

Missouri ZIP Code Health Rankings

Deriving Sub-County Level Population Health Indices
with Hospital Discharge Data Using the County
Health Rankings Framework

Brian Waterman, MPH Missouri Hospital Association

Mat Reidhead, MA Missouri Hospital Association

Min Lian, MD, PhD Washington University in St. Louis

Elna Nagasako, MD, PhD, MPH Washington University in St. Louis



Presenter Disclosures

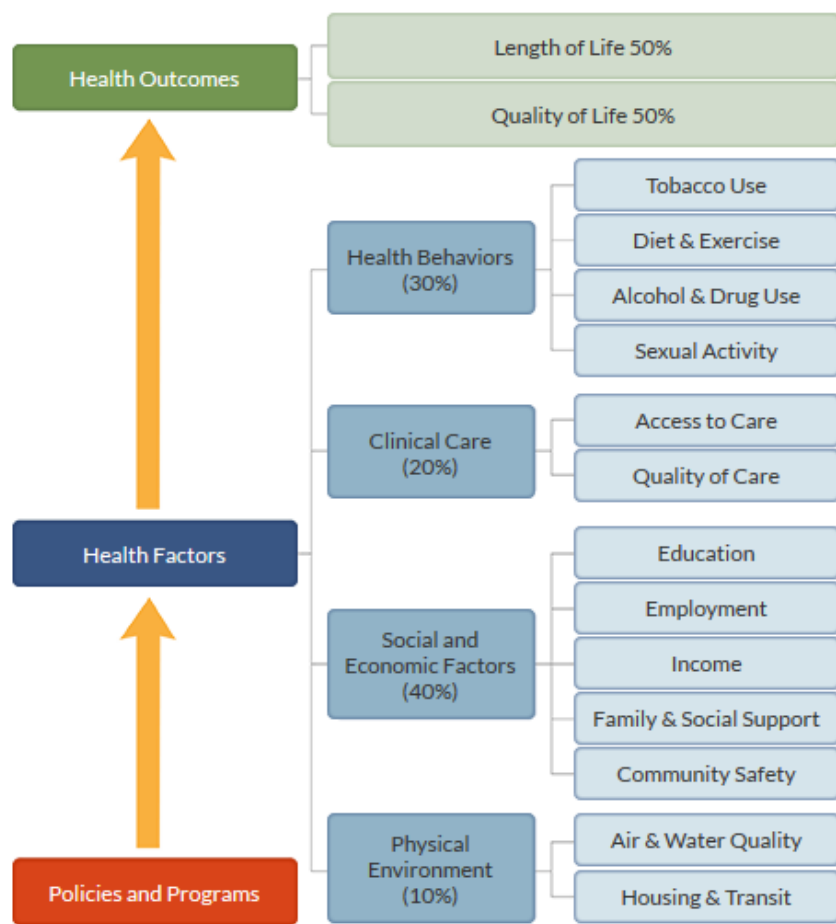
- Brian Waterman
 - The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:
 - No relationships to disclose



Project Background

- County Health Rankings & Roadmaps 2015 Research Grant
 - Washington University School of Medicine and Missouri Hospital Association
 - Advisory committee: academic/health disparities, community benefit, health foundation, local public health
- Project Aim:
 - Extend CHR&R conceptual model to the ZIP-level using widely-available data
 - Inform Community Health Needs Assessments
 - Target scarce community intervention resources

CHR&R Model



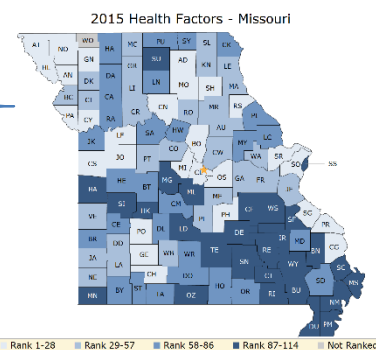
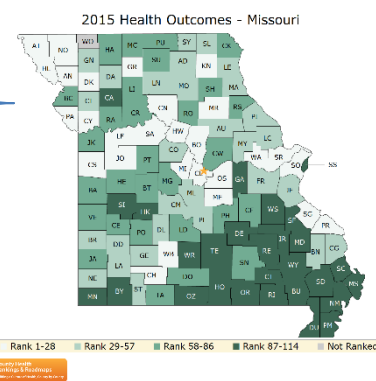
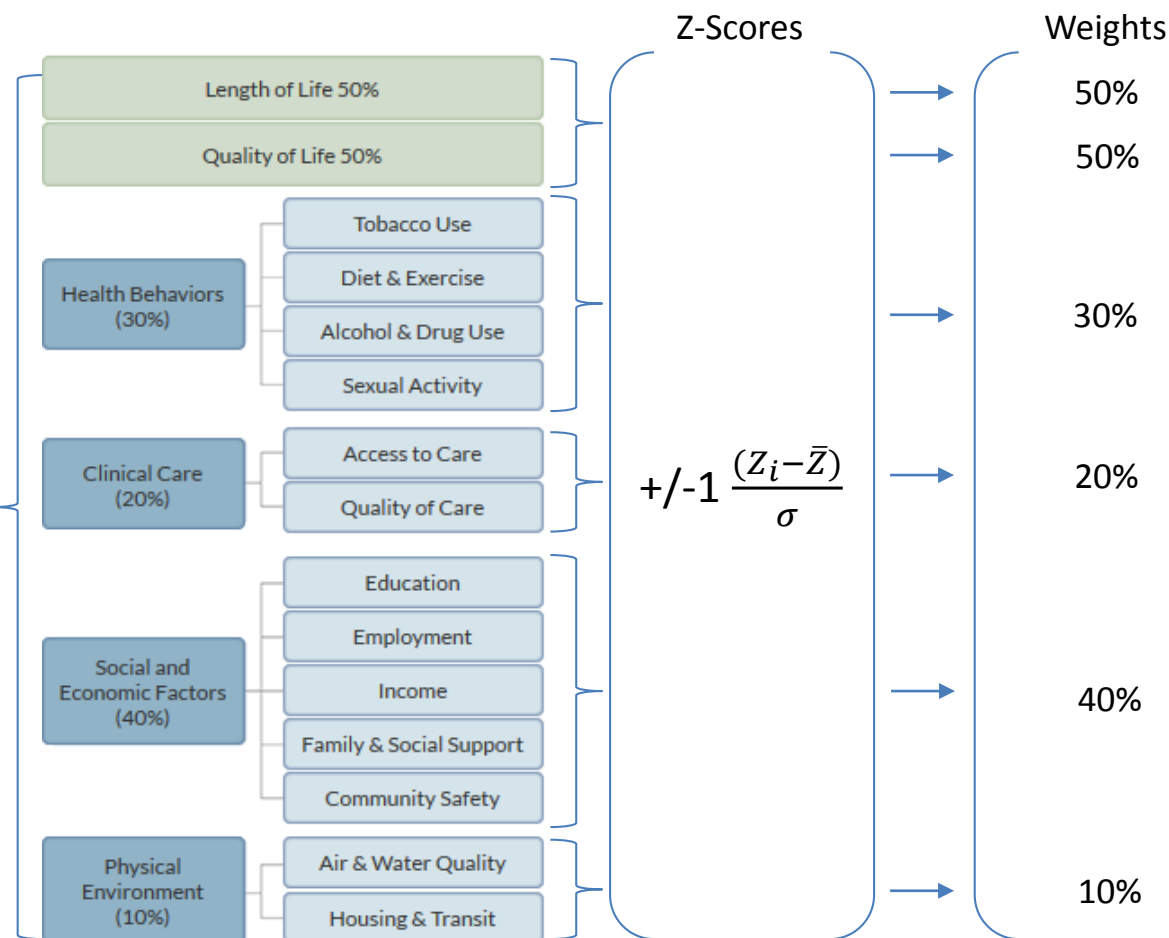
County Health Rankings model © 2014 UWPHI

- County-level health ranking system for 50 states and DC
- Population health model:
 - Health policies and programs influence health factors that result in health outcomes
- Measures compiled from 20+ sources into health factors and health outcomes domains
 - CDC, Census, BLS, USDA, FBI, HRSA, Dartmouth, etc.
- Overarching Goal: Promote action by raising awareness of multiple factors influencing health differently across counties
 - Prioritize → Intervene → Evaluate → Repeat

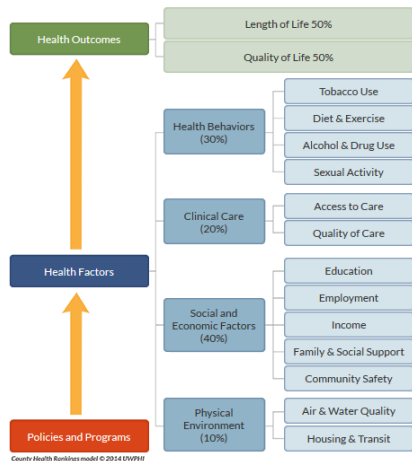
CHR&R Measurement

Measures → Model → Standardize & Weight → 2 Ranked Domains

20+
Sources



Our Approach



- Based on underlying CHR&R population health model
- Uses data available at ZIP-level
 - 3yrs hospital IP/OP/ED discharges (health factors)
 - Nielsen-Claritas (socioeconomic/demographic/environmental factors)
- ZIP-level indices fit to CHR&R domains
- Weighted aggregation at county-level for comparison to CHR&R results
- Scalable to other states



Data & Methods

- Data

- HIDI FY 2012-2014 Inpatient, Outpatient & ED Discharges for Missouri Residents
 - 36,176,000 Records
 - Health Factors & Outcomes Identified with diagnosis, CCS, MDC, Disposition & Expected Payer Codes
 - Aggregated at County & ZIP Levels
- Nielsen-Claritas 2015 PopFacts Premier for Missouri Counties and ZIP Codes
 - Health Factors—Socioeconomic, Clinical Access & Environmental Factors

- Methods

- Candidate variables screened evaluated at county-level with pairwise correlations and stepwise regression
- Model refined using principle components analysis & multilevel modeling
 - Standardized ZIP data → principal components → multilevel regression * ZIP to county weighting file
- Derived county-level results compared with 2015 CHR&R Ranks with using pairwise correlation and weighted kappa methods
- Proportion of variation at sub-county level assessed with model-based intra-class correlations and visually depicted using mapping methods

Comparative Results: County to County

Health Factors:

Weighted Kappa = 0.66

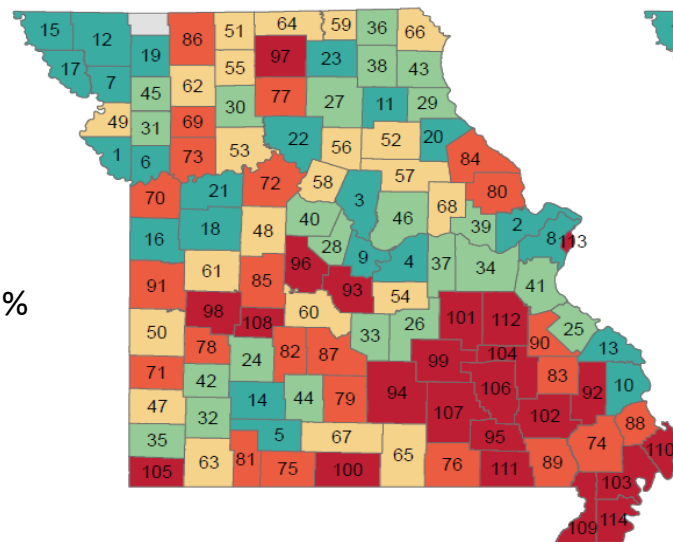
Correlation = 0.87

Percent of Counties in:

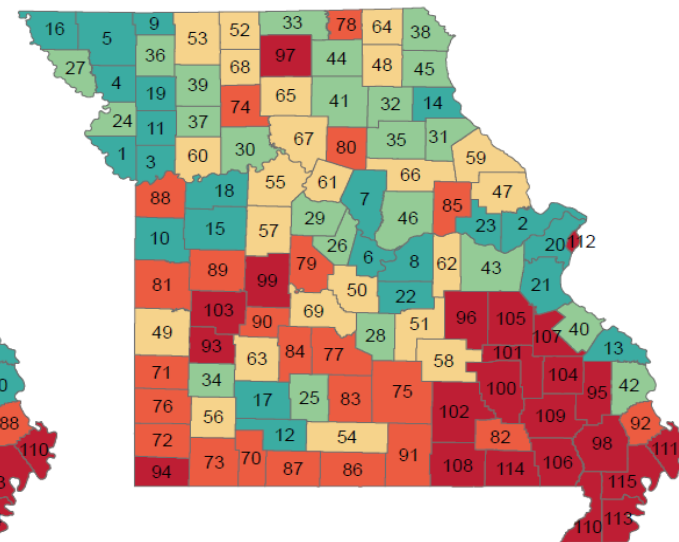
Same Quintile = 48%

Within One Quintile = 93%

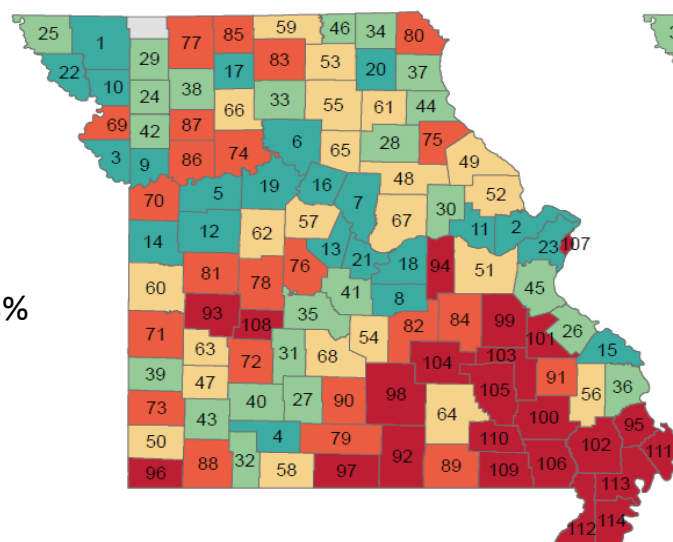
2015 CHR&R Health Factors Rankings



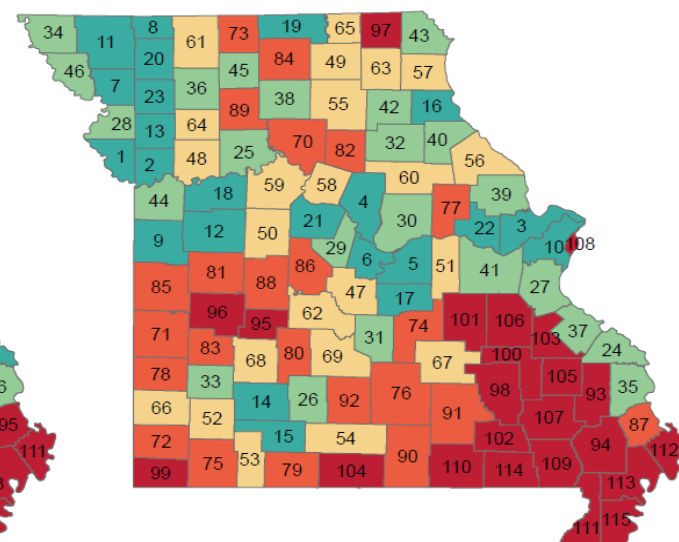
Aggregated ZIP-Derived Health Factors Rankings



2015 CHR&R Health Outcomes Rankings



Aggregated ZIP-Derived Health Outcomes Rankings:
CHR&R Augmented Model Option



Health Outcomes:

Weighted Kappa = 0.54

Correlation = 0.83

Percent of Counties in:

Same Quintile = 49%

Within One Quintile = 83%

Comparative Results: County to ZIP Code

Sub-County Variation:

- Approximately half of the variation in derived health factors and outcomes scores observed at the ZIP code level

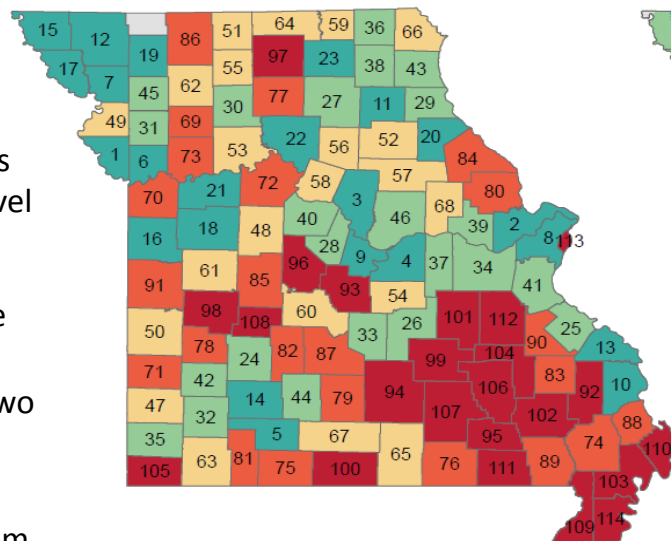
Health Factors:

- 38.9%** of ZIP codes in same quintile as parent county.
- 15.9%** of ZIP codes in top two CHR&R county quintiles in bottom two ZIP quintiles.
- 18.2%** of ZIP codes in bottom two CHR&R county quintiles in top two ZIP quintiles.

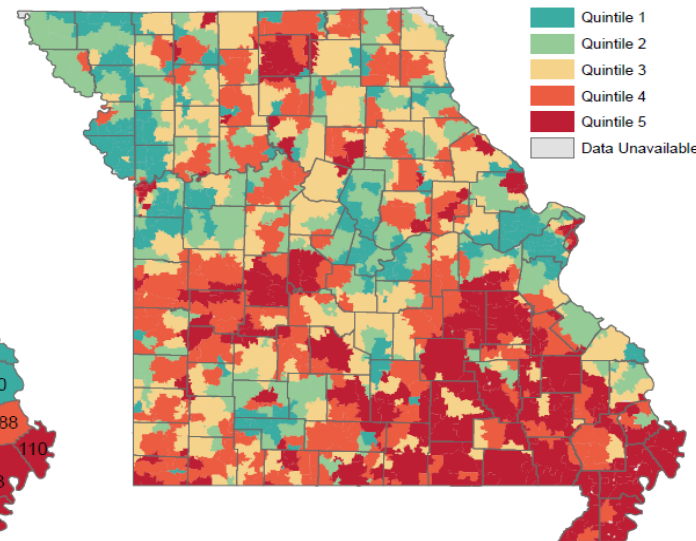
Health Outcomes:

- 36.4%** of ZIP codes in same quintile as parent county.
- 20.5%** of ZIP codes in top two CHR&R county quintiles in bottom two ZIP quintiles.
- 22%** of ZIP codes in bottom two CHR&R county quintiles in top two ZIP quintiles.

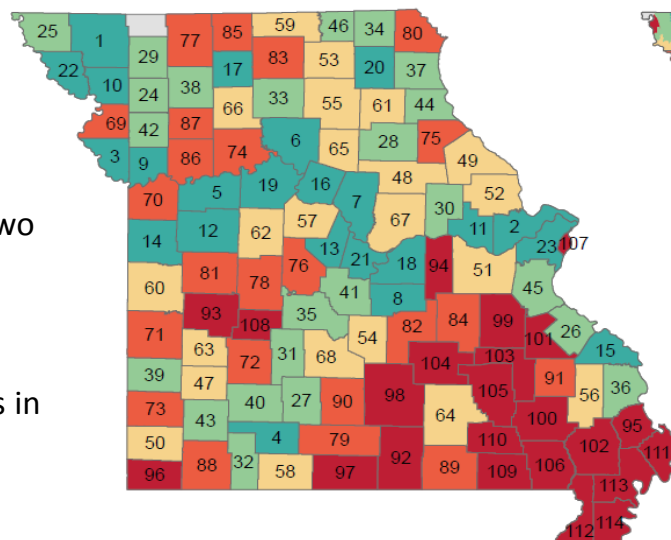
2015 CHR&R Health Factors Rankings



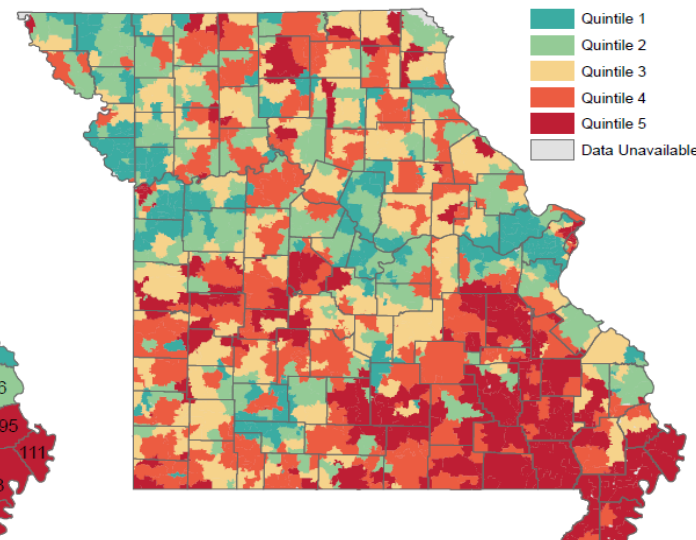
ZIP-Level Health Factors Rankings



2015 CHR&R Health Outcomes Rankings



ZIP-Level Health Outcomes Rankings:
CHR&R Augmented Model Option



Comparative Results: County to ZIP Code

Sub-County Variation:

- Approximately half of the variation in derived health factors and outcomes scores observed at the ZIP code level

Health Factors:

- 38.9%** of ZIP codes in same quintile as parent county.
- 15.9%** of ZIP codes in top-two CHR&R county quintiles in bottom-two ZIP quintiles.
- 18.2%** of ZIP codes in bottom-two CHR&R county quintiles in top-two ZIP quintiles.

Health Outcomes:

- 36.4%** of ZIP codes in same quintile as parent county.
- 20.5%** of ZIP codes in top-two CHR&R county quintiles in bottom-two ZIP quintiles.
- 22%** of ZIP codes in bottom-two CHR&R county quintiles in top-two ZIP quintiles.

ZIP Combined Quintile							ZIP Health Ranking vs. 2015 CHR		
							Combined Agreement	#	%
CHR Combined Quintile	1	2	3	4	5	Total	4-5Q ZIPs in 1-2Q County	74	17.7%
	123	68	28	14	13	246	4-5Q ZIPs in Top Q County	27	11.0%
	24	46	55	40	7	172	1-2Q ZIPs in 4-5Q County	64	17.6%
	17	41	51	53	18	180	1-2Q ZIPs in Bottom Q County	12	7.1%
	23	29	43	42	59	196	ZIPs in same Q as Parent County	359	37.3%
	4	8	15	44	97	168			
Total	191	192	192	193	194	962			

ZIP HO Quintile							Heath Outcomes Agreement		
								#	%
CHR HO Quintile	1	2	3	4	5	Total	4-5Q ZIPs in 1-2Q County	83	20.5%
	109	63	28	24	10	234	4-5Q ZIPs in Top Q County	34	14.5%
	29	41	51	33	16	170	1-2Q ZIPs in 4-5Q County	83	22.0%
	20	38	57	42	23	180	1-2Q ZIPs in Bottom Q County	14	8.1%
	29	40	35	50	52	206	ZIPs in same Q as Parent County	350	36.4%
	4	10	21	44	93	172			
Total	191	192	192	193	194	962			

ZIP HF Quintile							Health Factors Agreement		
								#	%
CHR HF Quintile	1	2	3	4	5	Total	4-5Q ZIPs in 1-2Q County	67	15.9%
	119	71	31	12	13	246	4-5Q ZIPs in Top Q County	25	10.2%
	25	52	56	33	9	175	1-2Q ZIPs in 4-5Q County	69	18.2%
	16	32	52	49	13	162	1-2Q ZIPs in Bottom Q County	18	10.4%
	25	26	31	58	66	206	ZIPs in same Q as Parent County	374	38.9%
	6	12	21	41	93	173			
Total	191	193	191	193	194	962			

ZIP worse than parent county

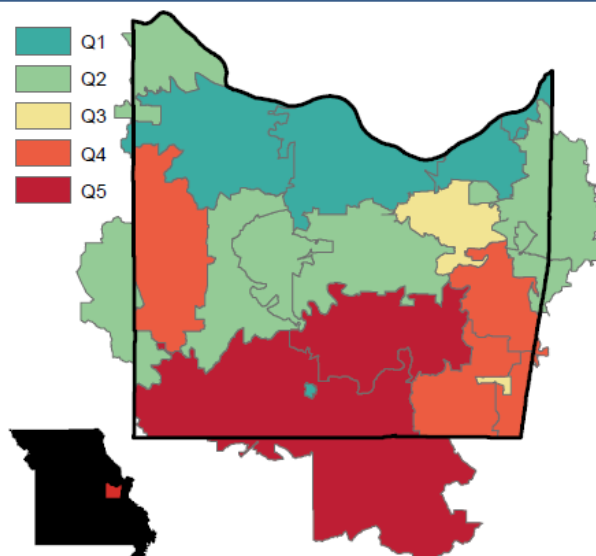
ZIP better than parent county

ZIP same as parent county

Sub-County Variation: Rural and Urban Examples

Rural Franklin County, Missouri

ZIP Ranking Range:
158 to 828 (of 976)



Franklin County Characteristics

Health Factors Rank: 38 of 115
Health Outcomes Rank: 35 of 115
2015 Population 102,426
Percent Non-White: 3.4

Top-Ranked ZIP Codes

ZIP	Name	Statewide Rank of 976
63068	New Haven	158
63055	Labadie	165
63090	Washington	180

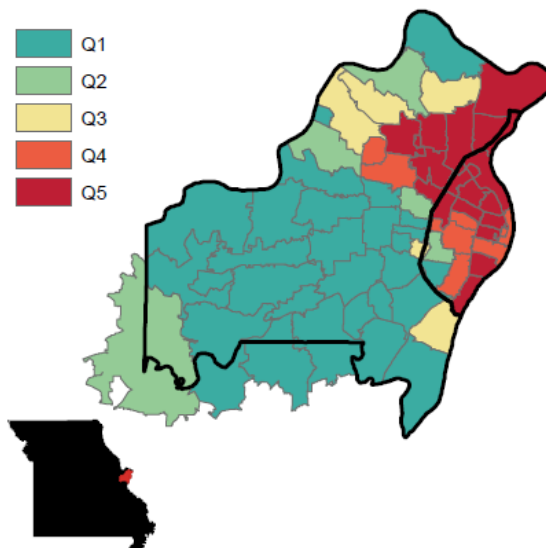
Bottom-Ranked ZIP Codes

ZIP	Name	Statewide Rank of 976	Top Health Determinant	Top Social Determinant
63077	Saint Clair	828	Smoking	Unemployment
63080	Sullivan	810	Mental Health	ED Visits
63041	Grubville	753	Premature Deaths	Childhood Poverty
63072	Robertsville	686	Smoking	Unemployment
63037	Gerald	649	Kidney Disease	Preventable ED Visits
63060	Lonedell	645	Smoking	Unemployment

Sources: Author's Calculations, 2016 County Health Rankings, and Roadmaps and U.S. Census Bureau QuickFacts

Urban St. Louis City & County, Missouri

ZIP Ranking Range:
2 to 964 (of 976)



St. Louis city and County Characteristics

Health Factors Rank: 114 & 3 of 115
Health Outcomes Rank: 111 & 20 of 115
2015 Combined Population 1,319,047
Percent Non-White: 35.9

Top-Ranked ZIP Codes

ZIP	Name	Statewide Rank of 976
63005	Chesterfield	2
63038	Glencoe	4
63040	Grover	5

Bottom-Ranked ZIP Codes

ZIP	Name	Statewide Rank of 976	Top Health Determinant	Top Social Determinant
63107	North City E.	964	Asthma	Unemployment
63113	The Ville	963	Asthma	Unemployment
63115	North City W.	962	Asthma	Unemployment
63133	Pagedale-Wellston	942	Asthma	Single Parent Household
63136	Jennings	929	Asthma	Single Parent Household
63134	Berkeley	914	Asthma	Single Parent Household

Sources: Author's Calculations, 2016 County Health Rankings, and Roadmaps and U.S. Census Bureau QuickFacts



Advisory Committee Feedback

Uses for Sub-County Data:

- Raising awareness of how needs vary within counties
- Distribute resources to where the needs are greatest
- Engage communities on health issues and factors that support healthy communities

Focal Audiences:

- Local public health agencies
- Hospital community-benefit programs
- Community health improvement programs
- Policymakers and advocates

Keys to Usability:

- Establish that data is trustworthy and reliable
- Develop a data delivery platform that is accessible for varied data skill sets among focal audiences
- Offer flexibility to stratify and group data in multiple ways (counties, legislative districts, defined service areas)



The Road Ahead

- Interactive reporting platform
- Evaluation of end-user data needs and experience
- Sustained production and delivery for Missouri
- Extension to other states
- Peer-reviewed manuscript

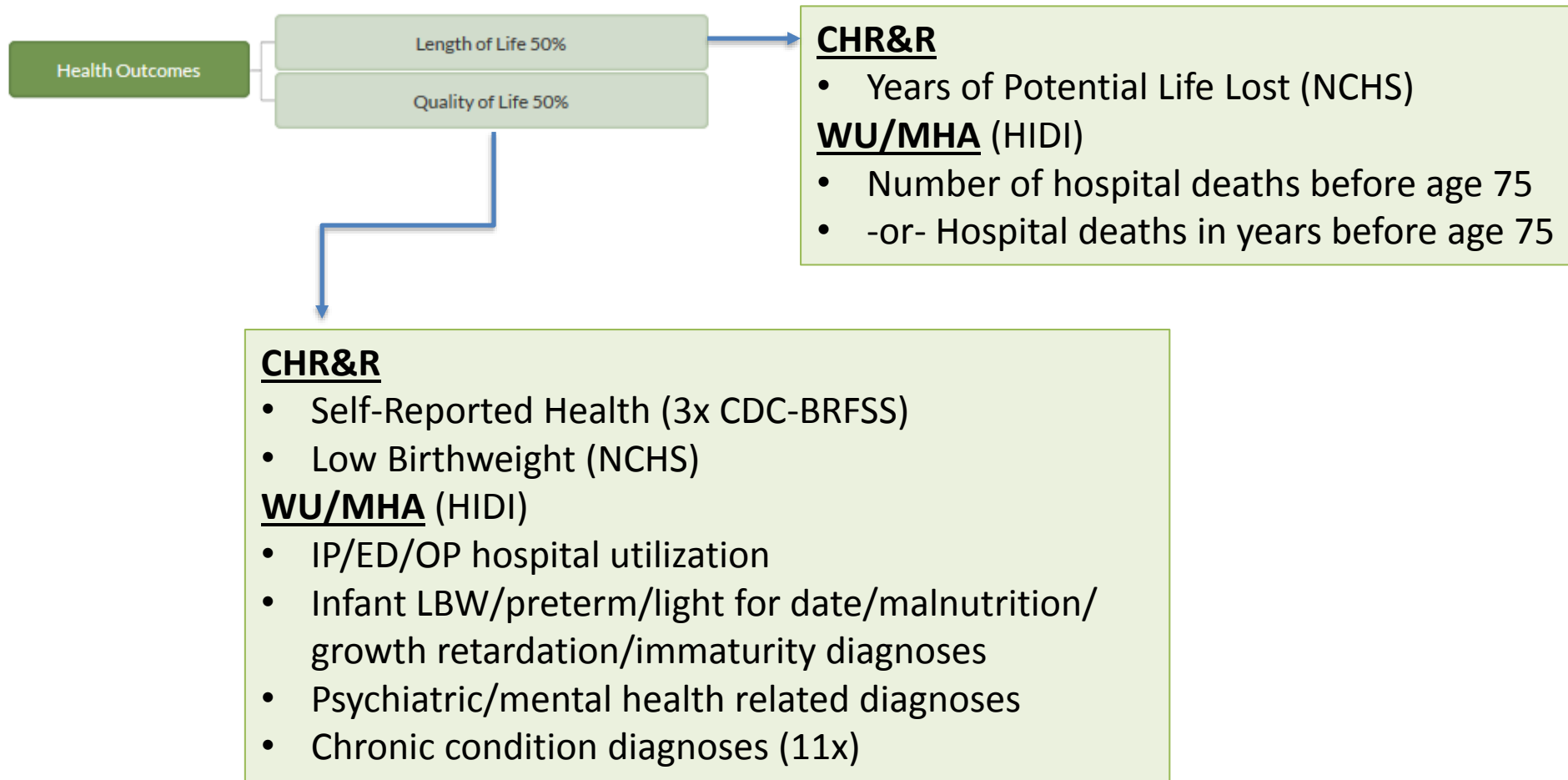


Discussion

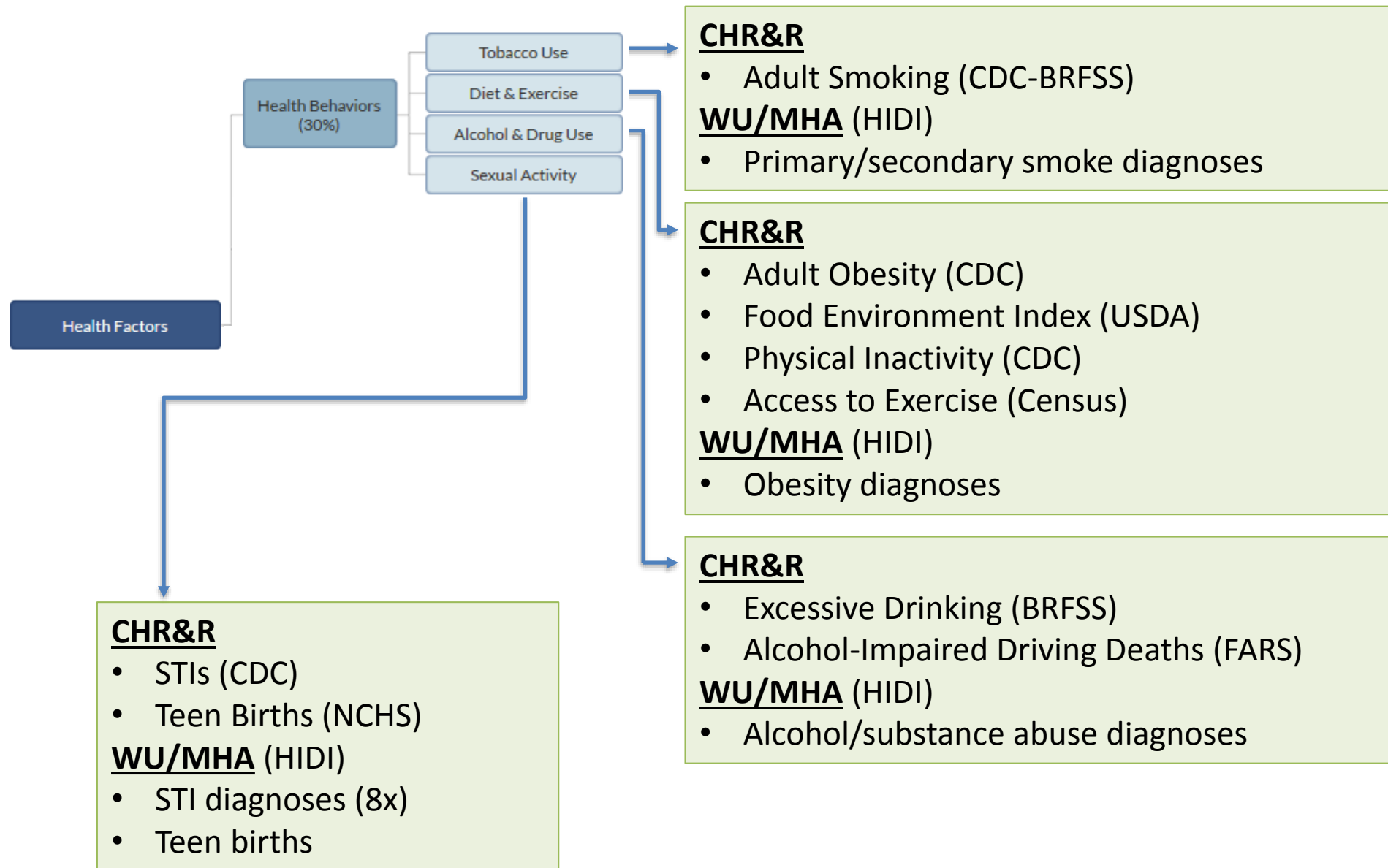
- Contact information:

Brian Waterman, VP of Analytic Business Solutions
Missouri Hospital Association
Hospital Industry Data Institute
bwaterman@mhanet.com

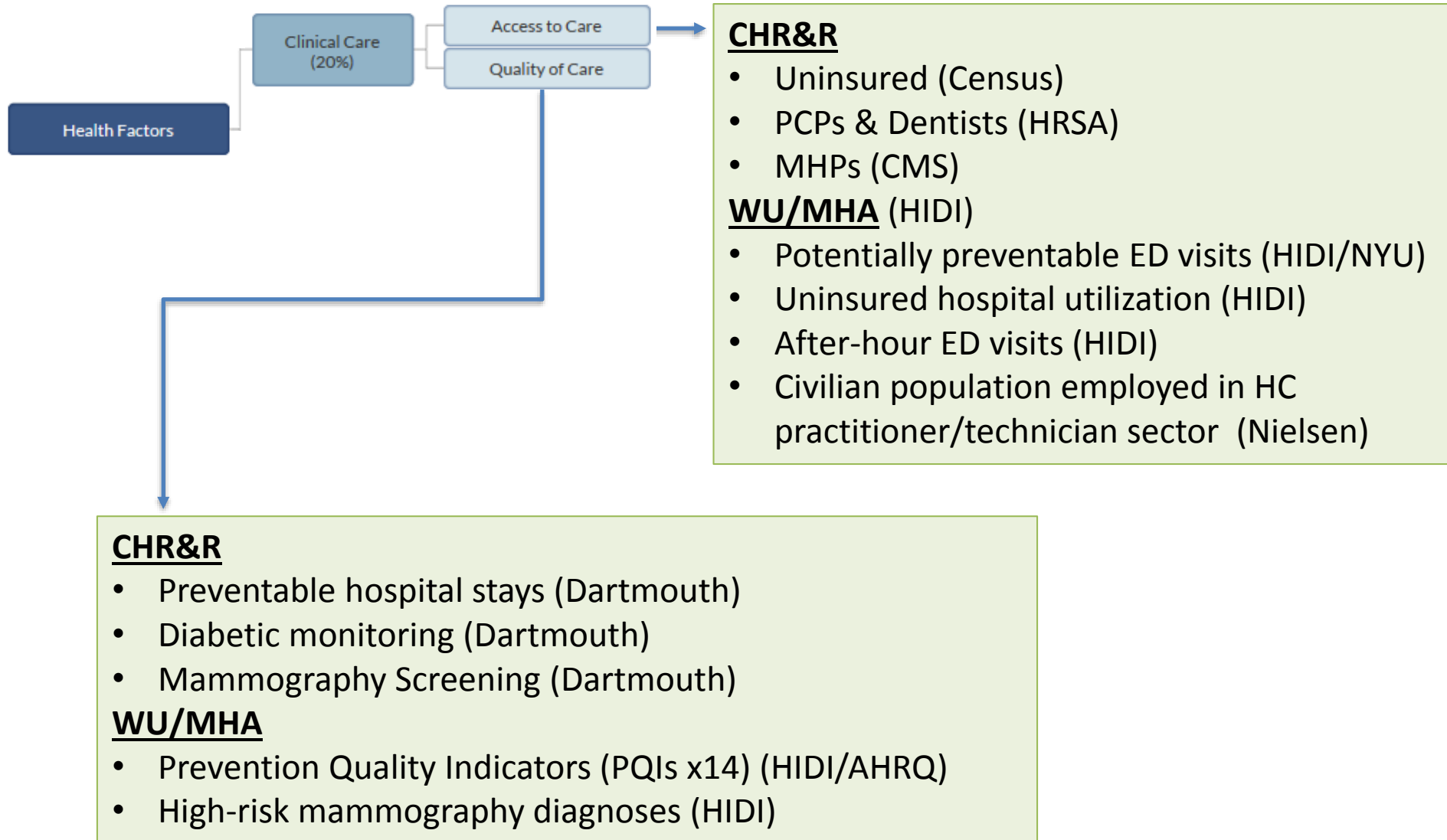
Data Map: Health Outcomes



Data Map: Health Factors--Behaviors



Data Map: Health Factors—Clinical Care



Data Map: Health Factors—SES Factors

Health Factors

Social and Economic Factors (40%)

Education

Employment

Income

Family & Social Support

Community Safety

CHR&R

- Violent crimes (FBI)
- Injury deaths (CDC)

WU/MHA (HIDI)

- Assault diagnoses
- Deaths with injury diagnoses

CHR&R (Census)

- Children in single-parent households
- Social associations

WU/MHA (Nielsen)

- Average household size
- Female headed households

CHR&R (Census)

- HS Grad; Some College
- ### WU/MHA (Nielsen)
- Age 25+ <HS; HS Grad; Some College

CHR&R (BLS)

- Unemployment
- ### WU/MHA (Nielsen)
- Unemployment
 - Blue collar occupation

CHR&R (Census)

- Children in poverty
- Income inequality

WU/MHA

- Childhood poverty (Nielsen)
- Income inequality = white median HHY : black median HHY (Nielsen)
- Median household income (Nielsen)
- Median home value (Nielsen)
- Rate of Medicaid hospital utilization (HIDI)

Data Map: Health Factors—Environmental

Health Factors



CHR&R

- Air pollution-particulate matter (NCES)
- Drinking water violations (SDWIS)

WU/MHA (HIDI)

- Hospital utilization for asthma

CHR&R

- Severe housing problems (CHAS)
- Drive alone to work (Census)
- Long commute driving alone (Census)

WU/MHA (Nielsen)

- Vacant housing units
- Renter occupied housing units