many cultures and societies and influences our way of life. GIS leverages geographic insight to ensure better communication, collaboration, and decision making. Esri software is deployed in more than 350,000 organizations globally, including Fortune 500 companies, government agencies, health systems, nonprofits, and universities.

Esri engineers the most advanced solutions for digital transformation, the Internet of Things (IoT), and advanced analytics to inform the world's toughest challenges. We hope you will be inspired to join the Esri community in using GIS to create a better future.

Visit us at esri.com/health.



[1] Healthy People 2030

[2] https://www.apha.org/topics-and-issues/health-equity/racism-and-health/racism-declarations

[3] https://www.rwjf.org/en/library/research/2017/05/what-is-health-equity-.html

[4] https://www.habitatmap.org/airbeam/user-stories/clean-air-carolina

[5] https://go.esri.com/CleanAirCarolinaStorymap

[6] https://go.esri.com/MilwaukeeSentinelArticle

[7] https://go.esri.com/MilwaukeeCountyCOVIDDashboard

[8] https://www.esri.com/en-us/lg/industry/government/city-baltimore-leads-place-based-housing-interventions

[9] https://cels.baltimorehousing.org/codemapv2ext/

[10] https://www.naccho.org/profile-report-dashboard

[11] https://data.hrsa.gov/map

[12] https://www.cdc.gov/statesystem/interactivemaps.html

[13] https://www.census.gov/programs-surveys/geography/data/interactive-maps.html

[14] https://livingatlas.arcgis.com/en/home/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