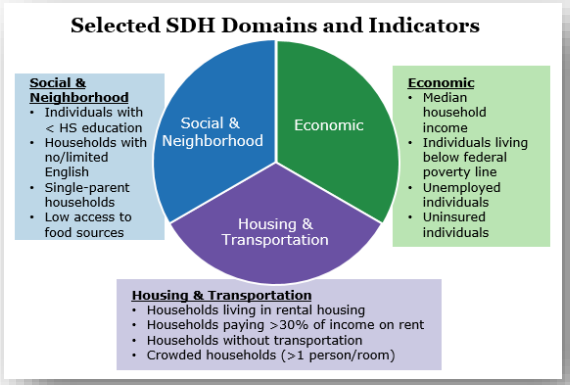
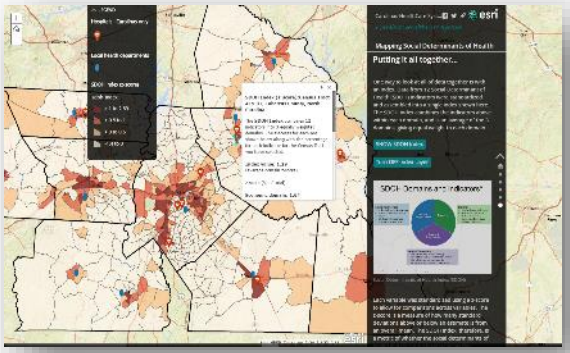
GIS Mapping of Social Determinants of Health as a Tool to Facilitate Community Collaborations





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Matthew C. Simon, MA
Kasey Decosimo, MPH

2017 Annual State Health Director's Conference
Raleigh, NC
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Presenters

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Agenda

Welcome and Intro (Gene)	5 min.
The Carolinas HealthCare Story (Dr. Cole)	10 min.
CHIS Project (Kasey)	5 min.
SDOH Mapping Project and other resources (Matt)	20 min.
Open Discussion	20 min.

Three "Take Home" Messages

1. **Hospitals & healthcare systems are moving into Social Determinants of Health (SDOH)**

2. **GIS mapping technology is rapidly improving and becoming more available to show SDOH at census tract levels**

3. **GIS/SDOH mapping is a powerful new tool to assist communities addressing their health needs and to develop new coalitions**

North Carolina Institute for Public Health (NCIPH)

- Service arm of the Gillings School of Global Public Health at UNC-Chapel Hill
- Since 1999 has served as a bridge between academia and partners in community organizations and government agencies

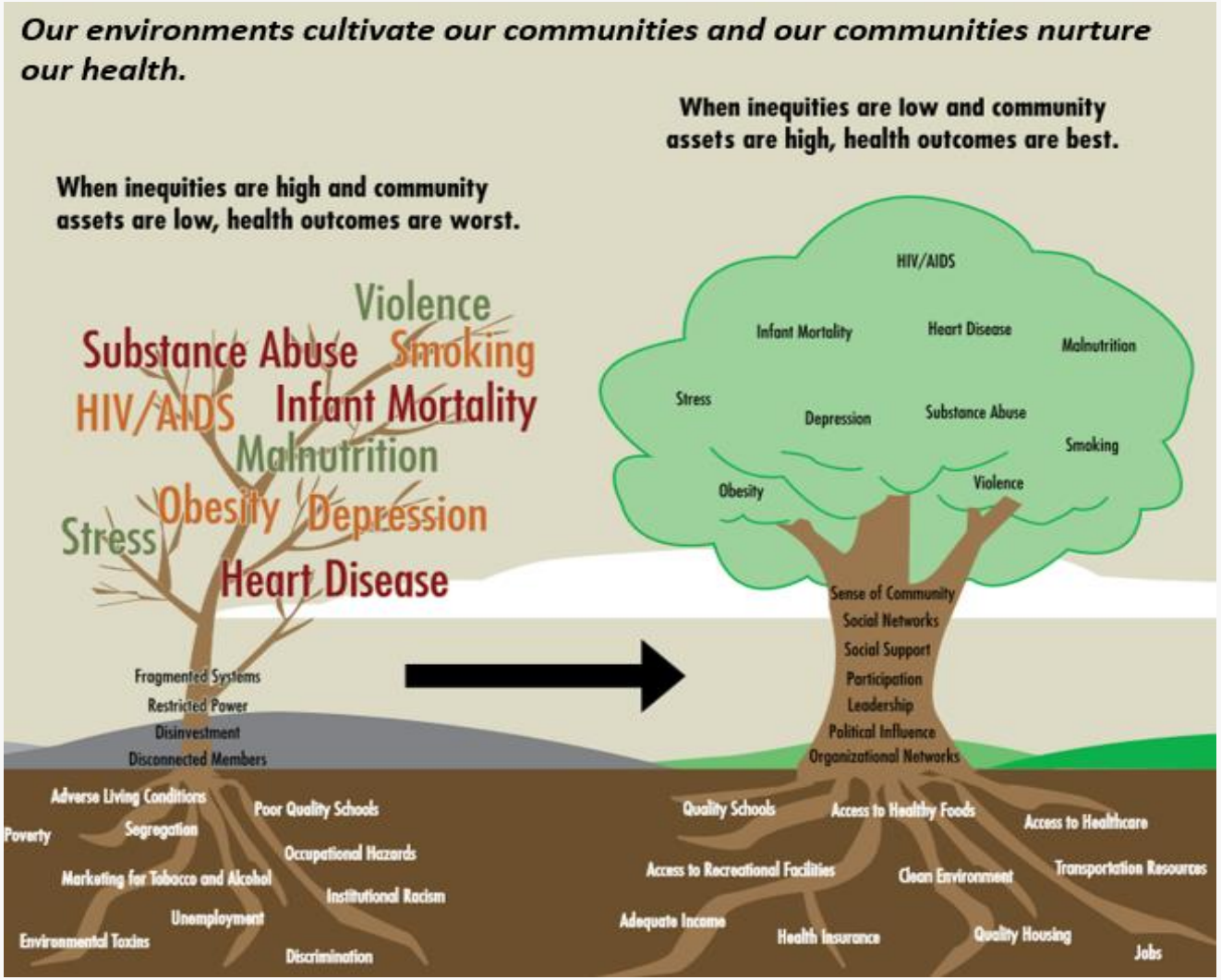
Deliver training, conduct research and provide technical assistance to transform the practice of public health for all

Context of One New Collaboration

- **NC Community Health Improvement Collaborative (CHIC) 2007→present**
- **Increasingly focused on CHNA implementation by non-profit hospitals**
- **April 2016 Carolinas Healthcare System (CHS) requested assistance on SDOH**
- **NCIPH found value of GIS mapping to assist CHS in community health improvement efforts and to develop community partnerships**

Social Determinants of Health (SDOH)

Conditions in the environment in which people live, work, play, and worship that affect a wide range of health and quality of life outcomes



Adapted from Anderson et al, 2003; Marmoetal, 1999; and Wilkinson et al, 2003.

Increasing Focus on Social Determinants of Health (SDOH)

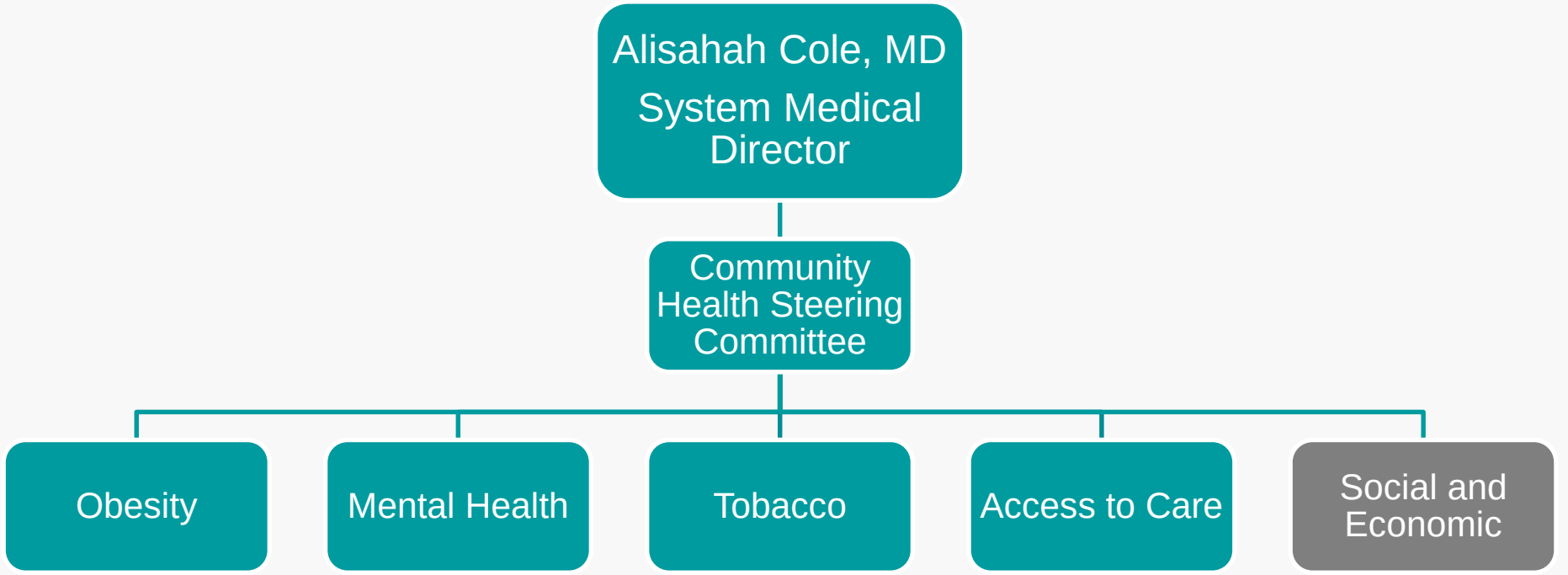
- **There is growing interest in addressing the SDOH as well as health care policy reforms to increase the efficiency and quality of care while improving health outcomes**

- **Hospitals are "anchor" institutions and can be a natural source of collaboration, leadership, and community support for broader health initiatives**

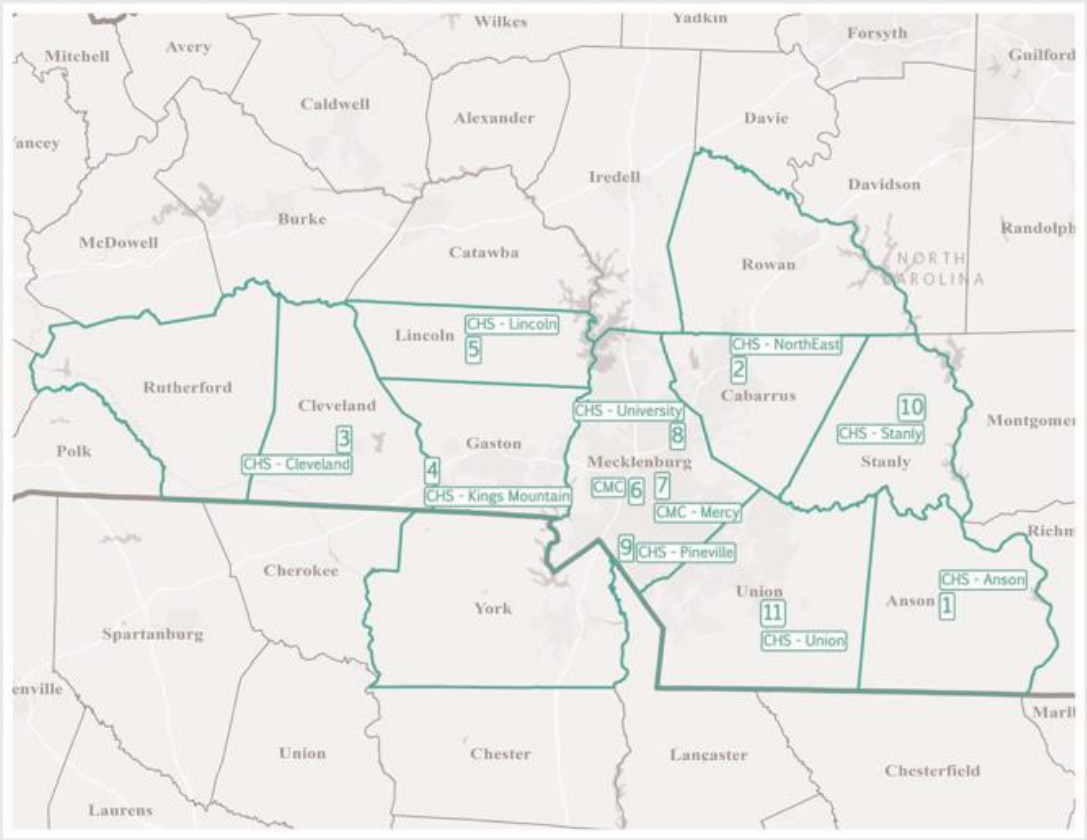
Source: Rosenbaum, Sara. (2016). https://www.brookings.edu/wp-content/uploads/2016/07/Rosenbaum-PDF-Layout-FINAL.pdf

THE CAROLINAS HEALTHCARE SYSTEM STORY

Community Health Strategy: Building Healthier Communities through HealthCare Culture Transformation



Carolinas HealthCare System Primary Enterprise Hospital Locations

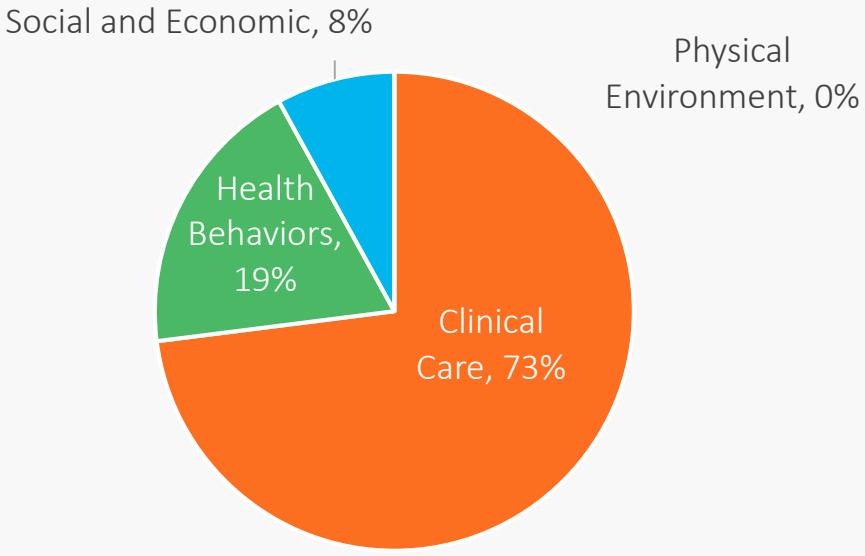


1. Carolinas HealthCare System Anson
2. Carolinas HealthCare System NorthEast
3. Carolinas HealthCare System Cleveland
4. Carolinas HealthCare System Kings Mountain
5. Carolinas HealthCare System Lincoln
6. Carolinas Medical Center
7. Carolinas Medical Center-Mercy
8. Carolinas HealthCare System University
9. Carolinas HealthCare System Pineville
10. Carolinas HealthCare System Stanly
11. Carolinas HealthCare System Union

Healthcare Focus on SDOH

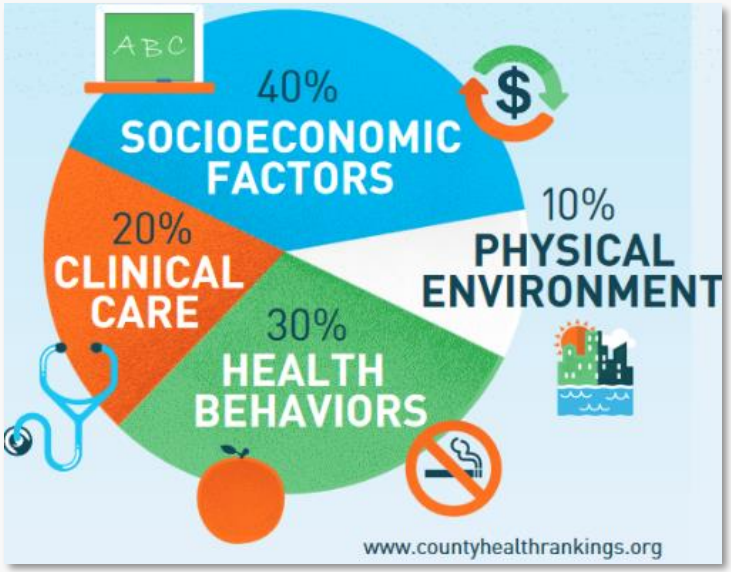
In community health improvement, growing interest in shifting the primary focus on clinical care and also addressing health behaviors, social and economic factors, and physical environment

Current Landscape: National Non-Profit Hospital Sample



April 2014, Public Health Institute

Where the CDC and RWJF Want To Go…



Community Health Improvement Study (CHIS) Process

- **What:** conduct a study of health factors and social determinants of health in each market
- **Why:** inform the work of community outreach and community health teams by identifying the barriers to health
- **How:** market sub teams will hold 3 meetings to review qualitative and quantitative data and prioritize health and social focus areas
- **Outcome:** Provide the information necessary for the system to identify health and social focus areas for 2017-2019

Why a Community Health Improvement Study (CHIS)?

- Compile market level data and community input to determine **census tract target areas**
- Help identify priority health and Social Determinants of Health (SDOH), by market, that impact communities throughout the CHS footprint for **collective health impact and outcomes**
- Inform the development of collaborative **strategy and action plans** that address health and SDOH across CHS footprint

Purpose of Engaging the LHD

- LHD is the expert
- We reviewed each county's CHA to better understand the coordination of community partners focusing on health and social determinants
- Validate data and findings
- Learn new trends and request opinions
- We also want to learn how CHS can be more collaborative on addressing health and SDOH across the region

Summary of Social Determinants of Health Recommendations by Market Facility, 2016

Social Determinants of Health	Anson	NorthEast	Cleveland	Lincoln	CMC Main + Mercy	CMC University	CMC Pineville	Stanly	Union*	TOTAL
Crowded Households										0
Educational Attainment		■		■		■		■		4
Food Access		■	■		■		■			4
Households Living in Rental Housing										0
Households with No/Limited English									■	1
Housing Costs (rental)			■							1
Lack of Health Insurance		■		■	■		■		■	5
Poverty	■		■		■	■	■	■		6
Median Household Income										0
Single Parent Households										0
Transportation	■			■					■	3
Unemployment	■					■		■		3

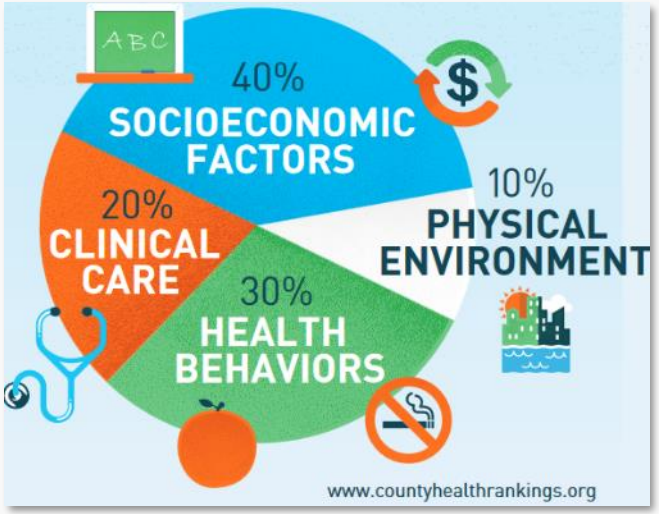
The Social Determinants of Health recommended by Market Facilities for the Carolinas HealthCare System Social and Economic focus area include (in order of priority, top four bolded):

1. **Poverty (6)**
2. **Lack of health insurance (5)**
3. **Educational attainment (4)**
4. **Food access (4)**
5. Transportation (3)
6. Unemployment (3)
7. Housing costs (rental) (1)
8. Households with no/limited English (1)
9. Single-parent households (0)
10. Households living in rental housing (0)
11. Household income (0)
12. Crowded households (0)

COLLABORATIVE PROJECT

Why Map SDOH?

- Understand the “upstream” social and economic factors that influence health in service area
- Identify needs and communities where CHS can leverage community benefit investments to address SDOH
  - Shifting from clinical care to address health behaviors and socioeconomic factors



Key SDOH Indicators

Economic Stability	Neighborhood and Physical Environment	Education	Food	Community and Social Context	Health Care System
Employment	Housing	Literacy	Hunger	Social integration	Health coverage
Income	Transportation	Language	Access to healthy options	Support systems	Provider availability
Expenses	Safety	Early childhood education		Community engagement	Provider linguistic and cultural competency
Debt	Parks	Vocational training		Discrimination	
Medical bills	Playgrounds	Higher education			Quality of care
Support	Walkability				

Health Outcomes

Mortality, Morbidity, Life Expectancy, Health Care Expenditures, Health Status, Functional Limitations

THE HENRY J. KAISER FAMILY FOUNDATION

CHIS Process

June 2016: development of 10 Market Teams

August 2016: CHS finalized establishment of a new strategic area: Community Health

August – September 2016: Market Teams met with LHDs to seek input and enhance the understanding of the public health process in assessing community health needs, priorities, and action plans

September 2016: CHS worked with NCIPH to map SDOH across the region and CHS conducted focus groups and reviewed findings from recent focus groups from LHDs

October 2016: Market Teams reviewed health and SDOH highlights and provided recommendations for the Social and Economic system focus area

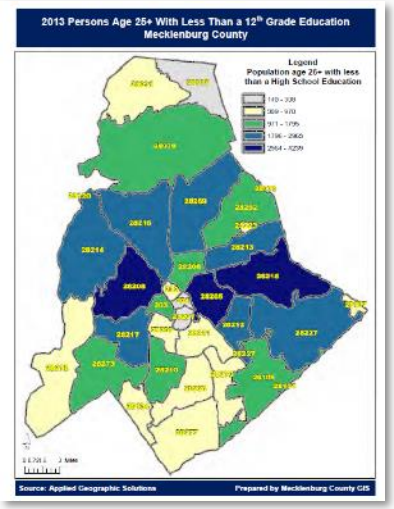
SDOH Data Analysis Request

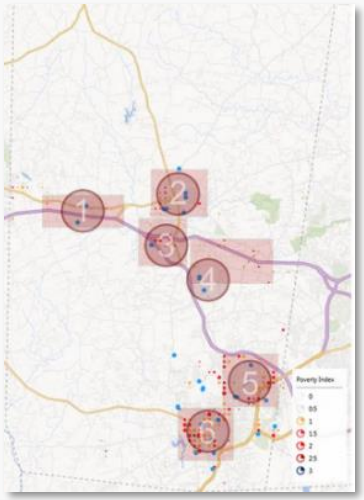
- Create maps of SDOH data for 10 county region
  - 10-12 SDOH indicators
  - Included food desert data
- Develop index of all indicators to identify communities of high need
- Summarize and review data at a county and regional level

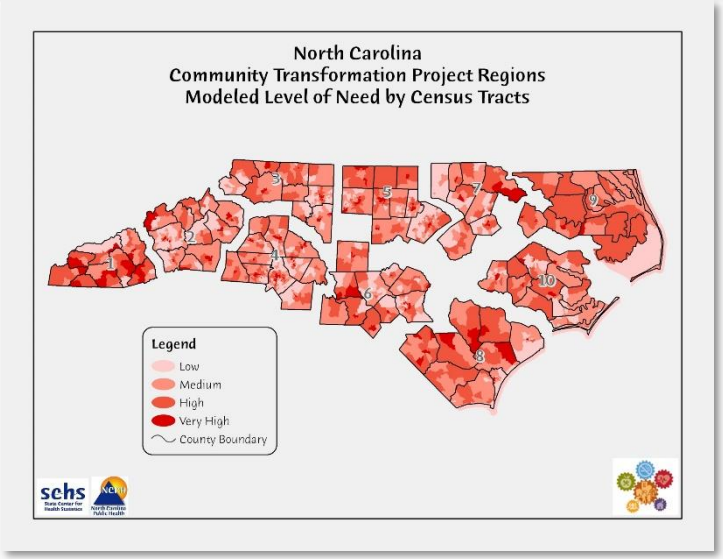
What Are Others Doing?

Examples:

- Mecklenburg LHD CHA (2013)
- Orange County LHD – areas of concentrated poverty (2014)
- CTG (2014) Health Needs Index



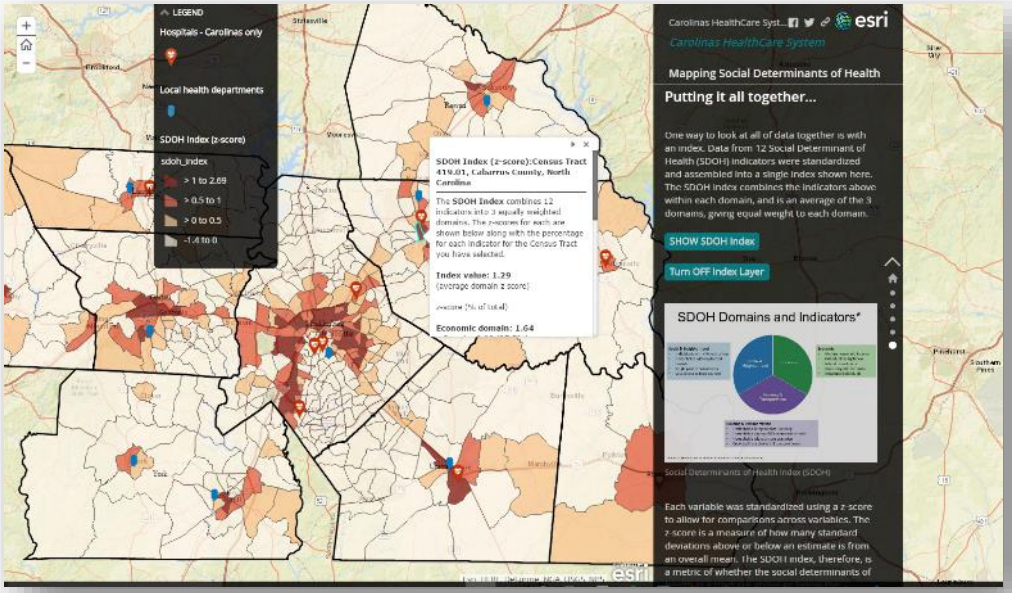




SDOH MAPPING TOOL

Mapping SDOH

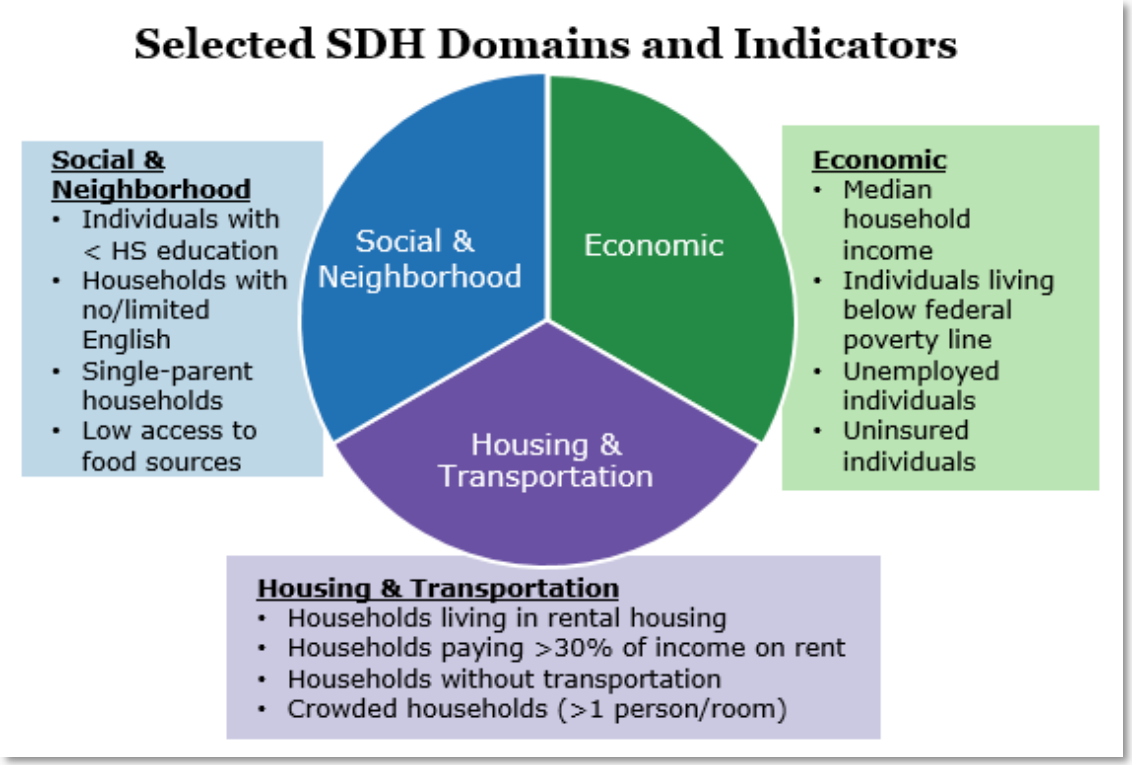
- 12 SDOH indicators at the neighborhood level (Census Tracts)
- Created index to summarize all indicators into a single variable (shown to the right)
- Interactive web map



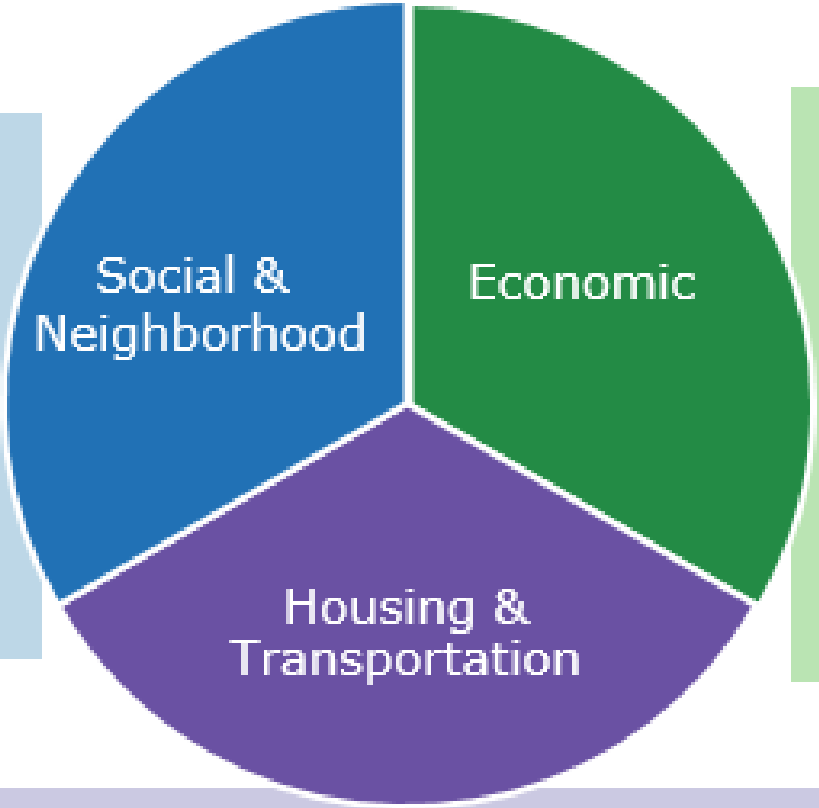
http://arcg.is/2bUNr4a

Mapping SDOH, cont.

- Identified indicators based on literature review
- Selected indicators available from the U.S. Census
  - American Community Survey 5-year estimates (2010-2014)
- Food desert data from USDA (2010)



Selected SDH Domains and Indicators



Social & Neighborhood

- Individuals with < HS education
- Households with no/limited English
- Single-parent households
- Low access to food sources

Economic

- Median household income
- Individuals living below federal poverty line
- Unemployed individuals
- Uninsured individuals

Housing & Transportation

- Households living in rental housing
- Households paying >30% of income on rent
- Households without transportation
- Crowded households (>1 person/room)

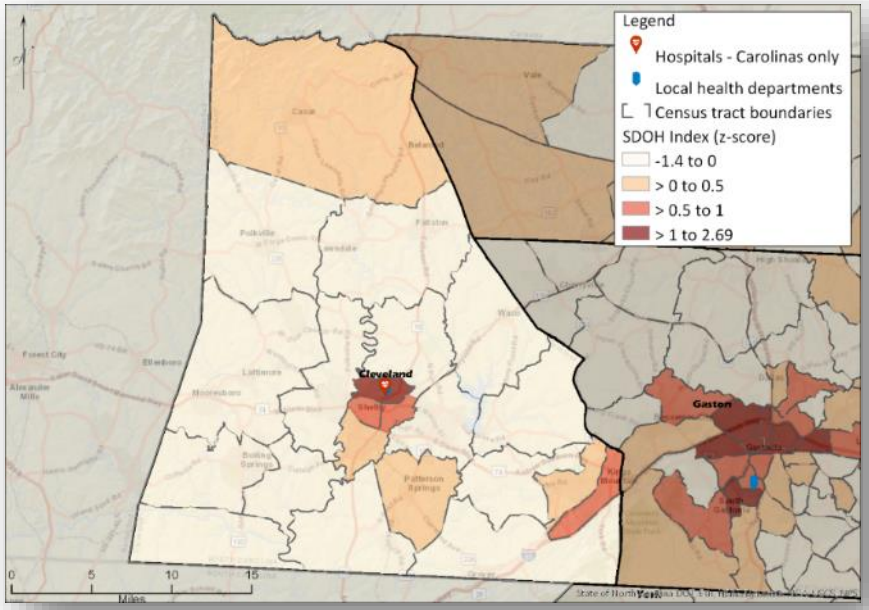
SDOH Index

- 12 standardized SDOH measures inform 3 indicators:
  - Economic
  - Housing & Transportation
  - Social Resources
- Indicators given equal weight
  - Regardless of number of census variables within indicator
    - Census variables may be ‘diluted’ within indicator if many variables
- SDOH index is mean value of the 3 indicators
  - < 0 indicates better than average score (low need)
  - > 0 indicates poorer than average (high need)

SDOH Index = Mean of Domain Scores

Census Tract	Economic Domain	Housing & Transportation Domain	Social & Neighborhood Domain	SDOH Index (Mean of Domains)
	z-score	z-score	z-score	z-score
Cleveland 9507	0.166	-0.165	-0.069	-0.023
Cleveland 9509	1.209	1.641	0.264	1.038
Cleveland 9511	0.786	0.860	0.184	0.610
Cleveland 9512	0.667	0.784	-0.159	0.430

SDOH Index indicates the degree to which social determinants within a given tract are above or below the 'regional' average



DEMO

Limitations

- U.S. Census Bureau's American Community Survey data is based on a sample
  - Although using best data available, samples are subject to sampling variability
  - Data normally published with a 90% confidence interval or a "margin of error"

- Index
  - Summary of complex socioeconomic phenomenon in a single number

Other Mapping Platforms

- Durham's Neighborhood Compass
  - http://compass.durhamnc.gov/
- National Platforms
  - Community Commons
    - https://www.communitycommons.org/maps-data/
  - UDS Mapper from Health Landscape
    - http://www.udsmapper.org/
  - FactFinder https://factfinder.census.gov/

State Center for Health Statistics Resources

- Health and Spatial Analysis Branch
  - Dianne.Enright@dhhs.nc.gov
  - (919) 715-4473
  - http://healthstats.publichealth.nc.gov/
- North Carolina Health Atlas
  - County-level, sub-county available on request
  - Small numbers

Group Discussion and Questions

SDOH and ACS Lit Review

- Krieger, N. (2003). Choosing area based socioeconomic measures to monitor social inequalities in low birth weight and childhood lead poisoning: The Public Health Disparities Geocoding Project (US). *Journal of Epidemiology & Community Health, 57*(3), 186-199. doi:10.1136/jech.57.3.186

- California Health Disadvantage Index | Public Health Alliance of Southern California. (n.d.). Retrieved July 05, 2016, from http://phasocal.org/ca-hdi/

- Nancy Krieger, Jarvis T. Chen, Pamela D. Waterman, David H. Rehkopf, and S.V. Subramanian. Painting a Truer Picture of US Socioeconomic and Racial/Ethnic Health Inequalities: The Public Health Disparities Geocoding Project. American Journal of Public Health: February 2005, Vol. 95, No. 2, pp. 312-323. doi: 10.2105/AJPH.2003.032482

- Spielman, S. E., Folch, D., & Nagle, N. (2014). Patterns and causes of uncertainty in the American Community Survey. Applied Geography, 46, 147-157.

Extra stats slides

Variable Standardization Methods

- Indicator variables created as proportion of individuals (or households) with [X] in tract
- z-scores (*z*) create a standard metric for comparing different indicators
  - Based on estimate (*x*), CHS regional mean (μ), & standard deviation (σ): $$z = \frac{x - \mu}{\sigma}$$
  - Measures the deviation of a tract estimate from the overall mean
  - Allows for comparison across different variables
  - Maintains overall trend

Domain Score = Mean score across all indicators

Economic Domain:

Census Tract	Median Income (HH)		Living in poverty (I)		Unemployed (I)		Uninsured (I)		Domain Mean
	est	z-score	%	z-score	%	z-score	%	z-score	z-score
Cleveland 9507	$44,805	0.422	14.7%	-0.156	12.4%	0.158	17.9%	0.241	0.166
Cleveland 9509	$19,126	1.412	43.7%	2.283	18.5%	1.174	15.7%	-0.034	1.209
Cleveland 9511	$28,238	1.061	33.6%	1.430	12.1%	0.111	20.3%	0.541	0.786
Cleveland 9512	$33,017	0.877	27.3%	0.906	17.2%	0.954	15.4%	-0.069	0.667

Housing & Transportation Domain:

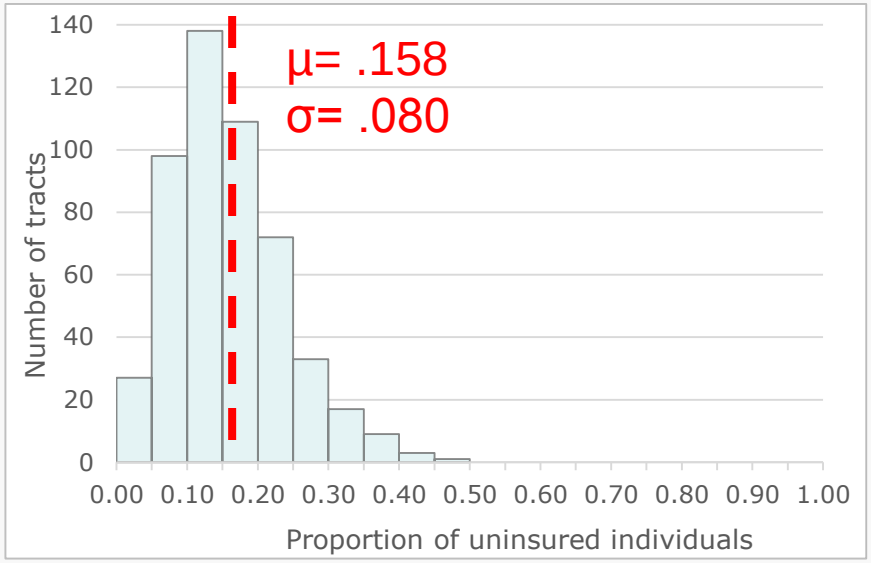
Census Tract	Living in Rental Housing (HH)		>30% income on rent (HH)		No Transportation (HH)		Crowded HH		Domain Mean
	%	z-score	%	z-score	%	z-score	%	z-score	z-score
Cleveland 9507	28.5%	-0.307	50.5%	0.065	7.8%	0.163	0.9%	-0.582	-0.165
Cleveland 9509	67.4%	1.522	74.9%	1.558	22.9%	2.290	6.1%	1.195	1.641
Cleveland 9511	57.4%	1.049	66.8%	1.061	15.1%	1.187	3.0%	0.146	0.860
Cleveland 9512	47.2%	0.573	65.6%	0.987	12.2%	0.781	4.9%	0.794	0.784

Social & Neighborhood Domain:

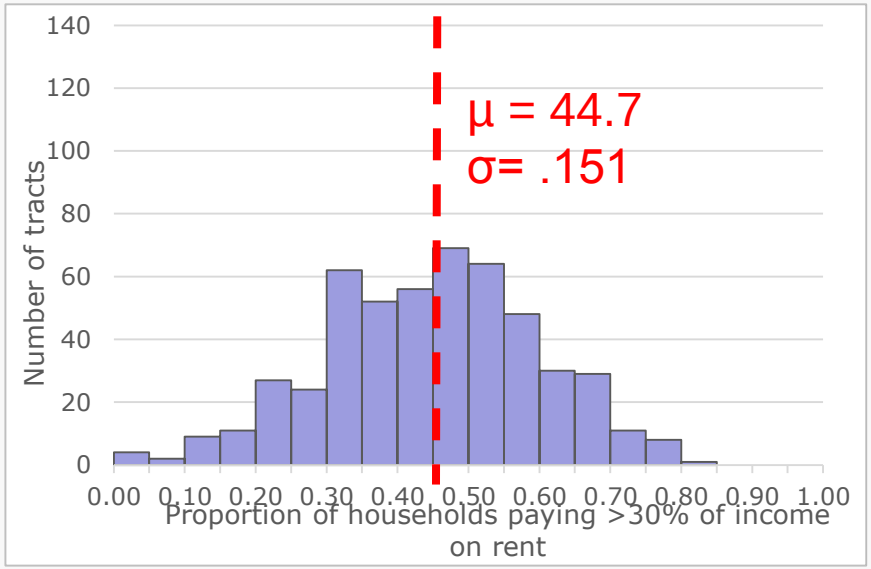
Census Tract	< HS Education (I)		No/Limited English (HH)		Low Food Access (I)		Single Parent HH		Domain Mean
	%	z-score	%	z-score	%	z-score	%	z-score	z-score
Cleveland 9507	19.2%	0.514	0.0%	-0.659	75.2%	0.419	8.4%	-0.548	-0.069
Cleveland 9509	22.2%	0.831	0.0%	-0.659	95.0%	0.956	12.1%	-0.071	0.264
Cleveland 9511	15.5%	0.140	2.1%	-0.200	80.0%	0.550	14.5%	0.247	0.184
Cleveland 9512	12.5%	-0.168	2.8%	-0.047	55.4%	-0.116	10.3%	-0.307	-0.159

How to compare 2 different variables?

- Percent uninsured
  - 507 tracts
  - ***Mean: 15.8%***
  - ***Std Dev: 8.0%***
  - ***Range: 1.6% - 47.6%***

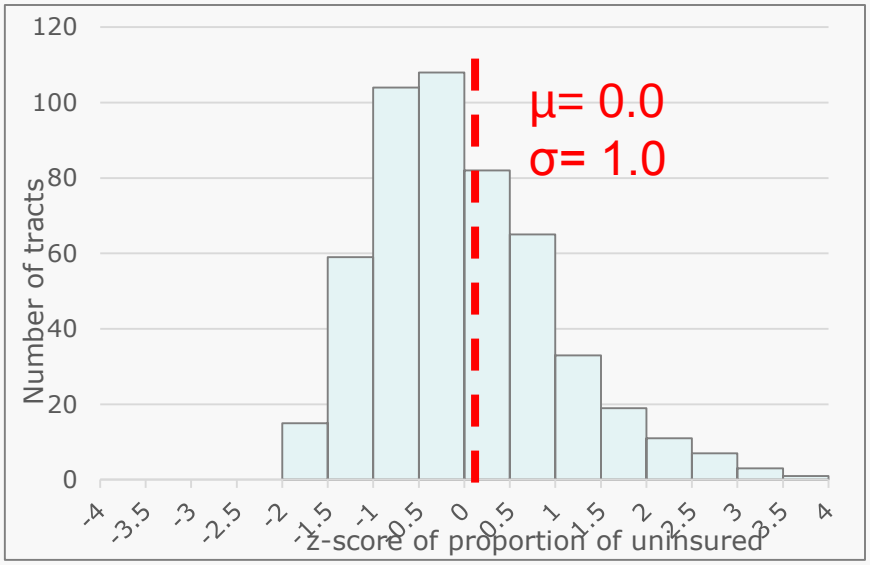


- Percent paying high housing cost
  - 507 tracts
  - ***Mean: 44.7%***
  - ***Std Dev: 15.1%***
  - ***Range: 0.0% - 80.3%***

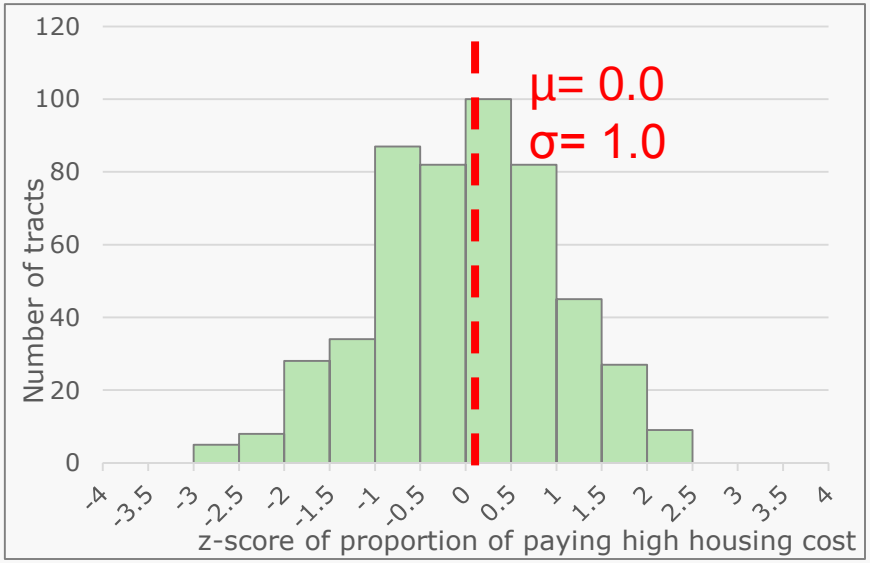


Z score standardization

- Percent uninsured
  - 507 tracts
  - Mean: 0
  - Std Dev: 1
  - Range: -1.78 – 3.98



- Percent paying high housing cost
  - 507 tracts
  - Mean: 0
  - Std Dev: 1
  - Range: -2.95 – 2.36



Sample z-score calculation

- Cleveland Co., Tract 9509
  - % households with no transportation:
    - Tract Mean (x): 286 / 1,250 = 22.9%
    - Regional Mean (μ)= 6.7%
    - Regional Std Dev (σ)= 7.1%
    - z score formula: $$z = \frac{x - \mu}{\sigma}$$
    - z = (.229 - .067)/.0707 = 2.29
  - **Translation:** In Tract 9509, the % households with no transportation are more than 2 standard deviations higher than the mean