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Racial and ethnic residential segregation and access to health care in rural areas

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Abstract

This study examined the relationship between racial/ethnic residential segregation and access to health care in rural areas. Data from the Medical Expenditure Panel Survey were merged with the American Community Survey and the Area Health Resources Files. Segregation was operationalized using the isolation index separately for African Americans and Hispanics. Multi-level logistic regression with random intercepts estimated four outcomes. In rural areas, segregation contributed to worse access to a usual source of health care but higher reports of health care needs being met among African Americans (Adjusted Odds Ratio [AOR]: 1.42, CI: 0.96-2.10) and Hispanics (AOR: 1.25, CI: 1.05-1.49). By broadening the spatial scale of segregation beyond urban areas, findings showed the complex interaction between social and spatial factors in rural areas.

Keywords

Residential segregation; Access to health care; Rural; Urban; Race/ethnicity

1. Introduction

To ensure equitable access to and utilization of primary and preventive care, addressing the potential challenges for rural populations in access to health care is an important concern. Though access to health care for rural populations is a priority for the Institute of Medicine and the Agency for Healthcare Research and Quality (AHRQ), limited empirical work considers the role of social and contextual-level factors within rural areas that may help or hinder access and utilization of health care. We posit that in rural areas, residential segregation, defined as the geographic and social isolation of racial/ethnic minorities, is a key social factor that corresponds with disparities in access to health care.

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Rural populations generally have higher morbidity and mortality rates relative to urban populations; individuals living in rural areas have fewer visits for preventive screenings, less access to specialists, and more preventable hospitalizations when compared to urban populations (Bennett, 2008, Chan et al., 2006, Laditka et al., 2009, Larson, 2006). Further, racial/ethnic minorities may face unique barriers in access to health care in rural areas. Depending on the outcome, there are mixed findings for whether African Americans and Hispanics in rural areas have less access and utilization of health care than their urban counterparts and less than similar non-Hispanic Whites (Bennett et al., 2012; Caldwell et al., 2016).

For generations, large concentrations of African Americans and Hispanics have resided in the rural south or southwest, respectively, which reflect historical legacies of slavery, racial/ethnic oppression and changing national boundaries (Lichter et al., 2012; Burton et al., 2011). Nationally, while rural areas are composed of more non-Hispanic Whites, between 2000 and 2010, racial and ethnic minorities accounted for 83% of the rural population growth (Johnson, 2012). Settlement patterns, and clusters of both established and new racial/ethnic minority residents, are often easily recognizable in rural areas (Burton et al., 2011). The proportions of African Americans and Hispanics in rural areas overall may be lower than in urban areas, but estimates of residential segregation are estimated to be similar to urban areas (Lichter et al., 2007). In particular, rural areas characterized by high rates of growth of Hispanic populations may be highly segregated when compared to more established rural Hispanic areas (Lichter et al., 2010).

Segregation can perpetuate racial and ethnic disparities in health by restricting educational and employment opportunities, shaping physical and social characteristics of local areas, and concentrating poverty (Williams and Collins, 2001; Phelan and Link, 2015). Fewer studies examine how segregation contributes to racial and ethnic disparities in access to health care, despite inadequate access being associated with poorer health outcomes and unnecessary costs (LaViest et al., 2011). We expect that racial/ ethnic minorities in rural areas will have restricted access to health care due to high levels of poverty and limited availability of health care resources. As racially/ethnically segregated communities tend to be low-income with restricted job and educational resources (Charles, 2003; Wilson, 1987), residents may have lower levels of access to health care when they live in areas with increasing levels of segregation. Specifically, higher concentrations of neighborhood poverty are negatively associated with reporting a usual source of health care and wellness visit (Litaker, 2005, Kirby and Kaneda, 2005). The problem may be worse in rural areas, where racial/ethnic minorities live in persistently poor areas (i.e. 20% or more of county is living in poverty continuously for the last 30 years); one-half of all African Americans and one-third of Hispanics are located in persistently poor areas, which are likely segregated from Whites and non-poor populations (Lichter and Johnson, 2007).

Another possible explanation linking segregation to access to health care are inequities in the local health care system and health care marketplace (Smedley et al., 2003). Similar to “white flight” in which neighborhoods transitioned from working class White to predominately African American, there was also health care “White flight” in which providers and hospitals relocated to more affluent and mostly White suburban areas (Smith,

2005). More recently, Hispanic immigrants may have inherited a lack of services as they moved into predominately African American neighborhoods (South et al., 2008). Current estimates show that high residential concentrations of African Americans are associated with public hospital closures and fewer primary care physicians (Ko et al., 2013; Gaskin et al., 2012). When health care is more segregated, minorities receive less health care and lower quality care when compared with Whites (Smith et al., 2007; Merchant et al., 2011). For rural areas, these experiences may be heightened, with more than 65% of rural counties being whole or partial Health Primary Shortage Areas, a designation used to increase the number of health professionals practicing in an area. In rural counties, Health Primary Shortage Areas are more likely to be in counties in which Hispanics and African Americans are the majority (Probst et al., 2004). From 2000 to 2011, rural counties with more non-White residents gained fewer rural health centers when compared to rural counties with more White residents (Ko et al., 2015). Understanding whether residential segregation contributes to access to health care, particularly in rural areas, can help to clarify whether "place-based" factors partially account for racial and ethnic disparities in health care.

The research linking residential segregation to health care has been primarily restricted to urban areas, with findings being mixed whether segregation consistently corresponds with lower levels of access to health care. On the one hand, fewer African Americans living in predominantly African American neighborhoods had an office-based physician visit in the past year, compared with Whites in predominantly White neighborhoods (Gaskin et al., 2011). Hispanic families who lived in neighborhoods with more Hispanics reported higher levels of dissatisfaction that their family could get needed medical care, relative to White families living in White neighborhoods (Kirby et al., 2006). On the other hand, being Hispanic and living in a predominantly African American county was associated with an increase in preventive screenings compared to Hispanics living in other types of counties (Benjamins et al., 2004). African Americans and Hispanics may also perceive fewer barriers to health care when they live in a county with people of a similar race/ethnicity (Haas et al., 2004).

A concern when calculating measures of residential segregation is the geographic unit used to describe the distribution of individuals across micro-units within macro-units. Conceptually, census block groups or tracts approximate "neighborhoods" and the residential separation of certain racial/ethnic groups within larger housing markets in a county or metropolitan area (Krieger et al., 2004). In rural areas, the geographies of scale for segregation are a particular challenge as census geographies vary more widely than those in urban areas and rural populations can live in areas where the nearest neighbors or physicians are miles away. Considering Christaller's (1933) classic notion of central places which specified how simple and specialized services are spatially arranged, the relevant macro-units of geographic areas may vary by service type (Dartmouth Institute, 2016), as adults may travel a few miles for primary care but possibly further for specialists and hospitals. Segregation challenges these classic notions of threshold and range for people seeking medical services. While people may access health care outside of their immediate residential area, living in a county characterized by higher levels of segregation could limit the placement of services in relation to that neighborhood and the social and financial resources needed to access those services, thereby creating a starkly uneven distribution of services

that would be less sensitive to changes in the spatial scale considered. In a national study of rural segregation, census blocks served as the micro-unit, and census designated places served as the macro-unit (Lichter et al., 2007). A review of research on African American residential segregation and health showed some variation in the macro-unit, with most studies using metropolitan statistical areas (48%) and census tracts as the micro-unit (White, 2011). In this study, we examine whether our results are sensitive to differing spatial scales.

This study tested three hypotheses to examine the potential influence of residential segregation in rural areas, operationalized as non-metropolitan areas, on access to four types of health care services. First, higher levels of segregation are expected to correspond to lower levels of access to health care. Second, the relationship between segregation and access to health care is predicted to differ by individual-level race/ethnicity. And third, in rural areas, the identified associations are hypothesized to remain even when the spatial scale of the segregation measure changed.

2. Methods

2.1. Data and sample

The study used individual, census tract, and county-level data from three sources. Individual-level data were drawn from the 2005 through 2010 Medical Expenditure Panel Survey (MEPS) Household Component File, which provided self-reported information regarding respondents' access to health care. The MEPS is conducted by AHRQ and is a nationally representative survey conducted in person in English and Spanish, with a response rate ranging from 54% to 61%. To obtain contextual level characteristics, county and tract information of MEPS respondents were merged with data from the American Community Survey 2005–2009 and the Area Health Resources Files 2010. We used restricted data for this study. The data file was created by AHRQ, and we conducted the analyses of this data file at the California Census Research Data Center.

The pooled 2005–2010 MEPS sample contained 113,814 respondents, aged 18–64. The Agency for Healthcare Research and Quality was able to match the addresses for 94.5% of respondents to county and census tract level data, resulting in an analytic sample of 107,593 respondents. Due to the restricted nature of data, we were unable to identify the tracts and counties of residence for the 6221 individuals in the pooled data who are therefore not in the analytic sample. Some individual-level variables contained missing data (n=722); a sensitivity analyses revealed minimal bias. Depending on the outcome, samples ranged in size. For national estimates, samples ranged from 106,024 to 49,992. For non-metropolitan area estimates, samples ranged from 16,545 to 7921.

2.2. Measures

2.2.1. Access to health care—Access to health care was defined as the capacity to obtain health care and the utilization of preventive screenings. Each outcome adheres to recommendations set forth by the U.S. Preventive Services Task Force, American Cancer Society, and Healthy People 2020 goals.

Usual source of health care gauges the capacity by which respondents can obtain health care and generally corresponds with increased use of primary care services and better health outcomes (Xu, 2002; Corbie-Smith et al., 2002). Respondents were asked: "Is there a particular doctor's office, clinic, health center, or other place that you usually go to if you are sick or need advice about your health?" We coded those responding yes or more than one place as 1, and those without a usual source of health care as 0.

Health care needs are met captures respondents who had no self-reported difficulties or delays in seeking medical care, dental care, or prescription medication in the past 12 months. Delayed or non-receipt of services may result in increased complications or worse prognosis (Diamant et al., 2004). Similar to other research, six related questions were combined (Peterson, 2010, Shi and Stevens, 2005). Respondents were asked: "In the last 12 months, was anyone in the family unable to obtain medical care, tests, or treatments they or a doctor believed necessary?" And "In the last 12 months, was anyone in the family delayed in getting medical care, tests or treatments they or a doctor believed necessary?" Dental and prescription medication needs were asked in a similar manner. We coded those responding no to all questions as 1, and those who responded affirmatively to any one of the six questions as 0.

Cholesterol screening is used in the primary prevention of cardiovascular disease, leading to potential pharmacological treatment or behavior change (Weintraub et al., 2011). Respondents were asked "About how long has it been since (person) had (person)'s blood cholesterol checked by a doctor or other health professional?" We coded those responding within the past 5 years as 1, and those with a screening more than 5 years ago as 0. We restricted this outcome to adults age 35–64 based on current recommendations.

Cervical screening is one the most reliable and effective cancer screening tests available, and improves chances for successful treatment (Vesco et al., 2011). Female respondents were asked: "When did (person) have (person)'s most recent Pap test?" We coded those responding within the past 3 years as 1, and those with a screening more than 3 years ago as 0. We restricted this outcome to females age 21–64 based on current recommendations.

2.3. Racial/Ethnic residential segregation

There are five commonly conceptualized geographic dimensions of racial/ethnic segregation; evenness, exposure, concentration, centralization, and clustering (Massey, 1988). We captured the exposure dimension by using the isolation index, which measures the extent to which a member of a racial/ethnic group is likely to live with and be in contact with members of this same group (as opposed to other group members). Though the dissimilarity index is more frequently used, the isolation index offers several advantages. It is more strongly correlated with socio-economic resources, particularly among African Americans, when compared to the dissimilarity index (Kawachi and Berkman, 2003). Further, in contrast to the dissimilarity index, the isolation index accounts for the relative size of each minority group, which may be important when examining rural areas due to smaller population size.

The isolation index ranges from 0 to 100, with higher scores indicating greater segregation. For an easier interpretation of the results, we standardized the African American and Hispanic isolation index to a mean of 0 and a standard deviation of 1. To calculate the isolation index we used the tract as the micro-unit, and county as the macro-unit. Counties were selected as they are the primary political units of local government and have programmatic importance, and tracts represent more proximal environments. Use of counties may also be better at capturing rural and low-income minority residents who may choose to live immediately outside the city limits (Blanchard, 2007). On average there were 21 tracts within each county. Since we used a national sample, a limitation of this approach is that the geographical size of the tracts may vary by region. To test Hypothesis 3 (i.e. the sensitivity of the spatial scales), the isolation index was also calculated as block groups nested in counties, and block groups nested in tracts.

2.4. Other contextual characteristics

A respondent's county of residence, was defined as rural or urban using the Metropolitan Statistical Area (MSA) Codes designated by the 2000 Office of Management and Budget standards for defining MSA to Census Bureau populations estimates (Office of Management and Budget, 2000). An MSA (urban area) is a large population nucleus combined with adjacent communities that have a high degree of economic and social integration with the nucleus. In New England, metropolitan areas consist of cities and towns rather than whole counties. Respondents lived in a non-metropolitan area (rural area) if their residence was in a micro-politan (population 10,000–49,999) or non-metropolitan county (population <10,000).

The supply of health care in a county was assessed by the ratio of primary care physicians per 10,000 county residents and the ratio of hospital beds per 10,000 county residents. Poverty was measured at the tract level as the percentage of households living below the federal poverty threshold and was standardized to a mean of 0 and a standard deviation of 1.

2.5. Individual level characteristics

Demographic variables included gender, age, self-reported race/ethnicity (non-Hispanic White, non-Hispanic African American, Hispanic, and non-Hispanic other/multiple race). Socio-economic variables included household income relative to federal poverty guideline (FPL) and educational attainment. Insurance status was categorized hierarchically as uninsured at any time in the last year, insured public, or insured private. Other variables included subjective health status (excellent/very good, good, or fair/poor) and census region (Northeast, Midwest, South and Midwest).

2.6. Analysis

The main analysis involved 3-level, random intercept logistic regression equations to estimate the effects of segregation on each of the four indicators of access to health care. This approach accounts for the hierarchical structure of the data in that individuals who live in the same tract have the same tract-level characteristics while tracts within the same county have the same county-level characteristics. Level 1 was the individual-level data, level 2 was tract-level data, and level 3 county-level data. Using the entire national sample, separate models were run for African American segregation and Hispanic segregation for all four

outcomes. We then modeled each outcome and tested interaction terms between African American segregation by rural/urban area and Hispanic segregation by rural/urban area to determine whether the relationships varied.

We restricted the sample to rural areas (i.e. non-MSA), to ensure that the larger sample sizes of urban areas (i.e. MSA) were not masking findings. First we tested the bivariate association between segregation and each of the outcomes, and then adjusted for all other covariates. An interaction term tested whether the association between segregation and access to health care varied by individual-level race/ethnicity. Subsequent analyses (not shown here) examined whether results were sensitive to the specification of the units used to calculate the isolation index.

Data management and analysis were conducted with Stata version 13.0 using the survey estimation commands to account for the complex study design. Gllamm, a user written program estimated the multi-level models. Level 1 weights were scaled to sum to the county cluster size, which accounted for unequal selection probabilities of people within counties based on recommendations from previous simulation work (Carle, 2009, Rabe-Hesketh, 2006).

3. Results

The weighted distributions of the study variables relative to the overall U.S population and the nation's rural and urban population are presented in Table 1. In rural areas, while more nonelderly adults reported a usual source of health care, screening rates and reports of health care needs being met were lower when compared to urban areas. At the county-level, for the average African American, 25.7% of their neighbors were African American. For the average Hispanic, 23.5% of their neighbors were Hispanic. While rural areas had lower estimates of segregation than urban areas, rural areas were also less racially and ethnically diverse. Adults in rural areas had lower educational attainment, higher rates of public insurance enrollment, with the greatest proportion living in the South (42.4%).

Table 2 shows the association between residential segregation and nonelderly adult access to health care nationally. Both African American segregation and Hispanic segregation were negatively associated with having a usual source of health care (Adjusted Odds Ratio [AOR]: 0.93, 95%Confidence Interval [CI]: 0.88-0.99; AOR: 0.92, CI: 0.86-0.97, respectively). Unadjusted estimates showed that Hispanic segregation was positively associated with health care needs being met; however, after adjustment for individual, tract, and county-level variables, this association was no longer significant. Nationally, both types of segregation corresponded with an increase in rates of preventive screenings. In fully adjusted models, an increase of one standard deviation in African American segregation and Hispanic segregation was associated with higher odds of a cholesterol screening (AOR: 1.22, CI: 1.14-1.30; AOR: 1.09, CI: 1.00-1.18 respectively). And an increase of one standard deviation in African American segregation was associated with higher odds of a cervical screening (AOR: 1.10, CI: 1.03-1.17). The separate interactions between African American segregation and rural/urban residence and Hispanic segregation by rural/urban residence were non-significant when tested in the fully adjusted models (not shown here).

Table 3 shows the unadjusted and adjusted models in the sample restricted to rural areas. Increases in African American and Hispanic segregation were associated with lower odds of having a usual source of health care for nonelderly adults based on unadjusted estimates. However, in rural areas, after adjusting for county, tract, and individual covariates, segregation no longer had a significant association with a usual source of health care. In additional step-wise analyses (not shown here) when only county-and tract-level variables were added to the model, tract-level poverty was responsible for explaining much of the association between segregation and a usual source of health care. However, even in adjusted models, African Americans and Hispanics continued to have lower odds of a usual source of health care when compared to Whites.

An increase in African American segregation and Hispanic segregation was positively associated with nonelderly health care needs being reported as met (Table 3). After adjustment, relative to all other groups, African Americans had higher odds of reporting their health care needs were met when they lived in rural areas in which African American segregation was elevated (AOR: 1.42, CI: 0.96-2.10). Similarly, Hispanics who lived in more highly segregated Hispanic counties had higher odds of their health care needs being met (AOR: 1.25, CI: 1.05-1.49). In rural areas, we observed several null relationships between segregation and the screening outcomes. The exception was that an increase in Hispanic segregation was negatively associated with cholesterol screenings, but this relationship was no longer significant after adjustment. In the sensitivity analysis evaluating whether the associations between segregation and each outcome varied depending on the spatial scale used to define areas (i.e. tracts nested in counties, block groups nested in counties, block groups nested in tracts), the associations and findings remained relatively unchanged. Only in one fully adjusted model, when Hispanic segregation was calculated as block groups nested in tracts, did we find that higher levels of Hispanic segregation were associated with lower odds of a cervical screening; while using the current unit (tracts nested in counties) we did not show an association.

4. Discussion

This study investigated whether above and beyond individual-level characteristics, racial/ethnic residential segregation is associated with residents of rural areas reporting access to primary care and key screening services. Segregation, as measured using the isolation index, was negatively associated with a usual source of health care in rural areas based on unadjusted estimates, with tract-level poverty explaining much of this variation. Even after adjusting for income and health insurance, the proportion of African Americans and Hispanics in rural areas with a usual source of health care remained lower than non-Hispanic White's. Nationally, while screening rates were higher among adults living in areas with higher levels of segregation; in rural areas; this was not always the case. Lastly, in rural areas, while segregation and three of the outcomes did not differ substantially by individual level race/ethnicity; the exception was that more African Americans and Hispanics reported their health care needs were met when they lived in more highly segregated areas of the same race/ethnicity.

National estimates showed that living in a segregated area restricted a person's access to a usual source of health care, aligning with research that fewer Asian Americans and U.S. born Mexican Americans have a usual source of health care when living in areas with a high vs. low concentration of the same race/ethnicity (Chang and Chan, 2014; Gresenz et al., 2009). Another study, however, found no association between living in a neighborhood with a predominately Hispanic population and a regular source of health care (Prentice, 2006). In our study of rural areas, after adjusting for other covariates, the association between segregation and having a usual source of health care was no longer significant. Additional analyses revealed that tract-level poverty partially explained this association, while measures of health care supply did not. Given the established link between segregation and availability of health care this is a surprising finding. However, tract-level poverty emerged as a possible mechanism connecting segregation and health care disparities. Racial/ethnic residential segregation is closely linked to concentrations of poverty due to local economic opportunities and regional histories (Lichter and Johnson, 2007). Particularly for African Americans in the south and Hispanics in southwest, race and class are deeply intertwined due to the persistence of segmented labor markets and the reproduction of occupational opportunities through discrimination in the educational system (Aiken, 1990; Lichter et al., 2012). Our finding that fewer African Americans and Hispanics had a usual source of health care at the individual-level, when compared to Whites, even after controlling for insurance status, income, and educational attainment, may indicate that other factors were not captured or measured adequately in our study. For instance, there may be group differences in how accessible safety-net providers are to the uninsured or issues with language access with providers (Cordasco et al., 2011).

While segregation was positively associated with screenings according to national estimates, in rural areas we observed no significant associations between segregation and the screening outcomes. Community level initiatives implemented by the Centers for Disease Control and Prevention, such as the Racial and Ethnic Approaches to Community Health or the National Breast and Cervical Cancer Early Detection Program may have successfully targeted areas with higher concentrations of racial/ethnic minorities, which may be disproportionately located in urban areas. In urban areas, segregated areas may also have higher involvement of local organizations that are dedicated to assisting minorities or a greater availability of Spanish speaking physicians (Gresenz et al., 2009). Despite the weaker association observed between segregation and screening in rural areas, compared to urban adults, rural adults continued to have fewer screenings within recommended intervals, supporting the larger body of research of rural disadvantage for preventive health care (Laditka et al., 2009, Bennett, 2008).

In rural areas as levels of segregation increased, African Americans and Hispanics had higher odds of reporting that their health care needs were met. Similarly, Hispanics who lived in areas with more Hispanics perceived less difficulty in obtaining health care and better access to health care services (Haas et al., 2004; Gresenz et al., 2009). African Americans also report less barriers to obtaining care in areas with a high compared to low proportion of African Americans in a county (1.6% vs. 10.5%) (Haas et al., 2004). Our findings also suggest that non-minority groups (i.e. non-Hispanic White) who live in segregated areas may have higher unmet need or difficulty accessing health care as

compared to racial/ethnic minorities. For instance, one study found that Whites living in predominantly Hispanic zip codes had 55% lower odds of an office-based physician visit compared with Whites in predominantly White zip codes (Gaskin et al., 2011). Similarly, after controlling for area-level education and poverty, Whites in counties with a high proportion of Hispanics perceived more difficulty in obtaining health care in the past year compared with Whites living in counties with a low proportion of Hispanics (17.7% vs. 9.4%) (Haas et al., 2004).

That African Americans and Hispanics in segregated areas reported having their health care needs met underscores the need to identify assets and sources of resilience on which racial/ethnic minority communities rely. This finding, which runs counter to the broader research on residential segregation and health, aligns with literature on the “ethnic density effects”, which suggests that racial/ethnic minority groups are healthier when living in areas with a higher concentration of their own racial/ethnic group (Bécares et al., 2012). On the one hand, we might expect that racial/ethnic minorities living in segregated areas should have higher levels of health care need, as segregation is associated with poorer access to resources that correspond with poorer health outcomes, higher rates of stress, obesity, and hypertension (Kershaw et al., 2013, 2011; Williams and Collins, 2001). On the other hand, the need for health care is a subjective outcome, when compared to the other three outcomes in this study. Being around individuals of the same racial/ethnic groups may potentially “normalize” lower levels of access and subsequently higher reports of health care needs being met. Racial/ethnic minority concentration may reflect exclusion (i.e, segregation) of minorities as well as their preference (i.e., ethnic enclaves) for proximal residency; additional research is needed to understand the implications for accessing health care. Minority groups who live in more segregated communities may benefit from greater levels of social support, social cohesion, and better access to resources through social networks (Halpern, 1993; Pickett and Wilkinson, 2008). Particularly for Hispanics, living in areas with individuals of a similar ethnic background or of a common language may aid in the formation of social networks and the sharing of information on how to navigate the health care system or provide local assets for accessing the health care system that are unavailable elsewhere (Aldrich and Waldinger, 1990; Portes and Zhou, 1993). For African Americans, many segregated communities have needed to cultivate ways to counteract the effect of structural barriers by creating autonomous institutions (Geroniumus, 2000). In rural areas, heightened levels of self-reliance may also differentially impact the local social environment and perceptions of need (Klugman, 2008).

Higher reports of needs being met however, does not necessarily translate into access to specialty services, timely follow-up compliance, and adequate quality of care. The outcomes assessed in this study are related to primary care and not specialty care, the later of which is often needed to administer screenings and to provide intervention for positive screening results. The expansion of community health centers and migrant health clinics may have also eliminated some of the worst disparities in primary care by “filling in” the most underserved rural areas, while specialty care may still be difficult to locate in rural areas. Difficulties in accessing specialty services may help explain why racial/ethnic minority groups and rural populations continue to have later stage diagnosis of cervical cancer and cardiovascular disease when compared to non-Hispanic Whites and urban populations respectively (Singh,

2011; Keppel et al., 2010). Differences in referral and treatment are associated with more frequent recurrence, shorter disease-free survival, and higher mortality (Shavers and Brown, 2002).

This study has several limitations. First, the data are cross-sectional, which restricts us from drawing any causal conclusions. The self-reported household survey data in MEPS is also subject to recall bias. Due to smaller sample sizes, this study was unable to focus on American Indians/Native Americans, even though rurality characterizes the reservations on which many American Indians live. The nature of rurality, segregation and health care services on and near reservations may differ substantially from rurality, segregation and health care in other rural areas; therefore, this is an important area for future research. Our indicator for rural areas (i.e. non-metropolitan) includes both micropolitan and non-core areas, which may mask isolated rural areas. While the best available, our measures of health care supply are at the county-level and people may seek care in an adjacent county with differing availability. We are less concerned with this limitation since our outcomes are primary care related and people would be expected to travel less for this type of care, compared to specialist or hospital care. Measures that capture community level initiatives were not included in the original data file construction, which would have helped to explain our null findings from the screening outcomes. However, our multilevel analysis is strengthened by its use of the isolation index as a formal measure of segregation, when compared to measures of racial/ethnic composition (i.e. % Hispanic), since the isolation index more adequately capture historical and current forms of discrimination.

In conclusion, this study found that in rural areas, associations between residential segregation contributed to worse access to a usual source of health care but higher reports of health care needs being met among African Americans and Hispanics. The intersection of residential segregation and poverty appeared to reinforce some disparities in access to health care. The study's examination of residential segregation expands the field's disproportionate focus on individual-level determinants of health care, particularly in the context of rural areas. Broadening the spatial scale of segregation beyond its traditional urban focus and considering region along with specialty health care service indicators are important next steps. Future research should endeavor to articulate a more comprehensive concept of disparities so that both social and spatial factors are considered.

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Table 1

Sample characteristics adults age 18–64, Medical Expenditure Panel Survey, 2005–2010.

	National	Rural	Urban	*p*
Access variables, %				
Has usual source of health care	72.9	76.0	72.4	***
Health care needs are met	86.6	85.5	87.1	*
Had cholesterol screening	85.9	81.0	86.9	***
Had cervical screening	87.0	82.0	86.9	***
County level variables				
Black segregation (range)[a]	25.7 (0–85.4)	13.0 (0–83.5)	28.1 (0–85.4)	***
Hispanic segregation (range)[a]	23.5 (0–94.8)	10.8 (0–94.8)	25.6 (0–90.2)	***
Rural, %	16.4			
Primary care physicians/10,000 (range)	7.4 (0–43.0)	5.7 (0–42.7)	7.7 (0–43.0)	***
Hospital beds/10,000, mean (range)	32.3 (0–489.8)	37.2 (0–489.8)	31.6 (0–489.8)	
Tract level variable				
Proportion in poverty (range)	13.4 (2.8–47.3)	16.8 (3.2–47.3)	12.8 (2.8–47.3)	***
Individual level variables				
Gender, %				
Male	49.0	50.0	49.4	
Female	51.0	50.0	50.7	
Age, mean (range)	40.4 (18–64)	41.5 (18–64)	40.2 (18–64)	***
Race/Ethnicity, %				***
White, Non-Hispanic	66.6	82.0	63.4	
Black, Non-Hispanic	12.0	7.9	12.7	
Hispanic	15.0	6.3	16.4	
Other	6.8	3.8	7.5	
Educational attainment, %				***
Less than high school	9.9	11.1	9.7	
High School/GED	40.3	48.1	38.8	
Bachelors +	34.5	25.6	36.2	
Highest degree inapplicable/under 25	15.4	15.3	15.4	
Income relative to the federal poverty line, %				***
Less than 125%	15.3	18.1	14.7	
125–199%	12.1	15.0	11.7	
200–400%	30.9	35.0	30.2	
More than 400%	41.7	32.3	43.4	
Insurance, %				***
Insured private	63.0	60.2	64.3	
Insured public	6.9	8.1	6.5	
Uninsured any time last year	30.0	32.0	29.2	
Self-reported health, %				***
Excellent/Very good	61.8	57.0	62.7	

	National	Rural	Urban	*p*
Good	27.1	29.0	26.7	
Fair/Poor	11.1	14.0	10.5	
Region, %				***
Northeast	18.3	11.9	19.5	
Midwest	21.9	32.0	20.1	
South	36.4	42.4	35.3	
West	23.3	13.7	25.1	
n	106,024	16,545	89,479	

Weighted data. urban=Metropolitan statistical areas, Rural=Non-metropolitan statistical areas. Unmet healthcare need sample.

* p<0.05,

** p<0.01,

*** p<0.001.

[a] Isolation index where a score near 100 indicates that African Americans or Hispanics live in areas where they are exposed only to other people of their own race/ethnicity.

Table 2

Three-level logistic regression models testing the association of segregation and access to Healthcare Nationally, Medical Expenditure Panel Survey, 2005–2010.

	Usual source of health care						Health care needs are met						Cholesterol screening						Cervical screening					
	OR	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***
African American segregation[a]	0.90	0.84, 0.96	***	0.93	0.88, 0.99	*	1.02	0.96, 1.08		0.98	0.92, 1.05		1.22	1.14, 1.31	***	1.22	1.14, 1.30	***	1.19	1.12, 1.27	***	1.10	1.03, 1.17	**
Hispanic segregation[a]	0.73	0.68, 0.78	***	0.92	0.86, 0.97	**	1.13	1.04, 1.22	***	0.99	0.92, 1.06		1.05	0.95, 1.15		1.09	1.00, 1.18	*	1.06	0.98, 1.14		0.99	0.93, 1.06	
n	104,939						106,024						62,919						49,922					

Weighted data, Abbreviations: OR, unadjusted odds ratio, AOR, adjusted odds ratio.

Separate models for African American segregation and Hispanic segregation. Adjusted estimates derived from a 3-level random intercept model as described in the text, which control for primary care physicians/10,000, hospital beds/10,000, urban/rural area, tract-level poverty, gender, age, race/ethnicity, educational attainment, income relative to the federal poverty line, insurance, self-reported health, and region.

[a]Isolation index standardized with mean=0 and SD=1,

*p <0.05,

**p <0.01,

***p <0.001.

Table 3

Three-level logistic regression models testing the association of segregation and access to healthcare for rural areas, Medical Expenditure Panel Survey, 2005–2010.

	Usual source of health care						Health care needs are met						Cholesterol screening						Cervical screening					
	OR	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***
African American Segregation[a]	0.83	0.71, 0.97	*	0.97	0.80, 1.18		1.16	1.01, 1.32	*	1.14	0.97, 1.34		1.00	0.87, 1.14		1.15	0.95, 1.40		1.10	0.95, 1.26		1.10	0.91, 1.34	
African American Segregation * African American				1.19	0.84, 1.71					1.42	0.96, 2.10	†				0.82	0.56, 1.19					1.22	0.76, 1.96	
Hispanic segregation[a]	0.76	0.64, 0.90	**	0.91	0.77, 1.08		1.14	1.00, 1.31	†	0.92	0.77, 1.09		0.89	0.78, 1.02	†	1.02	0.83, 1.26		0.94	0.81, 1.10		0.93	0.73, 1.18	
Hispanic segregation * Hispanic				1.18	0.92, 1.51					1.25	1.05, 1.49	*				0.98	0.79, 1.21					1.02	0.81, 1.30	
Primary care physicians/10,000				0.98	0.94, 1.03					0.98	0.95, 1.01					1.00	0.97, 1.04					1.00	0.96, 1.05	
Hospital beds/10,000				1.00	1.00, 1.00					1.00	0.98, 1.00					1.00	1.00, 1.00					1.00	1.00, 1.00	
Tract-level proportion poor[a]				0.99	0.89, 1.09					1.03	0.93, 1.14					0.86	0.74, 0.98	*				0.95	0.83, 1.08	
Female (ref=Male)				1.97	1.77, 2.20	***				0.70	0.62, 0.80	***				1.65	1.43, 1.89	***				NA		
Age[b]				1.37	1.28, 1.47	***				0.94	0.88, 1.01					1.96	1.76, 2.18	***				0.59	0.54, 0.64	***
Race/Ethnicity (ref=White, NH)																								
Black, NH				0.65	0.48, 0.86	**				1.44	1.05, 1.96	*				0.91	0.66, 1.25					1.47	1.04, 2.09	*
Hispanic				0.55	0.40, 0.77	**				2.35	1.63, 3.38	***				0.87	0.60, 1.25					1.39	0.93, 2.08	
Other, NH				1.35	0.73, 2.51					1.22	0.82, 1.81					0.99	0.60, 1.63					1.53	1.03, 2.26	*
Educational attainment (ref=Bachelors+)																								
Less than High School				0.59	0.48, 0.72	***				1.24	0.97, 1.58	†				0.38	0.29, 0.50	***				0.38	0.28, 0.53	***
High school/GED				0.86	0.72, 1.01	†				1.09	0.92, 1.29					0.56	0.46, 0.68	***				0.62	0.49, 0.78	***
Highest degree inapplicable/under 25				1.09	0.83, 1.41					1.61	1.23, 2.12	**				NA						0.33	0.20, 0.54	***
Income relative to federal poverty line (ref=over 400%)																								
Less than 125%				0.51	0.40, 0.64	***				0.49	0.38, 0.64	***				0.49	0.38, 0.63	***				0.66	0.48, 0.90	**
125–199%				0.61	0.48, 0.76	***				0.56	0.44, 0.71	***				0.48	0.38, 0.62	***				0.57	0.42, 0.76	***
200–400%				0.76	0.63, 0.90	***				0.62	0.50, 0.77	***				0.69	0.55, 0.86	***				0.63	0.47, 0.84	***
Insurance (ref=Insured Private)																								
Insured public				1.95	1.48, 2.57	***				0.61	0.50, 0.76	***				1.20	0.88, 1.65					0.80	0.58, 1.09	
Uninsured any time last year				0.37	0.32, 0.44	***				0.43	0.36, 0.51	***				0.42	0.35, 0.50	***				0.45	0.36, 0.57	***
Self-reported health (ref=Excellent)																								
Good				1.46	1.27, 1.67	***				0.51	0.43, 0.59	***				1.56	1.34, 1.80	***				0.82	0.70, 0.97	*

	Usual source of health care						Health care needs are met						Cholesterol screening						Cervical screening					
	OR	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***	**OR**	**95% CI**	***p***	**AOR**	**95% CI**	***p***
Fair/Poor				2.33	1.93, 2.82	***				0.23	0.19, 0.27	***				2.71	2.18, 3.38	***				0.69	0.54, 0.88	**
Region (ref=Northeast)																								
Midwest				0.73	0.45, 1.17					0.87	0.60, 1.26					0.87	0.59, 1.29					0.55	0.39, 0.78	***
South				0.49	0.30, 0.77	**				0.85	0.58, 1.23					1.04	0.70, 1.55					0.68	0.48, 0.97	*
West				0.55	0.32, 0.92	*				0.89	0.57, 1.38					1.20	0.78, 1.86					0.66	0.43, 1.00	†
n	16,494						16,545					10,374						7921						

Weighted Data. Abbreviations: NA, not applicable; OR, odds ratio; AOR, adjusted odds ratio.

Estimates derived from a 3-level random intercept models with separate models run for African American segregation and Hispanic segregation. Coefficients for covariates are from the African American segregation model.

† p <0.10,

* p <0.05,

** p <0.01,

*** p <0.001.

[a] Standardized with mean =0 and SD =1.

[b] 10-year increase.