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Jessica S. Ziembroski Ph.D

Erica L. Hauck MPA

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Rural Poverty Research Center
http://www.rprconline.org/

RUPRI Rural Poverty Research Center
214 Middlebush Hall
University of Missouri
Columbia MO 65211-6200
PH 573 882-0316

RUPRI Rural Poverty Research Center
Oregon State University
213 Ballard Hall
Corvallis OR 97331-3601
PH 541 737-1442

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Jessica S. Ziembroski Ph.D.

Rural Poverty Research Center

University of Missouri-Columbia

Erica L. Hauck MPA

Rural Poverty Research Center

University of Missouri-Columbia

Corresponding Author's Address:
Jessica S. Ziembroski Ph.D.
222 Middlebush Hall
University of Missouri
Columbia, MO 63124
(573) 882-0880

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Abstract

This article examines the independent and interactive effects of rural status and region of residence on health. Individual level factors related to poverty are also tested, in conjunction with rural and regional residence. Negative health effects of rurality were found only in the South, while positive health effects of rurality were found, but only in the Midwest. The results indicate a cumulative risk of rural and Southern residence for older men and women. Living in a rural place in the Midwestern United States may provide unique sources of health benefit as individuals age, which buffer previously observed rural risks to health overall. The findings are discussed in terms of health policy and interventions.

Keywords: rural, region, health, later adulthood

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Introduction

Prior research has established that individuals' mental and physical health is influenced by the social environment via three primary mechanisms: personal relationships and networks, individual socioeconomic status, and contextual effects of the places in which people live (Link & Phelan, 1996; Seeman & Crimmins, 2001). The last of these, often termed contextual or place effects on health, has received the least attention in the literature, especially as it relates to the health of older individuals. While the most powerful social determinants of adult health are contained within elements of individual socioeconomic status (House, 2002; Kreiger et al., 1997; Robert & House, 2000), much of the variation in health outcomes among individuals remains unexplained.

That said, some variation appears to be accounted for by the context or characteristics of the setting in which individuals reside. Low socioeconomic status at the neighborhood level has been demonstrated to independently increase physiological stress, health problems and levels of psychological distress in adults (Boardman et al., 2001; Robert, 1999; Schulz et al., 2000). It has been clearly recognized that where one lives, and the characteristics of that place are related to health and illness, both in concordance with individual level factors and after controlling for individual-level characteristics (Turnstall et al., 2004). However, the effects on health of the place in which one lives in later life, beyond the neighborhood, are yet untested.

Health may be influenced by alternate representations of place, such as the region of the country in which one lives, or whether that place is urban or rural. This study uses

data from the Health and Retirement Study to investigate the health consequences of living in a rural environment in the United States or in certain regions during late adulthood, after controlling for other factors. Of primary interest is whether cumulative mental and physical health risks exist due to combinations of rural and regional status, above and beyond the risks associated with rural status or region alone.

Place Effects on Health of Older Adults

A growing body of research has established associations between place of residence and health outcomes among adults. These studies demonstrate that the characteristics of the place where someone lives impact various aspects of well being. Descriptions of this research include place, area, contextual, geographic and ecological effects on health. The majority of this research has been done at the neighborhood level, exhibiting links between neighborhood socioeconomic characteristics such as aggregate levels of income and education and health (Diez-Roux, 1998; O'Campo & Guyer, 1999; Schulz et al., 2000).

Moreover, neighborhood effects on health seem to persist as people age. Neighborhood level stressors such as poverty, crime, and violence have been associated with diminished psychological, biological, and quality of life outcomes during middle age, as well as lower levels of physical activity for the elderly (Fisher et al., 2004; Steptoe & Marmot, 2003). In general, the effects of place of residence on health outcomes beyond the immediate neighborhood-level are less understood (Diez-Roux, 2003). There may be discernable effects on health of different conceptualizations of place, namely rural status and U.S. region. These broader place effects on adult health

could help explain the significant health variation observed across rural versus urban or suburban places, and across regions.

Rural Health Outcomes

Rural places, outside of urbanized areas, are characterized by remoteness from large cities and relatively small populations (U.S. Bureau of the Census, 2000). Rural populations display higher rates of violent injury, ischemic heart disease, major depressive disorder, some cancers, and suicide as compared to their urban and suburban counterparts (Dennis & Pallotta, 2001; Eberhardt et al., 2001; Hauenstein, 2003; Ricketts, 2001; Slifkin et al., 2000). Rural elders also show a higher prevalence of functional disability, increased sedentarism and smoking, and less use of preventative care (Kumar et al., 2001). Further, compromised rural health has been related to stunted economic development, limited health and education services, lower income on average, and environmental risks (Castle, 2000; Ricketts, 1999; Hauenstein, 2003). As a result of the higher rates of poverty that rural areas experience in general, there are limited human delivery systems, preventative care, and increased health risk behaviors that are linked to the higher incidence of chronic disease in rural places (Blakely & Woodward, 2000; Jacob et al., 1997). There clearly seems to be unique risks to health by living in a rural environment, most likely linked to geographic isolation paired with frequent rural economic disadvantages.

Despite research that has demonstrated a multitude of negative health outcomes related to rural residence, this study examines whether the negative health outcomes previously linked to rurality are demonstrated after controlling for other factors. Also,

we test whether the health effects of living in a rural area may vary in combination with other factors, such as region of residence and individual-level characteristics.

Health across U.S. Region

That there is considerable health variation across region in the United States is also well known. Numerous studies have noted clear regional discrepancies across specified health outcomes. In particular, there are significant differences in high blood pressure, coronary heart disease, and stroke by region of the country, with higher rates in the South and Southeastern regions (Barnett & Halverson, 2000; Borhani, 1965; Hajjar & Kotchen, 2003; Lanska & Kuller, 1995; Pickle & Gillum, 1999; Pickle et al., 1997). While concentrated poverty and segregation by race in the South has been demonstrated to explicate a portion of this discrepancy (Cooper et al., 2001), more complete explanations for observed health variation by this region and others are yet unknown (Auchincloss & Hadden, 2002; Taylor et al., 2002). There are yet unidentified regional characteristics that may have distinctive effects on health and mortality which accumulate over time (Cossman et al., 2003). This study attempts to identify whether rurality is a regional characteristic that explains some of the previously demonstrated regional differences on health.

The American South is the most rural region and experiences the risks associated with rural status more often, namely poverty (Economic Research Service, 2002; United States Bureau of the Census, 2000). This is paired with evidence that the South also experiences more poverty overall than any other region (Economic Research Service, 2002). The current study examines whether rural residence in the American South may encompass a cumulative risk to health, and contributes to worsened health outcomes

observed there. Whether similar risks to population health exist by living in a rural community in other regions of the U.S. is also examined in this study.

Individual-Level Characteristics

That increased poverty and socioeconomic disadvantages translate to poorer health for both men and women is largely unchallenged. Being of low socioeconomic status, minority status, or experiencing sustained poverty has specific hazardous effects on health that increase with age (Everson et al., 2002; Lynch, 2003). In particular, lack of socioeconomic resources and related stress has been shown to acutely damage emotional health and raise levels of depression in older adults (Miech & Shanahan, 2000; Rios et al., 2001; Turner, 1999), especially for older women (Gatz & Fiske, 2003). Aging individuals who experience individual poverty risks to health may be especially vulnerable if they also reside in impoverished places. This follows existing research findings that indicate that individual socioeconomic factors work in conjunction with characteristics of places to influence health for adults (Curtis & Jones, 1998; MacIntyre et al., 2002), including for older adults (Weinstein et al., 2003). This study reexamines this proposition through the investigation of the joint effects of gender, race-ethnicity, and education with rural status and region on health in later life.

Cumulative Risk

Cumulative risk theory posits that the negative effects of singular risks can be compounded by the existence of additional risks (Gutman et al., 2002; 2003; Sameroff et al., 1993). According to the theory, the cumulative negative effects of two risks to health may in some cases be more severe than the sum of the risks together (Evans, 2003). Research findings confirm this supposition in terms of child outcomes (Evans 2003). For

adults, much of the inequality over the life course has been linked to cumulative advantages and disadvantages which individuals experience over time, including in terms of health (Dannefer 2003; Shuey et al., 2003). Within the field of social gerontology, cumulative advantage/disadvantage theory is applied to older individuals with an inherent emphasis on the passage of time. In this study, we test if cumulative advantage or disadvantage exists related to place of residence in terms of health. Explicitly, we explore the effect of each combination of rural status and region on the health of older individuals.

In addition to testing the cumulative effects of rural status and region, this study also examines if rural or regional status may create cumulative risk when combined with individual-level characteristics. Those who often experience socioeconomic disadvantages, especially poverty, may be at additional risk in combination with rural residence or residence in a certain region. Individual-level characteristics examined in this study are: female gender, minority status, and low educational attainment. Each of these characteristics has been previously associated with lower socioeconomic status and poverty.

Research Questions

In summary, this research expands upon the current literature that has tested place effects on the health of older adults by addressing the following research questions: (1) Do rural residence or region of residence predict health for those in later adulthood?; (2) Does the combination of rurality and region of residence together better explain variation in the health of older adults, more so than rurality or region of residence alone?; (3) Does the combination of relevant individual-level characteristics (female gender, minority

status, low educational attainment) with rurality or residence in a particular region of the U.S. result in cumulative health risks for older adults?

Data and Analysis

Data

This study utilizes data collected by the Health and Retirement Study (HRS), a nationally representative, longitudinal survey of adults aged 51 to 61 and their spouses, developed for policy analysis use by the Social Security Administration (SSA). The study began in 1992, and follow-up interviews with participants have been conducted every two years since the study's implementation. The data for these analyses come from Waves 1, 2 and 3 of the RAND HRS Data files, which are processed and streamlined versions of HRS. Only a few variables in the RAND HRS Data files are unchanged copies of raw HRS variables; most variables have undergone some processing, and many are the result of more than one HRS variable. The current sample consists of all non-institutionalized, non-proxy respondents that are present during each wave of the survey.

Independent Variables

Four categories of independent variables taken from Waves I, II, and III of the HRS data are utilized in these analyses: demographic characteristics, socioeconomic characteristics, social ties and relationships, and place of residence. The demographic variables include age, sex, race/ethnicity and marital status. Age is measured in continuous years and sex is a dichotomous measure. Race/ethnicity is a categorical variable: non-Hispanic White, non-Hispanic Black, Hispanic. Black is used to represent African American status. Dummy variables were created with non-Hispanic White as the reference category. Since other races constituted a small percentage of the sample (3%),

and preliminary multivariate analyses found no statistically different health outcomes compared to non-Hispanic Whites, they are excluded from the analyses. For these analyses, marital status is measured at each wave as: currently married, never married, divorced or separated, and widowed, at each wave. This variable does not distinguish between married couples and partnered couples that are not married but live together much like a married couple. Dummy variables were created with married or partnered as the reference category.

Socioeconomic characteristics include education, total household income, wealth, as well as car and home ownership. Education is measured as a categorical variable in 1992 with categories for: less than high school, GED, high school, some college, college and above. Dummy variables were created with high school as the reference category. The lack of ownership of either a car or home at each time point is also included as a categorical measure. The lack of ownership of either a car or home for older adults of this age group may indicate poverty status and is included for this reason. Prior research has identified that educational qualifications and financial asset indicators paired with a deprivation variable serves as the best measure of socioeconomic status (Grundy & Holt, 2001).

Variables measuring social ties and relationships include the number of residents living in the respondent's household, and the number of living children, siblings and parents. Prior research has verified that social ties and relationships have beneficial effects on the health of older adults, and thus, they are included as controls in these analyses (Kawachi & Berkman, 2001). Place of residence variables include rural residence indicated by metropolitan/nonmetropolitan status and Census region (South,

Northeast, West and Midwest). These variables were provided by a separate HRS file released in 2004 and were merged with the use of a unique identifier. Dummy variables were created, with Northeast region as the reference category, as it experiences the least poverty of any region (Economic Research Service, 2000).

Dependent Variables

To provide a comprehensive view of the health of older adults in the sample, three dependent variables related to health outcomes were tested at each wave: total number of health conditions, mobility limitations, and depression. All three of these indicators of chronic health problems are well-established indices that were developed and tested for reliability and consistency by RAND.

Total number of health conditions is an index of the sum of diagnoses by a doctor for the following health problems: high blood pressure, diabetes, cancer, lung disease, heart disease, stroke, psychiatric problems, and arthritis. While measuring disease is still an important gauge of health measurement, it has been extended to include functional consequences of diseases and quality of life, such as disability. Mobility limitations provide a measure of disability. The mobility limitation index measures an individual's difficulty (0 = no difficulty; 1 = difficult) in performing five different tasks: walking one block, walking several blocks, walking across a room, climbing one flight of stairs and climbing several flights of stairs.

Depressive symptoms are an important indicator of general well being and mental health among older Americans. Higher levels of depressive symptoms are associated with higher rates of physical illness, greater functional disability, and higher health care utilization (Barefoot & Schroll, 1996). Depression is measured with a subset of items

from the Center for Epidemiologic Studies Depression (CES-D) scale (Radloff, 1977). The CES-D score is the sum of five “negative” indicators minus two “positive” indicators. The negative indicators measure whether the respondent experienced the following sentiments all or most of the time in the preceding week: depression, everything an effort, sleep is restless, felt alone, felt sad, and could not get going. The positive indicators measure whether the respondent felt happy and enjoyed life all or most of the time during the preceding week.

Analysis

Ordinary Least Squares (OLS) regression models were utilized to examine the relationships between rural and regional residence and health after controlling for relevant factors. All analyses are weighted using the respondent-level weight provided by the HRS. OLS models were tested across three time periods to test whether the effects of rural and regional residence occur over time and to control for prior health problems. 1994 and 1996 health outcomes were regressed on 1992 and 1994 predictors, respectively.

To test how rural status and individual characteristics related to poverty work together to influence health, interaction terms were created. An interaction effect exists when the impact of one independent variable depends on the existence of another independent variable. We created interaction terms by multiplying rural status by (1) region of residence, (2) high school dropout status, (3) African-American status, (4) Hispanic status, and (5) female gender. We conducted incremental F tests to assess model fit with the OLS models. To assess the contribution to the model of each interaction term, an incremental F test done with block regression for each model. First,

a main effects model was tested, followed by a full model regression that included the product terms. Finally, an incremental F test was done comparing the main effects model versus the full model.

To control for prior health status, for each model a lagged dependent variable or static-score is used. In this model, Y_t is predicted from its earlier value Y_{t-1} from the independent variable X at the same time period, and from a random error term. This method also controls regression to the mean, or the negative correlation between initial scores on a variable and subsequent change. Other longitudinal methods (growth curve models), which better estimate change and its correlates were also investigated, however no significant change in these health measures were identified during the time interval tested from 1992-1996. Robust standard errors were calculated using STATA in the examination of design effects and clustering. This does not appear to be a problem in the current analyses.

Results

Table 1 provides descriptive statistics regarding sample respondents' race, marital status, level of education, and age. In addition, measures of wealth and income, and the lack of ownership of a car and house are summarized for the current sample along with social network characteristics and rural and regional residence. The majority of the current sample resides in the South region (42.05%), followed by the Midwest (23.80%). As a result of the original HRS oversample of Florida residents, the number of Southern residents is high (25.70%), however we used respondent weights to correct for this clustering effect.

Lagged Multivariate Regression Models: Main Effects

Socio-demographic Factors. Socio-demographic variables used as controls performed as expected in the current models. To illustrate these effects, bivariate correlations that were statistically significant ($p<.001$) at all 3 time lags are discussed (i.e. Time 1 predictors correlated with Time 2 health outcomes, Time 1 predictors correlated with Time 3 health outcomes, and Time 2 predictors correlated with Time 3 health outcomes). Some noteworthy patterns emerged among the socio-demographic control variables entered in the models.

Across all domains and in each model tested, women experienced more health risks than men as they age. Female gender was associated with more depressive symptoms ($r_{12} = .081$, $r_{13} = .127$, $r_{13} = .105$), mobility limitations ($r_{12} = .114$, $r_{13} = .131$, $r_{23} = .132$), and total number of health conditions ($r_{12} = .094$, $r_{13} = .092$, $r_{23} = .084$). Being widowed or divorced was also consistently detrimental to health over time. Being widowed was associated with more depressive symptoms ($r_{12} = .112$, $r_{13} = .107$, $r_{23} = .086$), mobility limitations ($r_{12} = .092$, $r_{13} = .078$, $r_{23} = .084$), and total number of health conditions ($r_{12} = .081$, $r_{13} = .077$, $r_{23} = .072$) and being divorced was also related to worse health in terms of depressive symptoms ($r_{12} = .142$, $r_{13} = .138$, $r_{23} = .125$), mobility limitations ($r_{12} = .087$, $r_{13} = .109$, $r_{23} = .113$), and total number of health conditions ($r_{12} = .098$, $r_{13} = .099$, $r_{23} = .094$). Having low levels of education, specifically not finishing high school, was predictably was linked to worse mental and physical health as measured by depression ($r_{12} = .186$, $r_{13} = .253$, $r_{23} = .226$), mobility limitations ($r_{12} = .187$, $r_{13} = .223$, $r_{23} = .201$), and total health conditions ($r_{12} = .142$, $r_{13} = .160$, $r_{23} = .164$). Finally, African Americans consistently demonstrated higher levels of total number of health

conditions (r_{12} = .109, r_{13} = .113, r_{23} = .113), while Hispanics reported more depressive symptoms over time (r_{12} = .107, r_{13} = .178, r_{23} = .143).

Rural Residence and Region of Residence. Table 2 presents results for health measures regressed on rural residence and South, Midwest, and West region of residence, after controlling for relevant factors related to health. Neither rural nor regional residence alone was consistently related to the health outcomes tested. Rural residence at Time 1 was weakly associated with increased total number of health conditions at Time 2 (β_{12} = .062, $p < .05$) and Time 3 (β_{13} = .066, $p < .05$), yet rural residence at Time 2 did not indicate a relationship with health conditions at Time 3 (β_{23} = .054, ns).

While Southern residence influenced each aspect of health in Table 2, these effects did not persist across each time interval. Living in the South region was associated with depression (β_{12} = .129, $p < .05$; β_{23} = .155, $p < .01$), total number of health conditions (β_{23} = .137, $p < .001$; β_{13} = .101, $p < .01$), and mobility limitations (β_{12} = .105, $p < .01$; β_{13} = .083, $p < .05$), but these findings were non-significant at the other time intervals tested. Even less consistent patterns emerged for Western residents. Western residence at Time 1 or Time 2 was associated with increased mobility limitations at Time 3 (β_{12} = .131, $p < .01$; β_{13} = .139, $p < .01$).

Lagged Multivariate Regression Models: Interactive Effects

Interaction effects between rural status and South and Midwest regions on the three respective health outcomes tested are displayed in Table 3 and Table 4. No interaction terms were significant between rural status and West region of residence and therefore are not displayed. Rural by South interactions and rural by Midwest interactions are shown in Table 3 and Table 4 after controlling for race, marital status,

level of education, age, wealth, income, ownership of car or house, and social network characteristics. As mentioned earlier, we also test interactive effects between rural and regional status and female gender, Black and Hispanic status, and high school dropout status. None of these interaction terms were consistently significant in the models tested, as exemplified in Table 3 and Table 4.

Detrimental Rural Effects Unique to South Region Individuals. As displayed in Table 3, the rural by South interaction term at Time 1 was associated with total number of health conditions at Time 2 ($\beta_{12} = .141$, $p < .05$) and Time 3 ($\beta_{13} = .139$, $p < .05$). Also, the rural by South interaction term at Time 2 was associated with total number of health conditions at Time 3 ($\beta_{23} = .160$, $p < .05$). For non-South residents, there was little difference in the total number of health conditions when comparing rural and non-rural residents. However, for residents of the South, those in rural areas reported a greater number of health conditions than did non-rural residents. Table 3 also shows significant rural by South interaction effects at each time period on mobility limitations and depressive symptoms, after controlling for demographic characteristics, socioeconomic characteristics, and social ties and relationships.

Additionally, the rural by South interaction term at Time 1 was associated with mobility limitations at Time 2 ($\beta_{12} = .182$, $p < .05$) and Time 3 ($\beta_{13} = .125$, $p < .05$), and the rural by South interaction term at Time 2 was associated with mobility limitations at Time 3 ($\beta_{23} = .119$, $p < .05$). For non-South residents, there was little difference in the number of mobility limitations reported when comparing rural and non-rural residents. Yet, for residents of the South, those in rural areas reported a greater number of mobility limitations than did non-rural residents.

Finally, the rural by South interaction term at Time 1 was significantly associated with depressive symptoms at Time 2 ($\beta_{12} = .202$, $p < .05$) and Time 3 ($\beta_{13} = .198$, $p < .05$), and the rural by South interaction term at Time 2 was associated with depressive symptoms at Time 3 ($\beta_{23} = .249$, $p < .05$). For non-South residents, rural residents reported fewer depressive symptoms than non-rural residents. Conversely, for residents of the South, those in rural areas reported a greater number of depressive symptoms than did non-rural residents.

Beneficial Rural Effects Unique to Midwest Region Individuals. Contrary to the negative effects on health of rural status paired with South region, rural by Midwest interactions revealed opposite effects. As displayed in Table 4, there were significant rural by Midwest interaction effects that predicted reduced health problems on each measure, after controlling for demographic characteristics, socioeconomic characteristics, and social ties and relationships. Specifically, the rural by Midwest interaction term at Time 1 was associated with depressive symptoms at Time 2 ($\beta_{12} = -.238$, $p < .05$) and Time 3 ($\beta_{13} = -.223$, $p < .05$), and the rural by Midwest interaction term at Time 2 was associated with depressive symptoms at Time 3 ($\beta_{23} = -.304$, $p < .05$). For non-Midwest residents, there was little difference in the total number of depressive symptoms when comparing rural and non-rural residents. Nonetheless, for residents of the Midwest, those in rural areas reported fewer depressive symptoms than did non-rural residents.

Similarly, a significant relationship was found between the rural by Midwest interaction term at earlier time points, and mobility limitations at later time points, as shown in Table 4 ($\beta_{12} = -.210$, $p < .05$, $\beta_{13} = -.145$, $p < .05$, $\beta_{23} = -.183$, $p < .05$). For non-Midwest residents, rural residents reported more mobility limitations than non-rural

residents. Conversely, for residents of the Midwest, those in rural areas reported fewer mobility limitations than did non-rural residents.

Lastly, Table 4 indicates that the rural by Midwest interaction term at Time 1 was associated with better overall health at Time 2 (β_{12} = -.245, $p < .001$) and Time 3 (β_{13} = -.254, $p < .001$). Also, the rural by Midwest interaction term at Time 2 was associated with health conditions at Time 3 (β_{23} = -.273, $p < .05$). For non-Midwest residents, rural residents reported more health conditions than non-rural residents. Yet, for residents of the Midwest, those in rural areas reported fewer health conditions than did non-rural residents.

Discussion

The first key finding of this study is that we failed to find consistent main effects of living in either a rural community or particular region of the U.S. on the health of retirement-age adults over time. This adds to the literature on rural and regional health, which is largely descriptive, and indicates broad rural and Southern region disadvantages to health. Neither of these wide-ranging disadvantages was consistently confirmed in the analytic models here, after controlling for relevant factors.

Instead, the impact of residence in rural places appears to be dependent upon location within a region. The second key finding is that rural status and region of residence *together* predict longitudinal health outcomes for older Americans, even after controlling for relevant factors. For persons who live in rural areas of the South, there seem to be cumulative risks to health across all health domains tested. More specifically, rural residence only appears to have a negative health effect upon those in the South. In addition, for older rural residents in the Midwest, we do not find evidence of cumulative

risk, but rather rural environments that are associated with positive health outcomes. Exclusively, there appear to be some positive aspects of rural residence above and beyond the control variables, but only in the Midwest.

The third key finding is that we failed to find evidence for cumulative effects of rural or regional status combined with individual-level characteristics. That is, there was no support for a unique risk to women, minorities, or those of limited educational background from living in a rural place or specific region, beyond that explained by relevant control variables. We believe that this result lends support to the contention that there are indeed effects of the context of rural and regional locations on health, that these are not simply proxies for the composition of the population in these places. Rather, the results suggest evidence for "place effects" on health at broad categorizations, which is an extension of prior research showing neighborhood-level influences on the mental and physical health of adults.

One important implication of this study is that local context matters significantly in terms of health in later adulthood. Clearly, there are elements of rural environments that are embedded in surroundings that powerfully impact daily life, and ultimately health. We argue that one element that merits investigation is area-level poverty, which is likely extremely precarious to health and well being throughout the life course.

The exposure of older people to the combined effects of increased area-level poverty in rural places with increased concentrated poverty in the South presents a plausible explanation for current findings. Lower levels of rural poverty in the Midwest may contribute to the observed advantage to mental and physical health in the rural Midwest (Economic Research Service, 2000). Structural and behavioral factors such as

reduced access to health care, greater environmental exposure, transportation difficulties, increased health risk behaviors, and chronic stress increase disease and mortality, and each is related to greater area-level poverty (Adler & Newman, 2002). It may be that an environment of poverty, together with geographic isolation, powerfully determines health through the mechanisms of available resources, norms, and culture. Understanding incidence and depth of poverty in rural places and the concurrent effects on health may be critical in improving health during aging.

Closer examination of rural environments could produce tailored policy and programs for vulnerable socioeconomic and demographic groups, according to area characteristics, which may improve health and chronic illness. This follows recommendations from studies that advocate exploration of the characteristics of populations in regions, and the characteristics of regions themselves, in order to separate out spatial and social context for improving population health (Cossman, 2003).

A limitation of the current study is that the effects of place of residence on health during late midlife here were only analyzed across the metropolitan /non-metropolitan spectrum at the large geographic distinctions of region. More specific geographic information about rural communities and regions, such as data on area poverty, should be utilized in future work. The HRS data here also did not permit longitudinal analyses to establish effects of location of residence on health change over time. Despite these shortcomings, the strength of the HRS health and socio-demographic measures provide rich data that can be generalized to the U.S. population of those in later adulthood approaching retirement.

Adequately promoting the health of aging populations will become increasingly important in coming years. This may be especially true in rural places, where a large proportion of rural communities are comprised of older persons (Aldwin & Gilmer, 2004). The projected increase of those 65 and older in the United States between 2000 and 2050 is 147%, from approximately 1 percent of the population to 21 percent (U.S. Census Bureau, 2004). The costs of chronic diseases and disability will be tremendous without strategic approaches to their prevention and treatment. In light of the diversity of rural America (Rosenblatt, 2001), healthy aging may be best accomplished via the knowledge of local conditions and culture and concurrent strategic interventions.

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Table 1

Descriptive Statistics for Variables Used in the Analyses

	Time 1: 1992 (N)	Time 2: 1994 (N)	Time 3: 1996 (N)
Age in Years	55.53 (8,061)	57.40 (8,061)	58.40 (8,061)
Race: White	73.63% (8,051)		
Black	16.18% (8,058)		
Hispanic	8.23% (8,047)		
Percentage Female	54.35% (8,061)		
Education: Dropout	25.18% (8,061)		
GED	5.11% (8,061)		
High School	32.95% (8,061)		
Some College	19.40% (8,061)		
College	17.36% (8,061)		
Marital Status: Never Married	3.46% (8,059)	3.55% (8,059)	3.43% (8,036)
Separated/Divorced	13.73% (7,885)	13.68% (7,894)	13.41% (8,036)
Widowed	6.32% (8,059)	7.74% (8,059)	8.89% (8,036)
Married/Partnered	76.78% (8,059)	75.31% (8,059)	74.27% (8,036)
Nominal Family Income	$47,225 (8,061)	$51,434 (8,061)	$55,008 (8,061)
Nominal Family Wealth	$219,946 (8,061)	$240,511 (8,061)	$270,580 (8,061)
Poverty Indicators: No Owned House	19.46% (8,061)	19.45% (8,061)	23.77% (8,061)
No Owned Car	11.15% (8,061)	10.41% (8,061)	11.10% (8,061)
Social Network: Living Siblings	2.52 (7,907)	2.52 (7,890)	2.89 (5,795)
Living Parents	0.59 (7,862)	0.51 (7,903)	0.48 (7,696)
Household Residents	2.65 (8,061)	2.80 (8,061)	2.42 (8,061)
Children	3.29 (8,061)	3.26 (8,061)	3.42 (8,061)
Place of Residence: Rural	26.89% (10,273)	28.49% (9,315)	29.10% (8,943)
South	42.05% (10,290)	42.66% (9,269)	42.22% (8,671)
West	15.93% (10,290)	15.68% (9,269)	16.02% (8,671)
Midwest	23.80% (10,290)	23.98% (9,269)	24.31% (8,671)
Northeast	18.22% (10,290)	17.68% (9,269)	17.45% (8,671)

Note. Weighted data reported in table.

Table 2

Regression Equation of the Effects of Rural and Regional Residence on Health Outcomes

	CESD			Health Conditions			Mobility Limitations		
	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3
Rural	-.051	-.013	-.017	.062*	.054	.066*	.007	.045	.047
	(.053)	(.051)	(.052)	(.031)	(.033)	(.033)	(.030)	(.032)	(.032)
South	.129*	.155**	.108	.070	.137***	.101**	.066	.105**	.083*
	(.066)	(.063)	(.064)	(.039)	(.041)	(.041)	(.037)	(.040)	(.040)
West	-.007	-.058	-.041	.052	.059	.046	.070	.139**	.131**
	(.080)	(.077)	(.077)	(.047)	(.050)	(.051)	(.045)	(.049)	(.049)
Midwest	-.033	.040	-.005	.062	.075	.005	.076	.096	.060
	(.071)	(.068)	(.069)	(.042)	(.045)	(.045)	(.040)	(.044)	(.044)
Adj. R-sq	.137	.112	.106	.081	.085	.081	.106	.099	.100
N	7201	7262	7197	7599	7669	7599	7592	7657	7586

Note. Weighted data reported in table. CESD = Center for Epidemiologic Studies- Depression scale. Table does not present coefficients for control variables that were entered prior to entry of above variables. Control variables include race, marital status, level of education, age, wealth, income, lack of ownership of a car or house and social network characteristics.

* p<.05, **p<.01, ***p<.001.

Table 3

Regression Equation of the Interactive Effects of Rural and South Residence on Health Outcomes

	CESD			Health Conditions			Mobility Limitations		
	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3
Rural	-.148	-.111	-.153*	-.016	-.019	-.021	-.089*	.-.008	-.021
	(.076)	(.072)	(.074)	(.045)	(.047)	(.048)	(.043)	(.046)	(.047)
South	-.106	.014	-.072	-.053	.019	-.031	.014	.042	.007
	(.095)	(.093)	(.092)	(.055)	(.060)	(.059)	(.053)	(.058)	(.057)
West	-.027	-.082	-.074	.030	.045	.028	.062	.130**	.116*
	(.081)	(.078)	(.079)	(.048)	(.051)	(.051)	(.046)	(.050)	(.050)
Midwest	-.026	.054	.014	.071	.085	.060	.097*	.105*	.071
	(.072)	(.069)	(.069)	(.043)	(.045)	(.045)	(.041)	(.044)	(.044)
S*Black	.057	.100	.178	.123	.033	.028	-.108	-.027	.023
	(.131)	(.126)	(.127)	(.077)	(.082)	(.082)	(.074)	(.080)	(.080)
S*Hispanic	-.016	-.137	-.158	-.088	-.067	-.111	-.097	-.071	-.108
	(.182)	(.174)	(.177)	(.106)	(.112)	(.113)	(.101)	(.110)	(.110)
S*HSDrop	.230*	.110	.104	.092	.098	.112	.098	.070	.077
	(.111)	(.108)	(.108)	(65.000)	(.069)	(.070)	(.062)	(.068)	(.068)
S*Woman	.170	.092	.117	.083	.093	.115*	.012	.048	.049
	(.091)	(.089)	(.088)	(.053)	(.057)	(.057)	(.051)	(.056)	(.055)
S*Rural	.202*	.198*	.249*	.141*	.139*	.160*	.182**	.119*	.125*
	(.106)	(.100)	(.102)	(.062)	(.065)	(.066)	(.059)	(.063)	(.064)
Adj. R-sq	.139	.113	.106	.082	.085	.082	.108	.099	.100
N	7201	7262	7197	7599	7669	7599	7592	7657	7586

Note . Weighted data reported in table. S = South. CESD = Center for Epidemiologic Studies-Depression scale. Table does not present coefficients for control variables that were entered prior to entry of above variables. Control variables include race, marital status, level of education, age, wealth, income, lack of ownership of a car or house and social network characteristics.

* p<.05, **p<.01, ***p<.001.

Table 4

Regression Equation of the Interactive Effects of Rural and Midwest Residence on Health Outcomes

	CESD			Number of Health Conditions			Mobility Limitations		
	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3	Time 1-2	Time 2-3	Time 1-3
Rural	.017	.046	.069	.130***	.125***	.143***	.072***	.087*	.100**
	(.063)	(.060)	(.061)	(.037)	(.039)	(.039)	(.035)	(.038)	(.083)
South	.107	.139*	.084	.052	.120***	.082*	.051	.096*	.071
	(.066)	(.064)	(.064)	(.039)	(.042)	(.042)	(.037)	(.041)	(.041)
West	-.009	-.060	-.042	.057	.062	.050	.066	.136**	.129**
	(.080)	(.077)	(.077)	(.047)	(.050)	(.051)	(.045)	(.049)	(.490)
Midwest	.058	.089	.080	.226***	.259***	.231***	.111*	.181**	.146*
	(.103)	(.100)	(.099)	(.060)	(.065)	(.064)	(.058)	(.063)	(.063)
MW*Black	.035	-.027	-.071	-.119	-.099	-.085	.169	.005	-.004
	(.159)	(.153)	(.154)	(.094)	(.100)	(.101)	(.090)	(.098)	(.098)
MW*Hispanic	-.584	-.403	-.473	-.148	-.153	-.173	-.095	-.316	-.323
	(.378)	(.369)	(.372)	(.218)	(.231)	(.232)	(.208)	(.226)	(.226)
MW*HSDrop	-.279*	-.044	-.074	-.109	-.063	-.097	.033	.039	.031
	(.133)	(.129)	(.130)	(.078)	(.083)	(.083)	(.075)	(.081)	(.081)
MW*Woman	.057	.050	.054	-.102	-.148*	-.135*	-.009	-.083	-.064
	(.103)	(.100)	(.100)	(.061)	(.065)	(.065)	(.058)	(.064)	(.063)
MW*Rural	-.238*	-.223*	-.304**	-.245***	-.254***	-.273***	-.210*	-.145*	-.183**
	(.116)	(.111)	(.113)	(.069)	(.072)	(.073)	(.065)	(.071)	(.071)
Adj. R-sq	.138	.112	.106	.083	.087	.083	.108	.099	.100
N	7201	7262	7197	7599	7669	7599	7592	7657	7586

Note. Weighted data reported in table. MW = Midwest. CESD = Center for Epidemiologic Studies-Depression scale. Table does not present coefficients for control variables that were entered prior to entry of above variables. Control variables include race, marital status, level of education, age, wealth, income, lack of ownership of a car or house and social network characteristics.

* p<.05, **p<.01, ***p<.001.