

# Measuring Need Using Population Health Indicators: Some Composite Methods Shortchange Rural Counties

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# Composite Health Indices

## Summary measure of health

- Constructed from a set of population health indicators from multiple sources that have been transformed (e.g., scaled, normalized, standardized) and aggregated together in a single measure (Rothenberg et al., 2015)

## Used to monitor and compare the health between populations

- Geographical units (e.g., countries, states, counties)
- Socioeconomic groups

Rothenberg, et al. (2015). Urban health indicators and indices – current status. *BMC Public Health*, 15:494.

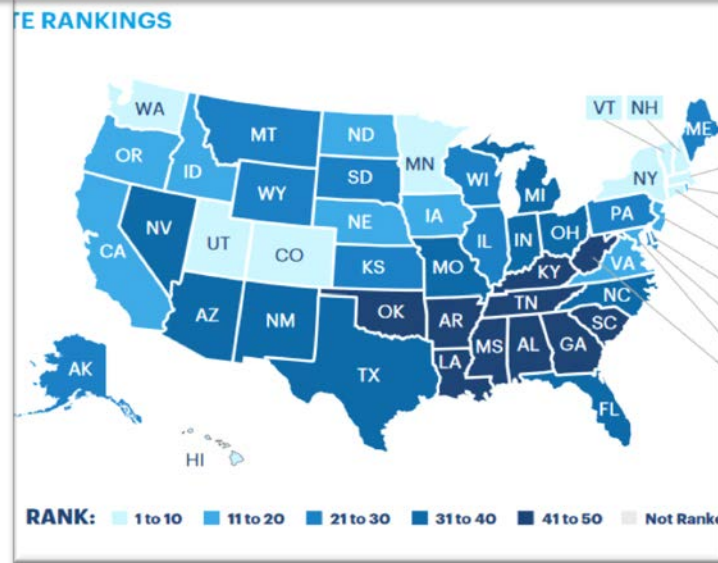


# Multiple Uses of Composite Health Indices

- Public communication
- Track changes overtime
- Problem identification
- Policy design and adoption
- Stimulate efforts to improve population health

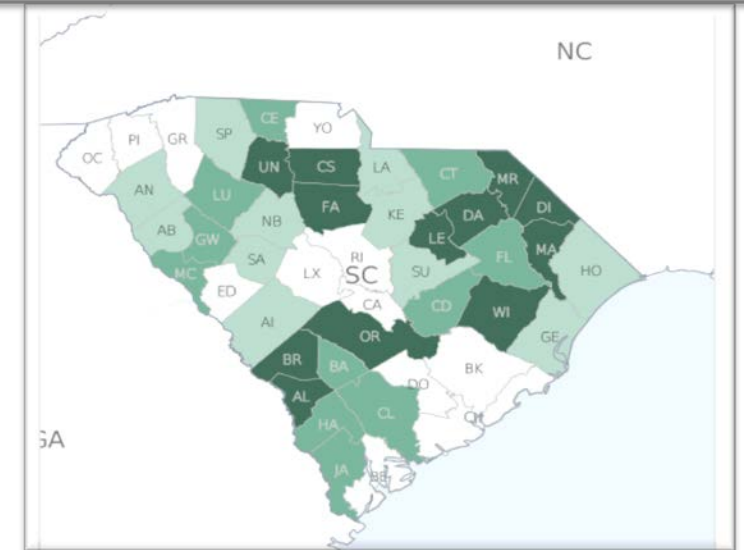
Oliver, TR. (2010). Population health rankings as policy indicators and performance measures. *Prev Chronic Dis*, 7:A101.

## America's Health Rankings



## Examples of Composite Health Indices in the United States

### County Health Rankings



The United Health Foundation – America's Health Rankings. Available at <https://www.americashealthrankings.org/>  
The University of Wisconsin Population Health Institute – County Health Rankings. Available at <http://www.countyhealthrankings.org/>

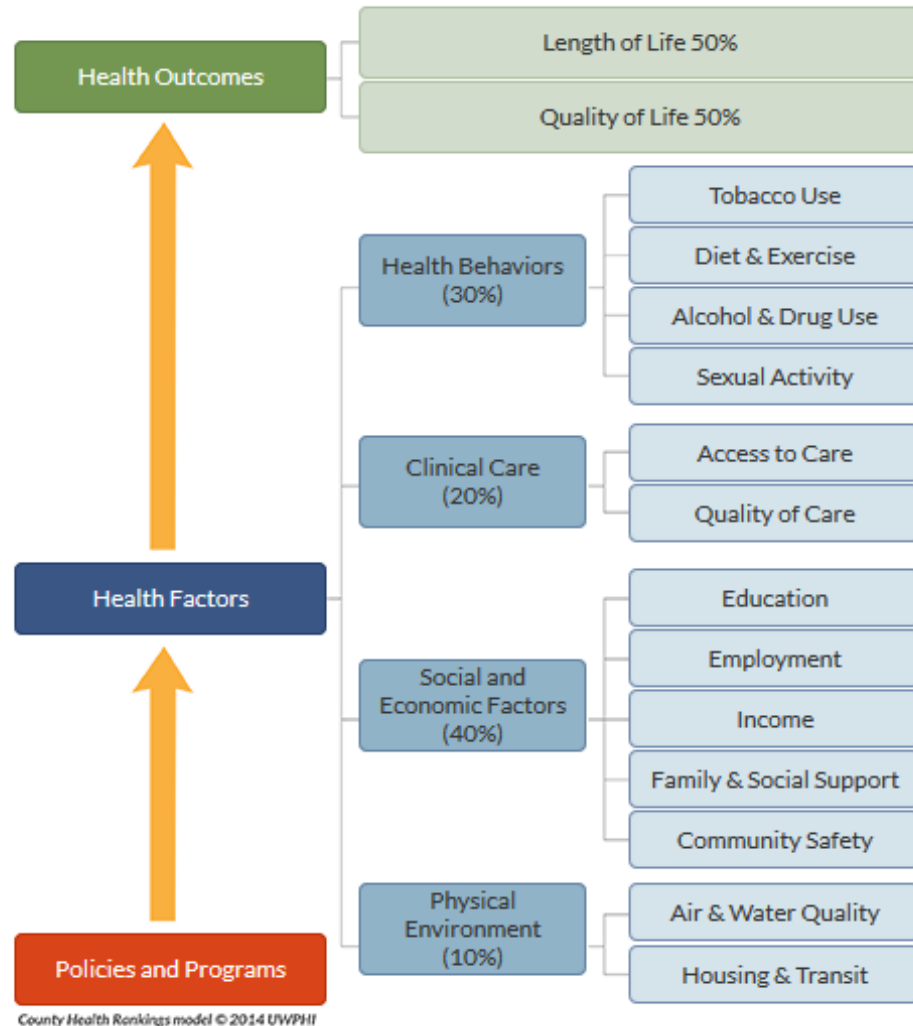


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# County Health Rankings



## Methods

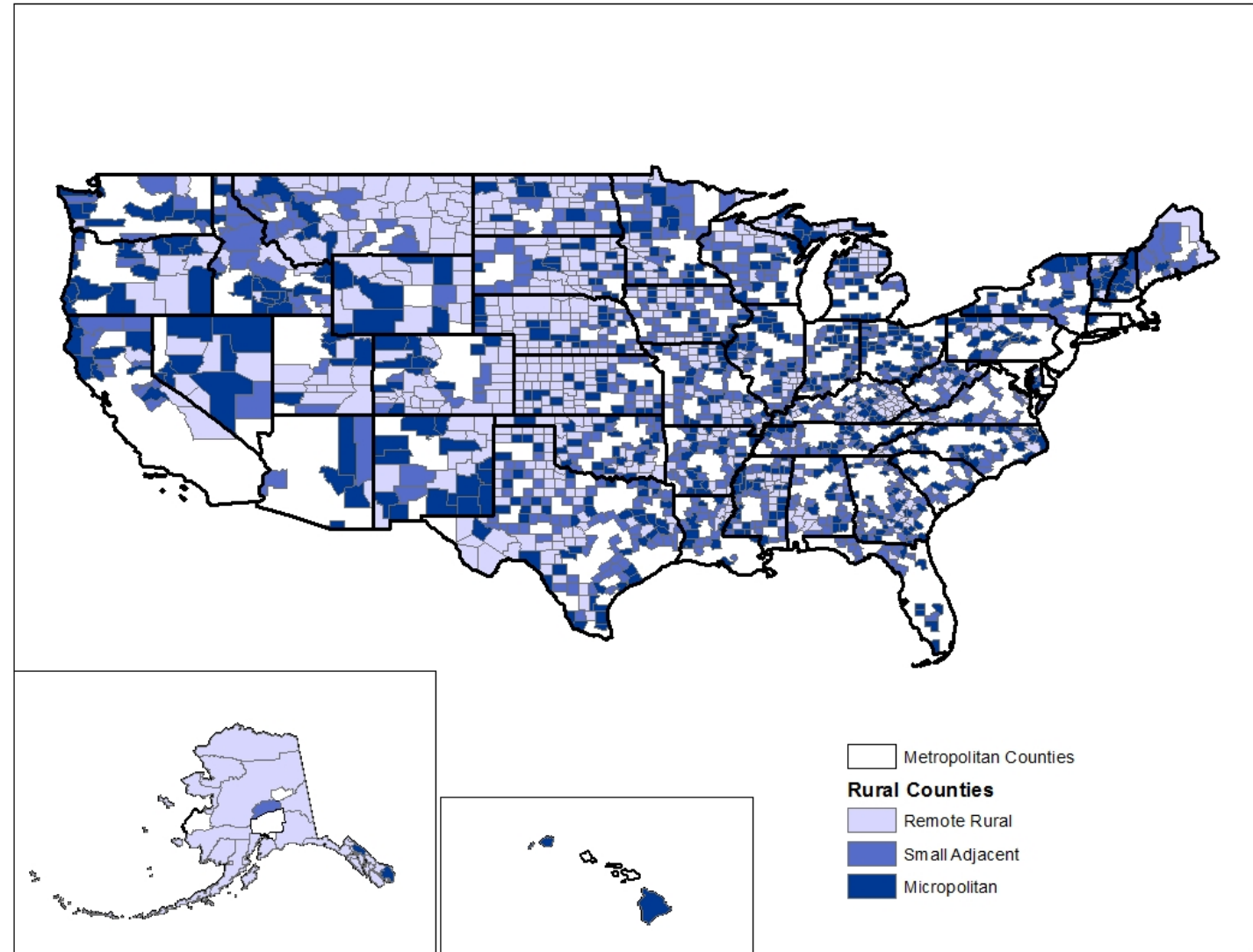
1. Gather data
2. Impute missing data using state mean
3. Normalize county values within each state for each measure using the average of counties in that state (z-scores)
4. Eliminate outliers
5. Multiply by scientifically-informed weights
6. Sum weighted scores
7. Rank counties by the sum of all measure scores

The University of Wisconsin Population Health Institute – County Health Rankings. Available at <http://www.countyhealthrankings.org/>



# Distribution of Rural and Urban Counties Across the United States

Category	Number of Counties
Metropolitan	1,166
Micropolitan	641
Small Adjacent	674
Remote Rural	655



Counties were characterized based on level of rurality using Urban Influence Codes: Urban (UICs 1, 2), Micropolitan (UICs 3, 5, 8), Small Adjacent (UICs 4, 6, 7, ), and Remote Rural (UICs 9, 10, 11, 12).



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Comparison of ranks for the 10 rural counties with poorest health outcomes

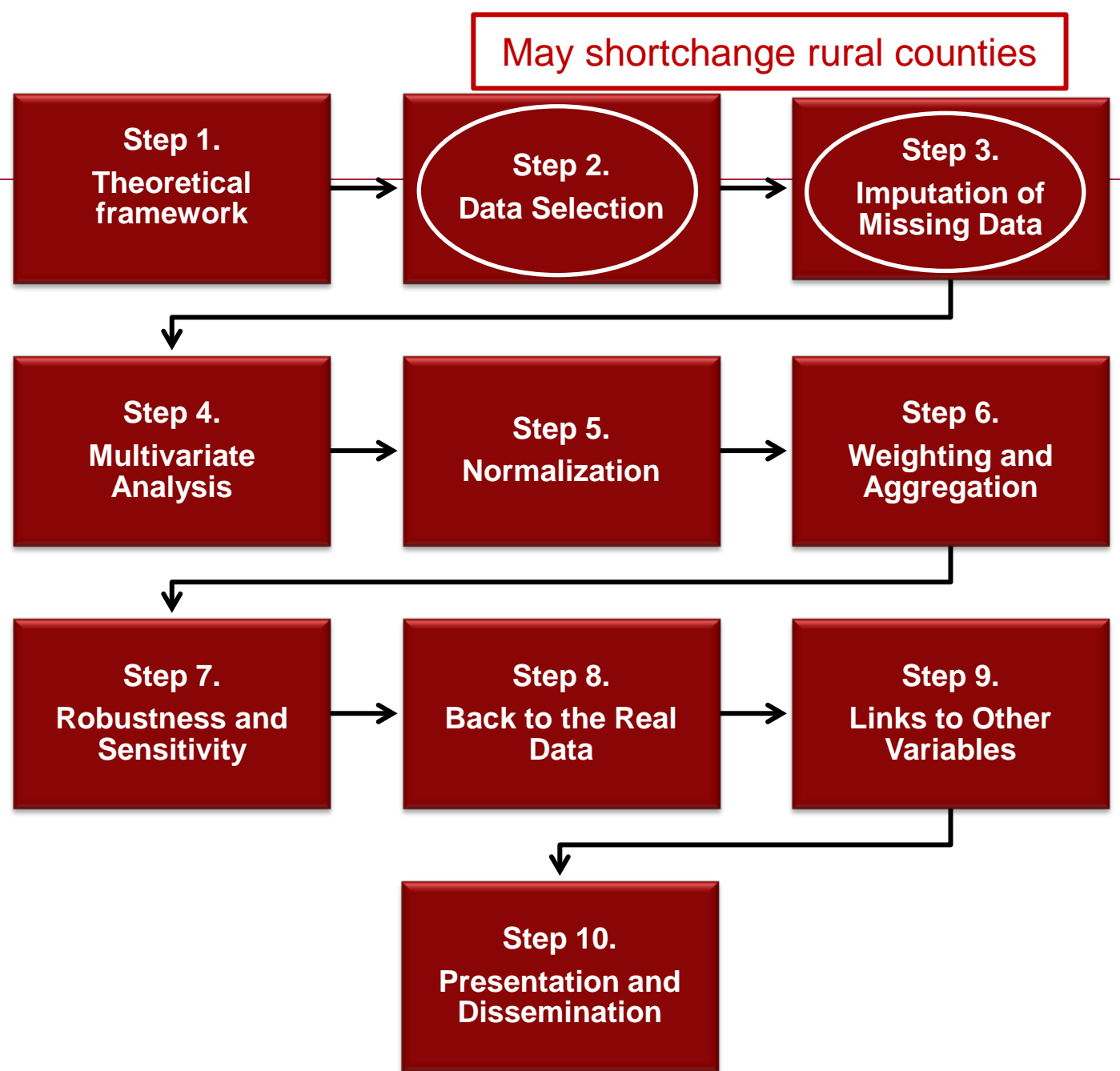
County	County Health Rankings (CHR)	YPLL	Age-adjusted All-cause Mortality	Absolute Difference (CHR and YPLL)	Absolute Difference (CHR and All-cause)
Coahoma, MS	1907	1895	1872	12	35
Wilcox, AL	1906	1898	1825	8	781
Holmes, MS	1905	1884	1805	21	100
McDowell, WV	1904	1901	1903	3	1
Phillips, AR	1903	1887	1882	16	21
Mingo, WV	1902	1891	1899	11	3
Sharkey, MS	1901	1885	1828	16	73
Pemiscot, MO	1900	1893	1869	7	31
Jefferson Davis, MS	1899	1866	1603	33	296
Jefferson, MS	1898	1848	1518	50	380





# Construction of Composite Health Indices

- Multiple steps in the process
- Caution required during all steps



Organisation for Economic Co-Operation and Development. (2008). Handbook on Constructing Composite Indicators – Methodology and User Guide.



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# Things to Consider during Data Selection

1. Availability of data at the desired geographic level of analysis
  - Use the average of multiple years of data
  - Proxy measures may be substituted
2. Timeliness
3. Accessibility
4. Accuracy

Focus Area	Measure	Weight	Source	Year(s)	Missing
<b>Length of life (50%)</b>	<b>Premature death</b>	50%	Mortality files	2012-2014	9% (169)
<b>Quality of life (50%)</b>	<b>Poor or fair health</b>	10%	BRFSS	2015	0
	<b>Poor physical health days</b>	10%	BRFSS	2015	0
	<b>Poor mental health days</b>	10%	BRFSS	2015	0
	<b>LBW</b>	20%	Nativity files	2008-2014	5% (93)

Example of a Summary Table of Data Characteristics from *County Health Rankings*

The University of Wisconsin Population Health Institute – County Health Rankings. Available at <http://www.countyhealthrankings.org/>  
 Organisation for Economic Co-Operation and Development. (2008). Handbook on Constructing Composite Indicators – Methodology and User Guide.



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# Imputation of Missing Data

- Types
  1. Case deletion
    - ↳ Ignores differences between cases with complete versus incomplete data
  2. Single imputation
    - ↳ Mean/median/mode substitution
  3. Multiple Imputation
  
- Overuse of imputation techniques can impact the overall quality of the composite index.

Organisation for Economic Co-Operation and Development. (2008). Handbook on Constructing Composite Indicators – Methodology and User Guide.



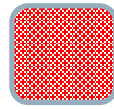
# Comparison of Unranked Rural Counties (n=63) in *County Health Rankings* to State and National Averages

Example of Case Deletion

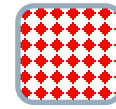
Population Health Indicator		Worse Health Outcomes		
		State Average (only) % (n)	National Average (only) % (n)	Both % (n)
Clinical Care	Uninsured	8% (5)	17% (11)	52% (33)
	Uninsured children	0%	6% (4)	92% (58)
	Poverty	25% (16)	0%	8% (5)
	Child poverty	11% (7)	3% (2)	32% (20)
	No primary care providers	-	78% (49)	-
	No dentists	-	86% (54)	-
	No mental health providers	-	48% (30)	-



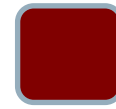
# Clinical Care



Worse health outcomes compared to **state** average



Worse health outcomes compared to **national** average



Worse health outcomes compared to both **state** and **national** averages

	Mental Health Providers	Dentists	Primary Care Physicians	Uninsured Children	Uninsured	
						Bristol Bay, AK
						Yakutat, AK
						Alpine, CA
	NA					Cheyenne, CO
						Hinsdale, CO
						San Juan, CO
	NA					Camas, ID
						Clark, ID
	NA					Stanton, KS
	NA					Wallace, KS
	NA					Carter, MT
	NA					Garfield, MT
	NA					McCone, MT
	NA					Petroleum, MT
	NA					Prairie, MT
	NA					Treasure, MT
	NA					Wibaux, MT
						Arthur, NE
						Banner, NE
						Blaine, NE
	NA					Deuel, NE
	NA					Garden, NE
						Grant, NE
						Hayes, NE
						Keya Paha, NE
						Logan, NE
						Loup, NE
						McPherson, NE
	NA					Sioux, NE
						Thomas, NE
						Wheeler, NE
						Harding, NM
						Billings, ND
	NA					Logan, ND
	NA					Sheridan, ND
						Slope, ND
	NA					Campbell, SD
	NA					Harding, SD
	NA					Hyde, SD
						Jones, SD
	NA					Sully, SD
						Borden, TX
						Glasscock, TX
						Kenedy, TX
						Kent, TX
						King, TX
						Loving, TX
						McMullen, TX
	NA					Motley, TX
						Roberts, TX
	NA					Sterling, TX
						Terrell, TX
	NA					Daggett, UT
						Plute, UT



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# Example of Single Imputation

State	Number of Rural Counties Missing data	Average Years of Potential Life Lost (YPLL)	
		Rural Counties	All Counties
Alaska	4	9246.05	8813.51
Colorado	4	7017.81	6663.9
Kansas	18	8077.68	7749.7
Montana	8	8868.80	8648.0
Nebraska	12	6872.43	6674.7
North Dakota	16	8189.12	8482.89
South Dakota	16	9420.28	8838.4
Texas	11	8680.02	8237.0

- County Health Rankings uses single imputation methods to replace missing data
  - ◆ Use corresponding state-level means
  - ◆ Method chosen for ease of communicating methods and final rankings with the public
- Modifications are needed to accommodate the unique characteristics of data from rural counties



# Use of Indices

Pros	Cons
Can summarize several elements into a single measure.	Poorly constructed composite index may be misinterpreted or send misleading policy messages.
Easier to interpret.	May invite simplistic policy conclusions.
Can assess progress over time.	May be misused if poorly constructed or lacks transparent methodology.
Reduce the visible size of a set of indicators without dropping the underlying information base.	May disguise limitations of data.

Organisation for Economic Co-Operation and Development. (2008). Handbook on Constructing Composite Indicators – Methodology and User Guide.



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# Future Directions

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- Determine which method works best for rural counties with missing data.
- Identify proxy measures and determine how they may impact the ranks



# Thanks!

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- Our web site:
  - ◆ [rhr.sph.sc.edu](http://rhr.sph.sc.edu)
- Core funding from:
  - ◆ Federal Office of Rural Health Policy, Health Resources & Services Administration, USDHHS
- Contact:
  - ◆ [brenemac@mailbox.sc.edu](mailto:brenemac@mailbox.sc.edu)





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