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Changes in Socioeconomic Mix and Health Outcomes in Rural Counties with Hospital Closures, 2005-2018

- Noncore (rural) counties experienced a higher number of complete hospital closures than their micropolitan peers, with this gap widening over time.
- Compared to micropolitan areas, noncore counties with closures experienced higher poverty and unemployment rates since the early 2010s.
- Compared to micropolitan areas, noncore counties with hospital closures began experiencing heightened age-adjusted all-cause and cardiovascular mortality rates since the early 2010s.

INTRODUCTION

When rural hospitals close their doors (as opposed to scaling back services or converting to a critical access hospital), the communities where they operate lose access to a host of general and acute inpatient services. From 2005 to 2020, almost 200 rural hospitals have closed their doors, with the number of closures rising rapidly since the Great Recession of 2008/2009.^{1,2} Previous studies, as well as recent Government Accountability Office (GAO) reports, have found that hospital closures affect rural residents' access to health care services particularly those who are elderly and low income.^{3,4} These trends are expected to continue, raising questions about the long-term impact that rural hospital closures will have on access to health care services and health outcomes for over 46 million Americans living in rural communities.^{5,6}

Hospital closures are associated with a disproportionate impact to older adults, racial/ethnic minority populations, those who experience poverty, and those with public insurance.^{4,7} In rural areas where local hospitals have closed, some people wait until their disease has progressed before seeking medical attention; others seek care outside of their own community and encounter personal and economic barriers to access.^{4,8} Yet, there remain few national studies that examine social, economic, and health-related trends within rural communities that have experienced a closure.

Monitoring rural hospital closure impacts on population health outcomes has additional policy-relevant implications. Local emergency departments, for example, are important access points for rural populations because of geographic isolation, as well as the likelihood of major clinical events or traumatic injuries (e.g., transportation-related accidents).⁹ Hospital closures can lead to treatment delays as well as adverse outcomes as a result of fracturing access to emergency medical care.¹⁰ In rural areas, where patients carry a greater risk of mortality from time-sensitive trauma (e.g., blunt-force injury, asthma, COPD) and cardiovascular conditions than their urban counterparts, the additional travel time has shown to be harmful.¹¹

Evidence on the net impact of hospital closures on outcomes such as mortality has been mixed. A study investigating 195 hospital closures between 2003 and 2011 found minimal changes in all-cause

mortality rates in hospital service areas following a hospital closure.¹² A recent study from California provides some indication that the overall effect of a hospital closure should be negative, as the authors found nearly a 6% increase in rural mortality as a result of hospitals shutting their doors (i.e., losing inpatient services).¹³ Understanding whether communities experiencing hospital closures are also experiencing poorer overall health outcomes – on a national scale – is important in order to identify the degree to which investment in ambulatory or alternative health care services are needed in the wake of these closures.

This report focuses on changes in socioeconomic mix and health outcomes that occurred in rural (micropolitan and noncore) counties with and without a complete hospital closure between 2005 – 2018. We examine differences in trends using the 2013 National Center for Health Statistics (NCHS) Rural Classification Scheme for Counties. The NCHS rural classification scheme is based on Office of Management and Budget (OMB) standards for defining metropolitan statistical areas.¹⁴

FINDINGS

Discrete changes in complete hospital closures experienced in micropolitan and noncore counties are shown in **Figure 1**. There were 65 out of 625 (5.1%) noncore (i.e., rural) counties impacted by a hospital closure between 2005 – 2018. A total of 37 out of 1,278 (5.9%) micropolitan counties were similarly impacted by a hospital closure over this same period. In all study years, noncore counties experienced a higher number of closures than their micropolitan peers, but the overall rates between the two areas were comparable. In agreement with the most recent GAO report,⁴ closures were particularly high in the later years of the study period between 2013-2018, with a widening gap between noncore and micropolitan counties occurring simultaneously.

Figure 1: Discrete changes in the number (%) of counties experiencing a complete hospital closure in rural counties (micropolitan and noncore) between 2005 – 2018.

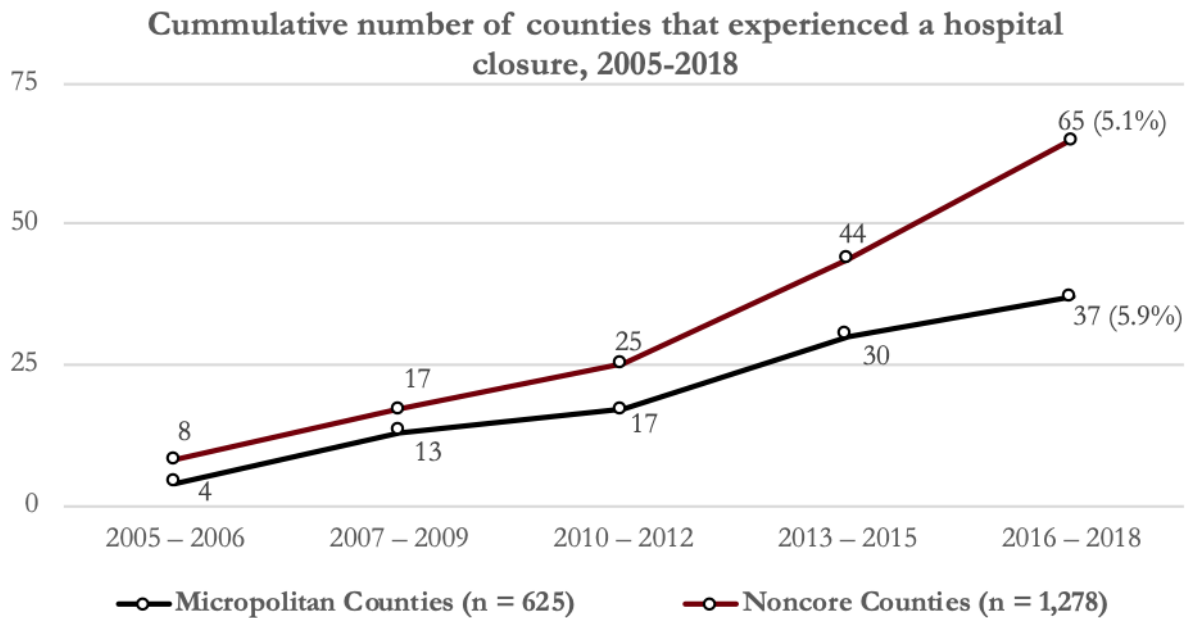
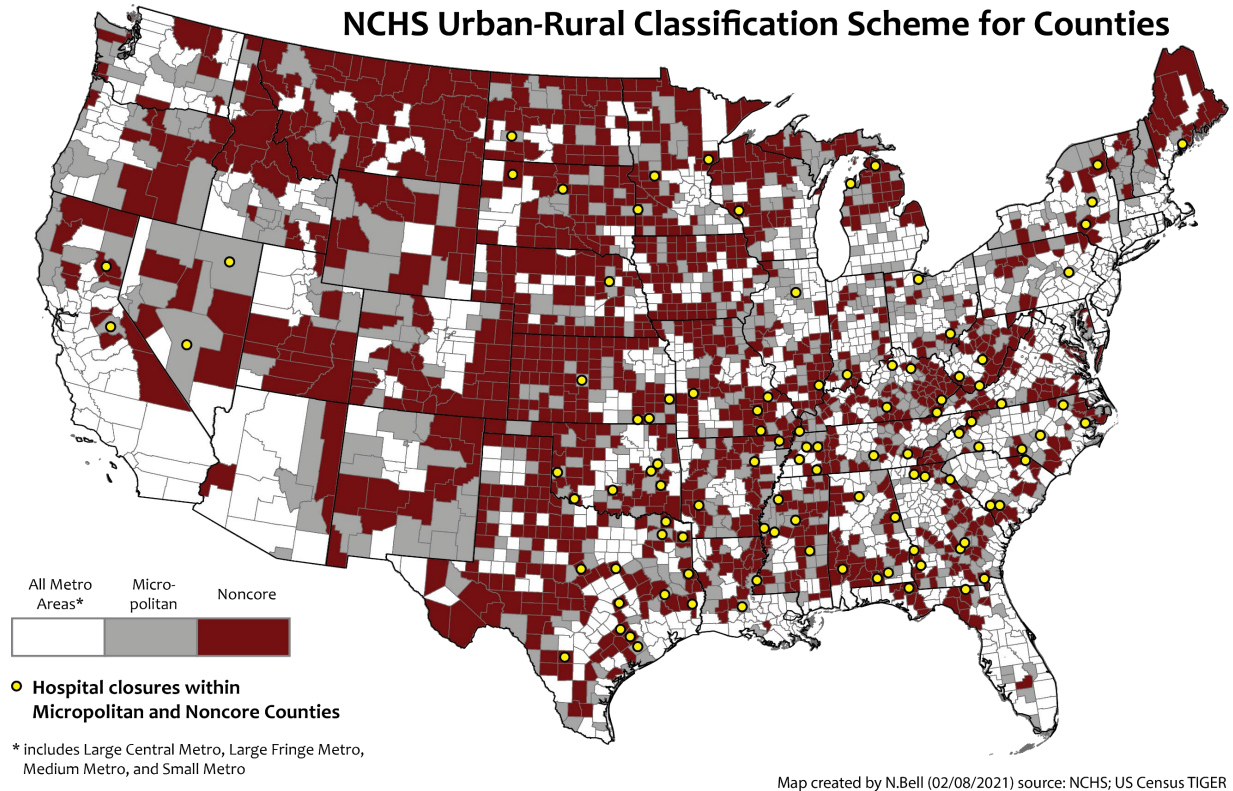


Figure 2 illustrates the locations of hospital closures between 2005 and 2018 that occurred in micropolitan and noncore counties in the contiguous U.S. Counties where closures occurred are shown as yellow points within the map. The majority (61%) of counties experiencing rural hospital closures were in the South region.

Figure 2: Map of complete hospital closures within NCHS micropolitan and noncore areas within the contiguous United States.



Some of these patterns may also be related to Medicaid expansion.¹⁵ For example, of all completed closures since 2013, 63.3% (38 of 60 rural hospital closures) of closures have occurred subsequent to a state’s decision not to expand Medicaid (as of April 2021). By frequency, rural hospital closures in non-expansion states over this time have been highest in Texas (14), followed by North Carolina (7), Tennessee (7), Georgia (7), as well as Mississippi (6) and Alabama (5). **Table 1** shows the number of closures within micropolitan and noncore areas over time among states that have never elected to expand Medicaid compared to those that have.

Table 1: Number (%) of hospital closures grouped by Medicaid expansion status between 2005– 2018 within micropolitan and noncore areas.

Status	Number (%) of Hospital Closures by Medicaid Expansion Status				
	2005 – 2006	2007 – 2009	2010 – 2012	2013 – 2015	2016 – 2018
Expansion	6 (50.0%)	12 (66.7%)	5 (41.7%)	9 (27.3%)	13 (46.4%)
Non-expansion	6 (50.0%)	6 (33.3%)	7 (58.3%)	24 (72.7%)	15 (53.5%)

Rural areas with closures experienced greater changes in social and economic characteristics since the early 2010s compared to their rural counterparts without closures.

Overall, few differences in socioeconomic characteristics were observed across micropolitan and non-core areas prior to 2013 – 2015. Specifically, unemployment rates emerged as significantly higher ($p < 0.05$) in micropolitan and noncore counties with a hospital closure after 2013 (see **Figure 3**). In that same time frame, area poverty rates were also higher in micropolitan and noncore counties that experienced a hospital closure (see **Figure 4**). From 2013-2015, noncore counties that experienced a closure also had significantly higher proportions of non-white residents than their noncore peers that did not have a closure (see **Figure 5**). All comparisons in Figures 3 - 5 represent discrete comparisons between rural classification types, not longitudinal changes in social or economic characteristics since a closure occurred. Longitudinal changes in county social and economic characteristics following a closure were similarly significantly different for the same indicators and same time periods shown here.

States ranking within the poorest social and economic characteristics included Kansas, Kentucky, Mississippi, South Carolina, and Tennessee. These trends follow parallel trends with respect to regional patterns of hospitals that have reported high risk of financial distress.¹⁶

Figure 3. Trends in area unemployment rates across counties by closure status and NCHS classification, 2005-2018

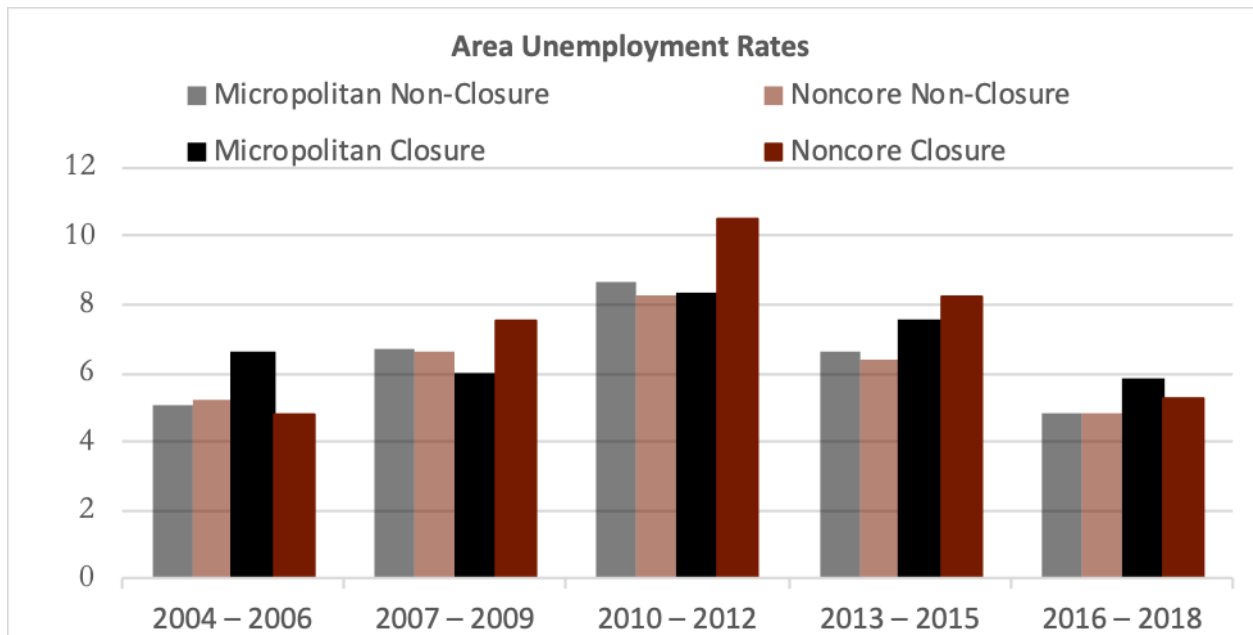


Figure 4. Trends in area poverty rates across counties by closure status and NCHS classification, 2005-2018

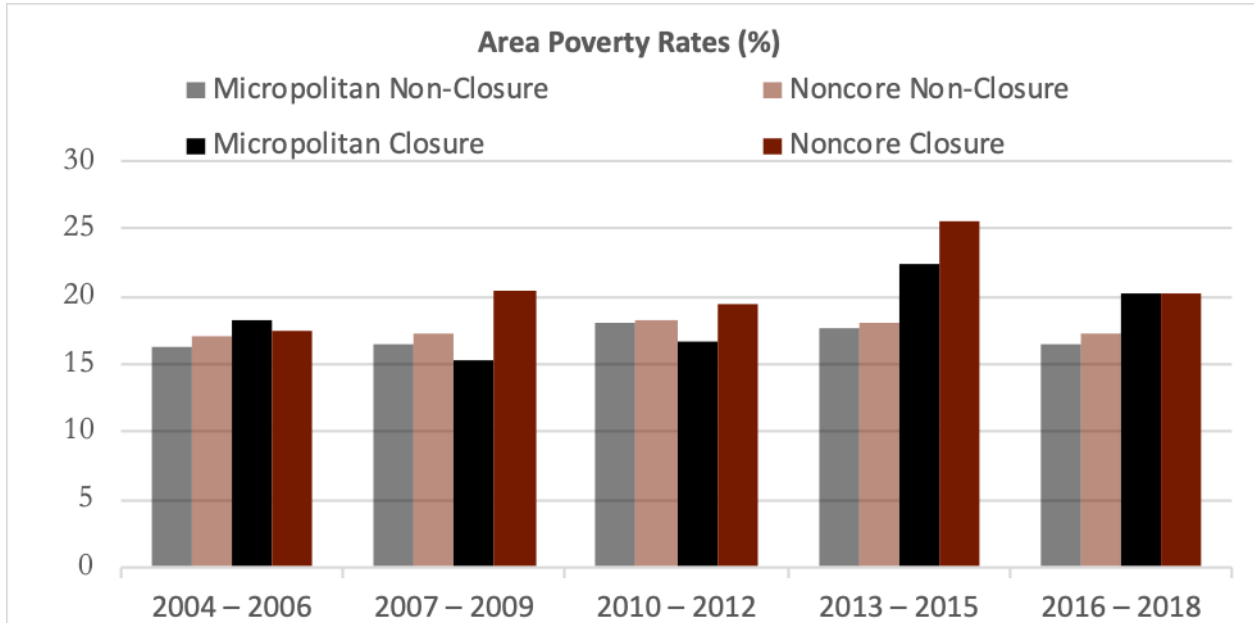


Figure 5. Trends in the proportion of non-white residents across counties by closure status and NCHS classification, 2005-2018

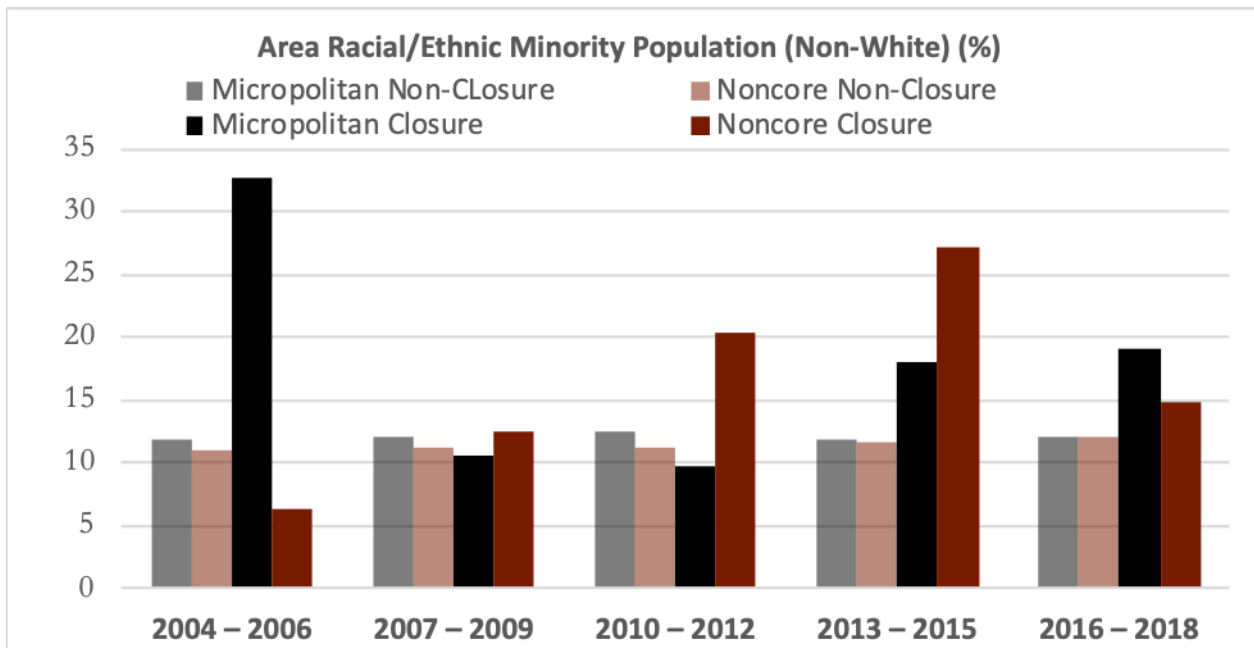


Table 2: Changes in age-adjusted all-cause mortality rates (per 100,000) among micropolitan and noncore counties, 2005-2018

	Age-Adjusted All-Cause Mortality				
	2005 – 2006	2007 – 2009	2010 – 2012	2013 – 2015	2016 – 2018
Micropolitan Area					
Non-Closure	872.1	846.8	831.5	831.9	837.6
Closure County	984.8	877.7	889.6*	928.7*	975.0*
Noncore Area					
Non-Closure	872.6	856.4	840.8*	842.1	845.1
Closure County	857.9	886.7	807.6	939.0*	916.8*

* p < 0.05

Differences in age-adjusted mortality rates between closure and non-closure rural counties are emerging over time.

In both micropolitan and noncore counties, changes in all-cause age-adjusted mortality suggest that hospital closures began to show a major impact after 2012 (see **Table 2**). There was an 8% - 16% increase in all-cause age-adjusted mortality within micropolitan or non-core counties that experienced a hospital closure compared to similarly classified non-closure counties depending on the period. Overall, the time periods where significant differences in age-adjusted mortality rates occur were largely the same time periods where socioeconomic characteristics were also statistically significantly higher.

Similar trends also emerged for cardiovascular-related mortality rates, which has historically been one of the leading causes of death in the U.S. Depending on year, closure counties classified as micropolitan experienced a 17% - 20% increase in cardiovascular-related mortality rates after 2012. We also examined differences in rates of specific causes of mortality that often are time-sensitive with need for definitive care, including cardiovascular diseases (e.g., ischemic heart disease), unintentional injuries (e.g., motor vehicle collisions), and respiratory diseases (e.g., influenza, COPD). Noncore closure counties experienced a 15% - 19% increase in time-sensitive cardiovascular-related mortality over the same period (results not shown). Both injuries and respiratory causes showed some evidence of trending upward, but we were limited to fewer time periods for comparisons because of data suppression owing to small counts at the county level within the three-year period used for the comparisons.

CONCLUSION


Between the period 2005-2018, hospital closures in both micropolitan and noncore counties across the U.S. increased, reflecting existing knowledge of this ongoing threat to health care access in rural America.⁵ By examining this trend across definitions of rurality, we found that noncore counties experienced higher numbers of hospital closures, with the gap widening between rural areas in recent years. Closures in all communities accelerated after 2008/2009, reflecting similar triggers seen with the wave of rural hospital closures in the 1980s. (i.e., national economic recession, changes to hospital reimbursement policy).¹⁷ Since 2013, closures also appear to be trending higher in states located in the Southeast U.S., many of which have the highest populations of uninsured individuals in the country.¹⁵ Many of these states also did not elect to expand their Medicaid program.

Additionally, rural counties that experienced hospital closures during this period were found to have multiple negative social, economic, and health outcomes compared to other similarly defined areas. Hospitals vulnerable to closure are often located in communities that are already experiencing financial distress.⁷ Since 2013, micropolitan and noncore areas that experienced a closure had increases in county unemployment and area poverty rates. Previous research on the effects of rural hospital closures occurring in the 1980s and 1990s indicated that those closures also signaled a deterioration of social and economic conditions in communities.^{14,15,18,19} These associations between negative economic outcomes and rural hospital closures suggest a broad set of structural challenges in rural areas that are both antecedent to and are potentially compounded by closures.

Although recent studies have documented the effect of rural hospital closures on reducing access to health care services,³ literature studying the effect of closures, both rural and urban, on changes in health outcomes remains limited. The few studies on the association between closures and mortality concluded mixed results. For example, a large-scale study found no impact of closures on mortality,¹² whereas others found adverse impacts as a result of urban hospital closures.²⁰ One study on rural hospital closures found that inpatient mortality for certain emergent conditions increased 5.9% following the closures, with no impact found for comparable urban hospital closures during the same time period.¹³

This is the first national study to examine the association of rural hospital closures with health outcomes at the county-level, specifically all-cause and cause-specific mortality. Beginning in 2013, counties with closures that occurred between 2005-2018 experienced increases in all-cause mortality and cause-specific mortality rates for cardiovascular disease. Although the specific mechanism for these increases in mortality at the local level is unclear, our study suggests that lack of Medicaid expansion, community social and economic declines, and cuts in access to care in communities in the form of hospital closures may have synergistic and compounding associations that result in negative health outcomes.

Our results indicate that federal legislation focused on mitigating the rural hospital closure crisis must go beyond assuring rural hospitals remain open. It is equally important to develop policies and interventions to address the social, economic, and health structures contributing to negative outcomes in affected communities.

	<p>This project was supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under grant number U1CRH30539 Rural Health Research Grant Program Cooperative Agreement for \$573,000 with no nongovernmental sources. This information or content and conclusions are those of the authors and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the U.S. Government. For more information about the Center, contact the Director Dr. Jan M. Eberth (jmeberth@mailbox.sc.edu) or Deputy Director Dr. Elizabeth L. Crouch (crouchel@mailbox.sc.edu).</p>
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APPENDIX

Methodology

Data Sources

Hospital closures during the study period were identified using the data from rural hospital closure trackers by North Carolina Rural Health Research Program (NC RHRP) at the Cecil G Sheps Center for Health Services Research. We applied this criterion to focus our understanding on closures that resulted in the loss of all hospital services (complete closures) rather than instances where a community only lost its inpatient and emergency department facilities (converted closures). For this analysis, all hospital closures included in the Sheps database were excluded if they did not occur in a micropolitan or noncore county.

For each evaluation, we used different linkages to various county-level administrative databases to assess changes in hospital closures over time on area socioeconomic characteristics and mortality outcomes. Census counties were the primary unit of analysis as they have programmatic importance at the federal and state levels for policy. They also enable linkages to an array of additional data sources that are typically not available at smaller spatial extents. In this analysis, these data included demographic and socioeconomic records from the 2005-2018 Area Health Resource Files and mortality records spanning the 2006 – 2018 Centers for Disease Control Wonder database.

Causes of death obtained from the CDC Wonder database were derived from ICD-10 codes. Cause specific reports (e.g., cardiovascular disease, injury, respiratory diseases) were derived from the entire list of relevant codes (e.g., J00-J98, diseases of the respiratory system) in part due to data suppression for small numbers that occur at the county scale. Injury-related causes of mortality were limited to unintentional causes only.

A distinguishing feature of this analysis is our use of the National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme (URCS) to characterize broader community contexts surrounding hospital closures. The NCHS Classification Scheme is a six-level county-metric based on the Office of Management and Budget (OMB) standards for defining metropolitan statistical areas (MSAs) and from census data. Because the URCS delineates MSAs as well as micropolitan statistical areas, we were able to assess changes in area health and socioeconomic characteristics within nonmetropolitan counties that have smaller nucleuses. A complete description of the URCS is available in the bibliography. We employed the 2013 NCHS Urban-Rural Classification Scheme for this analysis.

Statistical Analysis

In the unadjusted analyses, differences between means of continuous variables across NCHS classifications categories were compared using ANOVA. Differences in proportions of categorical variables were examined using chi square tests. All significance levels represent p-values < 0.05. All statistical analyses were completed in SAS for Windows, Version 9.2.