Place Matters

Identifying High Priority Target Areas (HPTAs) in Virginia

May 2nd, 2016

ESRI Southeast User Conference

Charlotte, NC

Virginia Department of Health

Office of Minority Health & Health Equity

Rexford Anson-Dwamena, MPH

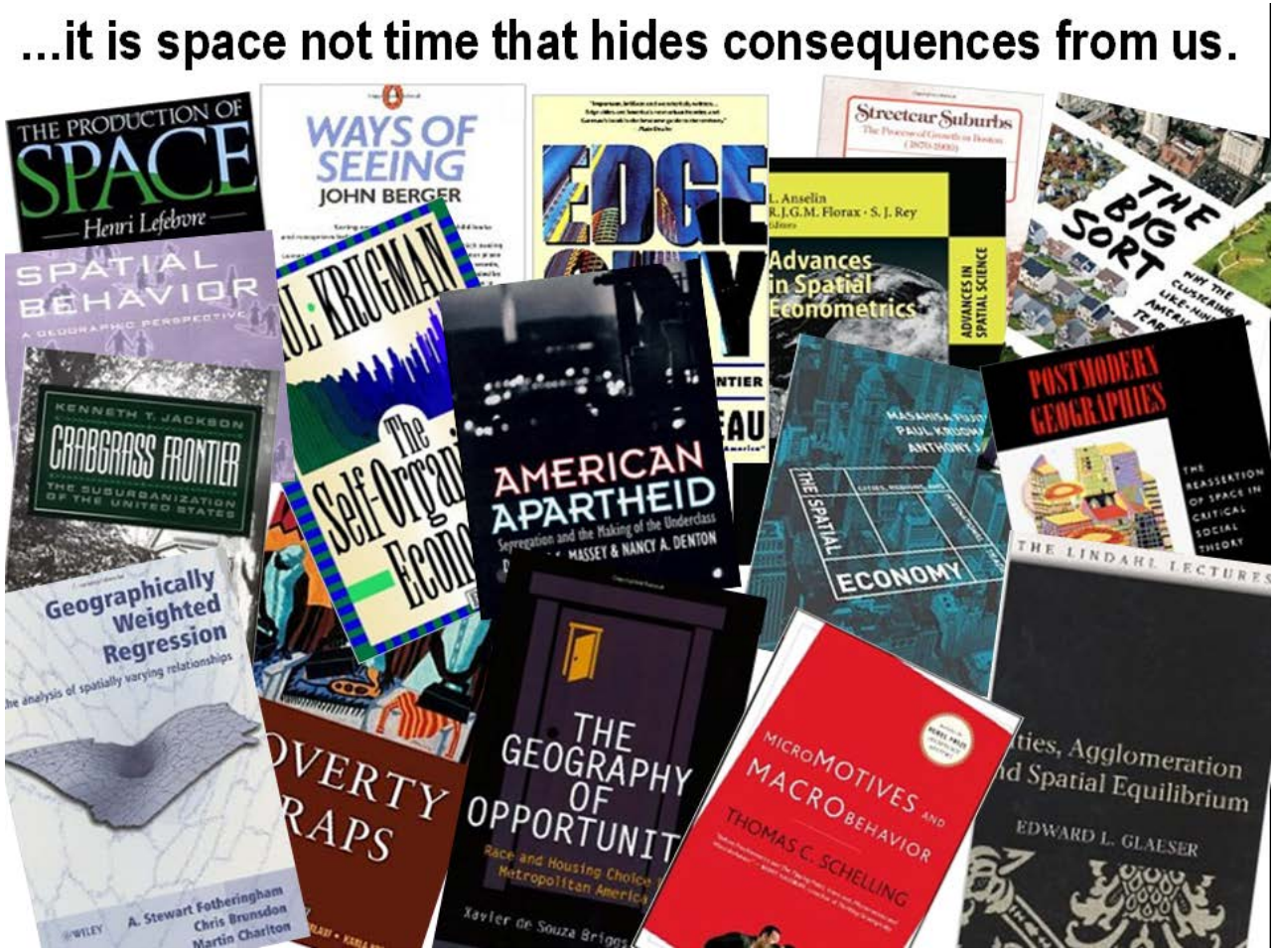
- **Objectives:**
- 1) Demonstrate knowledge of the variables used in creating a Health Opportunity Index and apply practical, community based solutions.
- 2) Determine how the Health Opportunity Index can be used to identify and address health disparities within the State.

John Snow, Father of Spatial Epidemiology

Map of Cholera Epidemic
1854

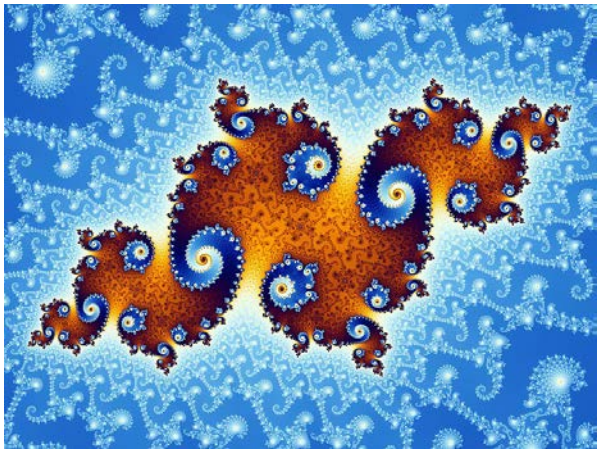
Place Matters

...it is space not time that hides consequences from us.

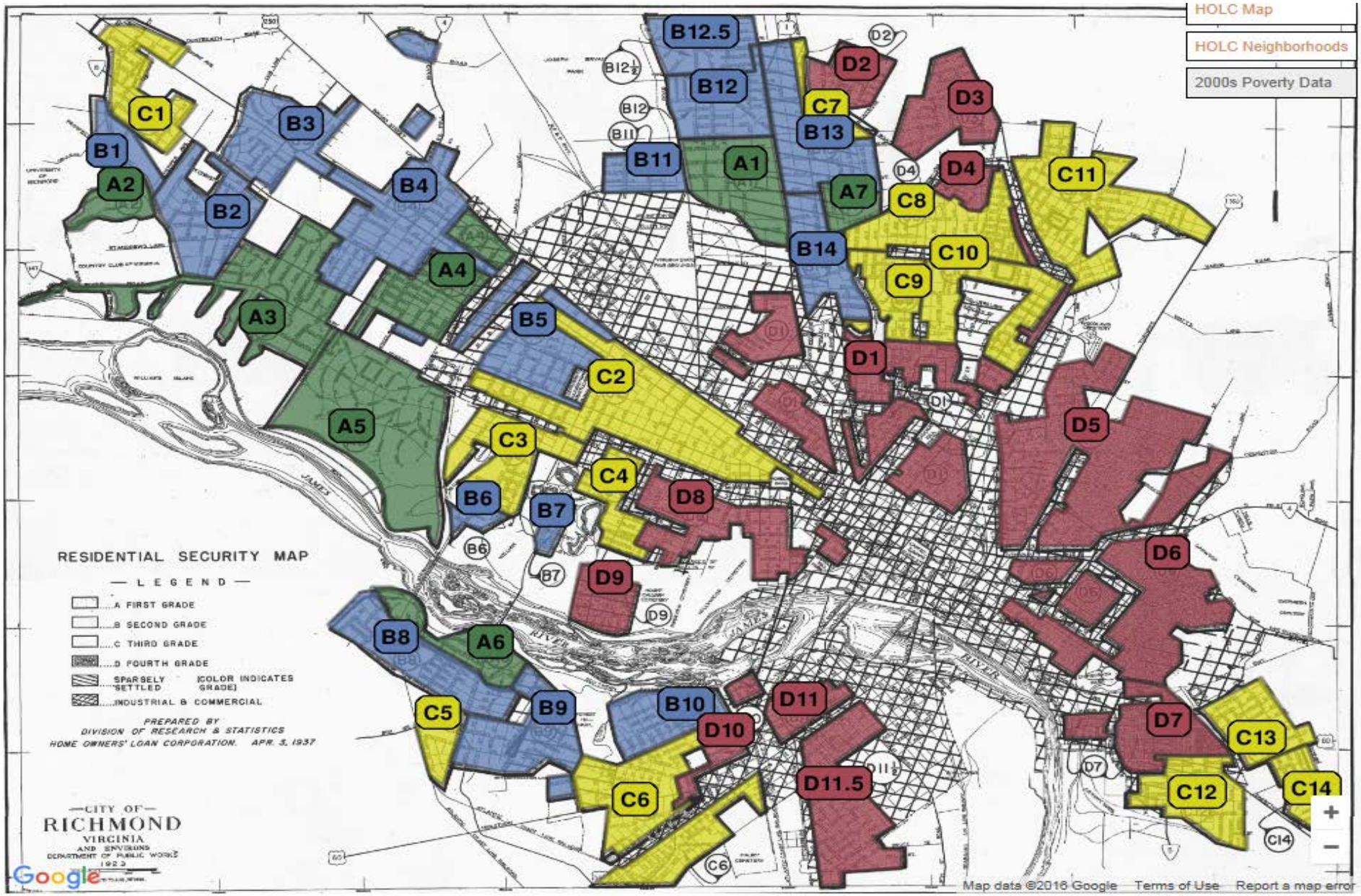


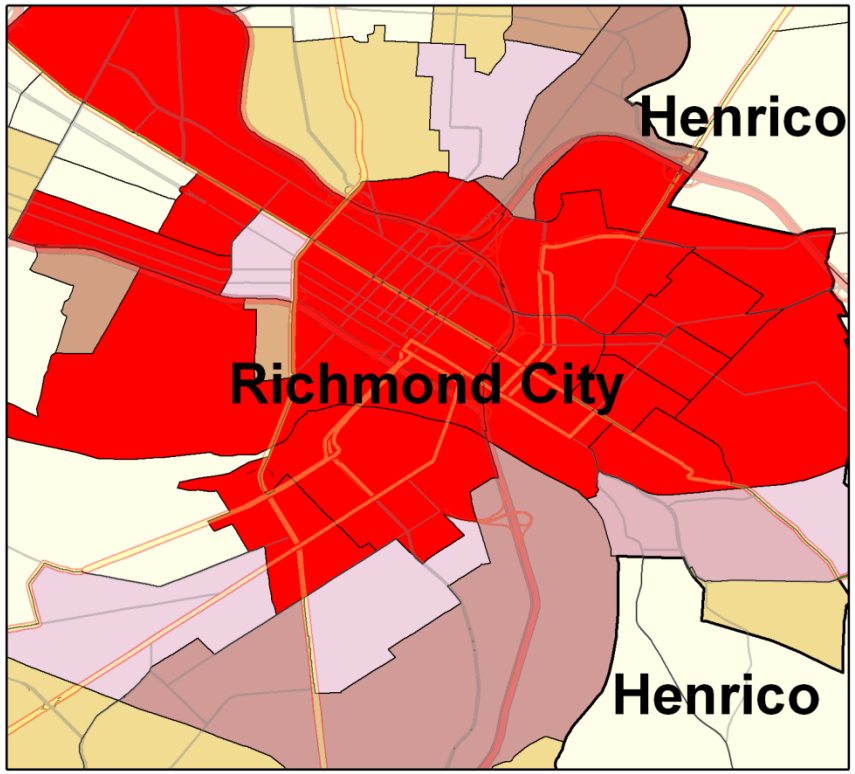
Things Change but….

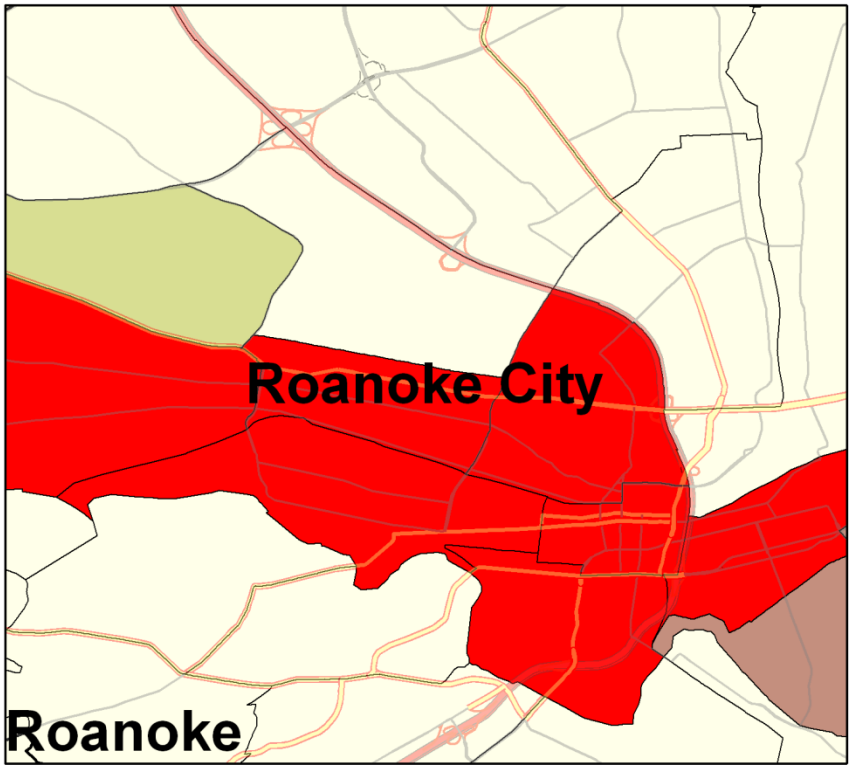
…systems remain highly sensitive to initial conditions



Chaos Theory (Butterfly Effect)





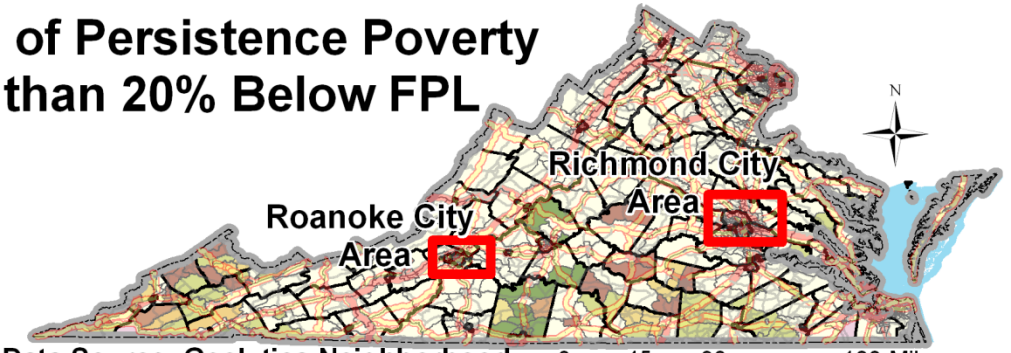


Decennial Census
> 20% Below Poverty

(0)	NONE
(3)	70
(5)	80
(7)	90
(8)	70, 80
(10)	70, 90
(11)	00
(12)	80, 90
(14)	70, 00
(15)	70, 80, 90
(16)	80, 00
(18)	90, 00
(19)	70, 80, 00
(21)	70, 90, 00
(23)	80, 90, 00
(26)	70, 80, 90, 00

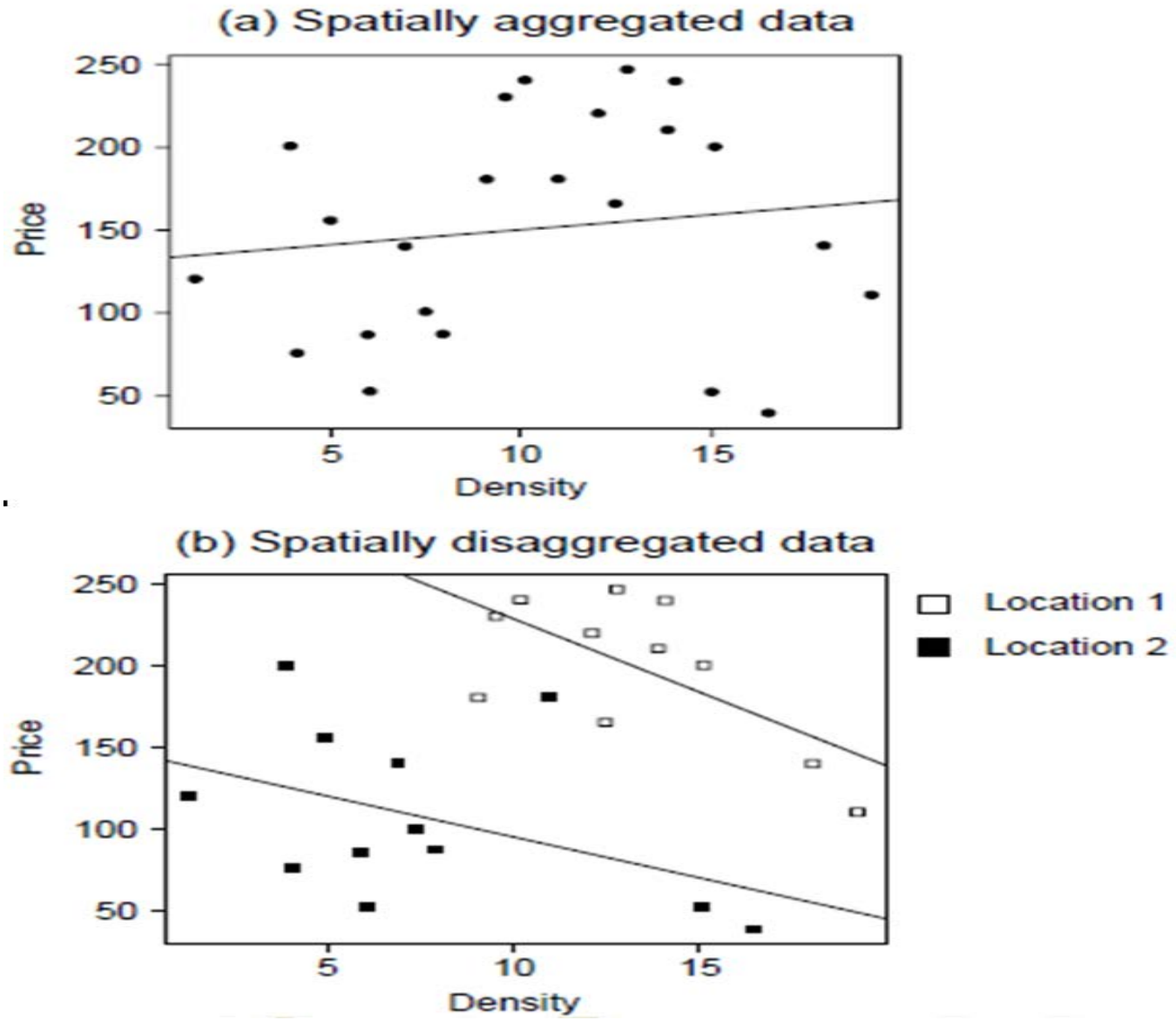
Virginia

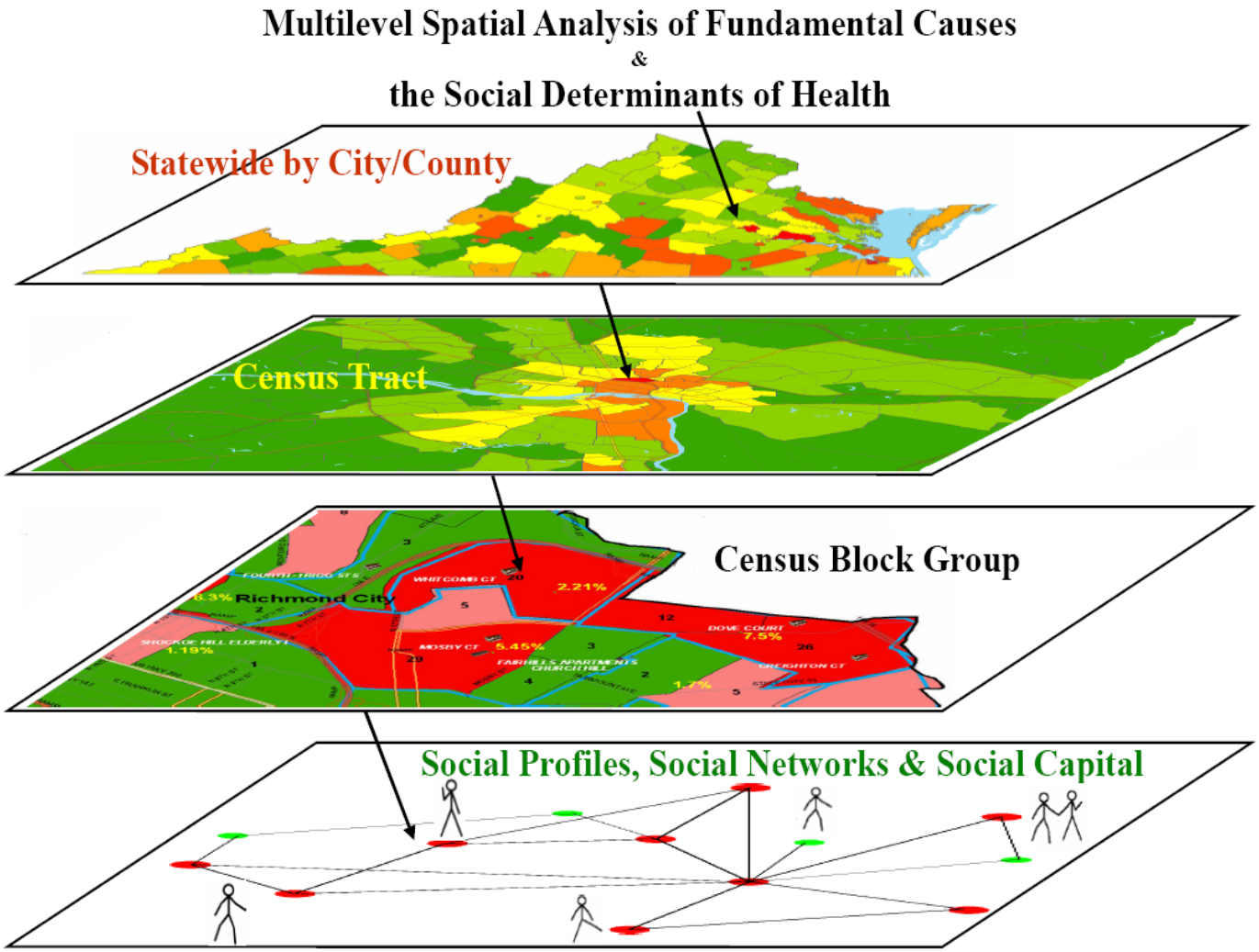
1970 ~ 2000 Census Tracts with Areas of Persistence Poverty Greater than 20% Below FPL

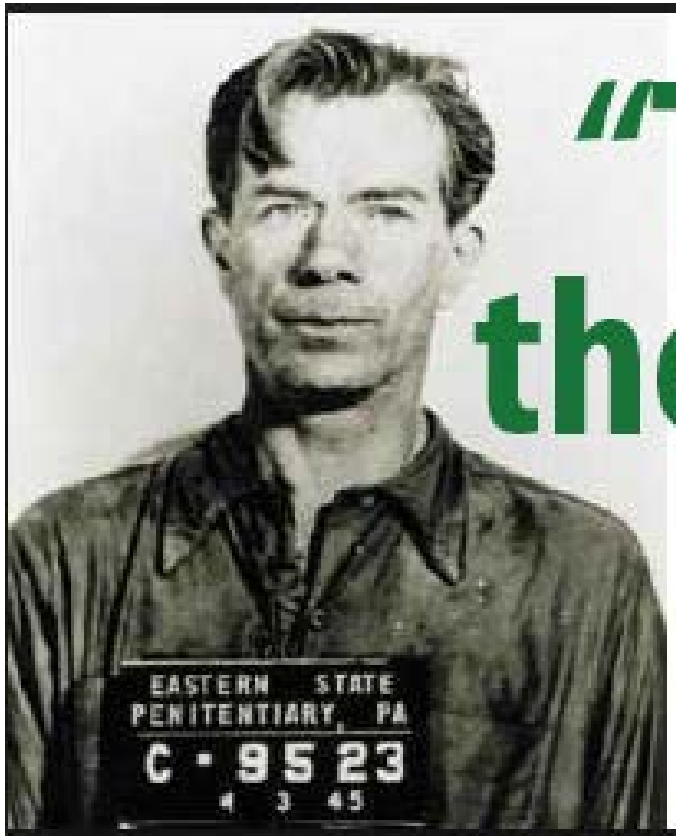


* Data Source: Geolytics Neighborhood Change Database, (NCDB) 1970 ~ 2000

Aggregation and Simpson's Paradox

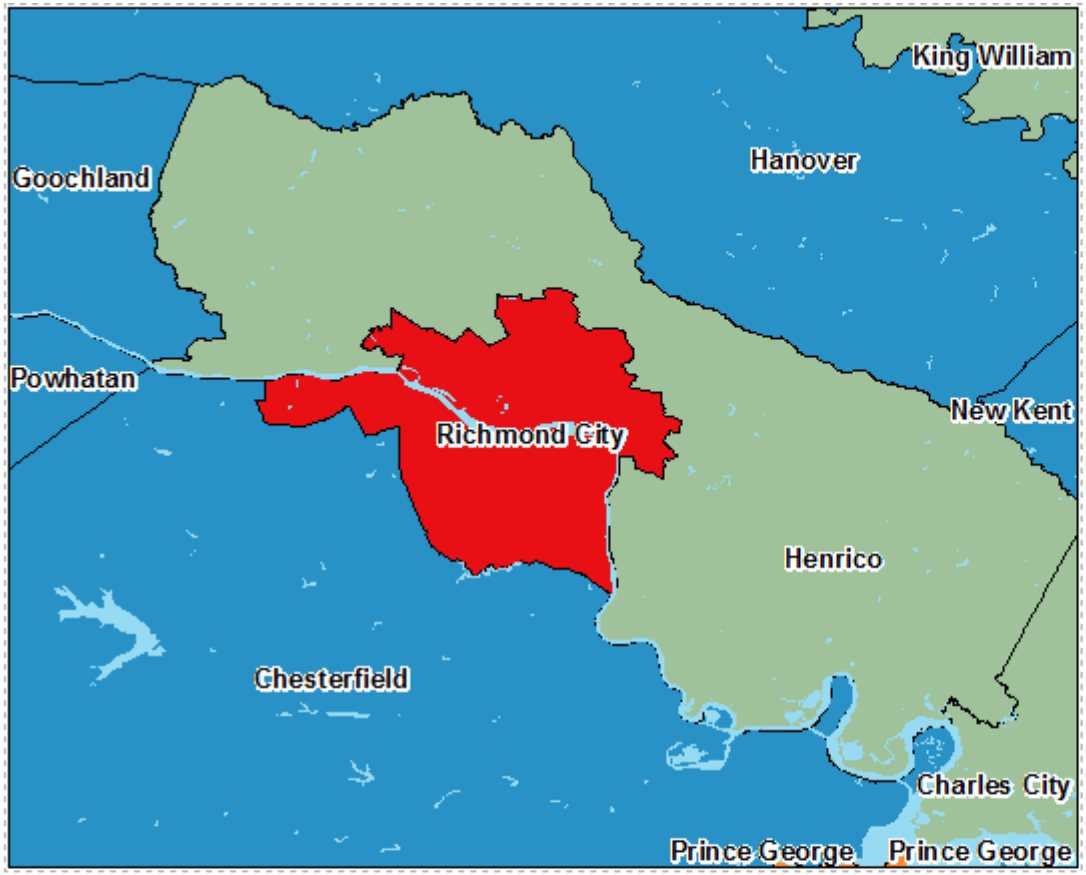



Multilevel Spatial Analysis of Fundamental Causes
&
the Social Determinants of Health
Statewide by City/County
Census Tract
Census Block Group
Richmond City
2.21%
5.45%
7.5%
Social Profiles, Social Networks & Social Capital



"That's Where the Money is..."

— *Willie Sutton*



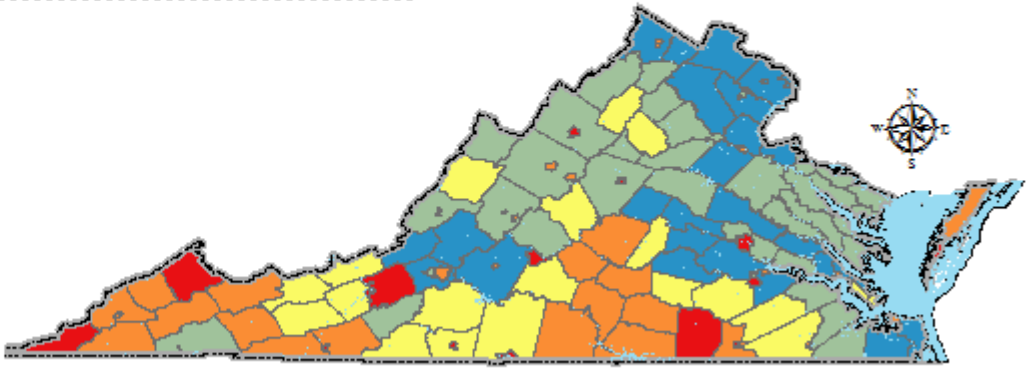
Virginia

Percent Poverty

2013 (5 Years Estimate)

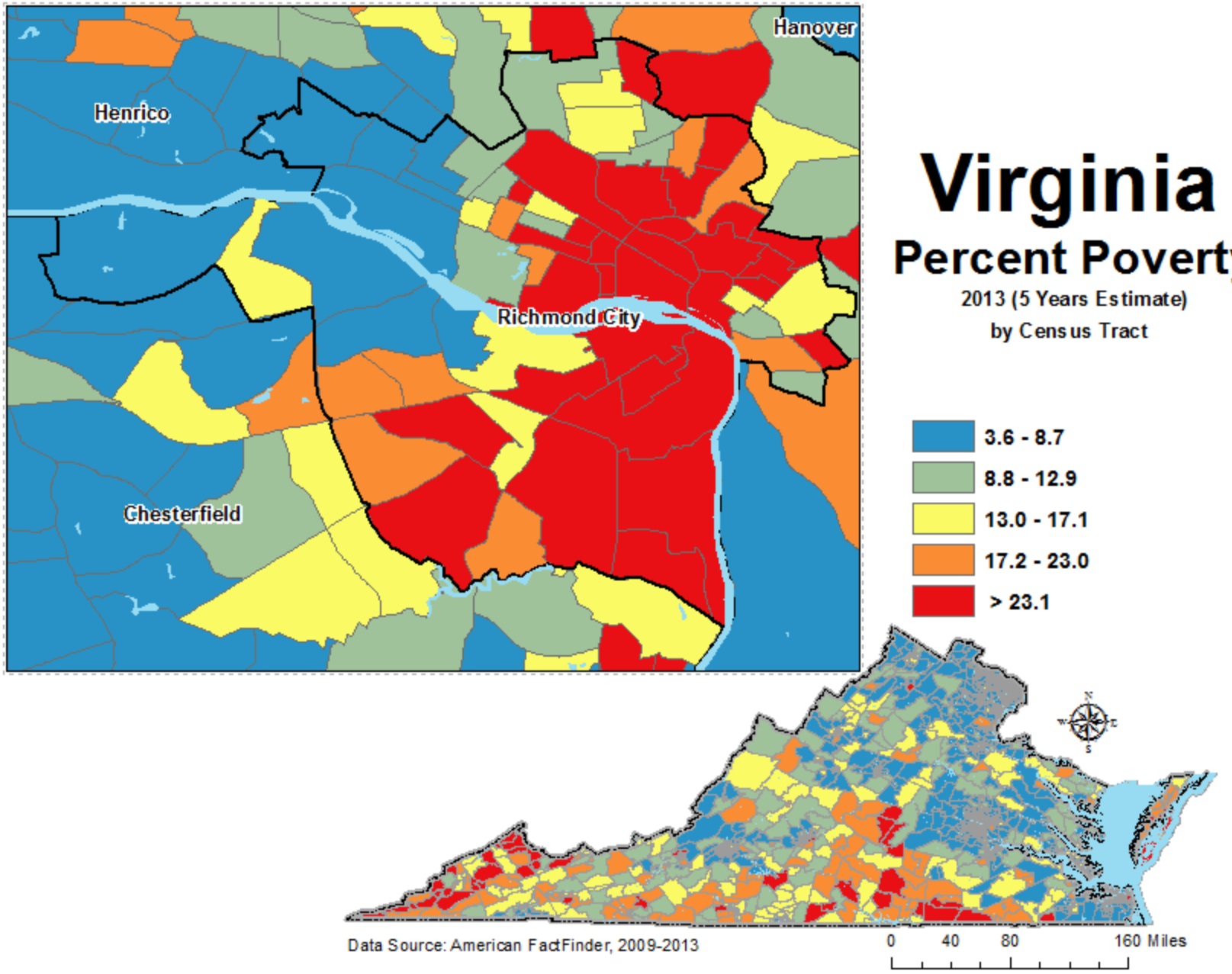
by County

- 3.6 - 8.7
- 8.8 - 12.9
- 13.0 - 17.1
- 17.2 - 23.0
- > 23.1



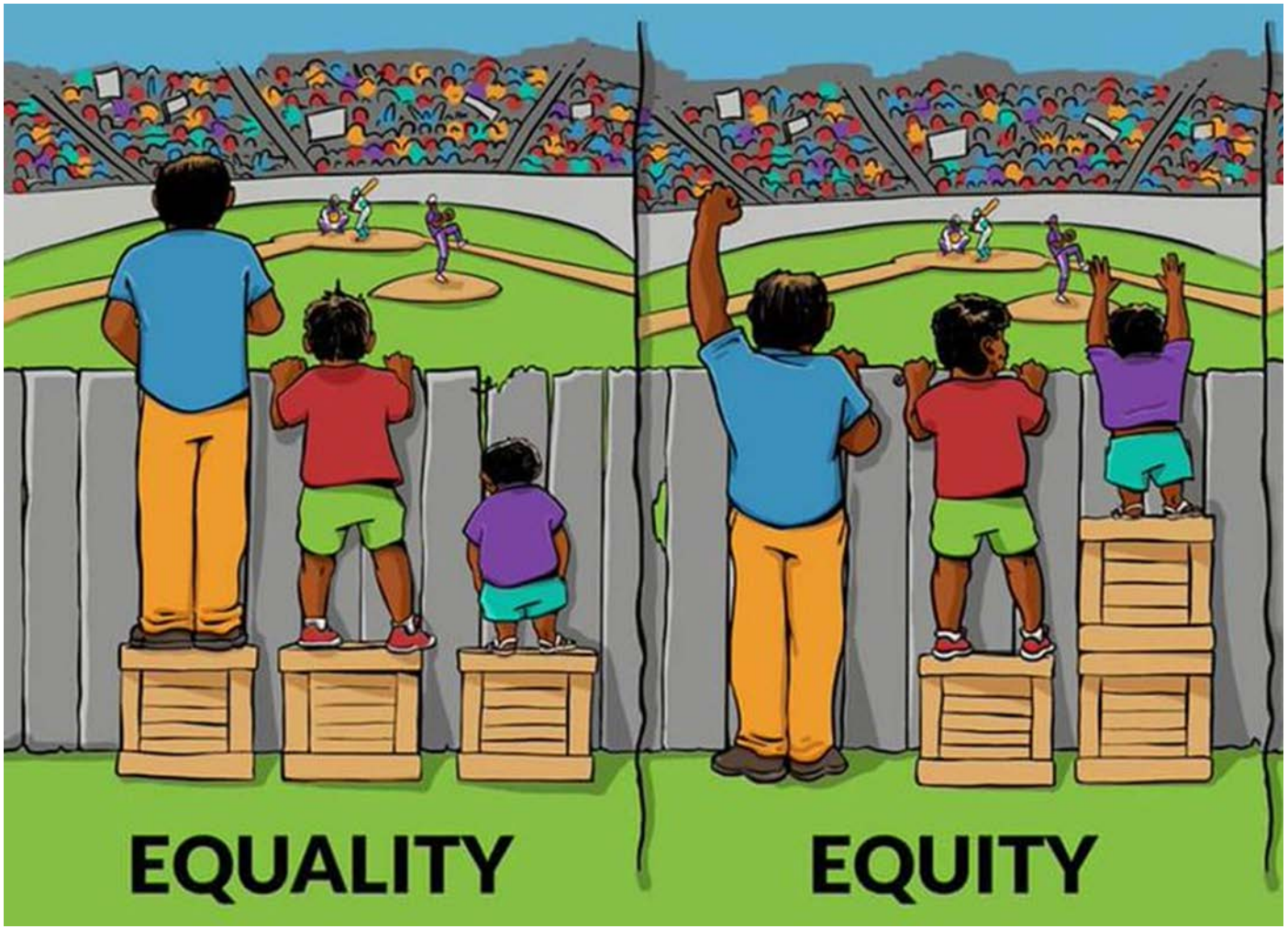
Data Source: American FactFinder, 2009-2013

0 55 110 220 Miles

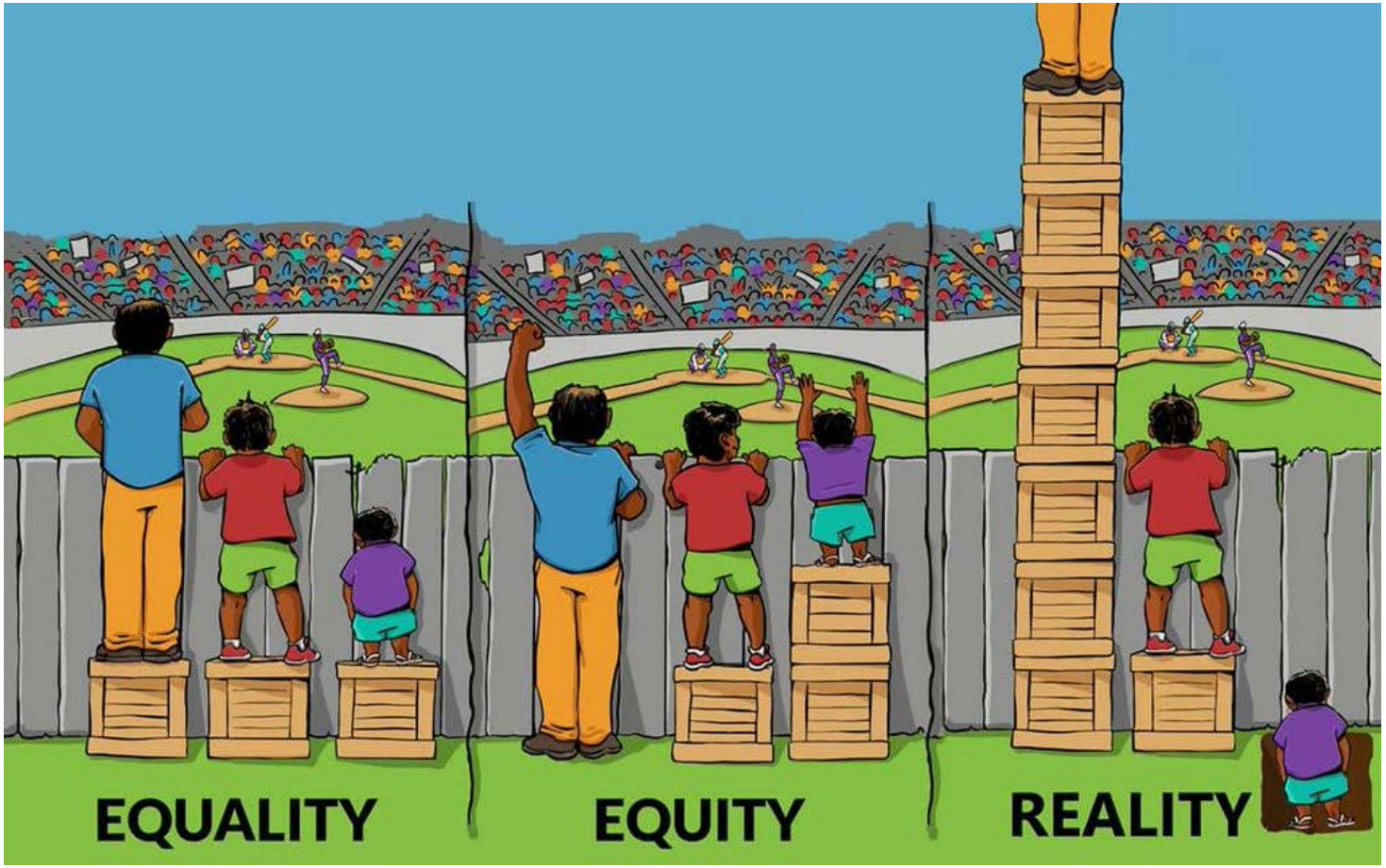

Hanover
Henrico
Richmond City
Chesterfield
Virginia
Percent Poverty
2013 (5 Years Estimate)
by Census Tract
3.6 - 8.7
8.8 - 12.9
13.0 - 17.1
17.2 - 23.0
> 23.1
N
W
E
S
Data Source: American FactFinder, 2009-2013
0
40
80
160 Miles

Why & How the Health Opportunity Index (HOI) Was Constructed

Health Equity



Health Equity



What is HOI?

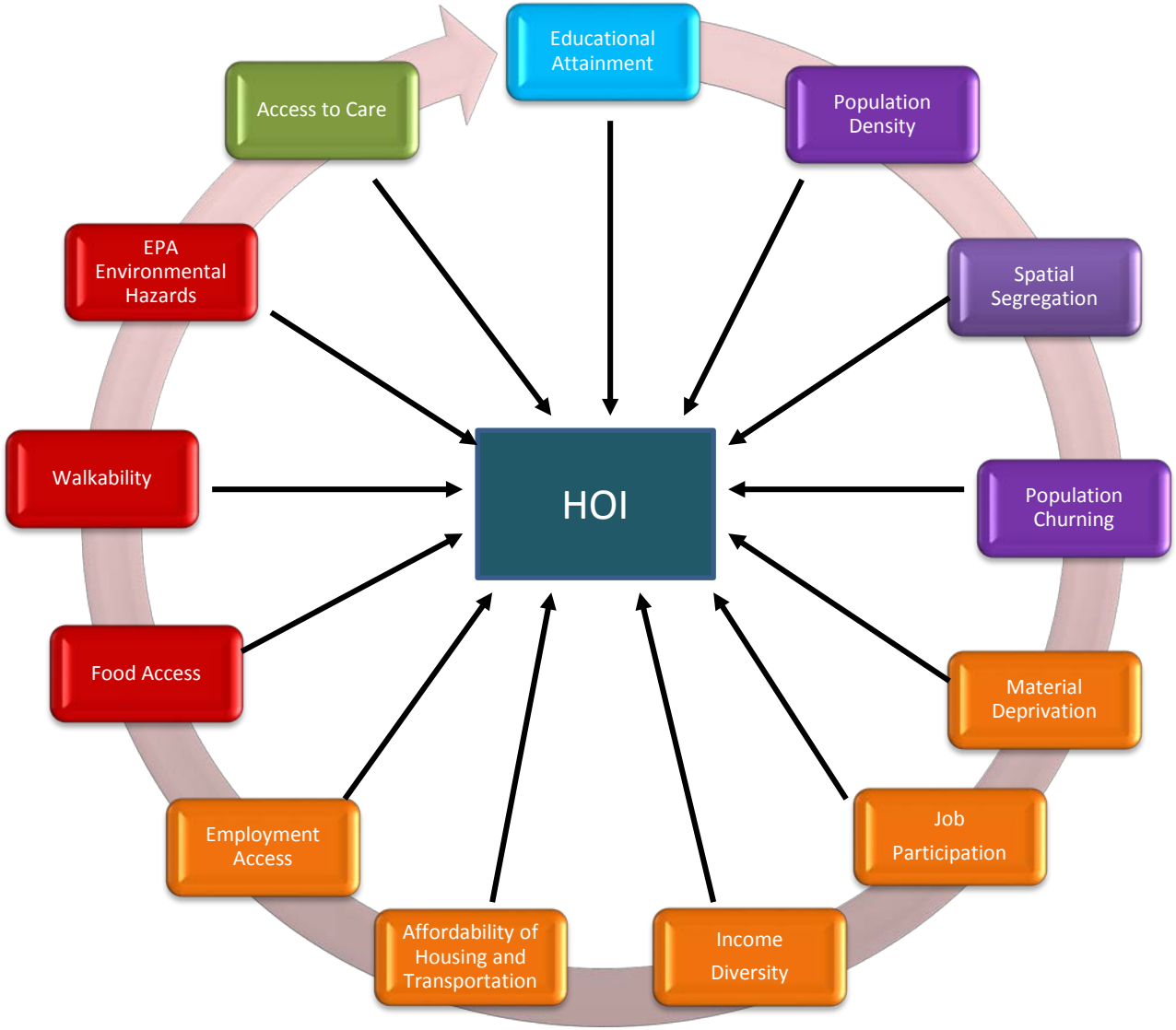
- Health opportunity Index (HOI) – The HOI is a composite measure comprising 13 indices that reflect a broad array of social determinants of health

Health Opportunity Index

Identifies areas and populations that are most vulnerable to adverse health outcomes based on Social Determinants of Health

Healthy People 2020: Five Elements of SDOH

Health Opportunity Index



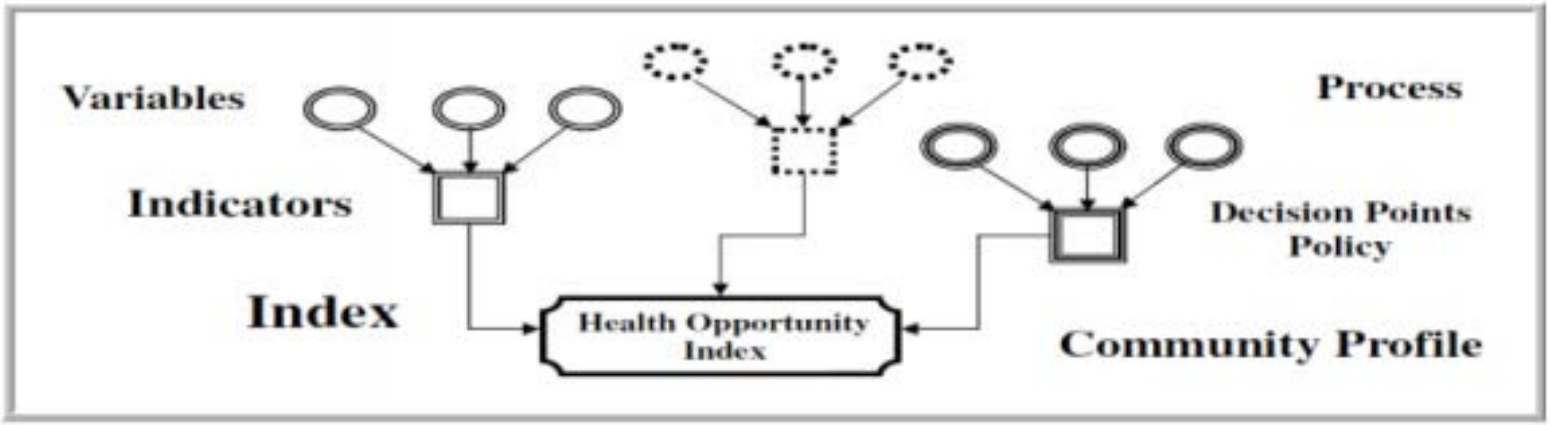
Structure

30+ Variables

13 Indicators

4 Profiles

1 Health Opportunity Index



The Health Opportunity Index 2.0

Environmental Quality Index (EPA)

Population Churning Index

Population-Weighted Density Index

Walkability Index *

Affordability Index

Education Index

Townsend Deprivation Index

Food Accessibility Index *

Employment Access Index

Income Inequality Index

Job Participation Index

Access to Care

Spatial Segregation Index *

*** Newly added indices to the HOI 2.0**

Health Opportunity Index

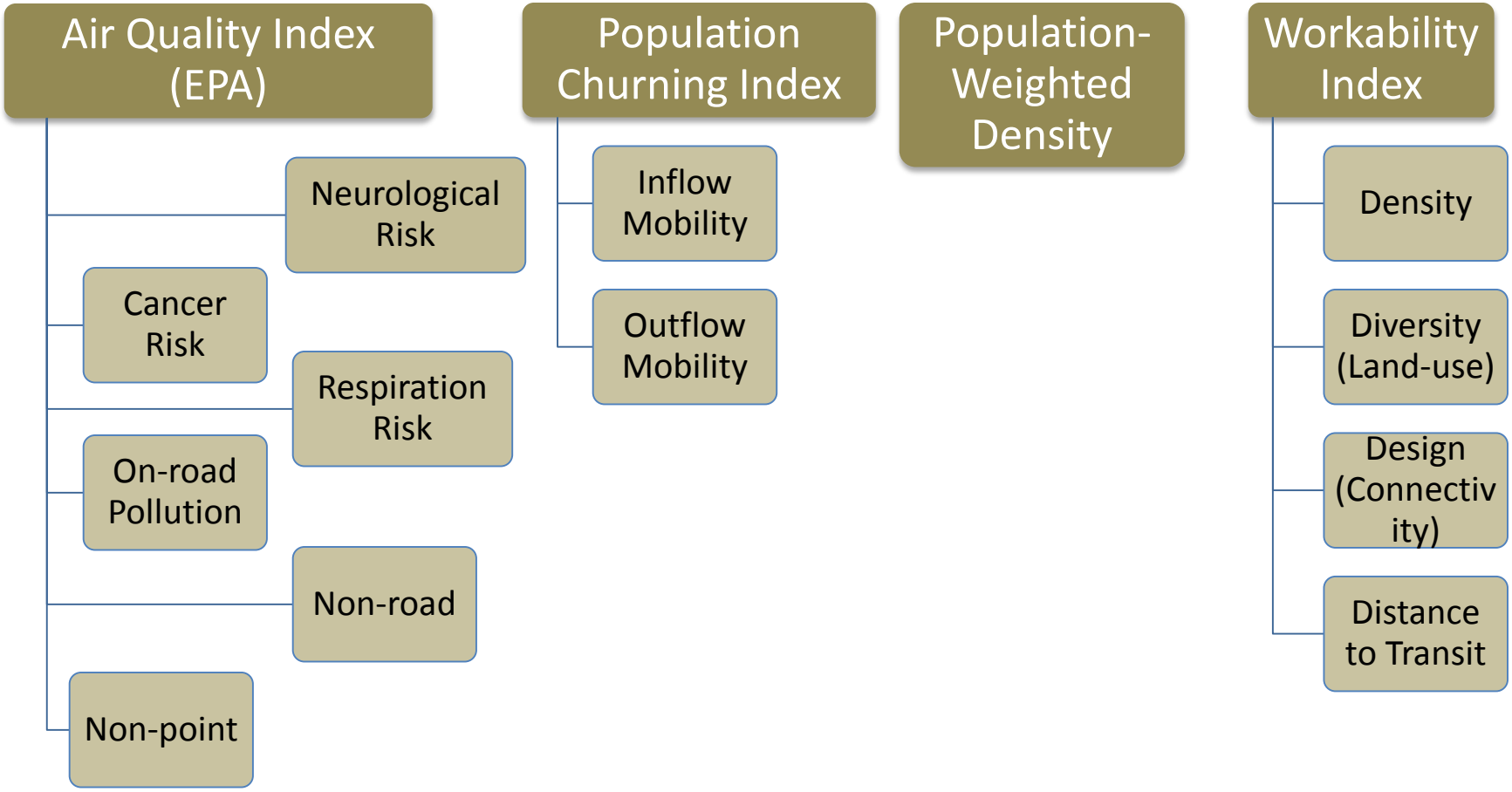
Community Environmental Profile

Consumer Opportunity Profile

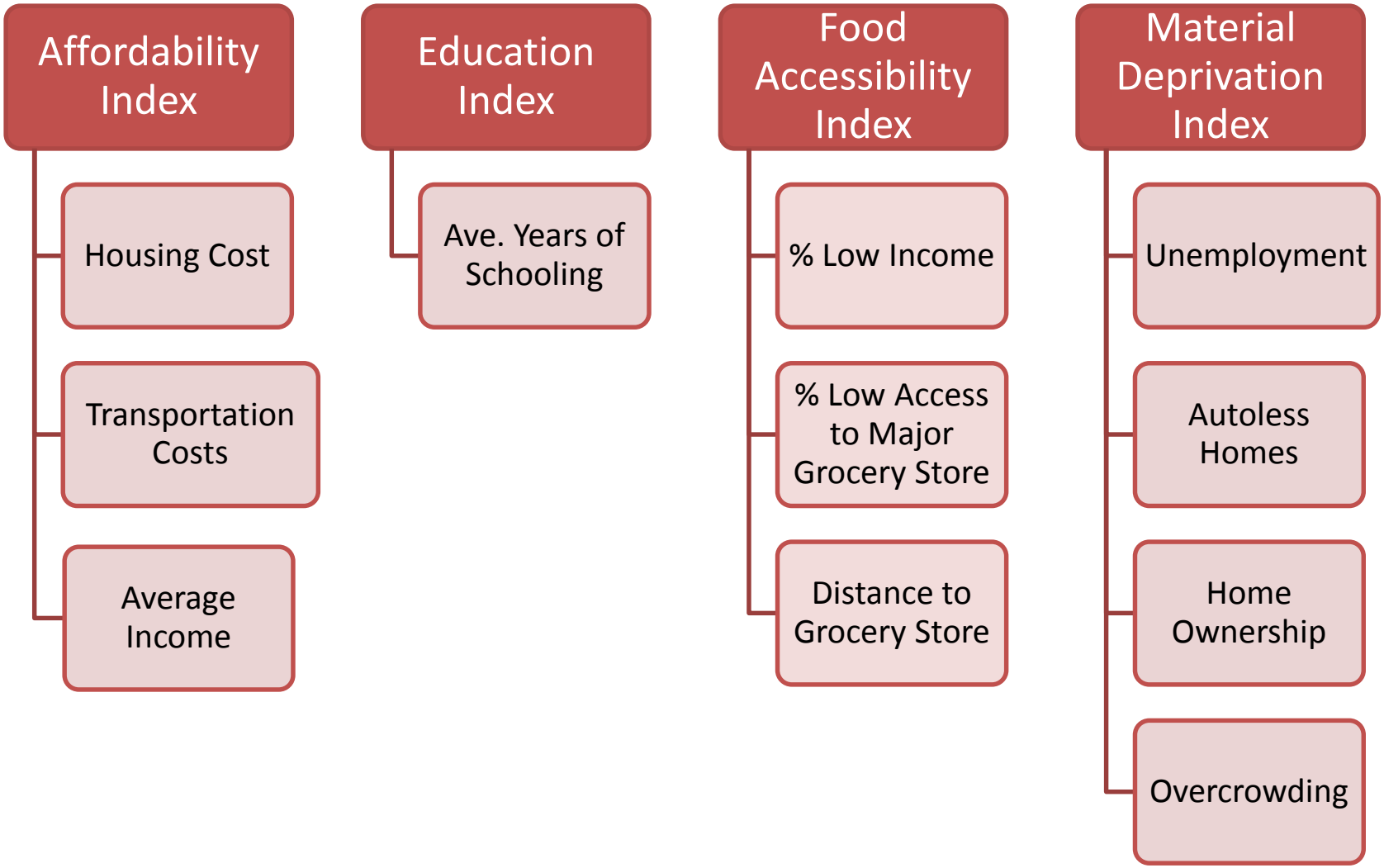
Economic Opportunity Profile

Wellness Disparity Profile

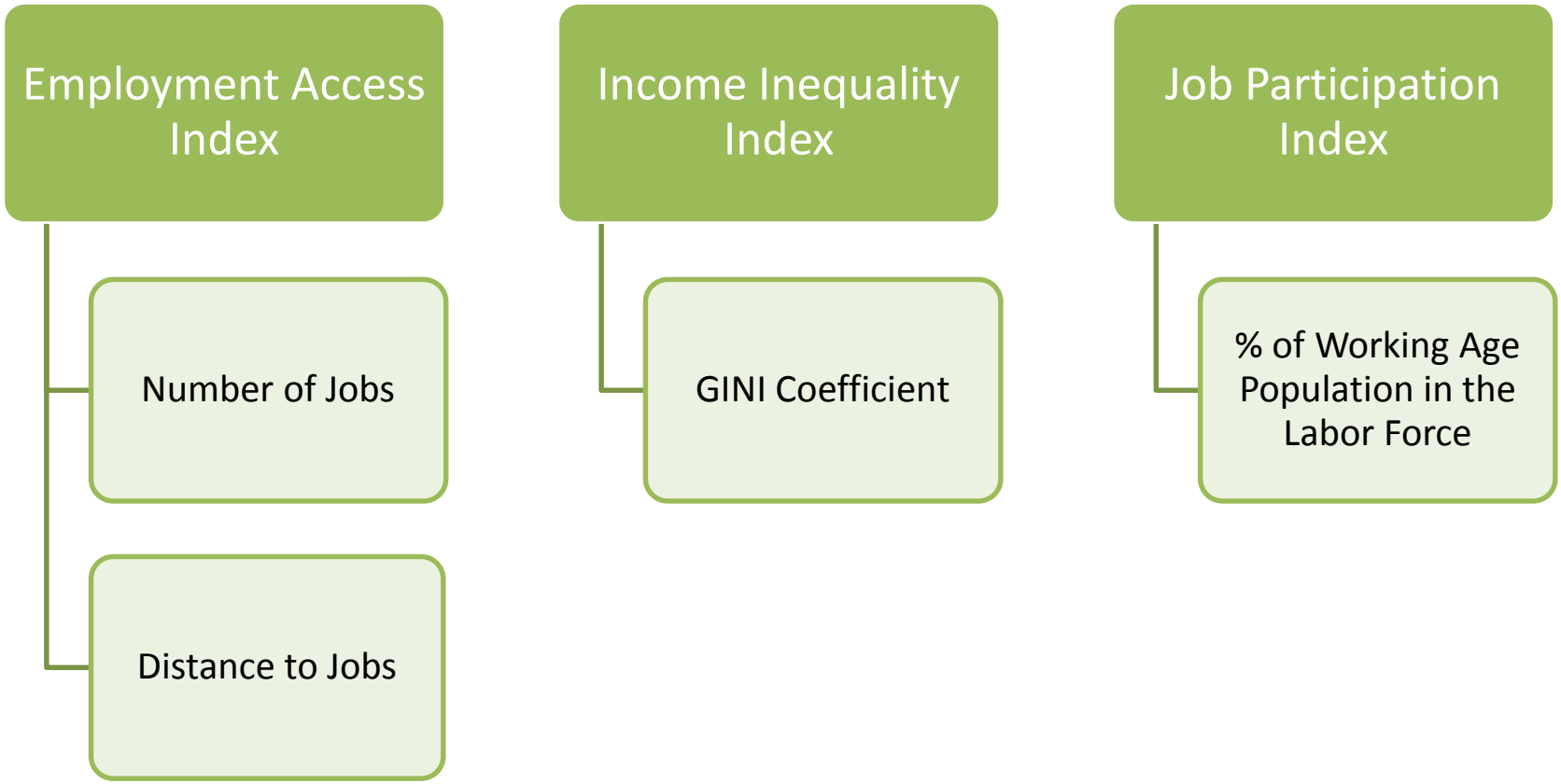
Community Environmental Profile



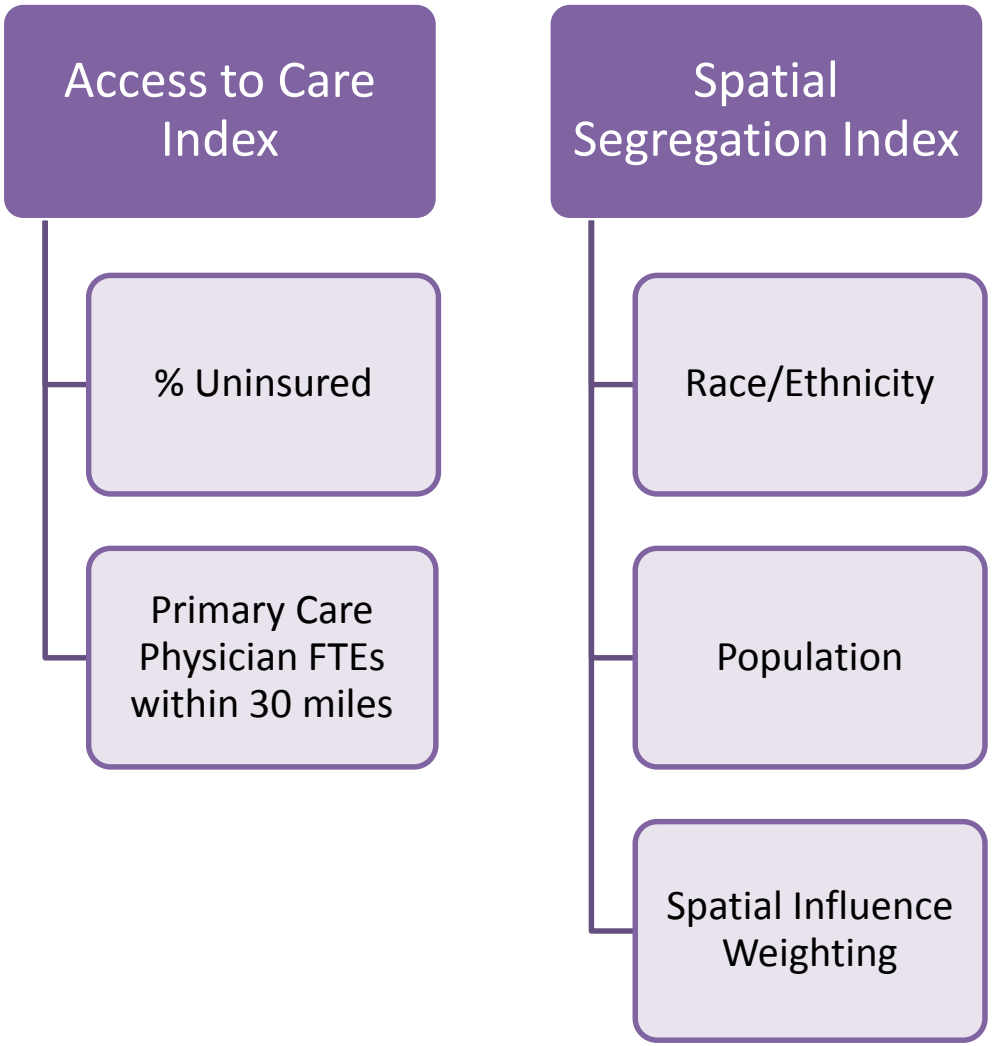
Consumer Opportunity Profile

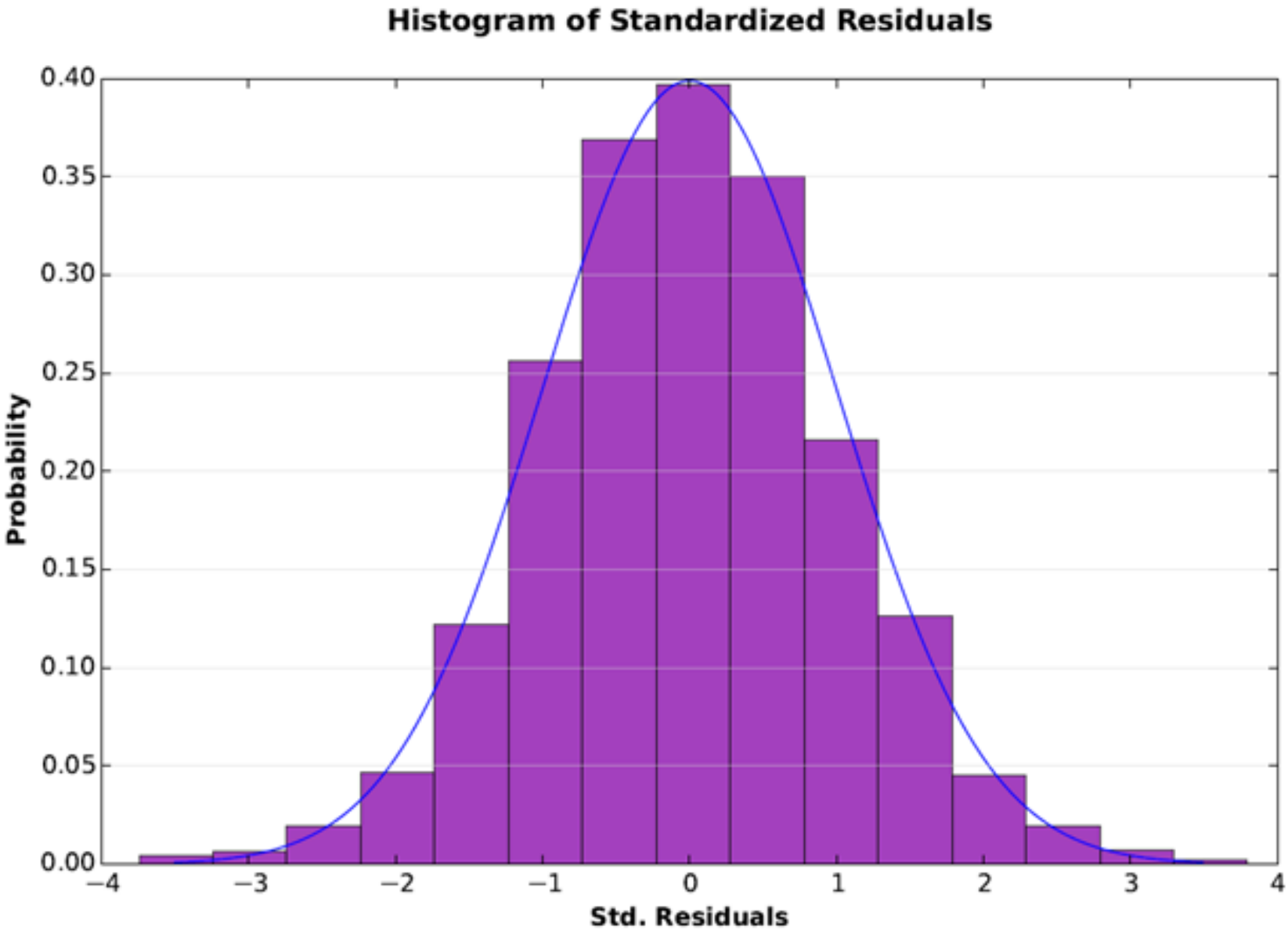


Economic Opportunity Profile



Wellness Disparity Profile

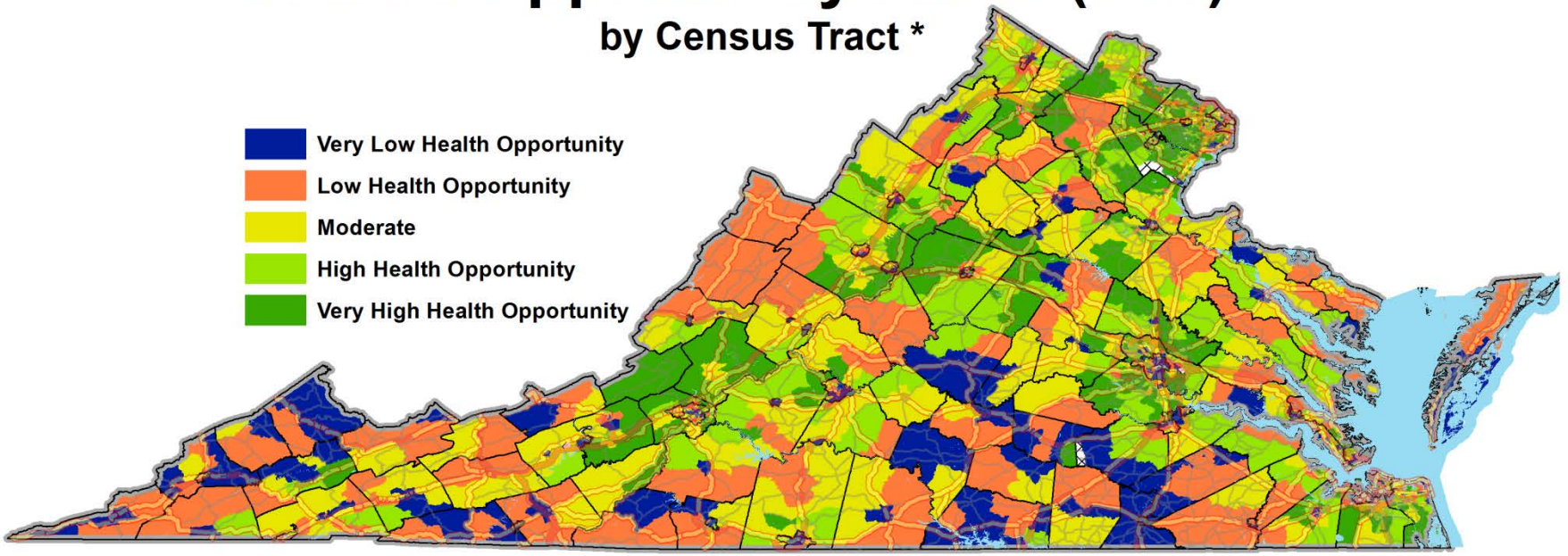



Histogram of Standardized Residuals
Probability
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−4
−3
−2
−1
0
1
2
3
4
Std. Residuals

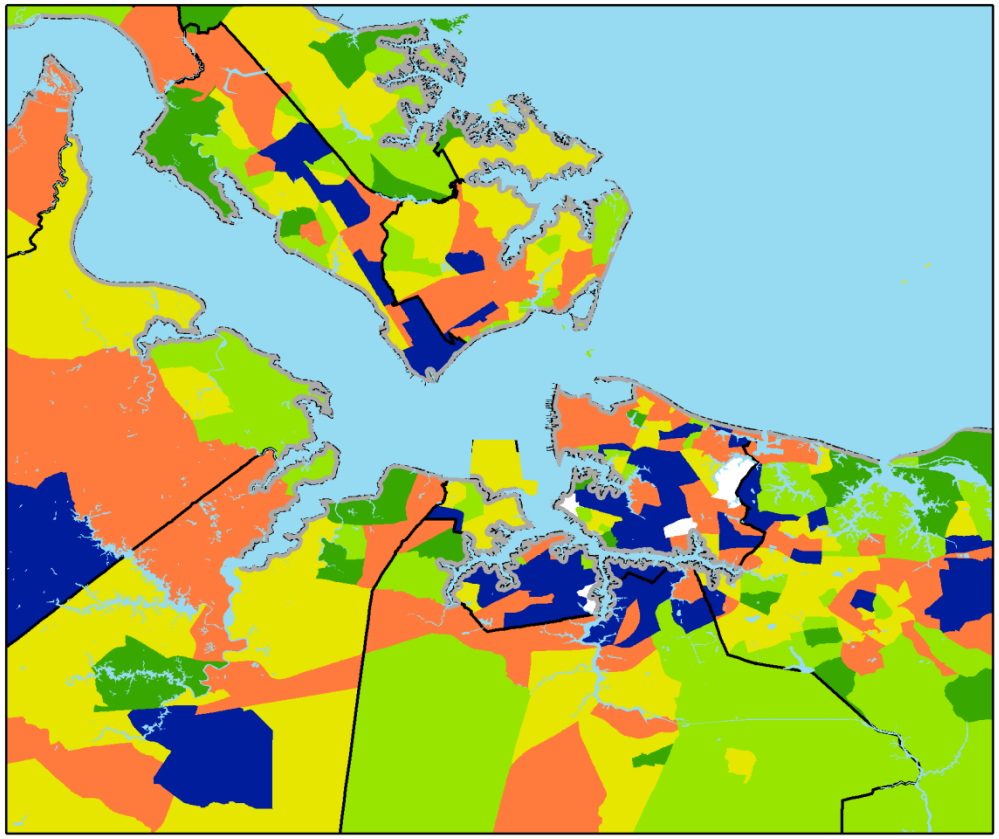
Virginia

Health Opportunity Index (HOI)

by Census Tract *



* Health opportunity Index (HOI) – The HOI is a composite measure comprising 13 indices that reflect a broad array of social determinants of health



Virginia

Disease-Free Life Expectancy * in Years

by Census Tract

2007 - 2013

< 60.0
59.9 - 63.9
64.0 - 67.5
67.6 - 71.4
> 71.4
No Data Available

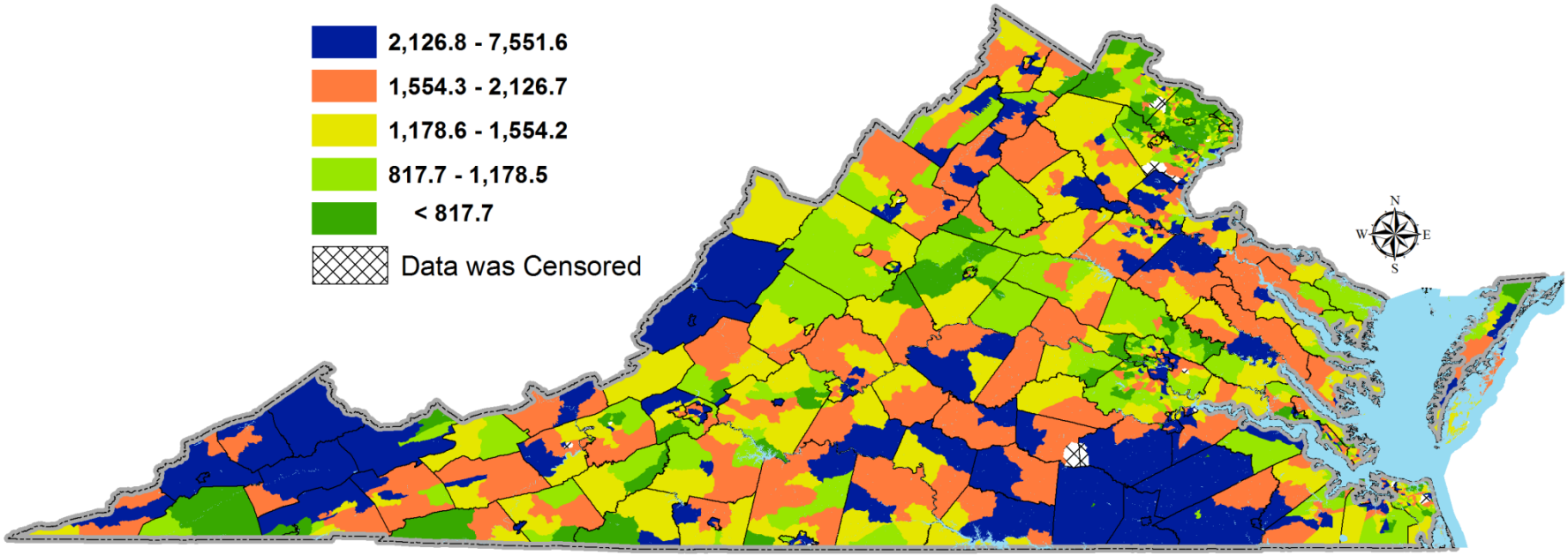
N
W E
S

0 40 80 160 Miles

* Data Sources: Virginia Health Statistics

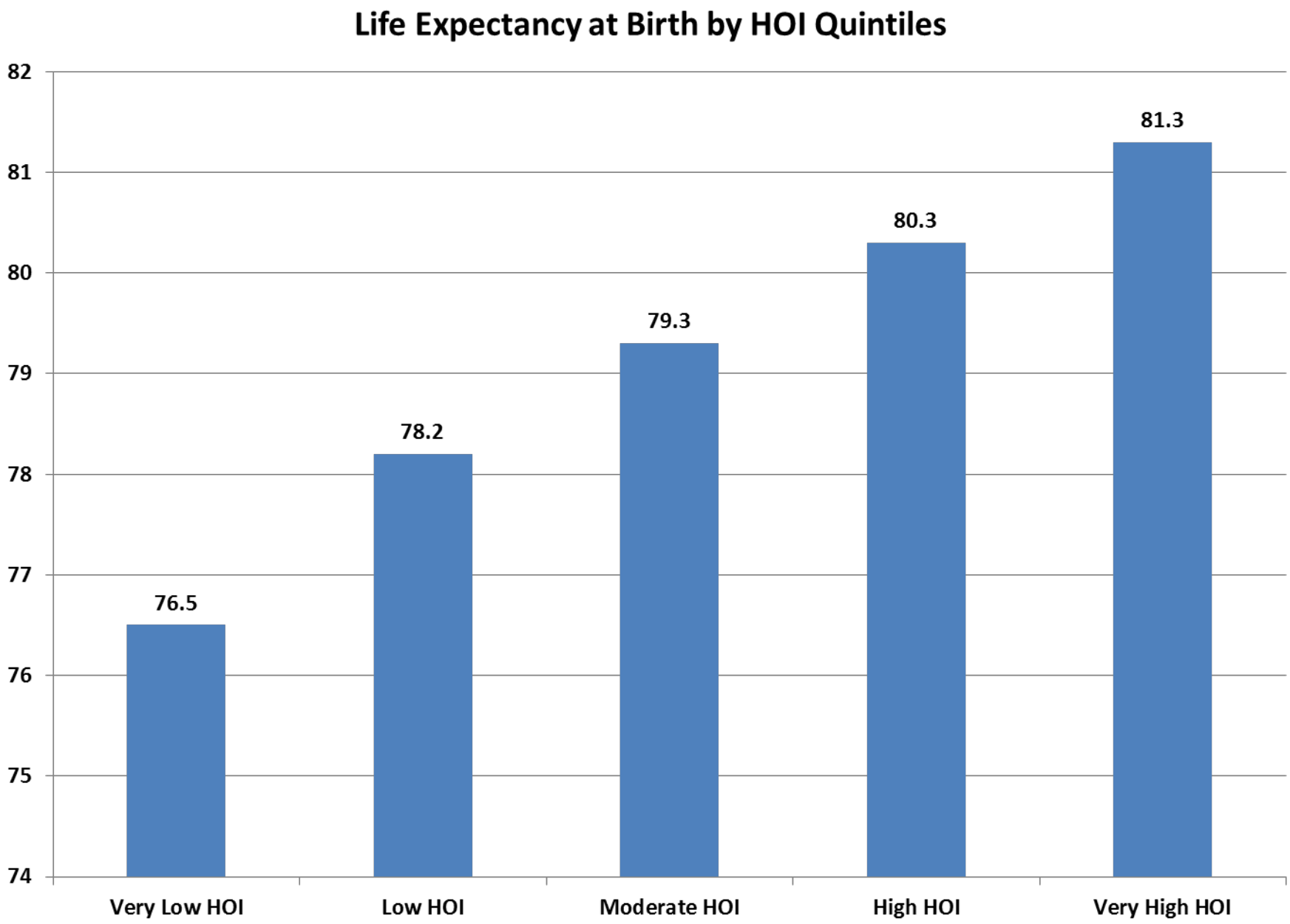
Virginia

Overall Prevention Quality Indicators * (PQIs) Composite **
Admission Rate per 100,000
by Census Tract

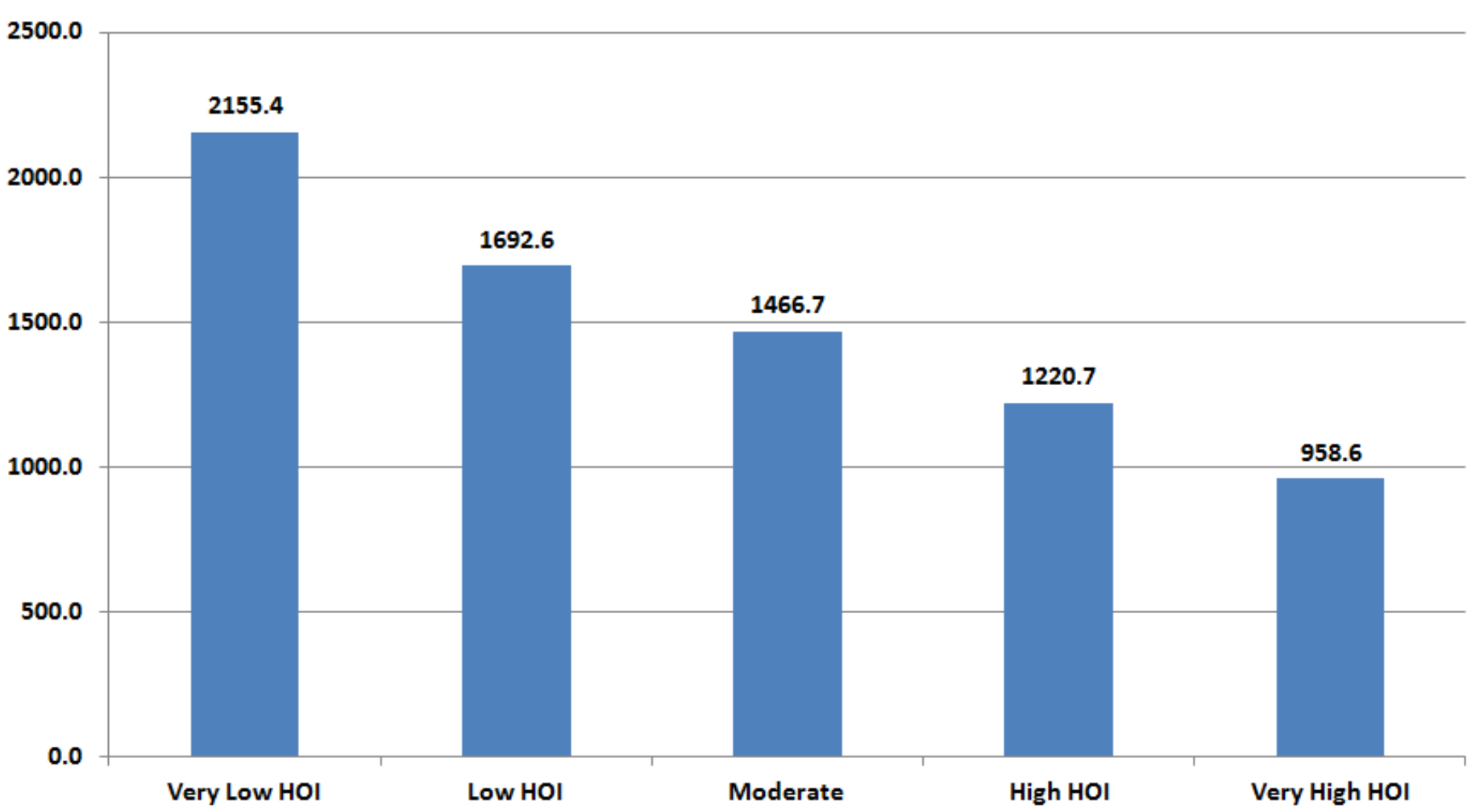


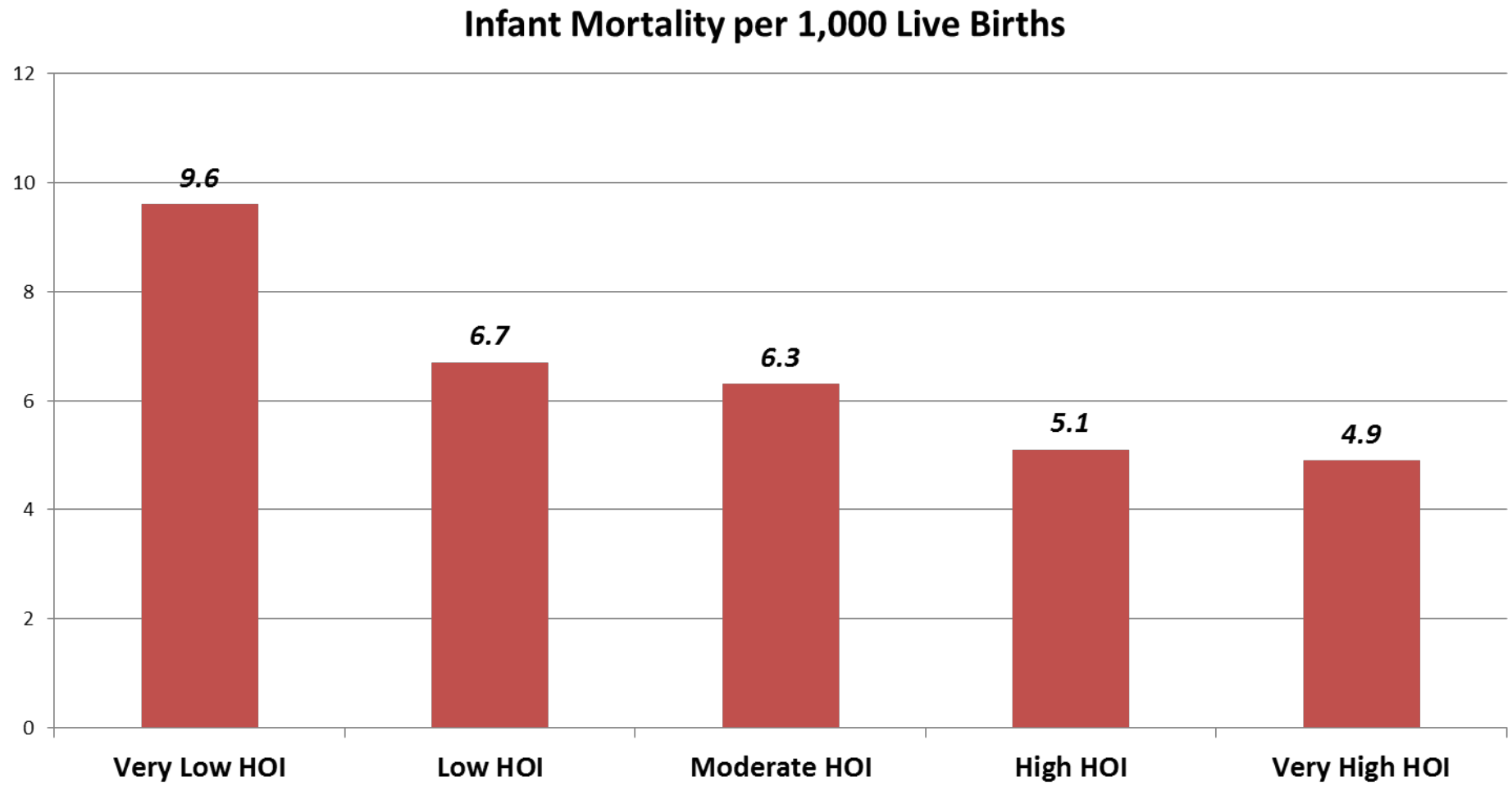
Data Source: Virginia Health Information (VHI), 2010 & 2012 Discharge Data *

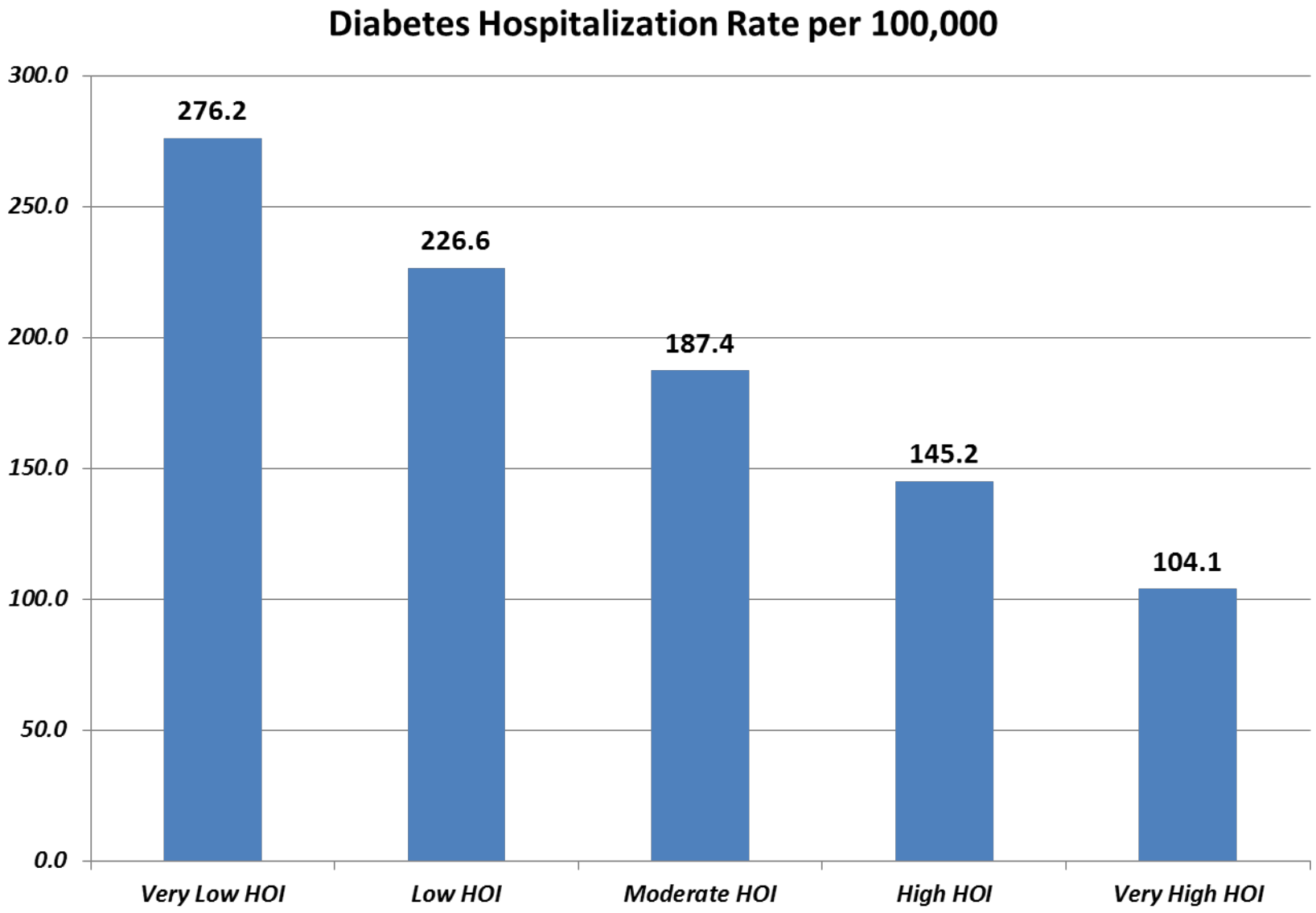
Composite PQI does not include Perforated Appendix, Low Birth Weights and Lower-Extremity Amputation **

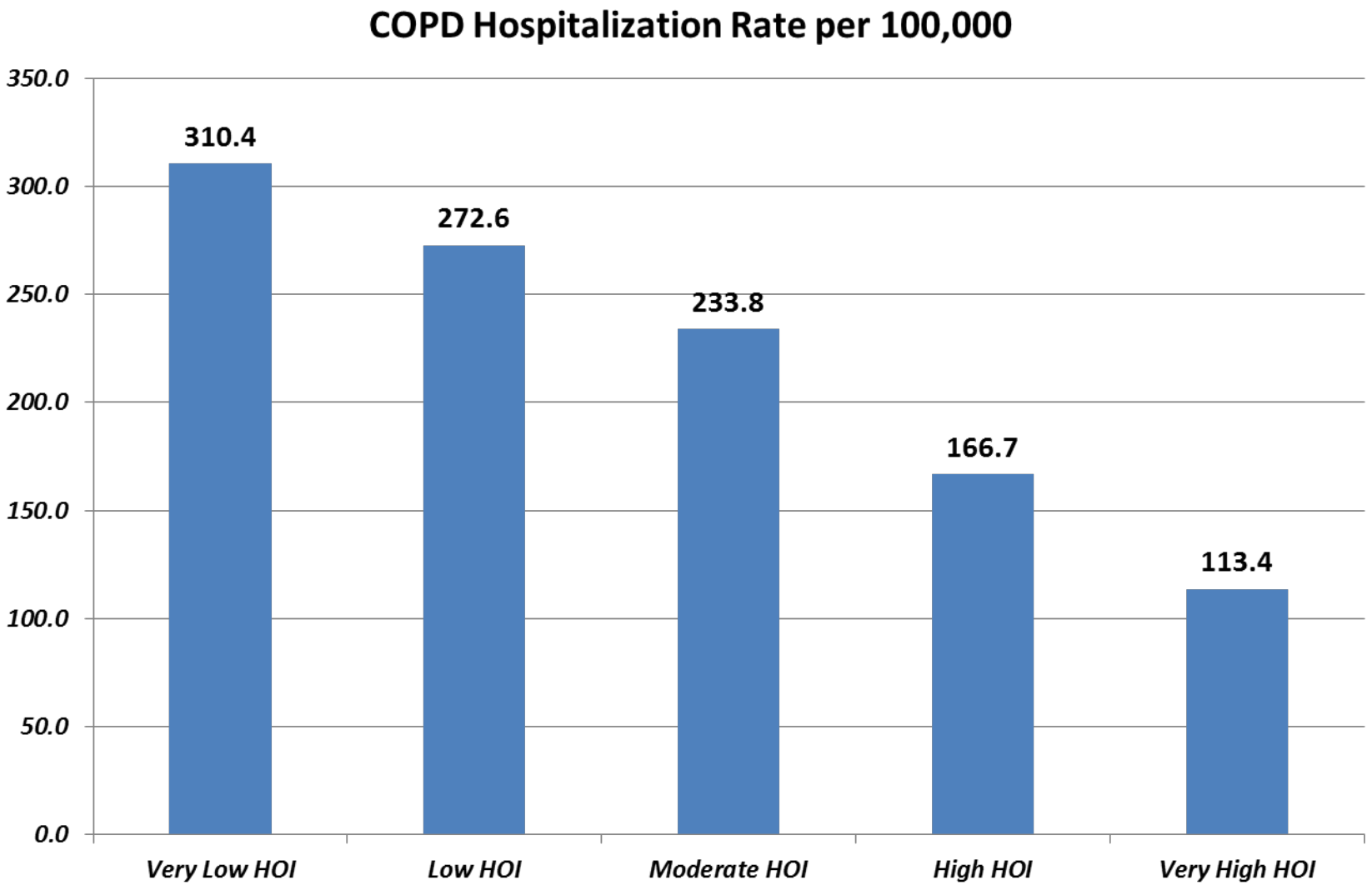

Life Expectancy at Birth by HOI Quintiles
82
81
80
79
78
77
76
75
74
76.5
78.2
79.3
80.3
81.3
Very Low HOI
Low HOI
Moderate HOI
High HOI
Very High HOI


Disability Free Life Expectancy by HOI Quintiles
70.0
68.0
66.0
64.0
62.0
60.0
58.0
56.0
60.6
63.5
66.0
67.9
69.2
Very Low HOI
Low HOI
Moderate HOI
High HOI
Very High HOI


Age-Adjusted-Rate for Potentially Prevention Hospitalization for Overall (Acute & Chronic) - Virginia, 2010 & 2012
2500.0
2000.0
1500.0
1000.0
500.0
0.0
2155.4
1692.6
1466.7
1220.7
958.6
Very Low HOI
Low HOI
Moderate
High HOI
Very High HOI

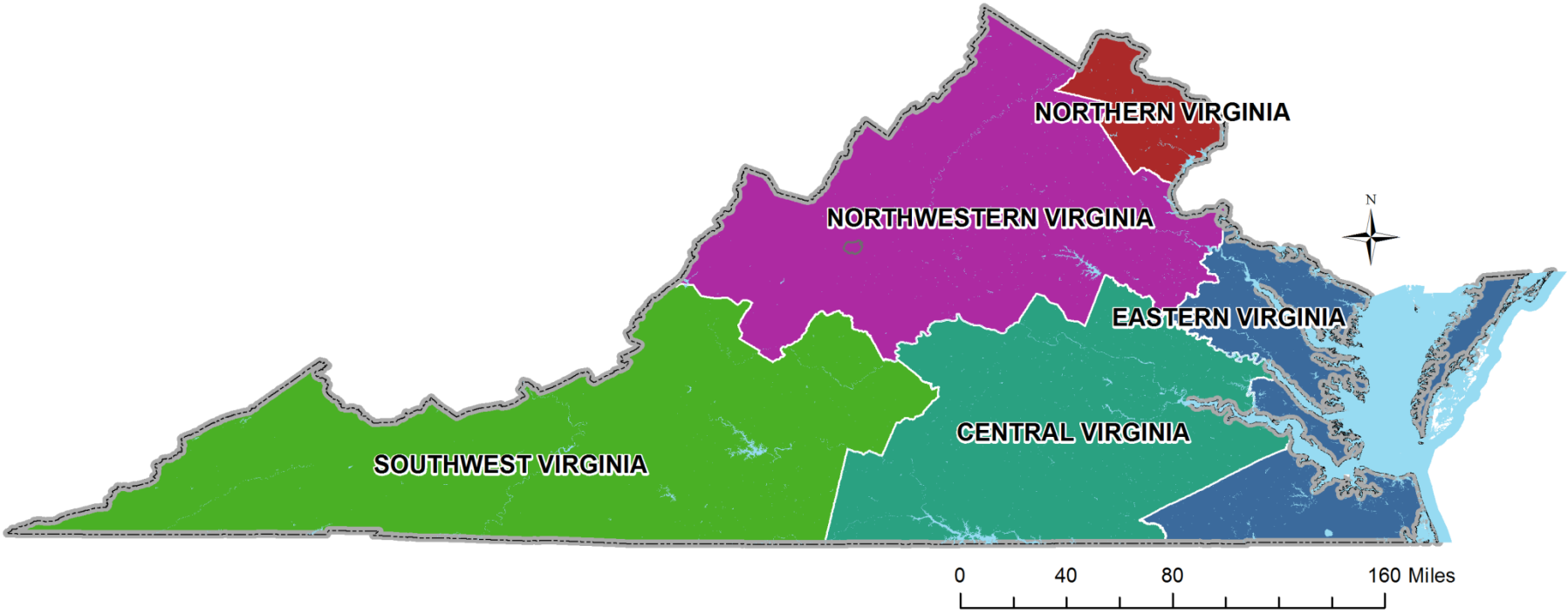

Infant Mortality per 1,000 Live Births
12
10
8
6
4
2
0
9.6
6.7
6.3
5.1
4.9
Very Low HOI
Low HOI
Moderate HOI
High HOI
Very High HOI


Diabetes Hospitalization Rate per 100,000
300.0
250.0
200.0
150.0
100.0
50.0
0.0
276.2
226.6
187.4
145.2
104.1
Very Low HOI
Low HOI
Moderate HOI
High HOI
Very High HOI


COPD Hospitalization Rate per 100,000
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
310.4
272.6
233.8
166.7
113.4
Very Low HOI
Low HOI
Moderate HOI
High HOI
Very High HOI

Data Modeling (PQIs & HOI)

Virginia
Health Planning Regions

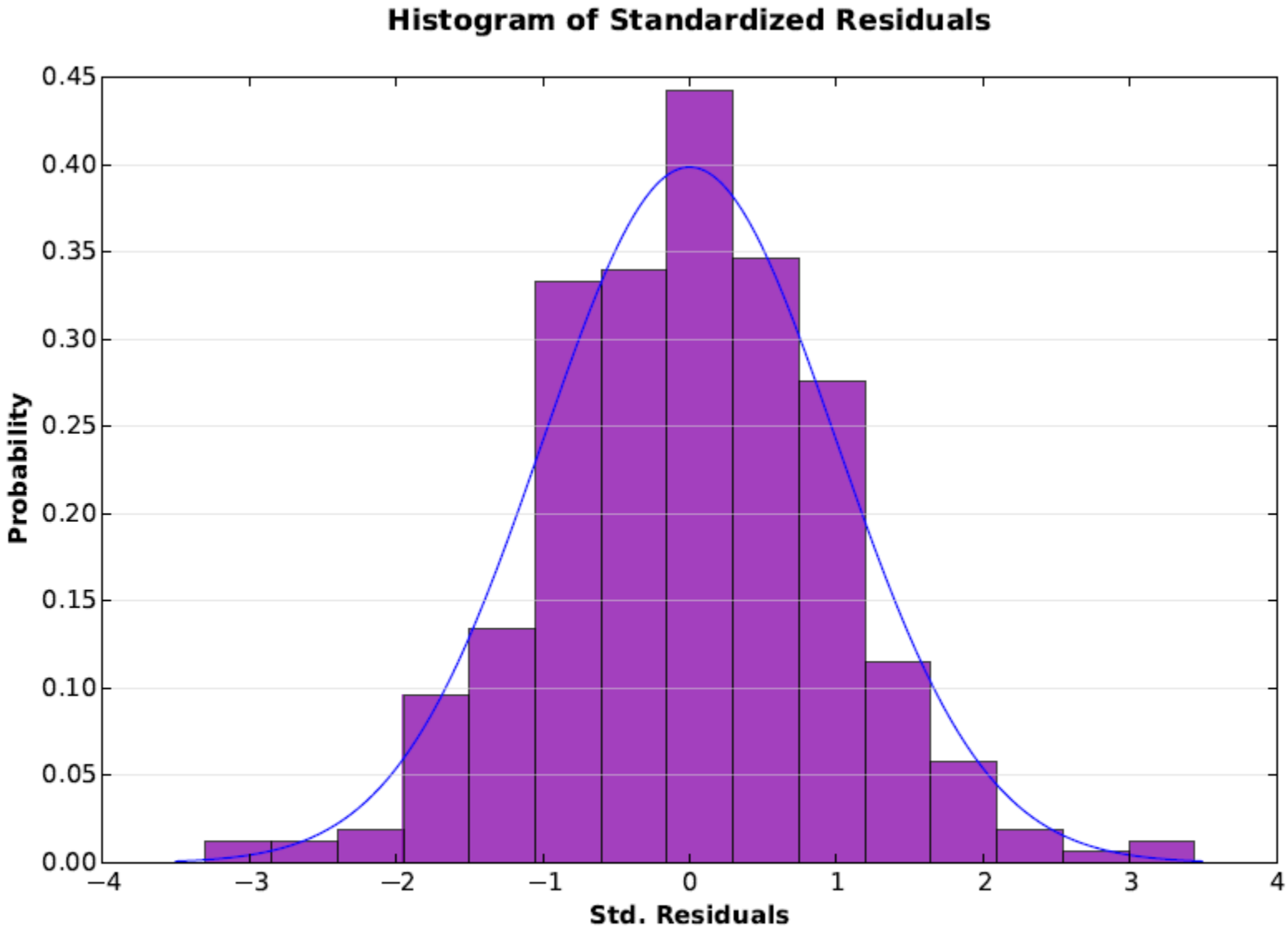


Summary of OLS Results - Model Variables

Variable	Coefficient [a]	StdError	t-Statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]	VIF [c]
Intercept	9.801152	0.522429	18.760752	0.000000*	0.682115	14.368761	0.000000*	--------
LHEALTHCAR	-0.719410	0.281916	-2.551856	0.011153*	0.269758	-2.666868	0.008026*	1.611975
LEMPLOYMEN	-0.354713	1.044870	-0.339481	0.734473	0.928512	-0.382023	0.702701	2.445448
LAFFORDABI	-0.596649	0.313140	-1.905375	0.057591	0.303751	-1.964269	0.050326	2.308890
LAIRQUALIT	-0.241014	0.395105	-0.610000	0.542280	0.408971	-0.589318	0.556051	2.522979
LPOPCHURNI	3.001968	0.394323	7.612961	0.000000*	0.487987	6.151742	0.000000*	1.802531
LEDUCATION	-4.125291	0.926786	-4.451182	0.000014*	1.208655	-3.413126	0.000735*	3.675080
LFOODACCES	-0.077145	0.267612	-0.288271	0.773326	0.256609	-0.300632	0.763891	1.122360
LINCOMEEQU	-0.669125	0.434024	-1.541676	0.124115	0.504075	-1.327430	0.185284	1.762406
LLABORFORC	-0.236184	0.423473	-0.557731	0.577409	0.623988	-0.378507	0.705308	2.177117
LPOPDENSIT	-4.472164	1.186994	-3.767637	0.000205*	1.353104	-3.305114	0.001066*	3.240029
LRACIALCOM	-0.231172	0.169129	-1.366842	0.172607	0.165826	-1.394067	0.164238	1.032371
LDEPRIVATI	-2.863713	0.372390	-7.690083	0.000000*	0.419116	-6.832742	0.000000*	3.732174
LWALKABILI	1.907688	0.536508	3.555751	0.000444*	0.530768	3.594200	0.000387*	3.195319

OLS Diagnostics

Input Features:	Central_Region_HOIEdit2	Dependent Variable:	CRUDE_RA_1
Number of Observations:	347	Akaike's Information Criterion (AICc) [d]:	319.839521
Multiple R-Squared [d]:	0.608213	Adjusted R-Squared [d]:	0.602468
Joint F-Statistic [e]:	105.874225	Prob(>F), (5,341) degrees of freedom:	0.000000*
Joint Wald Statistic [e]:	648.643280	Prob(>chi-squared), (5) degrees of freedom:	0.000000*
Koenker (BP) Statistic [f]:	30.407347	Prob(>chi-squared), (5) degrees of freedom:	0.000012*
Jarque-Bera Statistic [g]:	3.774798	Prob(>chi-squared), (2) degrees of freedom:	0.151465



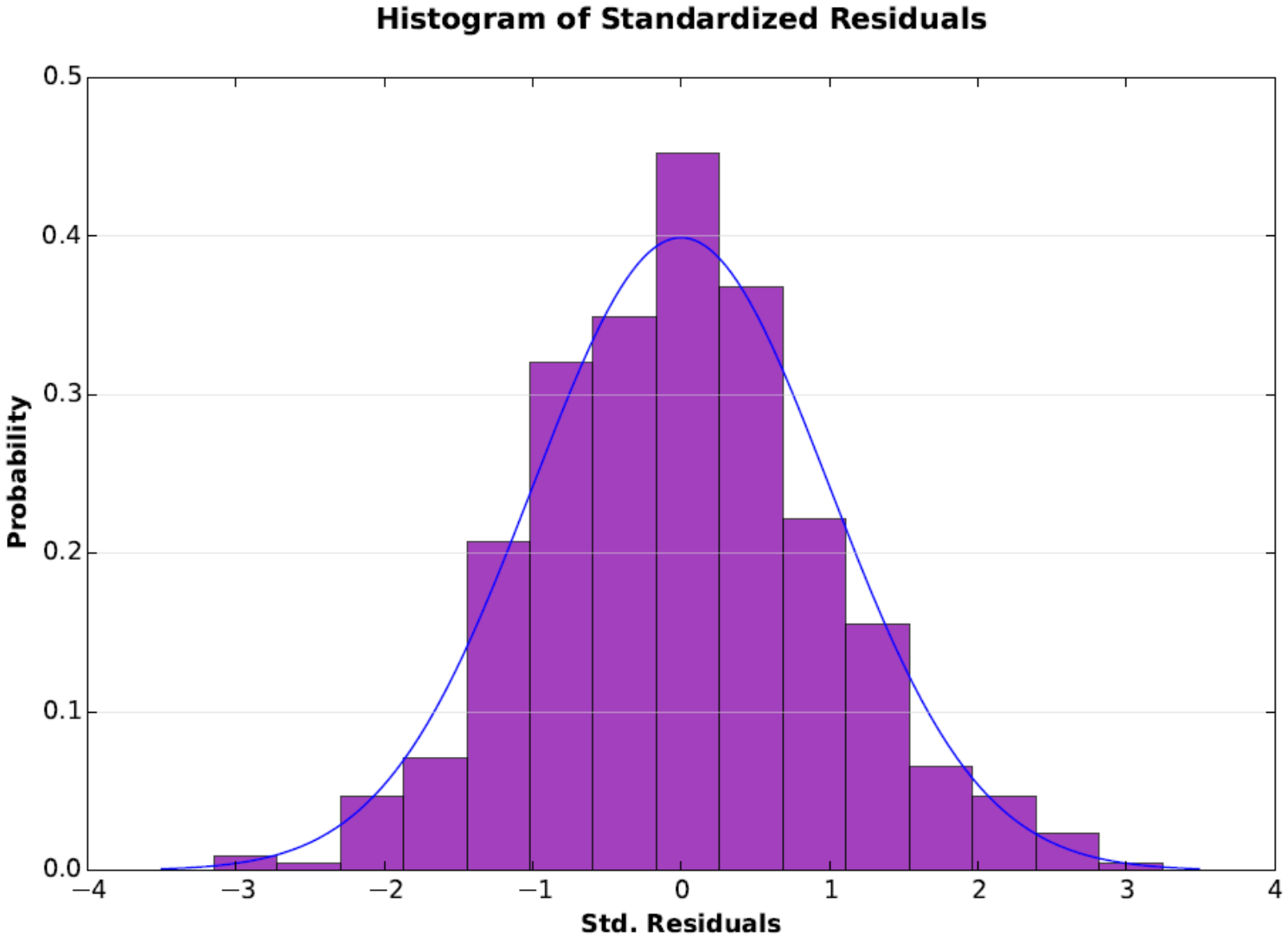
Ideally the histogram of your residuals would match the normal curve, indicated above in blue. If the histogram looks very different from the normal curve, you may have a biased model. If this bias is significant it will also be represented by a statistically significant Jarque-Bera p-value (*).

Summary of OLS Results - Model Variables

Variable	Coefficient [a]	StdError	t-Statistic	Probability [b]	Robust_SE	Robust_t	Robust_Pr [b]	VIF [c]
Intercept	12.194486	0.582673	20.928525	0.000000*	0.653000	18.674561	0.000000*	--------
LHEALTHCAR	-0.454497	0.245436	-1.851797	0.064662	0.227241	-2.000067	0.046042*	1.035870
LEMPLOYMEN	-0.835622	0.922455	-0.905867	0.365441	0.914663	-0.913585	0.361375	1.202239
LAFFORDABI	1.170292	0.660800	1.771022	0.077189	0.861602	1.358275	0.175017	3.112874
LAIRQUALIT	-0.617976	0.303670	-2.035024	0.042382*	0.316696	-1.951320	0.051589	1.273747
LPOPCHURNI	0.949087	0.381929	2.484979	0.013280*	0.429548	2.209501	0.027591*	1.777327
LEDUCATION	-5.523034	0.853828	-6.468553	0.000000*	0.979242	-5.640112	0.000000*	3.550741
LINCOMEEQU	-1.116064	0.467420	-2.387709	0.017321*	0.550642	-2.026841	0.043216*	1.672800
LLABORFORC	-4.267191	0.530255	-8.047426	0.000000*	0.636620	-6.702886	0.000000*	1.704858
LRACIALCOM	0.305087	0.188627	1.617411	0.106451	0.186124	1.639158	0.101839	1.009980
LDEPRIVATI	-0.764384	0.356569	-2.143716	0.032539*	0.371665	-2.056646	0.040244*	3.787084
LWALKABILI	0.099791	0.281791	0.354132	0.723407	0.308414	0.323562	0.746420	1.684972

OLS Diagnostics

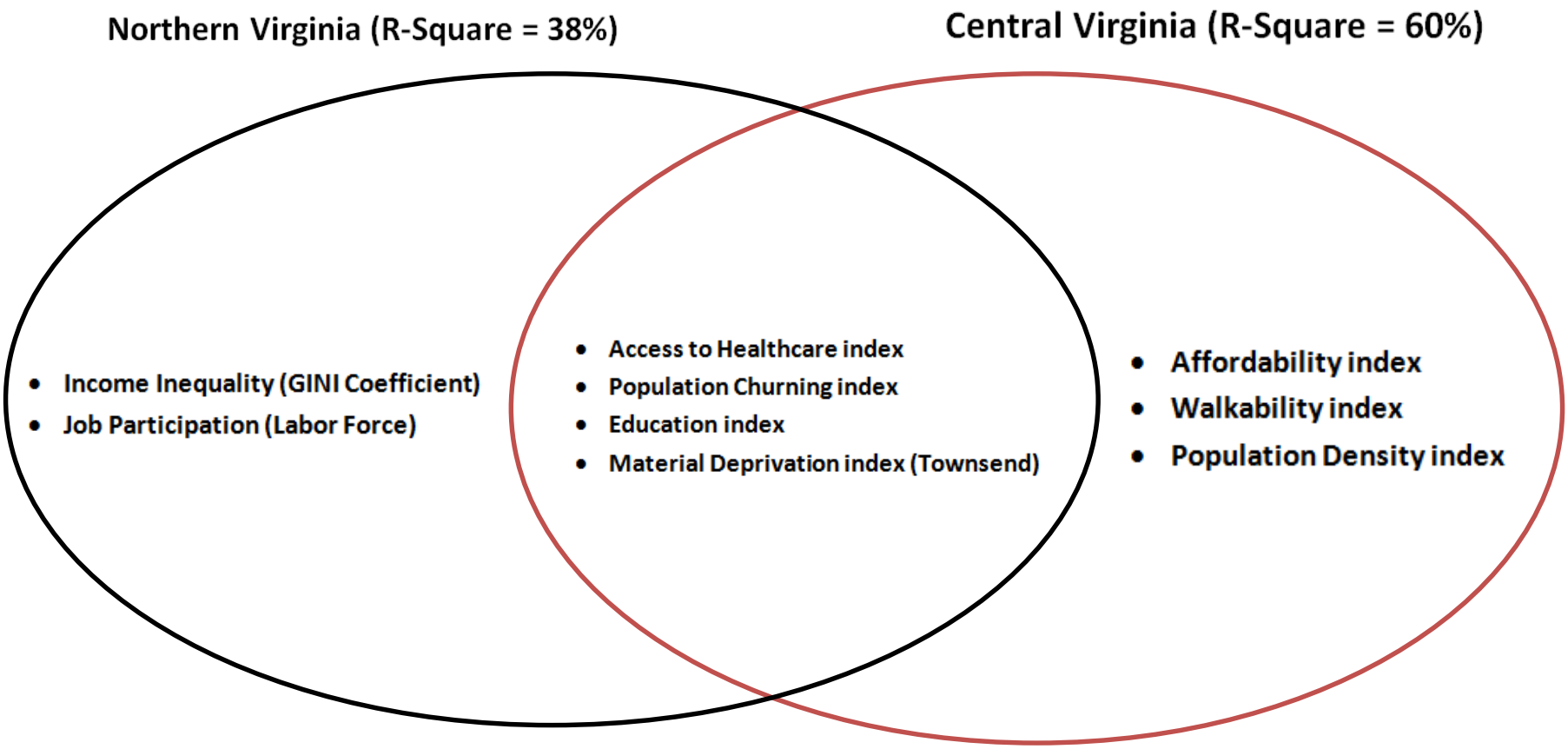
Input Features:	Northern_Region_HOI_Sel	Dependent Variable:	CRUDE_RA_1
Number of Observations:	498	Akaike's Information Criterion (AICc) [d]:	517.248230
Multiple R-Squared [d]:	0.389393	Adjusted R-Squared [d]:	0.375573
Joint F-Statistic [e]:	28.175386	Prob(>F), (11,486) degrees of freedom:	0.000000*
Joint Wald Statistic [e]:	296.065888	Prob(>chi-squared), (11) degrees of freedom:	0.000000*
Koenker (BP) Statistic [f]:	31.224737	Prob(>chi-squared), (11) degrees of freedom:	0.001015*
Jarque-Bera Statistic [g]:	1.954037	Prob(>chi-squared), (2) degrees of freedom:	0.376432



Ideally the histogram of your residuals would match the normal curve, indicated above in blue. If the histogram looks very different from the normal curve, you may have a biased model. If this bias is significant it will also be represented by a statistically significant Jarque-Bera p-value (*).

Ordinary Least Square Model

Dependent Variable: Overall Prevention Quality Indicator (PQI 90)



Uses of the HOI

- To identify the impact of social determinants of health on statewide health landscape
- To show that place matters when it comes to health
- To identify HOI indicators that are most influential on local health
- To learn from communities with good health despite adverse HOI indicators
- To build collaboration across all sectors to promote health equity

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