Measuring and Mapping Social Vulnerability in South Dakota

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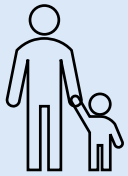
South Dakota Department of Health

Outline

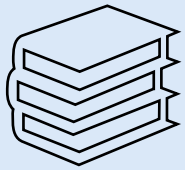
- Definition of social vulnerability
- Background of the Social Vulnerability Index (SVI)
- Methodology
- Mapping
- Accessing the data
- Examples

SOCIAL VULNERABILITY



Vulnerable populations are diverse groups of individuals who are at greater risk of poor physical, psychological and or social health. (Aday 2001)

Social vulnerability refers to the demographic and socioeconomic factors that affect the resilience of communities to prevent human suffering and economic loss during a hazardous event. (CDC)



Studies have shown the socially vulnerable are more likely to be adversely affected, i.e. they are less likely to recover from a disaster event and more likely to die.

CDC's Social Vulnerability Index

- Aims to identify areas in greatest need of resources before, during, and after a hazardous event
- Created by Federal Agency for Toxic Substances and Disease Registry
- Uses the U.S. Census data
- Publicly available

Hurricane Sandy - Breezy Point, NY Photographer – Pauline Tran

CDC. SVI FactSheet. Available at: https://svi.cdc.gov/Documents/FactSheet/SVIFactSheet.pdf

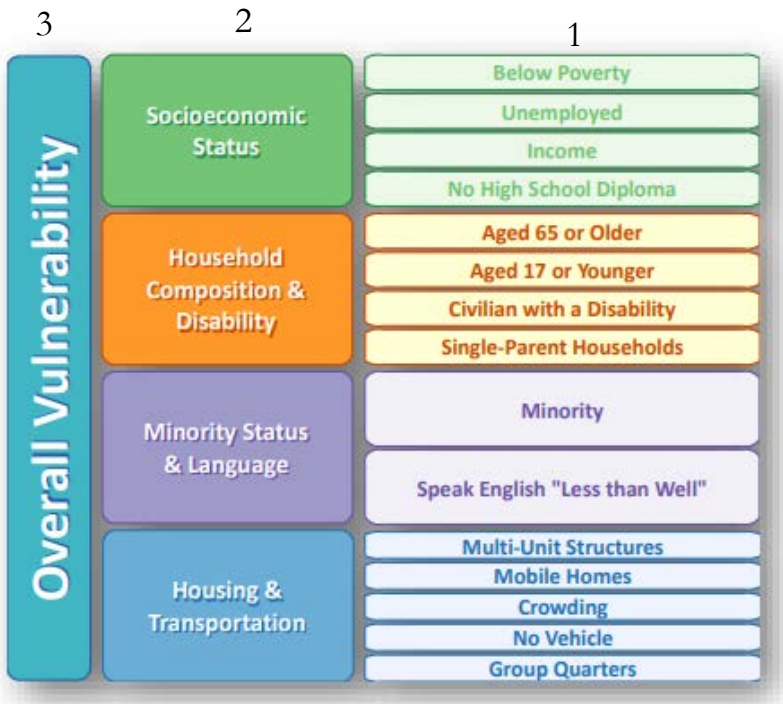
Methods (SVI)

- Ranked using percentiles
- A percentile rank is the percentage of tract at or below that rank scores

(SVI=0.8 More vulnerable than 80% of all tracts against which it is ranked)

- A higher percentile rank means greater vulnerability

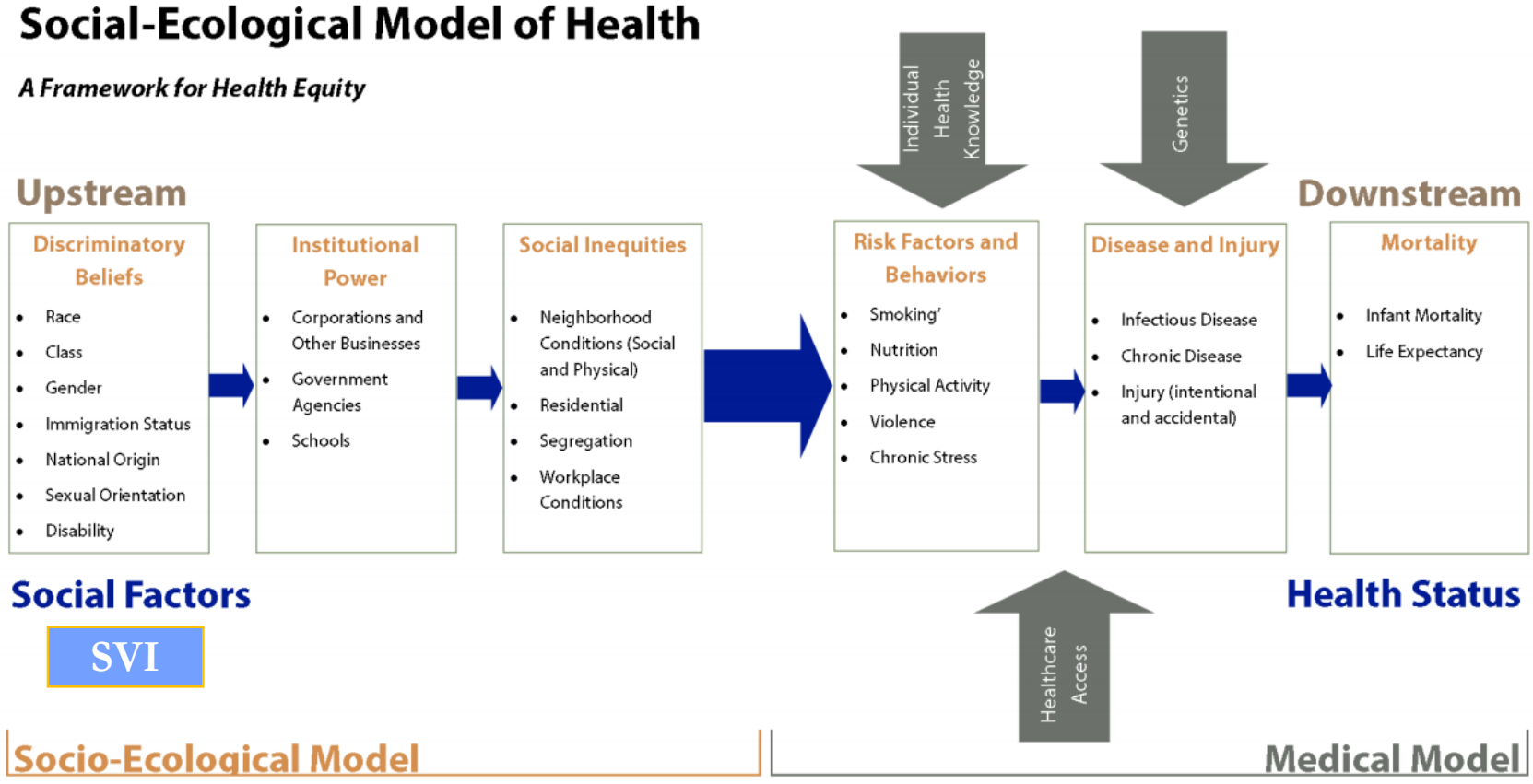
  - **0.0 least vulnerable**
  - **1.0 most vulnerable**



Social Vulnerability Index: Themes and variables

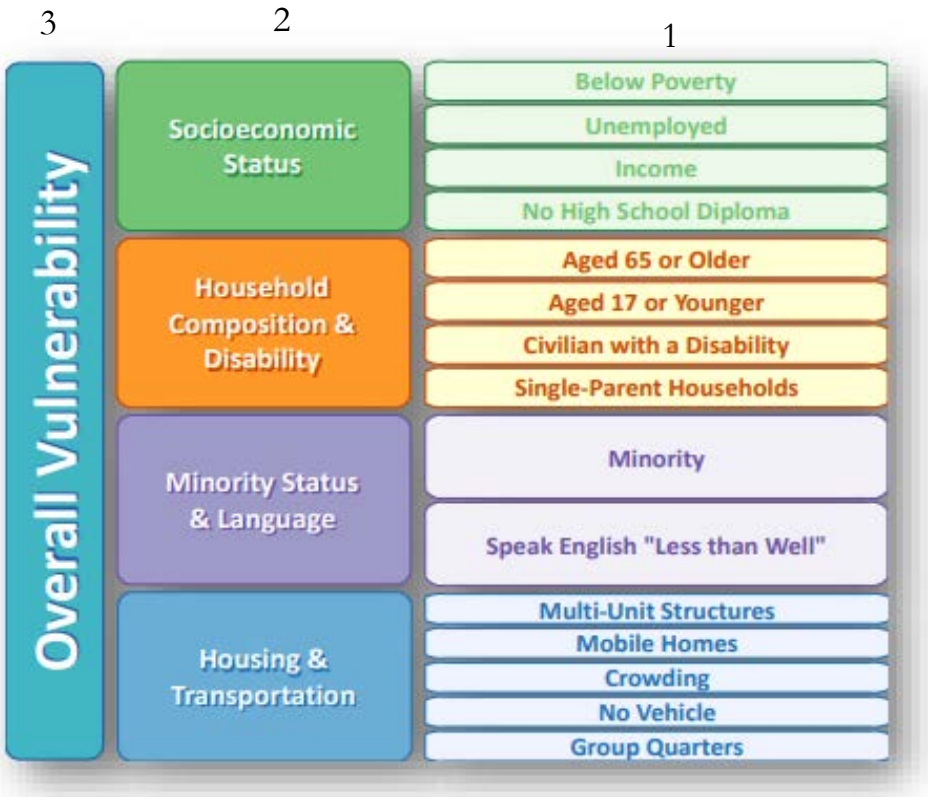
Data source: U.S. Census data

Inequities in Health Behaviors and Health Status



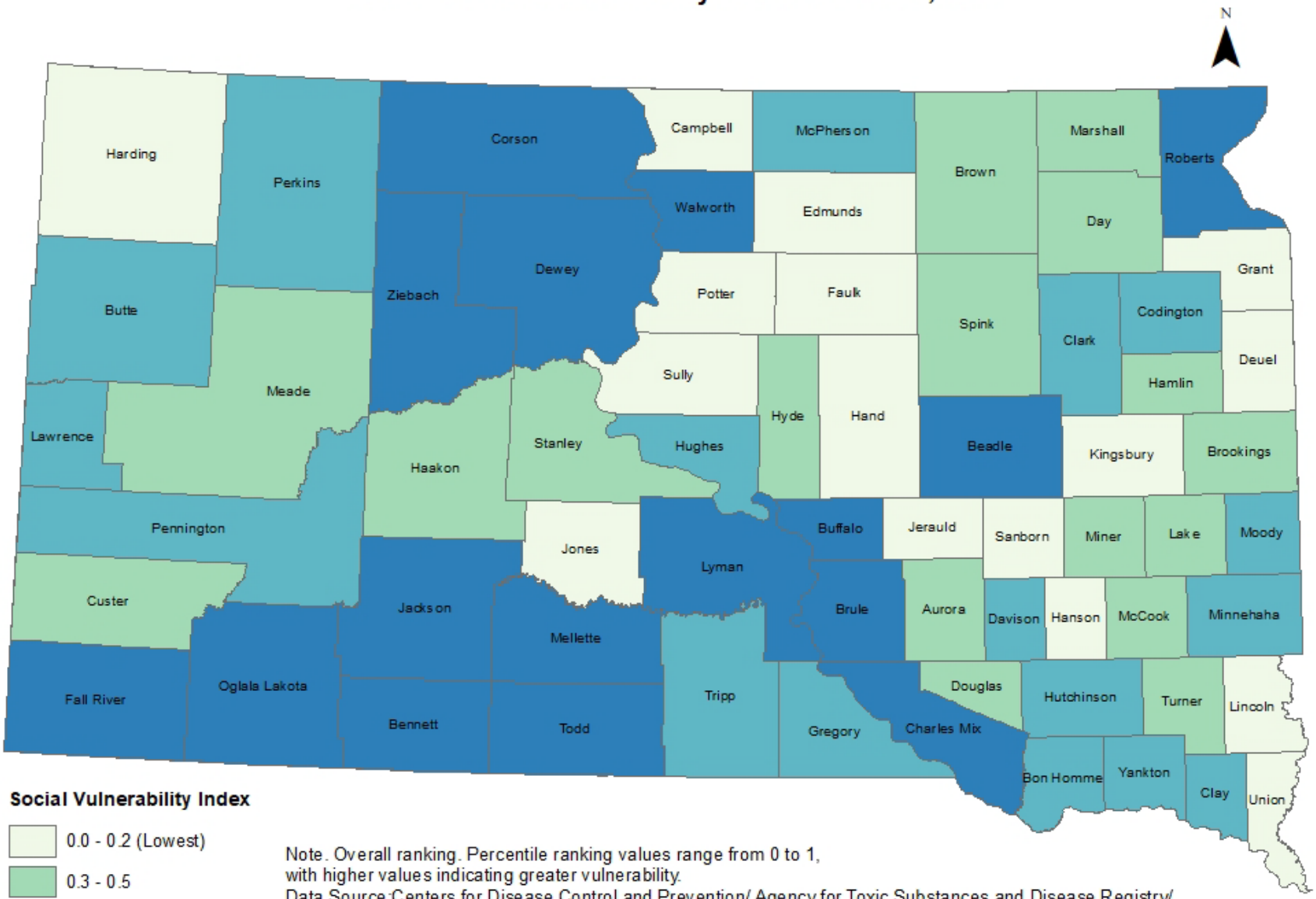
Vick, J., Thomas-Trudo, S., Cole, M., and Samuels, A.D. (Eds.). (2015). Health equity in Nashville. Metro Nashville Public Health Department Division of Epidemiology and Research and RWJF Center for Health Policy at Meharry Medical College.

Mapping Social Vulnerability Index South Dakota



Social Vulnerability Index: Themes and variables

Overall Social Vulnerability in South Dakota, 2016



Social Vulnerability Index

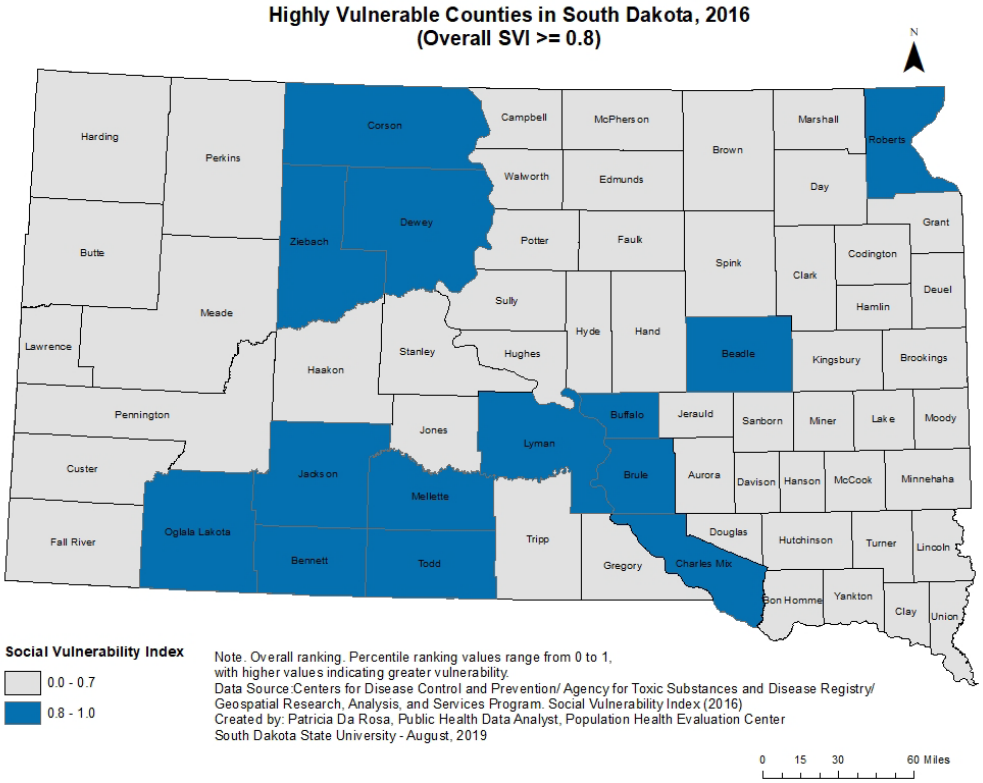
- 0.0 - 0.2 (Lowest)
- 0.3 - 0.5
- 0.6 - 0.8
- 0.9 - 1.0 (Highest)

Note. Overall ranking. Percentile ranking values range from 0 to 1, with higher values indicating greater vulnerability.
Data Source:Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index (2016)
Created by: Patricia Da Rosa, Public Health Data Analyst, Population Health Evaluation Center
South Dakota State University - August, 2019

0 15 30 60 Miles

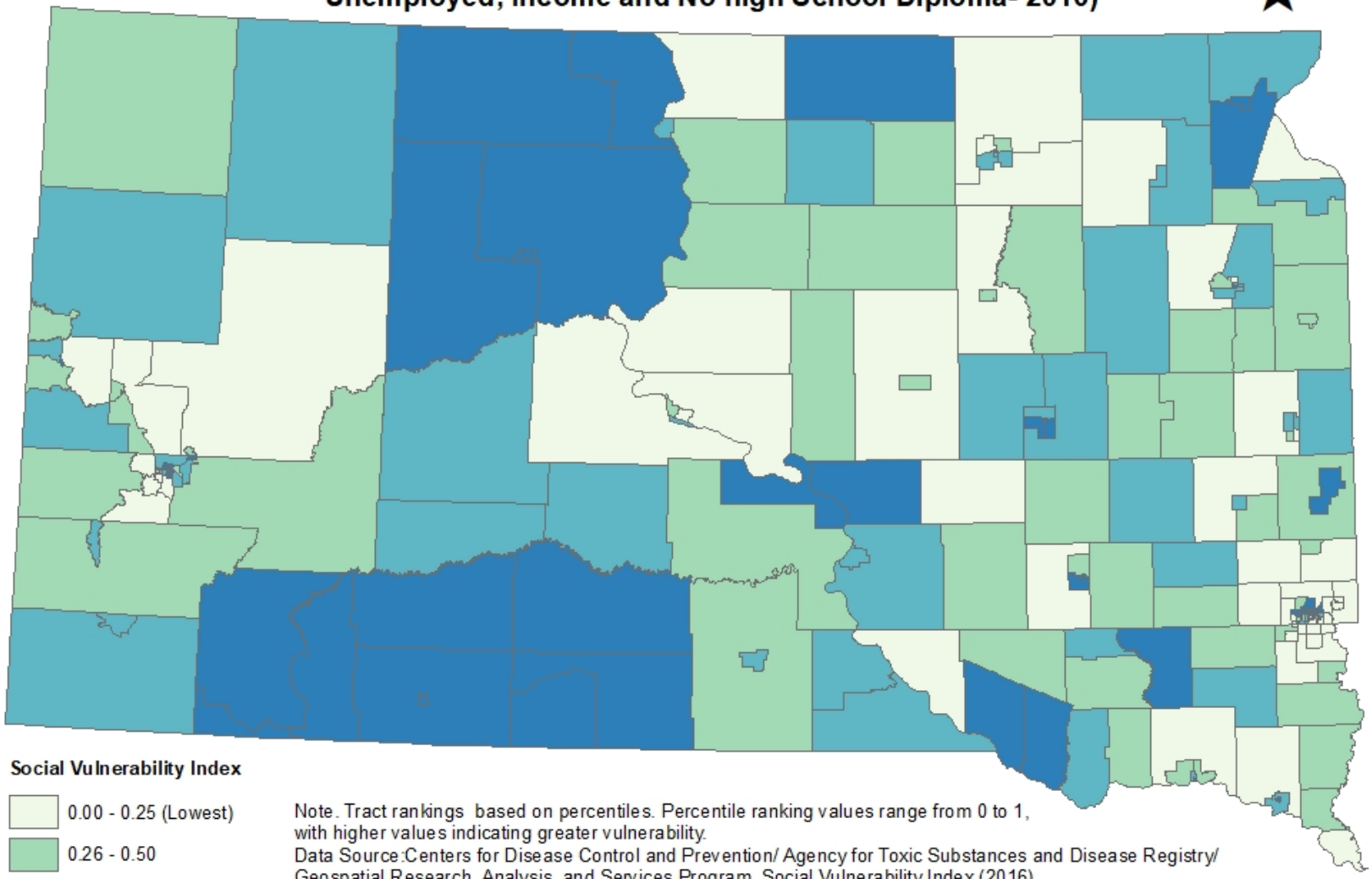
SD Counties with Overall SVI >0.8

1. Oglala Lakota
2. Todd
3. Buffalo
4. Ziebach
5. Mellette
6. Jackson
7. Dewey
8. Brule
9. Charles Mix
10. Bennett
11. Corson
12. Beadle
13. Roberts
14. Lyman



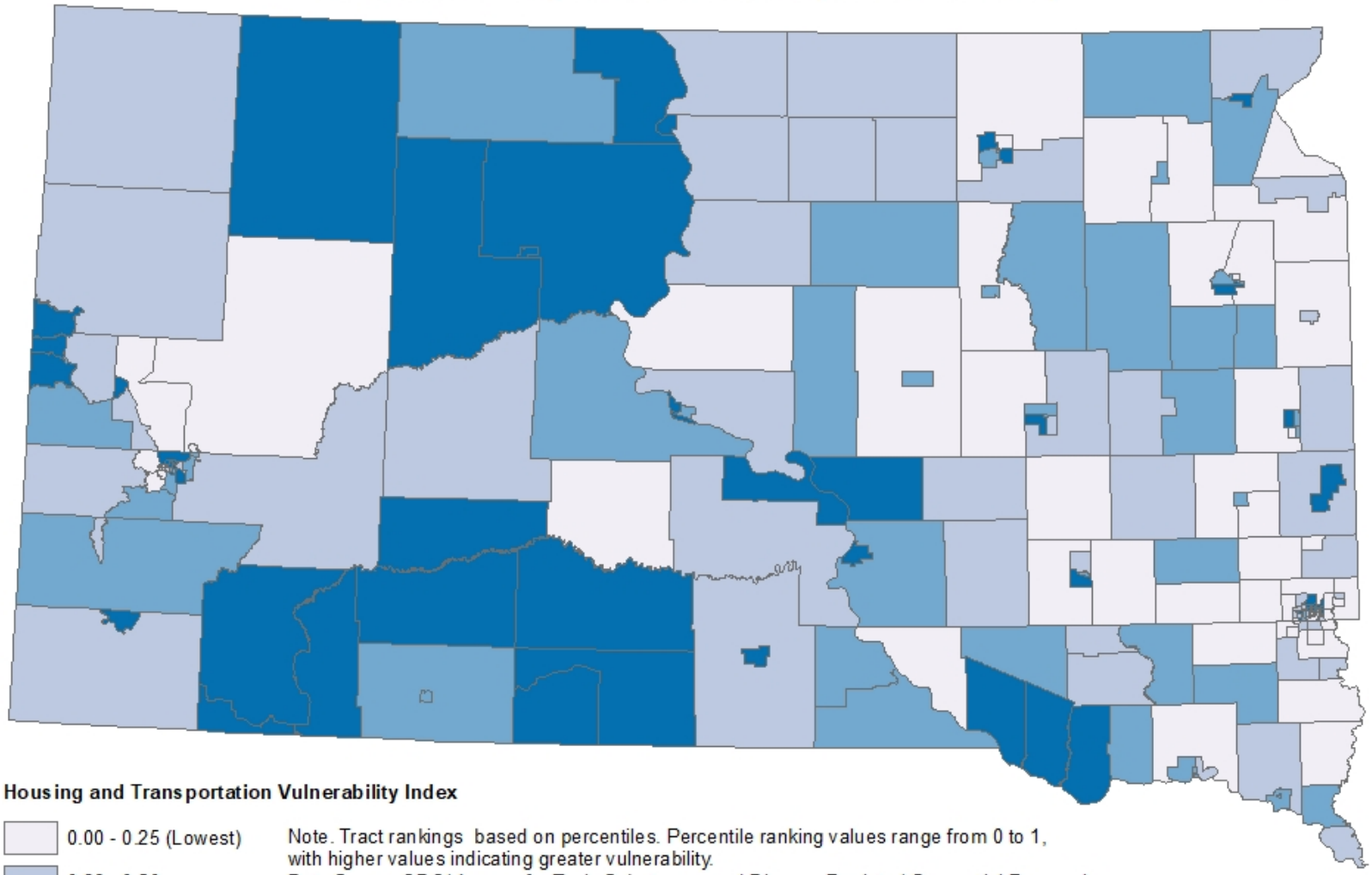
SVI= 0.8 More vulnerable than 80% of all counties against which it is ranked

Social Vulnerability - Socioeconomic Status- in South Dakota (Census Tract Index Based on Below Poverty, Unemployed, Income and No high School Diploma- 2016)



Note. Tract rankings based on percentiles. Percentile ranking values range from 0 to 1, with higher values indicating greater vulnerability.
Data Source:Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index (2016)
Created by: Patricia Da Rosa, Public Health Data Analyst, Population Health Evaluation Center
South Dakota State University - August, 2019

Social Vulnerability - Housing and Transportation- in South Dakota (Census Tract Index Score Based on Multi-Unit Structures, Mobile Homes, Crowding, No Vehicle, Group Quarters- 2016)



Housing and Transportation Vulnerability Index

- 0.00 - 0.25 (Lowest)
- 0.26 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00 (Highest)

Note. Tract rankings based on percentiles. Percentile ranking values range from 0 to 1, with higher values indicating greater vulnerability.

Data Source:CDC/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index (2016)

Created by: Patricia Da Rosa, Public Health Data Analyst, Population Health Evaluation Center South Dakota State University - August, 2019

0 20 40 80 Miles

EXAMPLES OF SVI USE IN CHRONIC DISEASES

Spatial Distribution of Overall Cancer Mortality and Cancer Risk Factors in South Dakota

Patricia Da Rosa[1], Ashley Miller[2], Kay Dosch[3], Mary Sarvis[3], Karen Cudmore[2]

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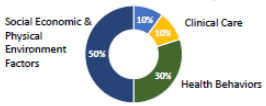
[2] Office of Chronic Disease Prevention and Health Promotion, South Dakota Department of Health, Pierre, SD
[3] South Dakota Cancer Registry, Office of Chronic Disease Prevention and Health Promotion, South Dakota Department of Health, Pierre, SD

INTRODUCTION

- What determines the health outcomes of a population is multifactorial. However, some factors play a larger impact than others.
- Health policies that promotes social disparities may contribute to a disproportionate cancer burden.
- Understanding the spatial distribution of overall cancer mortality and the social and behavioral factors in South Dakota (SD) is needed to better target cancer prevention and control efforts at the community level.

Factors Impacting Health



Adapted from R Tarlov, A. (1997).Determinants of Health Model. Annals of the New York Academy of Sciences. 896.281-93

OBJECTIVES

The aim of this cross-sectional study was to examine the spatial distribution of the age-adjusted mortality rates of overall cancer and the socioeconomic and behavioral risk factors across South Dakota.

METHODS

Data Sources

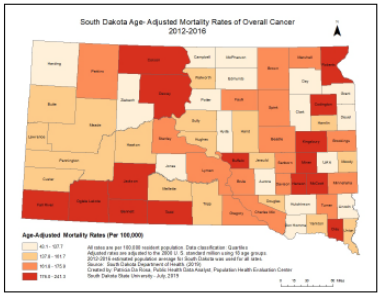
- Overall Cancer Mortality: South Dakota Cancer Registry (2012-2016)
- Behavior Risk Factors: County Health Rankings (2019) and the National Diabetes Surveillance System (2015).
- Social Vulnerability Index (2016): CDC/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program.

Measures

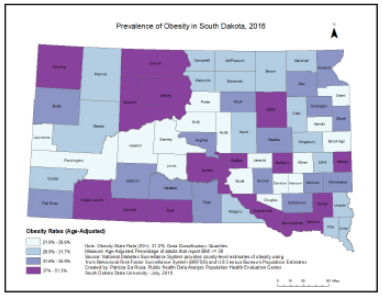
- County-level: age-adjusted mortality rate per 100,000, prevalence of obesity, smoking and physical inactivity.
- Census tract measures: Social Vulnerability Index (e.g., %poverty, %unemployed, with %with high school diploma) and housing and transportation (e.g., mobile homes, crowding, no Vehicle).

RESULTS

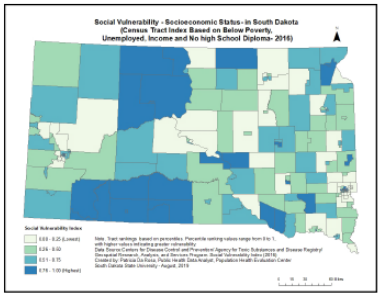
Age-Adjusted Cancer Mortality

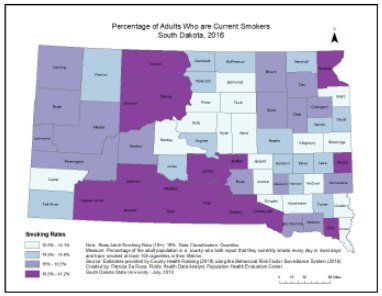


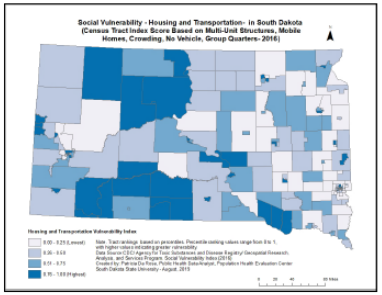
Behavioral Risk Factors

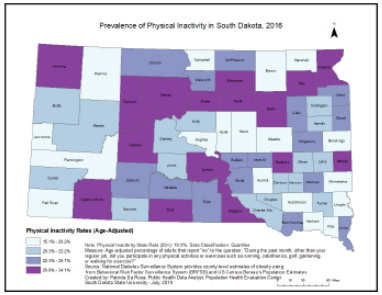


Social Vulnerability









Summary

- From 2012-2016, a total of 8,377 cancer-related deaths was reported in the state with 1,675 average annual deaths.
- The overall mortality state rate was 160.7 per 100,000 people, similar to the national rate (161.4/100,000).
- More than half (n=35) of SD counties have higher mortality rates than the state rate.
- The five counties with the highest age-adjusted mortality rates were: McCook, Buffalo, Dewey, Oglala Lakota, Todd.
- Social vulnerability (SES and Housing and Transportation), high smoking rates and obesity tend to be higher in the same regions as the overall cancer mortality rate

Limitations and Future work:

- This is a cross-sectional study; thus no inference on causal relationship can be done.
- Late-stage incidence may partially explain differences in mortality rates.
- Cluster analysis accounting for spatial autocorrelation (observations near to each other tend to be similar) may help identify areas at higher risk for cancer mortality.
- Similar work by cancer site and/or gender could also be performed to investigate whether similar patterns exist.

CONCLUSIONS

Overall cancer morality rates varied across the state. Cancer mortality rates tend to be higher in areas with greater social vulnerability and poor health behaviors. Identifying areas with greater cancer mortality risk may assist the SD Cancer Control and Prevention Program to allocate resources to address and reduce disparities in cancer mortality in South Dakota.

REFERENCES

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Freeman, H. P. (2004). Poverty, culture, and social injustice: determinants of cancer disparities. CA: A Cancer Journal for Clinicians, 54(2), 72-77.
Freeman, H. P. (2004). Poverty, culture, and social injustice: determinants of cancer disparities. CA: A Cancer Journal for Clinicians, 54(2), 72-77.
South Dakota Cacner Registry. Available at: http://getscreened.sd.gov/registry/data/
CDC/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Available at: https://svi.cdc.gov/

Acknowledgments:

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South Dakota State University

People residing in counties with elevated social vulnerability were associated with higher overweight/obesity rate.

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DOI: 10.15640/ijhs.v3n3a2
URL: http://dx.doi.org/10.15640/ijhs.v3n3a2

Social Vulnerability and Obesity among U.S. Adults

Ruopeng An[1] & Xiaoling Xiang[2]

Abstract

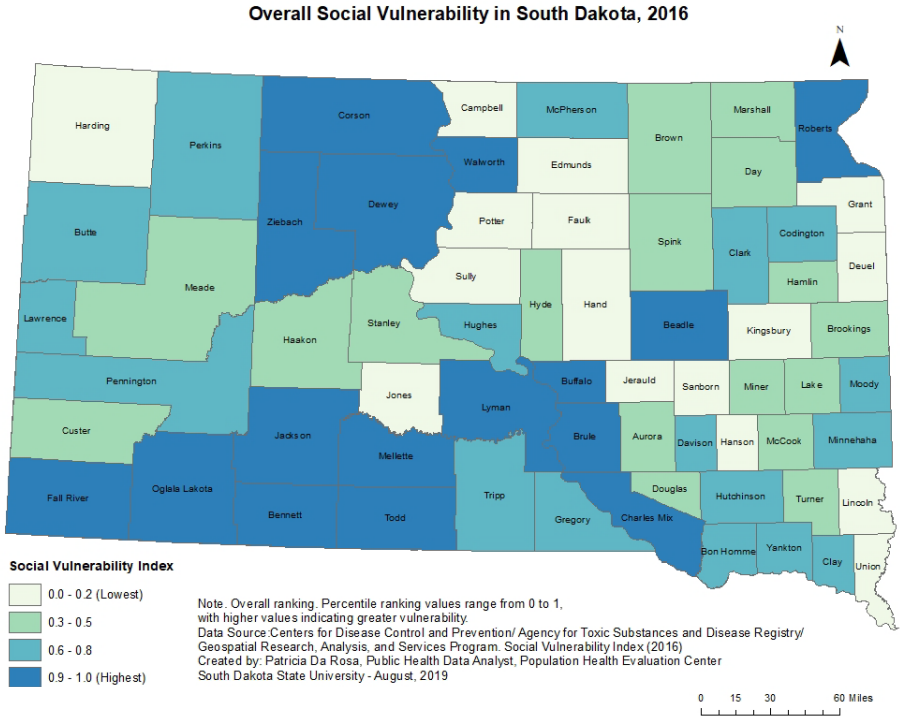
Obesity is a leading risk factor for morbidity and premature mortality. As a key indicator for public health preparedness, elevated social vulnerability may result in increased individual frailty. This study examined the relationship between residential county social vulnerability and overweight/obesity among U.S. adults.Individual-level data (661,360 adults residing in 2,250 counties) came from the Behavioral Risk Factor Surveillance System 2011 and 2012 surveys. County-level social vulnerability was measured by the Social Vulnerability Index (SVI) of the Centers for Disease Control and Prevention.Body mass index (BMI) was calculated from self-reported height and weight. Multilevel logistic regressions were performed to examine the associations between SVI quartiles and overweight/obesity.Compared to those residing in counties of the lowest SVI quartile, people living in counties of mid-low, mid-high, and highest SVI quartiles had 5.2% (95% confidence interval = 2.1%-8.4%), 6.8% (3.6%-10.0%), and 9.5% (6.0%-13.0%) higher odds of being overweight or obese (BMI ≥ 25), and 5.1% (1.9%-8.3%), 4.9% (1.8%-8.2%), and 7.1% (3.7%-10.6%) higher odds of being obese (BMI ≥ 30), respectively. Social vulnerability may profoundly impact individuals' weight-related behaviors and outcomes. SVI could be a useful tool to guild community-based obesity prevention and health promotion initiatives besides its intended use for emergency preparedness.

Keywords: Obesity; Social vulnerability; Multilevel model

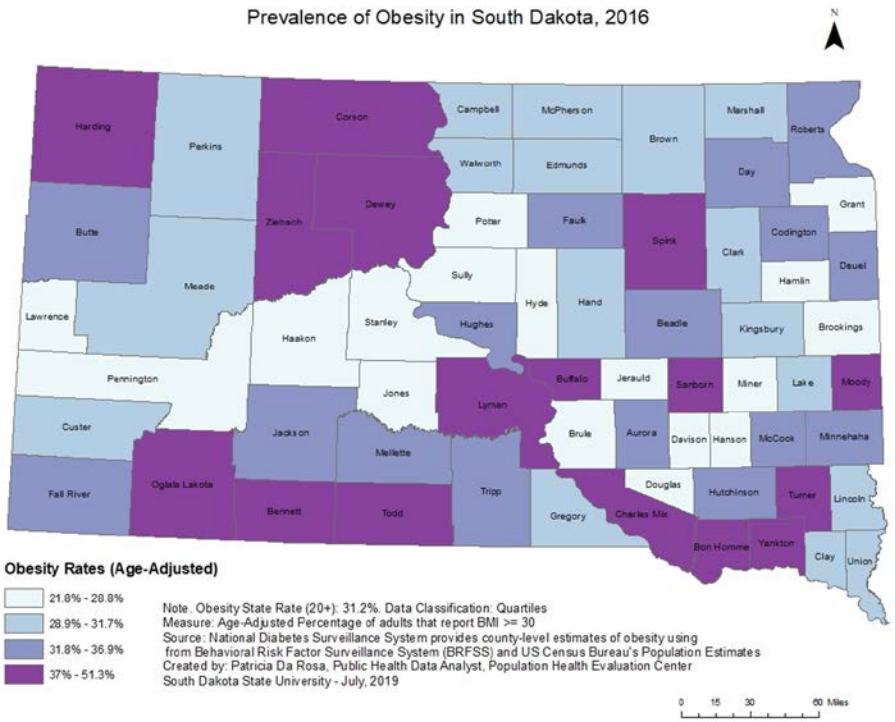
Introduction

Social Vulnerability and Obesity in South Dakota

Overall SVI



Obesity



$r = 0.465$, $p<0.001$

Social and environmental risk factors associated with county-level asthma emergency department visits

Jessica Kolling[1], MPH; Grete Wilt[1], MPH; Andrew Berens[1], MS; Heather Strosnider[2], MPH, PhD candidate; Owen Devine[3], PhD

[1]Geospatial Research, Analysis, and Services Program, Centers for Disease Control and Prevention (CDC) [2] Environmental Health Tracking Branch, CDC [3] Carter Consulting, Atlanta, GA

Background

Asthma is a chronic condition affecting an estimated 22.6 million people in the U.S. Exacerbation of asthma symptoms caused by exposure to triggers or poor asthma management can lead to emergency department (ED) visits. County-level rates of asthma ED visits vary significantly. Using data from the **CDC's Tracking Network** and the **CDC's Social Vulnerability Index** we sought to better understand geographic variation in asthma ED visits and to identify factors contributing to that variation.

Methods

Study Area

22 States participating in the CDC Tracking Network's data exchange program:

Data

County-level (2008-2012)

- Asthma emergency department visit standardized incidence ratios (SIR) (L_{ij})
- Median 24-hour average $PM_{2.5}$ (*PM*)
- Median 8-hour max Ozone (*o3*)
- Maximum daily temperature, (*MAXF*)
- Percent uninsured, 2010 (*PERUN*)
- The CDC's Social Vulnerability Index, 2010 (*SVI*)
  - Socioeconomic status
  - Household composition
  - Minority status & language
  - Housing & transportation

Bayesian Hierarchical Modeling

$$L_{ij} = B_1 * SVI_{ij} + B_2 * PM_{ij} + B_3 * o3_{ij} + B_4 * MAXF_{ij} + B_5 * PERUN_{ij} + v_{ij} \quad [1]$$

$$v_{ij} \sim N(B0_j, \sigma_j^2)$$

with hyperpriors

$$B0_j \sim N(\mu_{B0}, \gamma_{B0}^2),$$

$$\sigma_j \sim Uniform(0, 100)$$

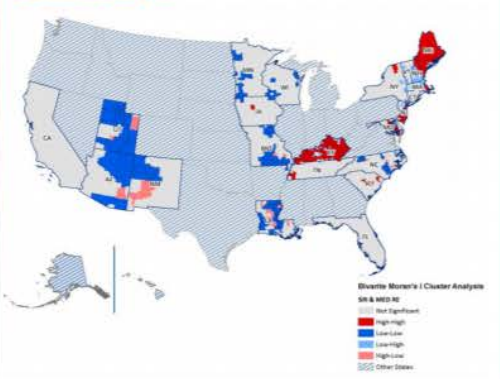
and

$$\mu_{B0} \sim N(0, 100000),$$

$$\gamma_{B0} \sim Uniform(0, 100).$$

- Models fit with Bayesian Monte Carlo Markov Chain methods using hierarchical mixed methods to control for state and county clustering
- The natural log of the observed SIRs: L_{ij}, is modeled as the outcome of interest [1]
- $B0_j$ is the random intercept for state j with σ_j^2 showing state-specific residual variation
- μ_{B0} corresponds to the mean state-level effects & γ_{B0} reflects variation among state intercepts
- Deviance Information Criteria (DIC) and estimated posterior distributions used to assess model fit
  - SVI alone versus with additional risk factors
  - No random effects, state only, county only, or state and county random effects

Spatial Analysis



- Results from a bivariate Local Moran's I comparing SIRs to the spatial lag of Median Random Effects Residuals
- Clustering indicates there are additional covariates contributing to spatial patterns that we didn't include in our model due to limited data availability

Results

- The model containing only SVI with state and county random effects provided the best fit to the data.
- We estimate a **12 to 16 percent increase in asthma ED visits for every increase in one unit of SVI** at the county level.
- The estimated posterior distributions for the other covariates were centered on zero and were not meaningful.
- After accounting for state & county random effects, we observed no meaningful difference in impact of SVI by state.
- Our spatial analysis of the random effects residuals suggests our model does not fully explain geographic variability in asthma ED visit rates (additional contributing variables not included in analysis).

Limitations

- Our results apply to county-level asthma ED visits and should not be applied at the individual level.
- Cross sectional are merely estimates of the complex issue of social vulnerability. There are likely additional place-based factors contributing to community level social vulnerability not included in SVI estimates.
- We did not include additional factors known to be associated with asthma ED visits at the individual level such as smoking and indoor air quality as a potential covariates due a lack of data.
- County level data including $PM_{2.5}$, ozone, and daily maximum temperature may not be at a fine enough geographic scale to reflect true variation in air pollution and temperature.

Conclusion

The CDC's Social Vulnerability Index is a strong predictor of county-level variation in asthma ED visits at the county-level among tracking states. While daily fluctuations in $PM_{2.5}$ and O_3 are associated with asthma ED visits, variability in county average annual concentrations do not contribute to variability in county SIR. Additional analysis should include an assessment into the specific social risk factors associated most strongly with asthma ED visit rates.

Takeaways

- SVI is a significant predictor of county-level asthma ED visits.
- However, SVI does not explain all the variability in county-level asthma ED visits.
- Spatial clustering still exists after accounting for SVI.

This study is one of the first attempts at exploring SVI data in the context of chronic disease. Understanding the relationship between social vulnerability and asthma ED visits can aid the development and implementation of public health actions to reduce the occurrence of asthma ED visits.

Contact Info

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GRASP

ENVIRONMENTAL PUBLIC HEALTH TRACKING

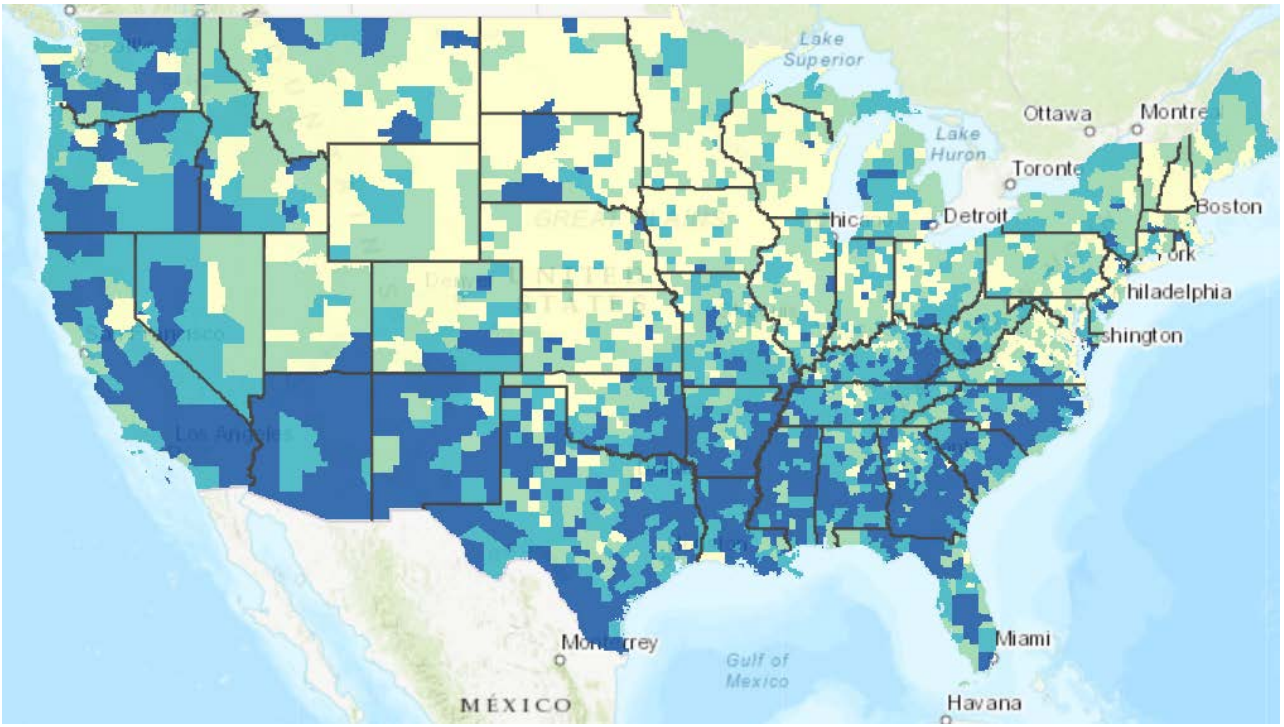
National Center for Environmental Health

Agency for Toxic Substance and Disease Registry

CDC ATSDR

Possible Questions on Vulnerable Populations and Public Health Practice

- Which groups are less likely to be screened for breast cancer? Where can we find them?
- Which groups will need essential resources to attend a health community event?
- Which groups are least likely to understand and respond to health education activities?
- Areas with higher number of emergency department visits



HOW TO ACCESS THE SVI DATASET

https://svi.cdc.gov/map.aspx

South Dakota State University

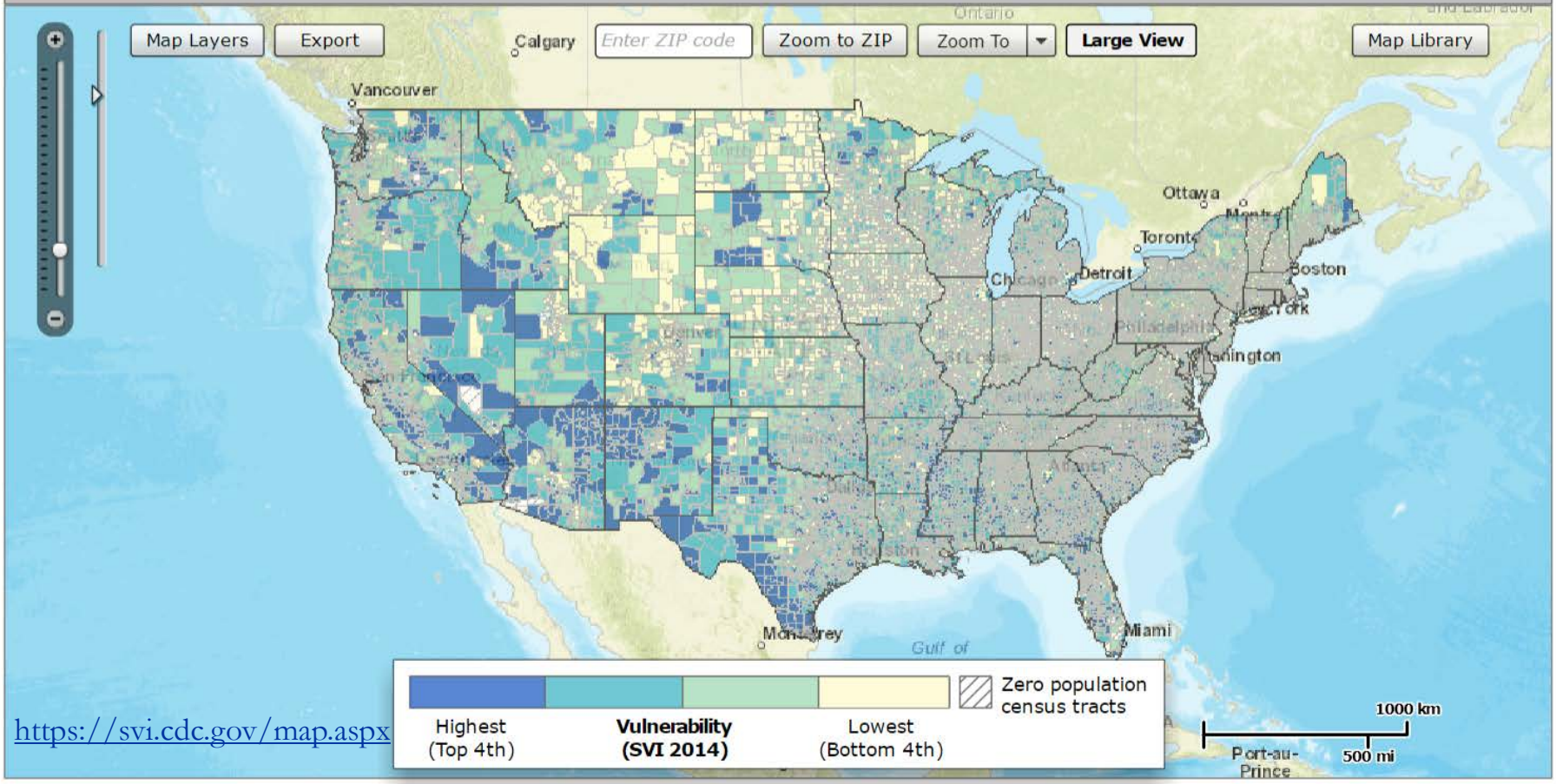
ATSDR Agency for Toxic Substances & Disease Registry

Social Vulnerability Index (SVI) Mapping Dashboard

State: All States | County: | Theme: Overall Vulnerability | SVI Year: SVI 2014 | Go! | Reset map

Now Showing: **Overall Vulnerability** | All States
[Data Classified by All US Census Tracts excluding PR]

SVI 2014



https://svi.cdc.gov/map.aspx

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA 30333, USA

ATSDR Agency for Toxic Substances and Disease Registry

SEARCH

ATSDR A-Z INDEX

CDC's Social Vulnerability Index (SVI)

- SVI Home
- Fact Sheet
- Data & Tools Download
- Publications & Materials
- SVI Interactive Map
- **Prepared County Maps**

Prepared County Maps

Download County Maps

Select from the dropdown menus below to view the prepared county map.

Year

2016

State

---------- Select a state ----------

County

------- Select a state first ---

View County Map

* Printing Tips

PDF display not loading? Download the most recent version of Adobe Reader here: "http://get.adobe.com/reader/

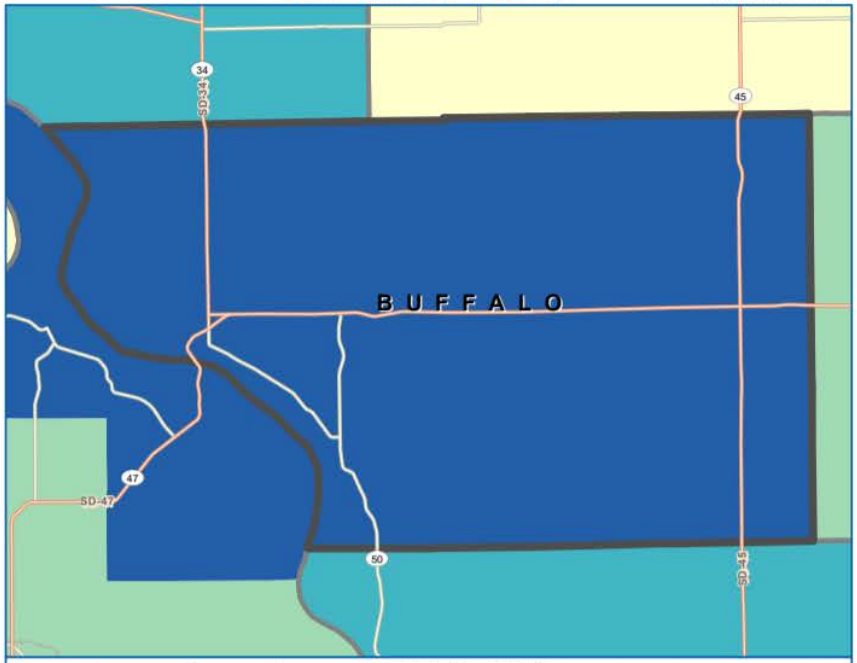
https://svi.cdc.gov/prepared-county-maps.html

CDC's Social Vulnerability Index 2016

Buffalo County, South Dakota

PART 1

Overall Social Vulnerability[1]



Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Data Unavailable[3]

0 1.25 2.5 5 7.5
Miles

Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. The **Social Vulnerability Index (SVI 2016)[4] County Map** depicts the social vulnerability of communities, at census tract level, within a specified county. SVI 2016 groups **fifteen census-derived factors** into **four themes** that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. Overall Social Vulnerability combines all the variables to provide a comprehensive assessment.

MAP PRODUCED 3/2/2018

GRASP

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

ATSDR

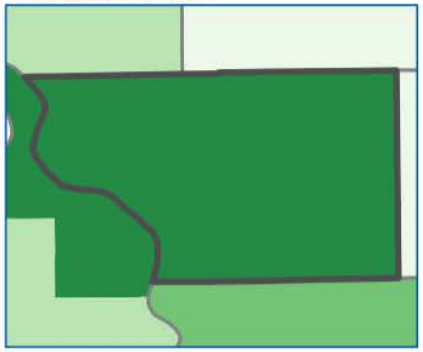
FINAL - FOR EXTERNAL USE

SVI 2016 – BUFFALO COUNTY, SOUTH DAKOTA

PART 2

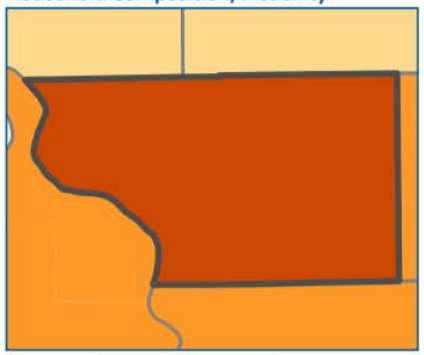
SVI Themes

Socioeconomic Status[5]



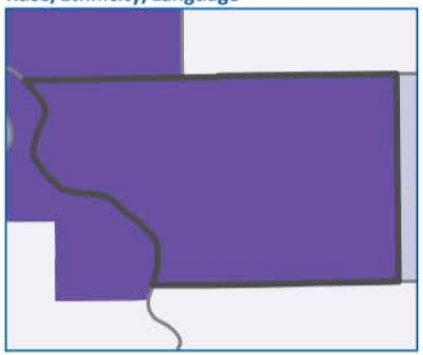
Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Household Composition/Disability[6]



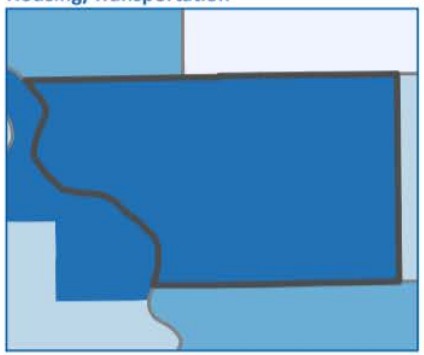
Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Race/Ethnicity/Language[7]



Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Housing/Transportation[8]



Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 15 variables. [3]Census tracts with 0 population. [4]The SVI combines percentile rankings of US Census American Community Survey (ACS) 2012-2016 variables, for the state, at the census tract level. [5]Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No High School Diploma. [6]Household Composition/Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and over with a Disability. [7]Race/Ethnicity/Language: Minority, English Language Ability. [8]Housing/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.
Projection: South Dakota Custom Lambert NAD83 (EJH).
References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 2011. 8(1).
CDC's SVI web page: http://svi.cdc.gov.

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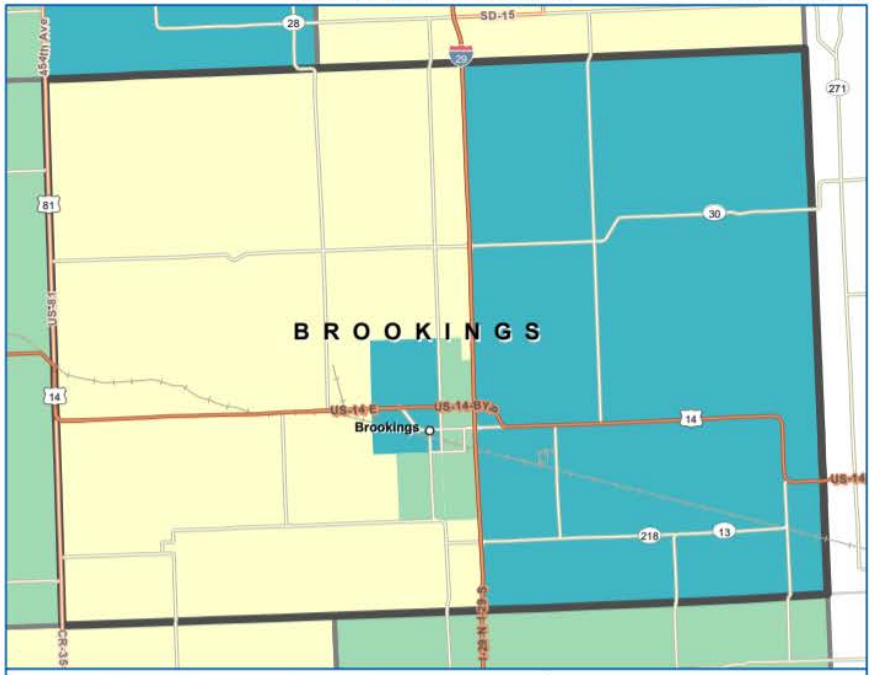
CDC's Social Vulnerability Index 2016

Brookings County, South Dakota

PART 1

Overall Social Vulnerability[1]



Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. The **Social Vulnerability Index (SVI 2016)[4] County Map** depicts the social vulnerability of communities, at census tract level, within a specified county. SVI 2016 groups **fifteen census-derived factors** into **four themes** that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. Overall Social Vulnerability combines all the variables to provide a comprehensive assessment.

MAP PRODUCED 3/2/2018

GRASP

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

ATSDR

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SVI 2016 – BROOKINGS COUNTY, SOUTH DAKOTA

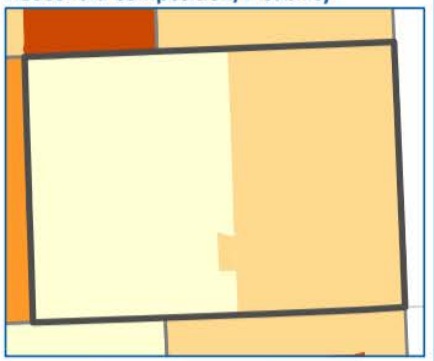
PART 2

SVI Themes

Socioeconomic Status[5]

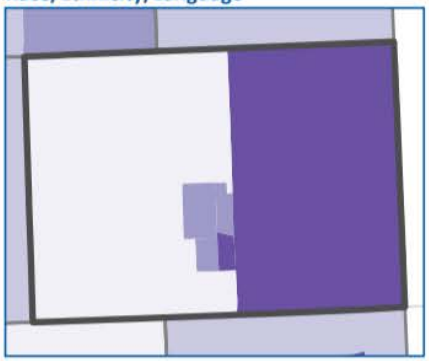
Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Household Composition/Disability[6]



Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Race/Ethnicity/Language[7]



Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Housing/Transportation[8]

Highest (Top 4th) | Vulnerability (SVI 2016)[2] | Lowest (Bottom 4th)

Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 15 variables. [3]Census tracts with 0 population. [4]The SVI combines percentile rankings of US Census American Community Survey (ACS) 2012-2016 variables, for the state, at the census tract level. [5]Socioeconomic Status: Poverty, Unemployed, Per Capita Income, No High School Diploma. [6]Household Composition/Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and over with a Disability. [7]Race/Ethnicity/Language: Minority, English Language Ability. [8]Housing/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.
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CDC's SVI web page: http://svi.cdc.gov.

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2. Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index **2016 South Dakota**. data-and-tools-download.html. Accessed on **8.30.2019**
3. Andrew, M. K., Mitnitski, A. B., & Rockwood, K. (2008). Social vulnerability, frailty and mortality in elderly people. PloS One, 3(5), e2232. doi:10.1371/journal.pone.0002232
4. Grabovschi, C., Loignon, C., & Fortin, M. (2013). Mapping the concept of vulnerability related to health care disparities: A scoping review. BMC Health Services Research, 13, 94. doi:10.1186/1472-6963-13-94

Questions?

South Dakota State University