RURAL-URBAN GRADIENTS IN MENTAL HEALTH IN OLDER ADULTS:
DOES CHOICE OF RURALITY MEASUREMENT MATTER?

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PRESENTER DISCLOSURES

BACKGROUND

- Lack of consensus among researchers on several aspects of defining "rurality", including:[1]
  - Finding the optimal geographic unit(s) on which to assess rurality
  - Defining and unifying the measurement of "rurality"
  - Understanding what specific aspects of rurality impact health and wellbeing

OBJECTIVES

1. To describe, compare, and contrast five measures of rurality, highlighting distributional properties, in US counties.
2. To determine how mental health status relates to rurality.
3. To demonstrate changing associations between mental health status and rurality based on the specific rurality measures used, and their implications for policy and research.

DATA SOURCES: FIVE MEASURES OF RURALITY

| Source	Rurality Measure	Variable Type	Distribution	Description
2003 USDA	Rural-urban continuum code	Ordinal	9 levels	Based on the proximity of counties to metropolitan statistical areas and population size, arranged as a continuum
2003 USDA	Urban influence code	Ordinal	12 levels	Based on the estimated economic influence of urban areas on counties and population size
2010 US Census	Log of population density	Continuous	Right-skewed	Natural log of the quotient of county population divided by county land area
2010 US Census	Proportion urban population	Continuous	Right-skewed	US Census definition of percent of county population considered "urban"
2010 US Census	Index of relative rurality[2]	Continuous	Approximately symmetric	Composite scale of several component variables. Ranges from 0 to 1.

DATA SOURCES:
MENTAL HEALTH IN OLDER ADULTS

- Data source: Behavioral Risk Factor Surveillance System (BRFSS), 2010
- Question asked: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"
  - Dichotomized to $\geq$ 1 day vs. 0 days
- Restricted to respondents age 60+
- Response rate for this question: 98.1%
- N = 176,999

STATISTICAL ANALYSIS

- **Univariate and spatial distributions**
  - **Descriptive statistics, histograms, and maps**
- **Bivariate associations**
  - **Spearman's correlation**
- **Associations between rurality and mental health**
  - **Weighted logistic regression with linear splines at quartiles or each rurality measure (tertiles for RUCC)**
- **Software used**
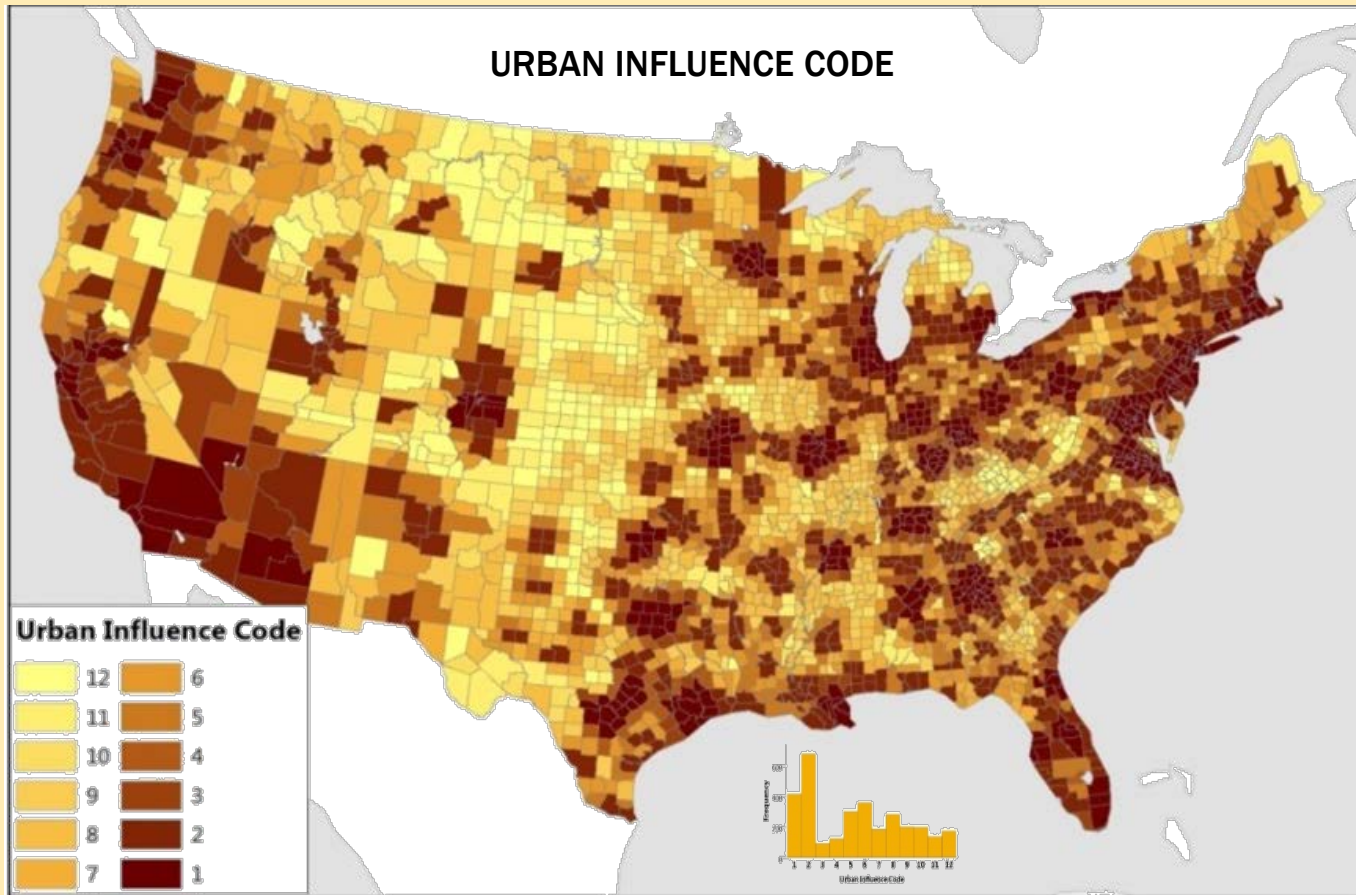 - **SAS v. 9.3 and ArcGIS v. 10**
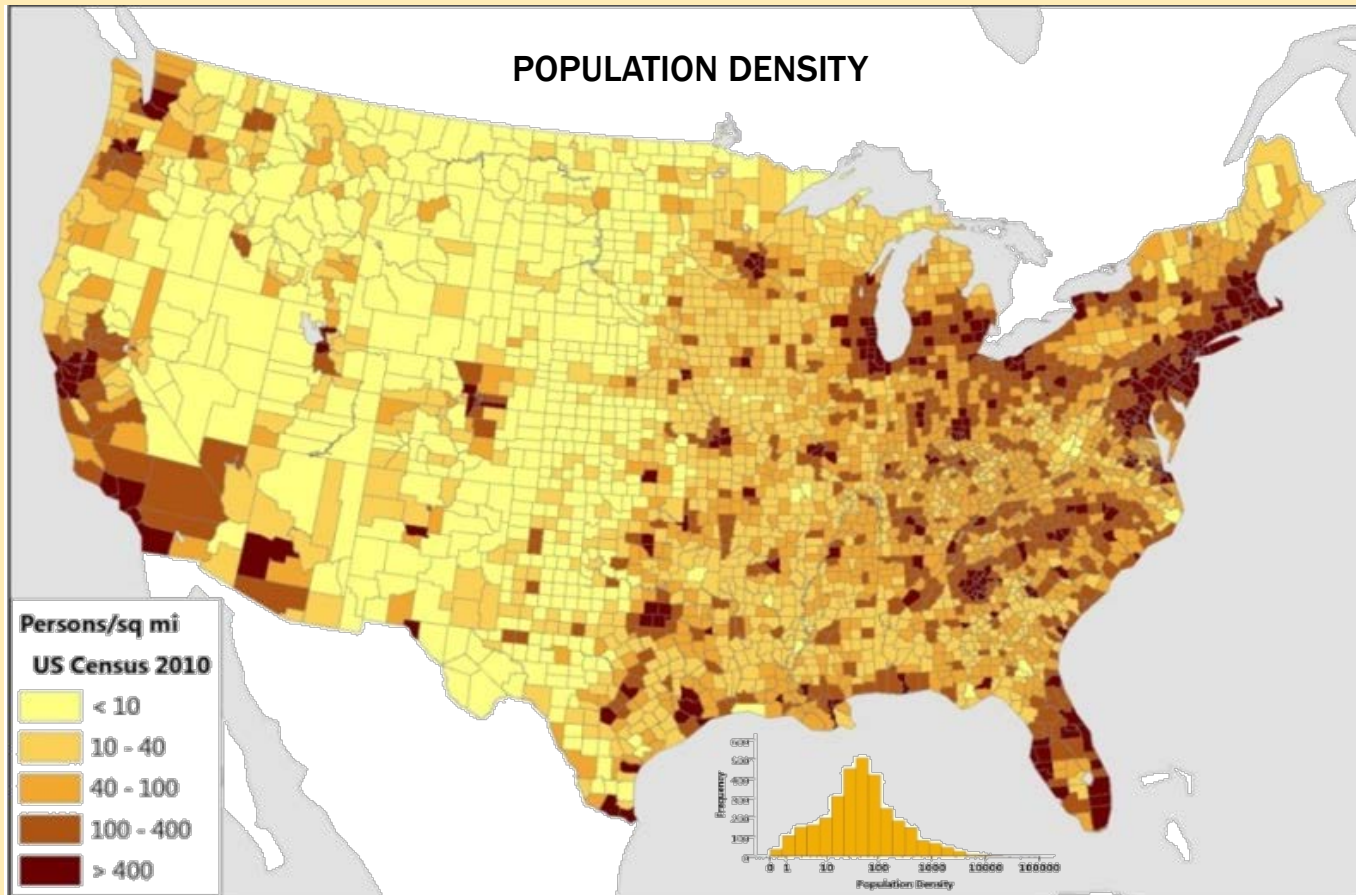
MENTAL HEALTH BY COUNTY
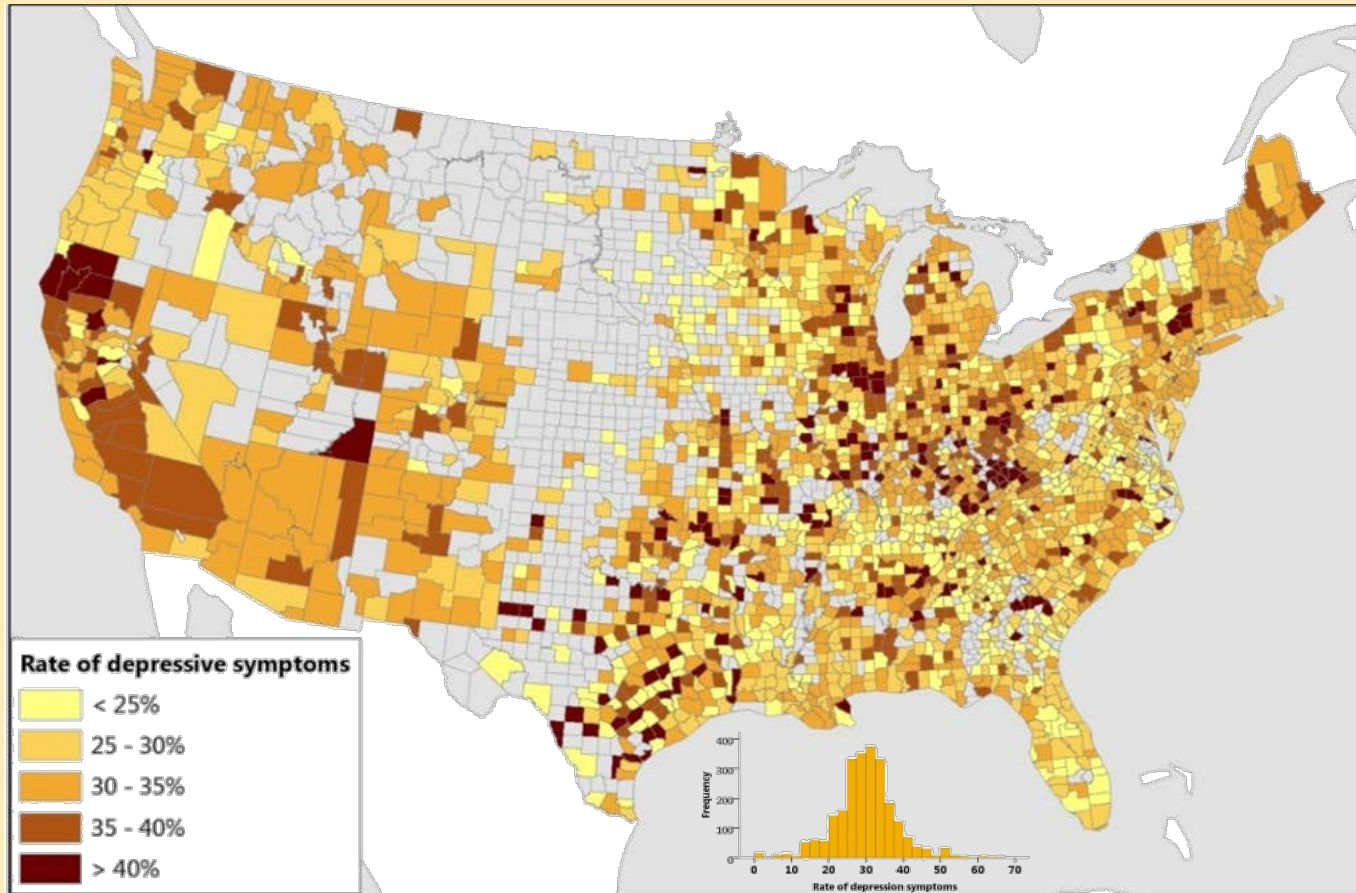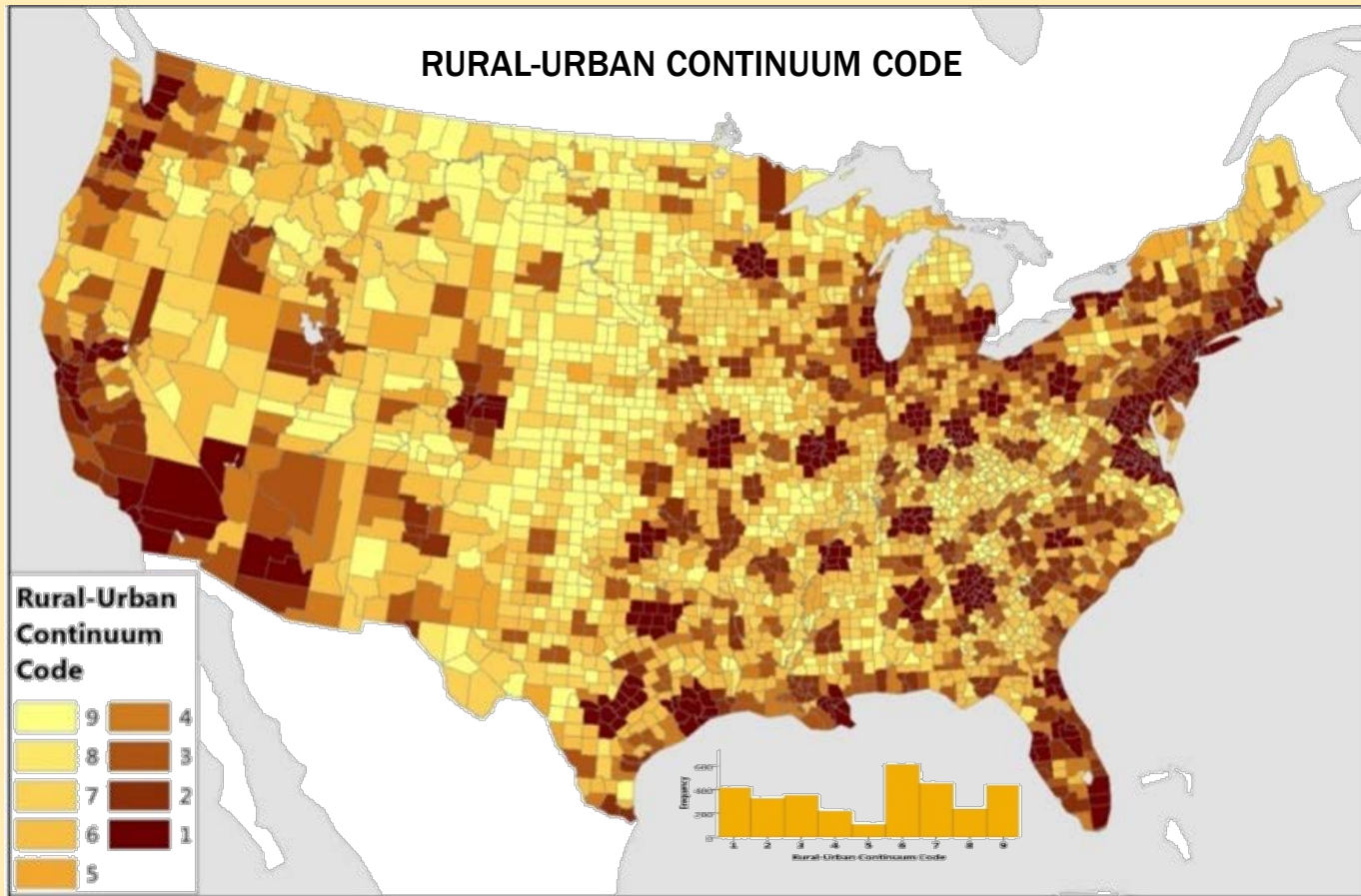
MEASURES OF RURALITY

MEASURES OF RURALITY

URBAN INFLUENCE CODE

MEASURES OF RURALITY

POPULATION DENSITY

MEASURES OF RURALITY

PERCENT URBAN POPULATION

Percent urban pop.
US Census 2010
- < 20%
- 20 - 40%
- 40 - 60%
- 60 - 80%
- > 80%

MEASURES OF RURALITY
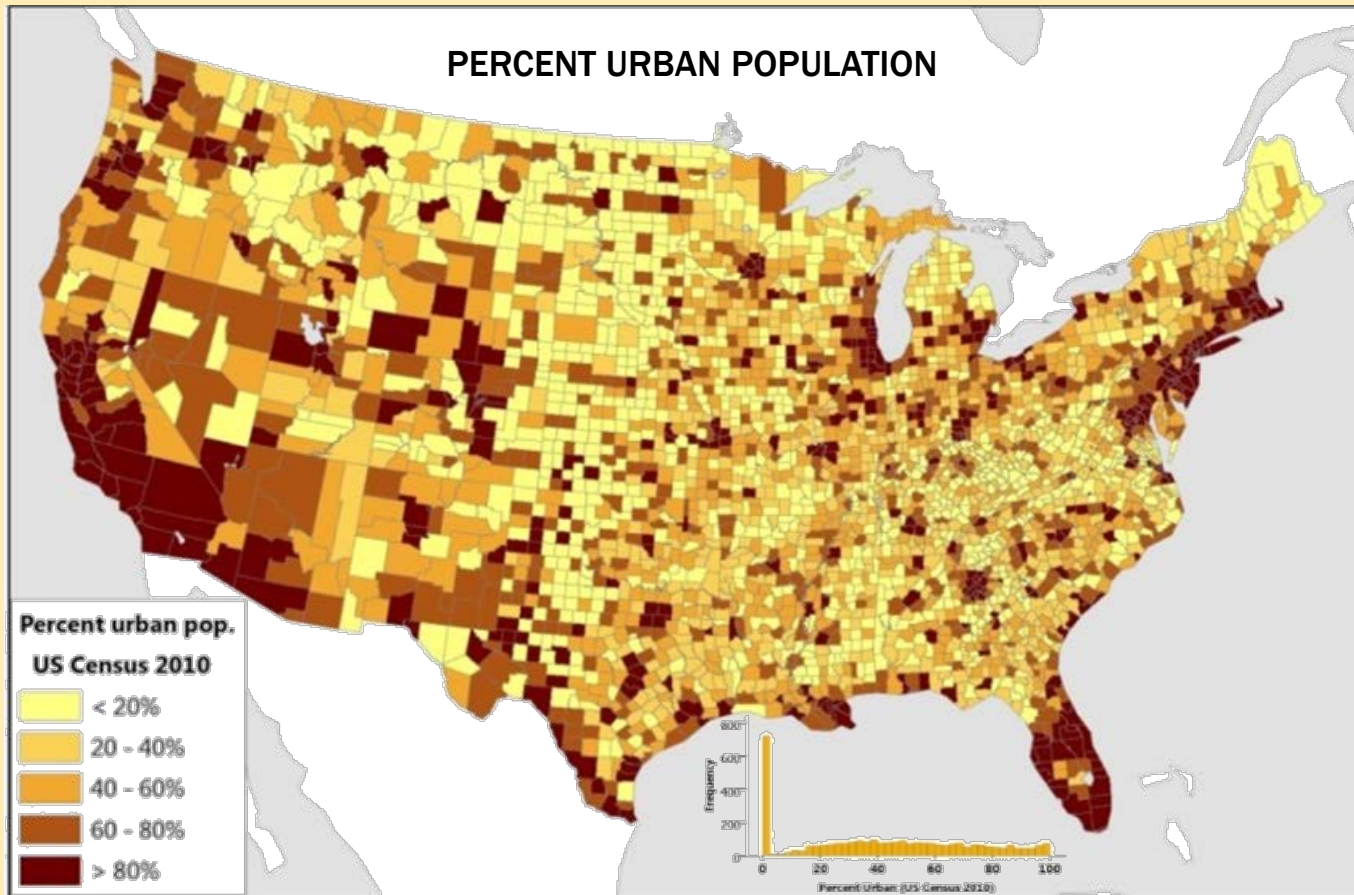
INDEX OF RELATIVE RURALITY
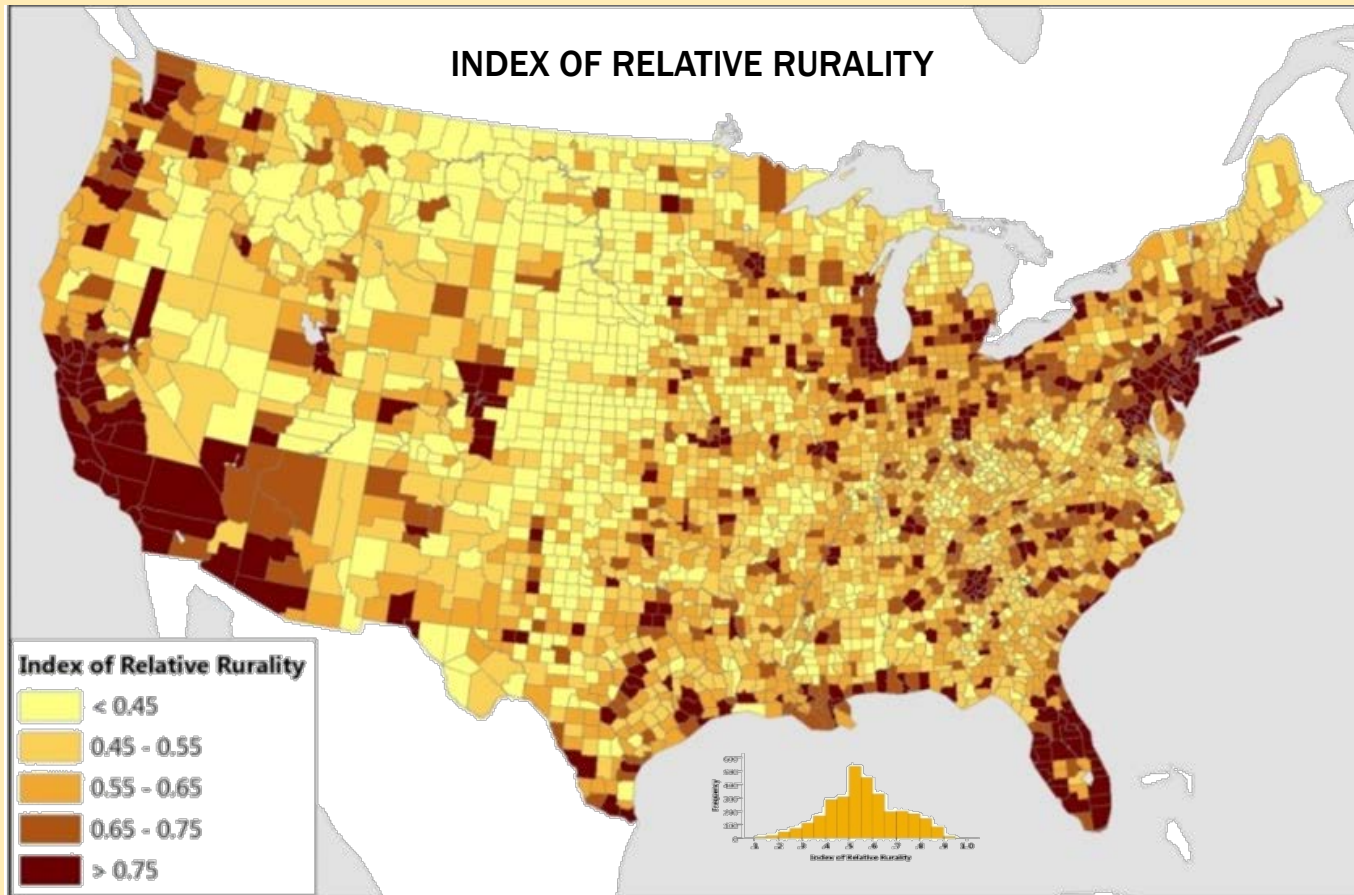
RURALITY DISCREPANCIES (USDA)

Rural Classification Discrepancy (2003)

More rural in UIC
Similar classification
More rural in RUCC
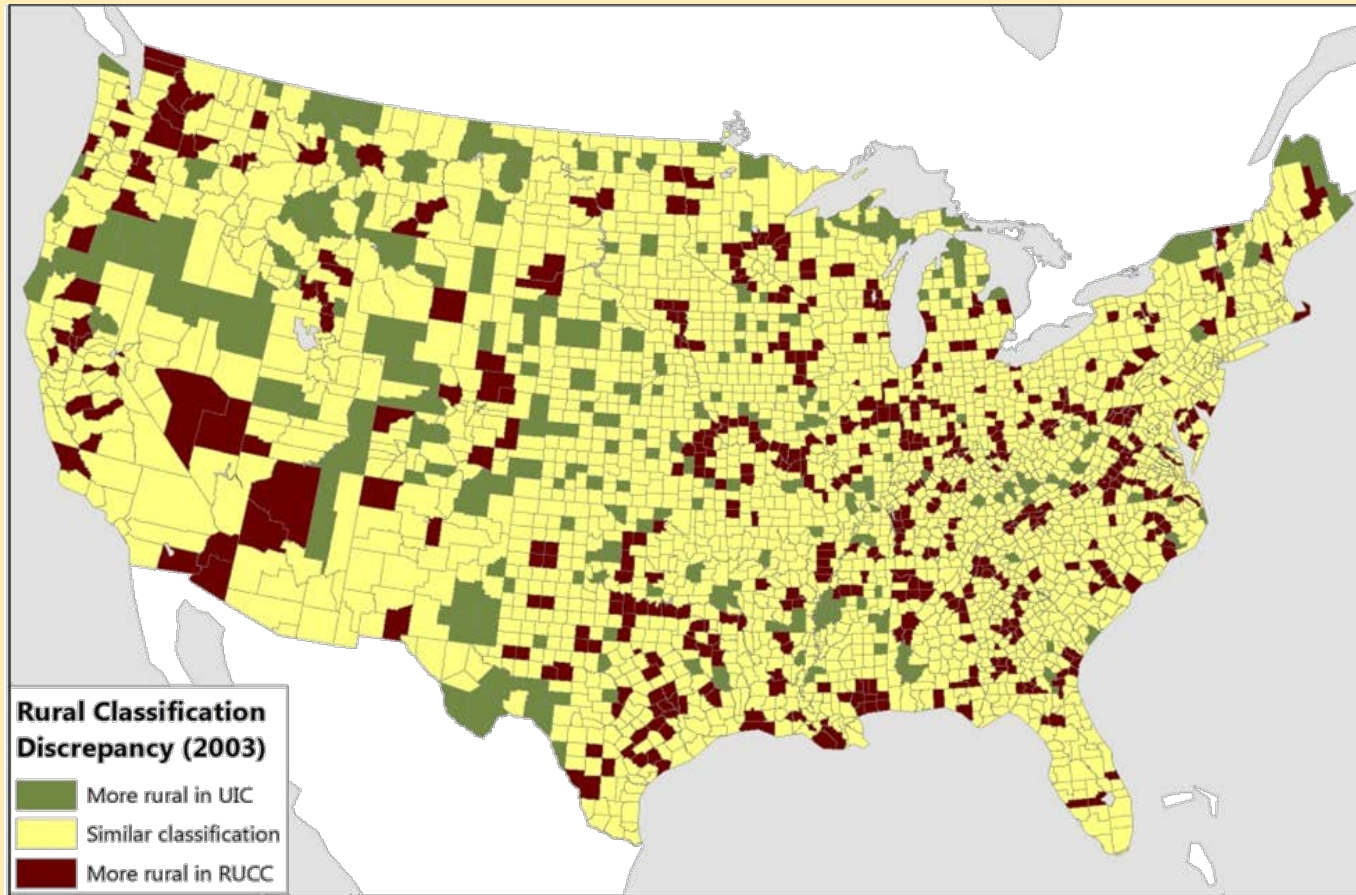
TEMPORAL CHANGES IN RUCC

RUCC Change (1993-2003)
- Much more rural
- More rural
- No change
- More urban
- Much more urban
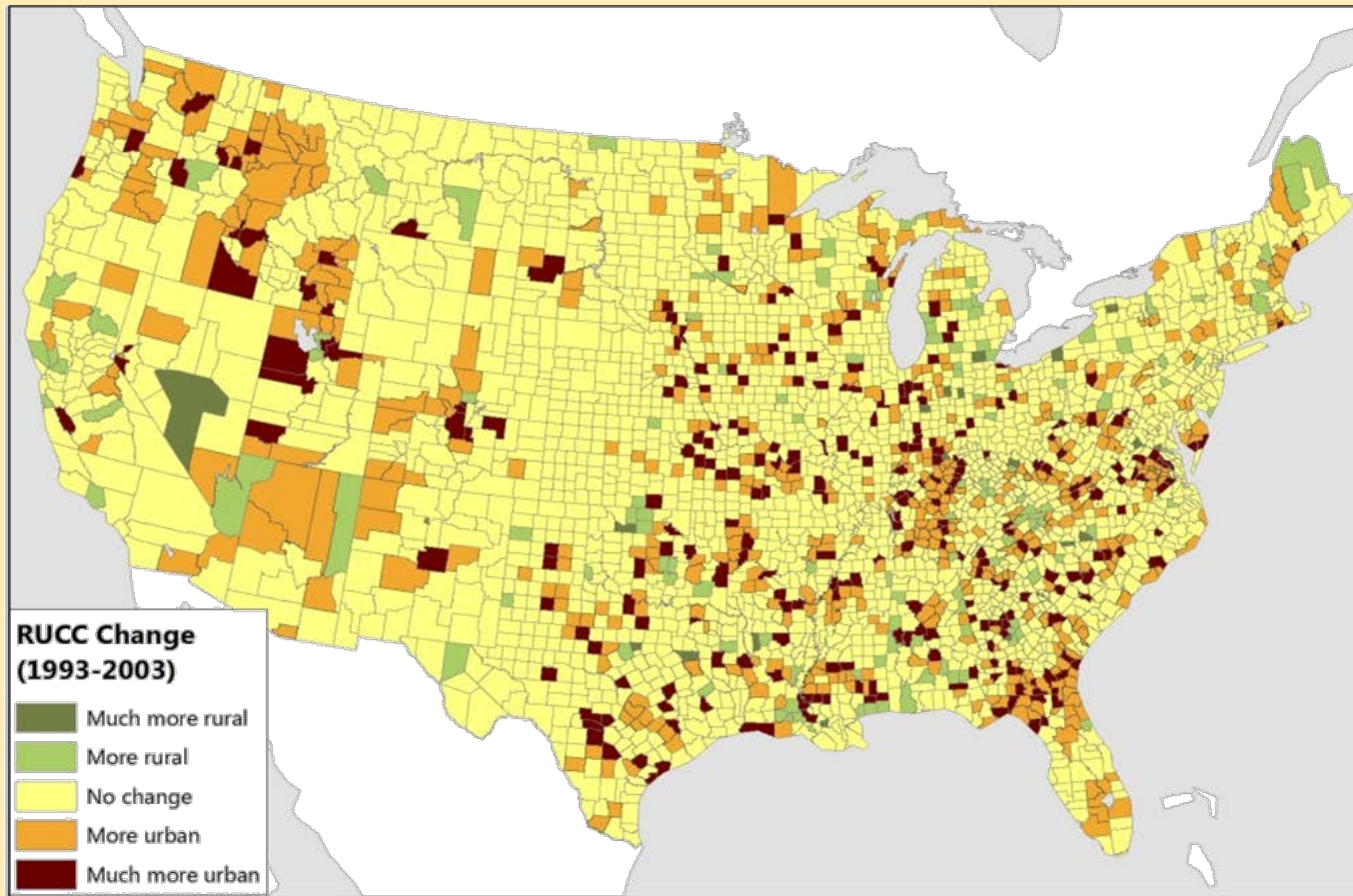
CORRELATION AMONG RURALITY MEASURES*

	Proportion Urban	Urban Influence Code**	Rural-Urban Continuum Code**	Index of Relative Rurality
Population Density	0.659	0.711	0.746	0.867
Proportion Urban		0.521	0.659	0.909
Urban Influence Code**			0.917	0.704
Rural-Urban Continuum Code**				0.789

*All p=values were < 0.01
**Reverse coding used

MENTAL HEALTH & RURALITY
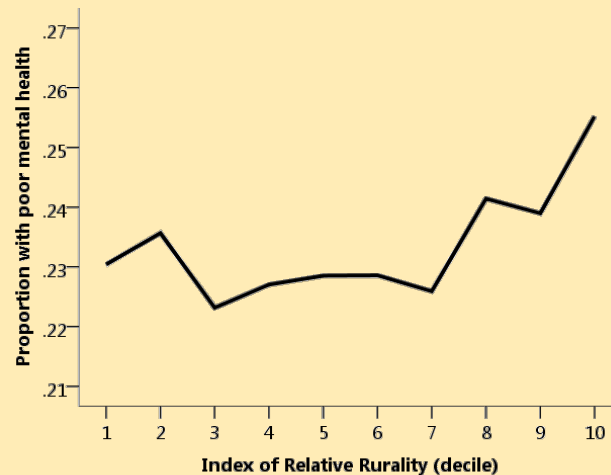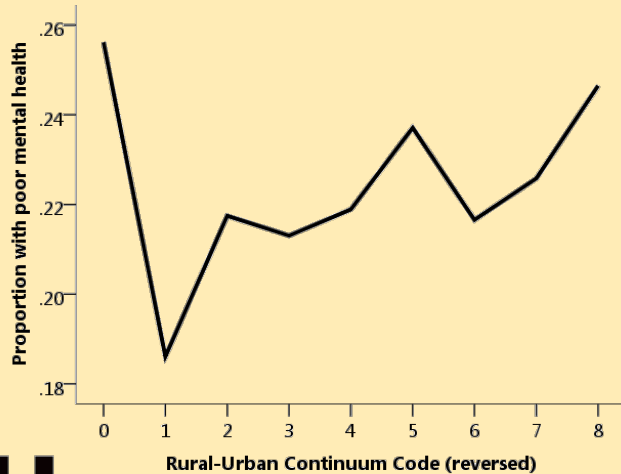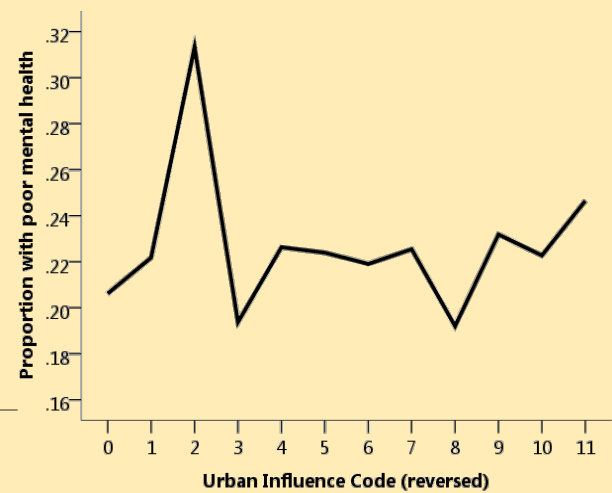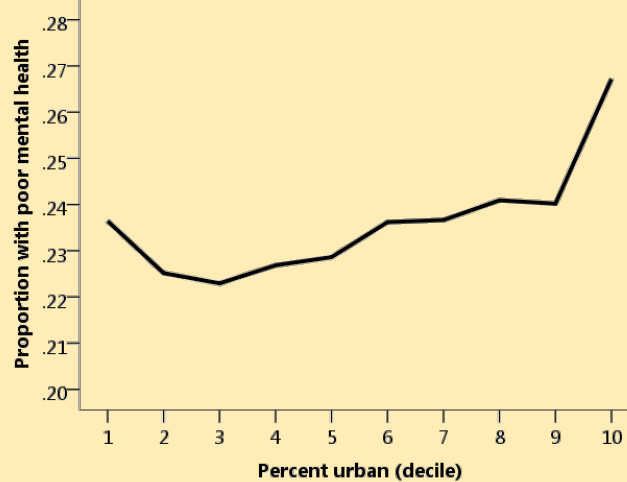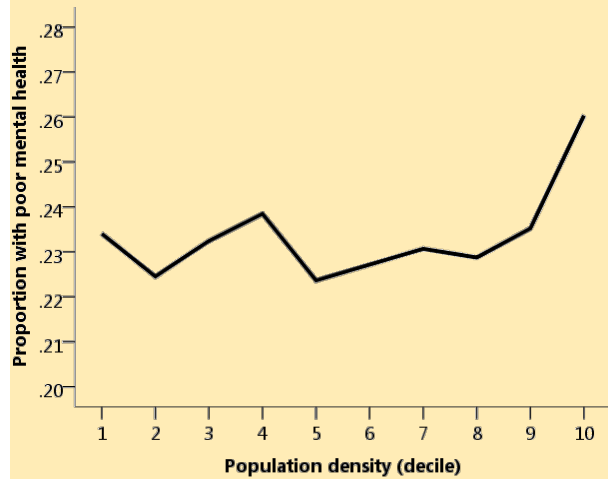
SPLINE-BASED PROBABILITIES OF POOR MENTAL HEALTH IN UIC

- **Non-linear association between mental health in older adults and rurality**
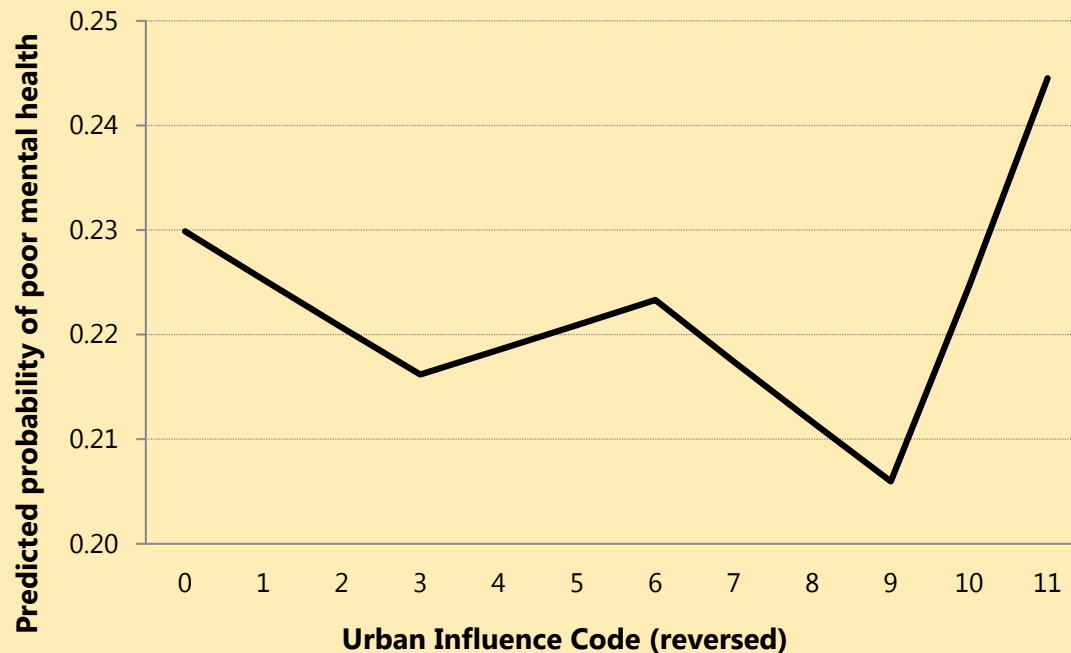
SPLINE MODEL ESTIMATES ODDS RATIOS (& 95% CI)

Model	Variable	Log Population Density	Proportion Urban	Urban Influence Code	Rural-Urban Continuum Code***	Index of Relative Rurality
Odds ratios (95% CI)						
Model 1: Unadjusted, no spline	Main effect	1.040 (1.040, 1.041)	1.305 (1.301, 1.308)	1.022 (1.022, 1.022)	1.034 (1.034, 1.035)	1.863 (1.853, 1.873)
Model 2: Adjusted*, no spline	Main effect	1.066 (1.066, 1.066)	1.526 (1.522, 1.530)	1.037 (1.037, 1.037)	1.055 (1.054, 1.055)	2.470 (2.456, 2.483)
Model 3: Unadjusted spline	Main effect	0.888 (0.882, 0.894)	0.422 (0.395, 0.450)	0.974 (0.971, 0.978)	0.990 (0.988, 0.993)	0.070 (0.056, 0.087)
	Quartile 1 spline	1.006 (0.994, 1.017)**	3.968 (3.670, 4.291)	1.041 (1.037, 1.046)	1.016 (1.013, 1.019)	62.54 (48.09, 81.33)
	Quartile 2 spline	1.201 (1.191, 1.211)	0.450 (0.437, 0.463)	0.953 (0.950, 0.955)	1.073 (1.071, 1.075)	0.111 (0.101, 0.123)
	Quartile 3 spline	0.978 (0.974, 0.982)	2.434 (2.390, 2.478)	1.156 (1.154, 1.159)		5.419 (5.209, 5.368)
Model 4: Adjusted* Spline	Main effect	0.921 (0.914, 0.927)	0.412 (0.385, 0.441)	0.978 (0.975, 0.982)	0.989 (0.986, 0.991)	0.048 (0.038, 0.060)
	Quartile 1 spline	0.942 (0.931, 0.953)	4.473 (4.124, 4.852)	1.029 (1.024, 1.034)	1.042 (1.038, 1.045)	80.94 (61.40, 106.7)
	Quartile 2 spline	1.358 (1.346, 1.370)	0.550 (0.534, 0.568)	0.979 (0.976, 0.982)	1.069 (1.067, 1.071)	0.336 (0.304, 0.372)
	Quartile 3 spline	0.905 (0.902, 0.909)	1.971 (1.935, 2.009)	1.162 (1.160, 1.165)		2.291 (2.198, 2.387)
-2 log likelihood						
Model 1		56075032.5	56075794.6	56096293.1	56081811.6	56060479.1
Model 2		52007430.5	52010238.6	52050881.9	52023722.2	51993952.6
Model 3		56064435.2	56063944.3	56073767.4	56071347.1	56051603.5
Model 4		51996170.9	52002617.3	52022351.9	52012513.0	51990751.5

SUMMARY OF FINDINGS

- **Moderately strong correlations were observed among five rurality measures**
  - USDA measures were strongly correlated
- **Associations between poor mental health and rurality depended largely on the choice of rurality measure.**
  - Relationships were largely curvilinear.
  - Best mental health outcomes were observed in areas of intermediate rurality.

STRENGTHS & LIMITATIONS

Strengths

- Large sample size
- Established, nationally representative sample
- First to examine five rurality measures and implications for health of older adults
- Explored non-linearity

Limitations

- Spatial coverage of mental health limited
- Question on mental health somewhat nebulous

FUTURE DIRECTIONS & IMPLICATIONS

- Examining the **Index of Relative Rurality**[2] as a meaningful composite measure of rurality

- Assessing regional differences in the categorization of rurality

- Search for reliable and valid measures of rurality is critical to better understanding determinants of health in older adults

REFERENCES

1. Isserman, AM. In the National Interest: Defining Rural and Urban Correctly in Research and Public Policy." (2005). *International Regional Science Review*, 28 (4): 465–499.
2. Waldorf, B. Measuring Rurality. (2007). File accessed at: http://www.incontext.indiana.edu/2007/january/articles/2_rurality.pdf

THANK YOU!

Questions?

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SAMPLE CHARACTERISTICS

Characteristic	Overall	Good mental health	Poor mental health
	N	N (weighted %)	N (weighted %)
Age category			
60-64	45722	31735 (70.4)	13987 (29.6)
65-69	40109	30534 (76.9)	9575 (23.1)
70-74	32290	25613 (80.0)	6677 (20.0)
75-79	25672	20620 (79.5)	5052 (20.5)
80+	33206	27178 (80.9)	6028 (19.1)
Sex			
Female	112101	82591 (72.8)	29510 (27.2)
Male	64898	53089 (81.2)	11809 (18.8)
Race			
White	156078	120052 (77.1)	36026 (22.9)
Black	12399	9154 (73.0)	3245 (27.0)
Asian	2292	1892 (78.5)	400 (21.5)
Native Hawaiian or PI	396	313 (77.3)	83 (22.7)
American Indian or Alaska Native	1854	1278 (65.2)	576 (34.8)
Other	1962	1479 (77.9)	483 (22.1)
Refused or missing	1944	1454 (70.7)	490 (29.3)

Characteristic	Overall	Good mental health	Poor mental health
General Health			
Excellent	23453	20523 (87.8)	2930 (12.2)
Very good	51584	42504 (82.9)	9080 (17.1)
Good	57546	44844 (78.1)	12702 (21.9)
Fair	29737	19831 (65.5)	9906 (34.5)
Poor	13805	7310 (51.2)	6495 (48.8)
Education level			
Less than high school	19309	13756 (70.1)	5553 (29.9)
High school graduate	57499	44087 (76.4)	13412 (23.6)
Some college	44961	34157 (75.4)	10804 (24.6)
College graduate	54849	43359 (79.7)	11490 (20.3)
Region			
Northeast	33801	25629 (76.2)	8172 (23.8)
South	66603	51335 (78.0)	15268 (22.0)
Midwest	34102	26348 (77.1)	7754 (22.9)
West	42493	32368 (73.9)	10125 (26.1)
BMI*	27.6 (5.4)	27.4 (5.2)	28.1 (6.1)
No. poor physical health days in past 30 days**	0 (5)	0 (2)	3 (20)