

Examining rural-urban differences in the availability of hospital-based cardiac services between 2010-2020

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Key Points:

- Between 2010 and 2020 there has been an overall net increase in the proportion of hospitals offering specialized cardiac healthcare services across the United States.
- In 2010 and 2020, 8.6% and 9.4% of hospitals in non-core rural counties offered specialized cardiac healthcare services, respectively, which was much lower than metropolitan hospitals (65.2% and 71.9%).
- From 2010 to 2020, the proportions of metropolitan and micropolitan hospitals offering specialized cardiac care substantially increased, but there was no significant change among hospitals in rural non-core counties.

INTRODUCTION

Heart disease is the leading cause of death in the United States, responsible for approximately 700,000 deaths in 2020.¹ Fortunately, over the last 50 years, because of medical advances and successful public health interventions, cardiac-related mortality has decreased by over 50.0%.² While overall improvements have been made in reducing the burden of heart disease and related mortality, there remain significant geographic disparities especially for rural areas. Persons living in rural areas have a 19% greater risk of developing heart disease than their urban peers.³ Compared to large (208 cardiac-related deaths per 100,000) and medium (221 cardiac-related deaths per 100,000) metropolitan areas, rural areas

(251 cardiac-related deaths per 100,000) have the highest age-adjusted cardiac-related mortality rates.^{4,5}

Improvements in cardiac-related mortality have been observed. However, this improvement has been slowest in rural areas where the reduction in mortality has been half that of large metropolitan areas.⁴ Between 2011-2017, large metropolitan areas experienced nearly a 1% annual percentage change reduction in cardiac mortality every year while in rural areas the reduction during this same time period was 0.3%.

Rural-urban disparities in cardiac morbidity and mortality are multifactorial and complex. Rural areas have a significantly higher prevalence of cigarette smoking, excessive alcohol usage, and high-fat diets – all of which are risk factors for the development of heart disease.⁶⁻⁸ However, it is equally vital to acknowledge the structural barriers that contribute to the observed disparities. Previous work has demonstrated that among patients who have suffered cardiac arrest, those who live in areas with worse geographic access to acute cardiac care have a significantly higher risk of later cardiac related mortality.⁹ Addressing issues regarding physical access to preventive, diagnostic, and interventional cardiac-related healthcare services is equally as vital as improving individual health behaviors.

Rural areas consistently have worse access to a wide variety of healthcare services due to a combination of low numbers of both providers and facilities to provide such services.¹⁰ Previous work from the Rural and Minority Health Research Center has demonstrated that residents living in rural areas often have to travel further distances to reach the nearest pharmacy, obstetric provider, and emergency room.¹¹ Lack of access to and availability of cardiac-related healthcare services may be one of the factors contributing to the cardiac-related burden disparities

between rural and urban areas. Of special interest are general cardiology services, diagnostic, and interventional catheterization. These services contribute to the prevention, detection, and acute treatment of cardiac related disease.

To date, there has been little work examining the availability of cardiac-related healthcare services in rural and urban areas. Additionally, considering the number of hospital closures, especially rural hospital closures¹² that have occurred over the past decade, it is equally important to examine how availability has changed over time. This current policy brief aims to 1) examine the availability of hospital-based cardiac healthcare services (general cardiology, diagnostic catheterization, and interventional catheterization) from 2010-2020 and 2) determine whether there have been rural-urban differences in the availability of hospital-based cardiac-related healthcare services.

METHODS

Hospital service data was sourced from the American Hospital Association annual survey from 2010 and 2020 and supplemented with data from the Centers for Medicare and Medicaid Services Provider of Services (POS) File dataset when data on service availability was missing. The three services examined were: general adult cardiology (GAC), adult diagnostic catheterization (ADC), and adult interventional catheterization (AIC). Only hospitals that were classified as general community or cardiac specialty service hospitals were included in this analysis. Hospitals that indicated that they provided the service themselves or through an agreed contract with a partner were categorized as providing the service. Rurality was defined using county-level Rural Urban

Continuum Codes (RUCC) which range in value from 1-9 with 1 being the least rural and 9 being the most rural. Three county-level rurality classifications were created: metropolitan counties (classification values 1-3), micropolitan rural (classification values 4-7), and non-core rural counties (classification values 8-9). We used frequencies and chi-square tests to examine the proportion of hospitals offering the specialized cardiac services of interest and if service offering differed by levels of rurality during the time periods.

To examine whether there was a statistically significant change in the proportion of hospitals offering each service category during the years 2010-2020, we used the Cochran Armitage test for trend. A two tailed p-value with a threshold of .05 was used to determine statistical significance for all hypothesis tests.

FINDINGS

Overall

Figure 1 shows the overall proportion of hospitals providing each service examined by year. In 2010 there was a total of 4,716 general medicine and/or cardiac specialty hospitals. Of these hospitals, 47.82% indicated that they provided general adult cardiology services, 40.44% provided adult diagnostic catheterization, and 33.78% provided adult interventional catheterization. By 2020, the overall number of available hospitals had decreased to 4,419 yet the proportion of hospitals offering GAC, ADC, and AIC increased during this time. Between 2010 and 2020, the proportion of hospitals providing GAC, ADC, and AIC had a net increase of 5.68%, 3.30%, and 6.95%, respectively. In both 2010 and 2020, AIC had the lowest proportion of hospitals indicating they are providing the service to patients.

Figure 1. The Proportion of Nationwide Hospitals Offering Cardiac Services in 2010 and 2020: General Adult Cardiology, Adult Diagnostic Catheterization, & Adult Interventional Catheterization



Differences across levels of rurality

Table 1 demonstrates the proportion of hospitals offering each of the examined cardiac services across the three rurality classifications (metropolitan, micropolitan, and rural non-core). Approximately 60% of hospitals included in this analysis were in located in large metropolitan counties in 2010 (59.30%) and 2020 (58.50%). In 2010, there was a statistically significant ($p < .05$) difference in the proportion of hospitals offering cardiac services across levels of rurality. The majority of hospitals in metropolitan areas reported providing GAC (65.24), ADC (59.76%) and AIC (51.86%). Rural micropolitan and non-core hospitals were much less likely to offer these services. Of hospitals in micropolitan counties, only 25.48% reported providing GAC, 15.02% reported providing ADC, and 9.11% reported providing AIC. Rural non-core counties have the lowest proportion of hospitals offering these services with only 8.61% offering GAC and less than 1.0% providing either ADC or AIC. Similar rural-urban gaps were also observed in 2020 in the proportion of hospitals offering cardiac services.

Changes from 2010 to 2020

Figure 2 visualizes the change in the proportion of hospitals offering each examined cardiac service across the three county rurality classifications (metropolitan, rural micropolitan, and rural non-core). Appendix Figures A-F show counties that have a hospital providing the examined services in 2010 and in 2020. There was a statistically significant ($p < .05$) increase in the proportion of hospitals offering GAC in metropolitan counties (+6.61%) and micropolitan counties (+6.62%), but there was no statistically significant change in the proportion of rural non-core hospitals offering GAC. For ADC services, there was a statistically significant increase in the proportion of hospitals offering such services in metropolitan (+4.82%) and micropolitan (+2.51%) but not rural non-core counties (+0.87%). The same trends were observed for AIC services. Within metropolitan and micropolitan counties there was a significant increase of 9.39% and 5.39%, respectively, but no significant change within rural non-core counties for this service.

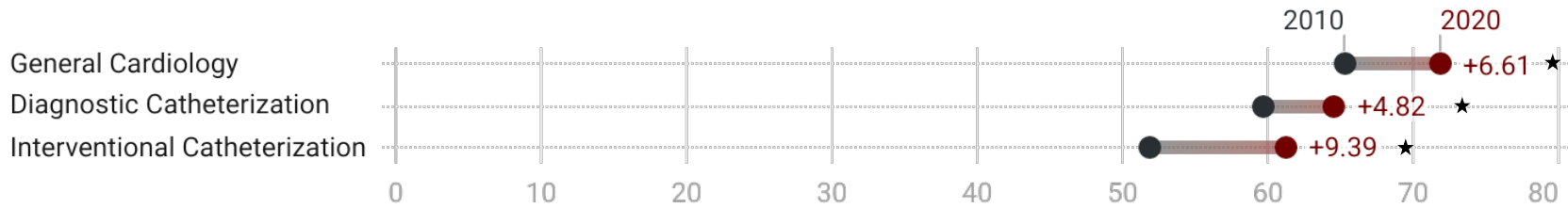
Table 1 Differences in the proportion of hospitals offering cardiac services across levels of rurality.

2010				
Hospital Services	Metropolitan Counties (n=2,796) *	Micropolitan Counties (n=1,558)	Non-Core Counties (n=362)	p-value
General Cardiology % (n)	65.24 (1,824)	25.48 (397)	8.61 (31)	<.001
Diagnostic Catheterization % (n)	59.76 (1,670)	15.02 (234)	0.56 (3)	<.001
Interventional Catheterization % (n)	51.86 (1,450)	9.11 (142)	0.28 (1)	<.001
2020				
Hospital Services	Metropolitan Counties (n=2,583)	Micropolitan Counties (n=1,483)	Non-Core Counties (n=353)	p-value
General Cardiology % (n)	71.85 (1,856)	32.10 (476)	9.43 (33)	<.001
Diagnostic Catheterization % (n)	64.58 (1,668)	17.53 (260)	1.43 (6)	<.001
Interventional Catheterization % (n)	61.25 (1,582)	14.50 (215)	0.86 (3)	<.001

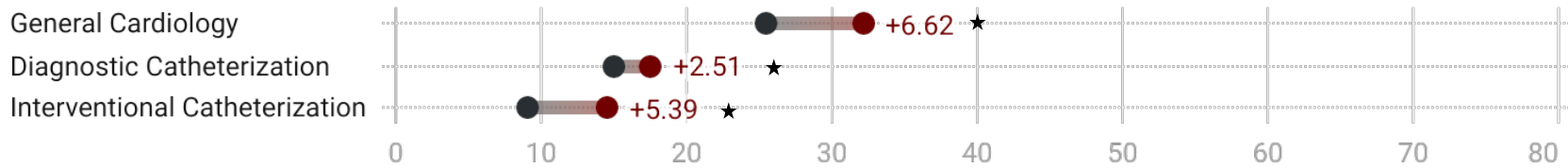
*Notes: Included sample sizes are the number of hospitals within counties

Figure 2. Changes in proportion of hospitals offering cardiac services from 2010-2020 across levels of rurality.

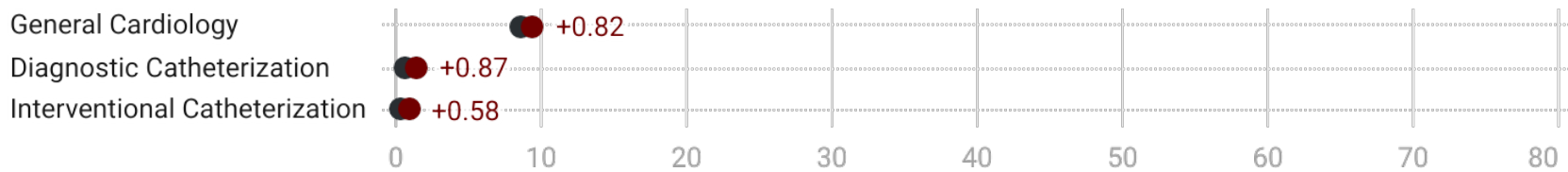
Metropolitan



Micropolitan



Non-Core



★ Denotes statistically significant ($p < .05$) change.

DISCUSSION

Rural patients face disproportionate barriers to hospital-based specialized cardiac care compared to their urban counterparts. Prior evidence has documented rural disparities in social determinants of health including higher rates of poverty, un-or-underinsurance, obesity, smoking, diabetes, hyperlipidemia, physical inactivity, and reduced access to cardiovascular specialists.¹³ More importantly, rural patients with heart diseases often have multiple comorbidities and shorter lifespans.¹⁴ The lack of hospital-based cardiac services in rural communities in tandem with rural residents' higher prevalence and higher cardiac mortality rates for heart failure, myocardial infarction, and stroke is concerning for the 60 million adults that live in rural areas across the United States.^{4,5} The American Heart Association recently made a Call to Action to examine rural health disparities in cardiovascular care and outcomes.¹³

While we found that the overall proportion of available general adult cardiology services, adult diagnostic catheterization, and adult interventional catheterization cardiac services increased from 2010 to 2020, this finding is underscored by the difference in service availability across the three rural classifications. Compared to the proportion of hospitals that provided specialized cardiac care in metropolitan counties, there was a notable decline in the availability of these services in rural micropolitan and non-core counties. With the decline in cardiovascular service availability in rural counties, longer travel times and delays in emergency cardiovascular care will arise negatively affecting cardiovascular outcomes including morbidity and mortality.¹⁵ These findings further support calls to action for geographically targeted public health strategies to improve care in rural areas.¹⁶

Efforts to maintain and increase the presence of cardiac services in micropolitan and rural non-core counties are vital to providing timely and life-saving care. Challenges to providing hospital based cardiac services include the increasing closures of rural hospitals and provider availability in rural areas. In the last decade, rural hospital closures have increased and the availability of cardiologists in rural areas has declined.^{12,17} Rural hospitals often struggle with staffing, and this is not just among specialists but also staffing for primary care disciplines, nurse practitioners, and physician assistants.¹⁸ Acute care,

such as cardiovascular services, is difficult to provide with a national nursing shortage which is worse in rural than in urban areas.¹⁹

Rural hospitals also struggle with their payer composition as rural areas have higher rates of uninsured and underinsured people than urban areas.²⁰ States that expanded Medicaid under the Affordable Care Act have seen decreased rates of uninsured patients in rural areas compared to states that did not expand Medicaid. States that expanded Medicaid have also had proportionally fewer hospital closures than states that did not expand Medicaid.^{12,20} Many of the most rural states in the United States chose not to expand Medicaid which has had a negative impact on the health and well-being of residents and the financial viability of hospitals in those states.²⁰

There are numerous programmatic and policy solutions proposed to increase cardiovascular services by providers in rural areas including incentivizing the expansion of visiting cardiology consultant clinics in rural communities.²¹ Specialty rotations could also be revamped by increasing rural rotations in specialty areas. Finally, loan forgiveness in rural areas is another avenue to the recruitment and retention of cardiologists to rural hospitals.¹³ Given the heavy reliance on Medicare and Medicaid reimbursements among rural hospitals, federal and state agencies may want to consider reimbursing community and home-based cardiac diagnostic care and/or alternatives to hospital-based programs in rural and underserved communities.²²

As stated in the call to action for rural health from the American Heart Association: “a systematic approach to ensuring that essential cardiovascular services remain available, even if there is no financial model that would support full hospital services, is needed...there is likely a core set of services that could be prioritized and financially subsidized when needed”.¹³ Further research to examine possible solutions for increasing and maintaining cardiac healthcare services in rural areas is warranted.

APPENDIX

Data Sources

Data for this analysis came from the 2010 and 2020 releases of the American Hospital Association (AHA) Annual Survey. Three hospital-based cardiac service lines were examined: general cardiac care (GC), diagnostic catheterization (DC), and interventional catheterization (IC). These three service lines were used because they are useful indicators of a facility's ability to provide general preventive, diagnostic, and interventional cardiac care to patients. For hospitals documented in the AHA dataset but with missing indicator data, we used the 2010 and 2020 Centers for Medicare and Medicaid Services (CMS) Provider of Services (POS) Files to complement the AHA data on whether or not the hospital provided the examined service. AHA and POS data files were linked using the Medicare Provider Number. The AHA annual survey is sent to all AHA registered and non-AHA registered hospitals in the country and has an average response rate of approximately 83%.

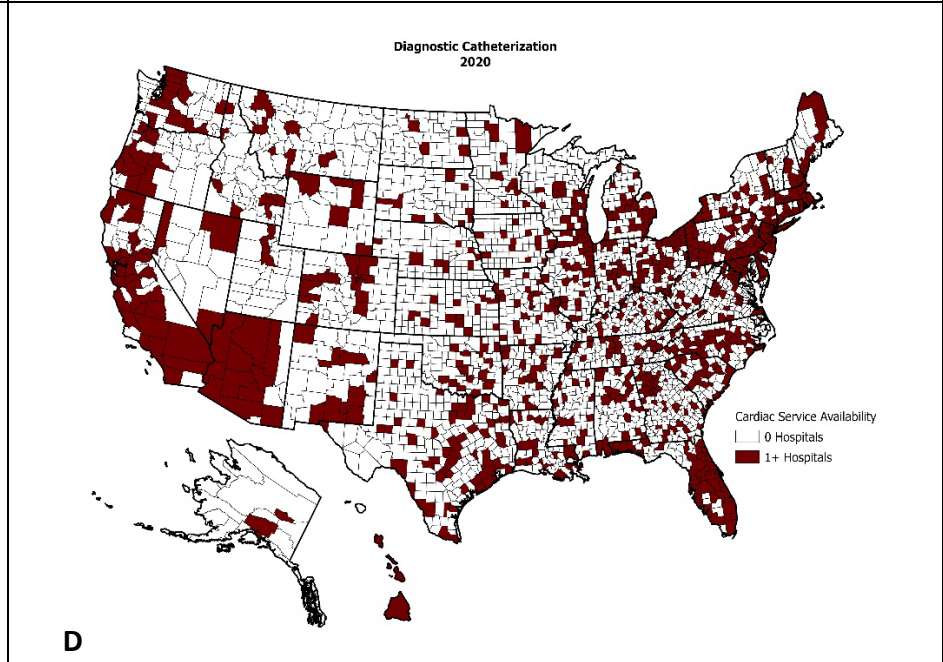
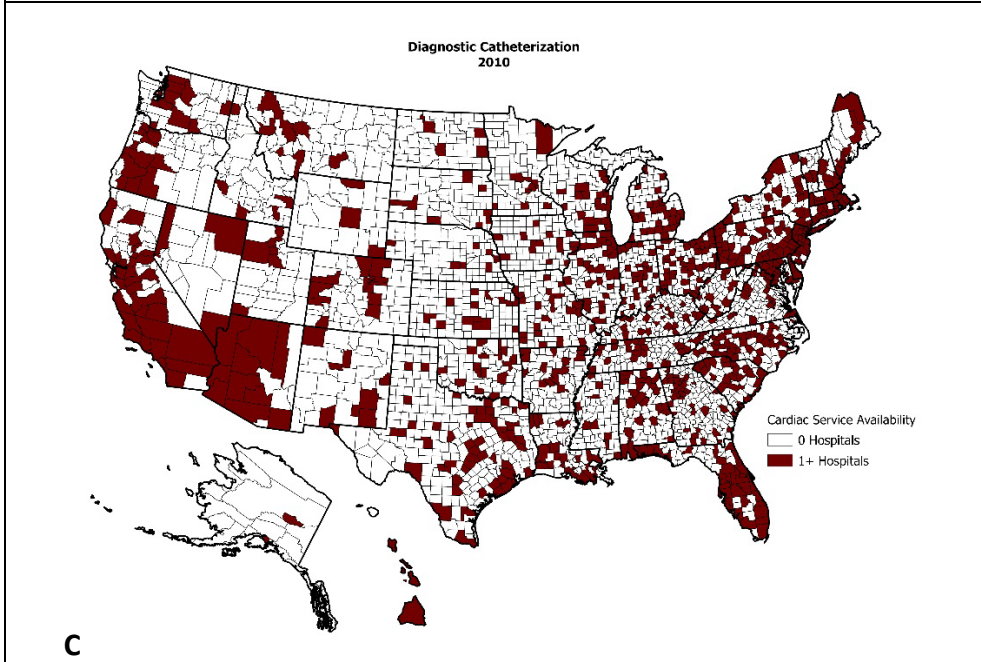
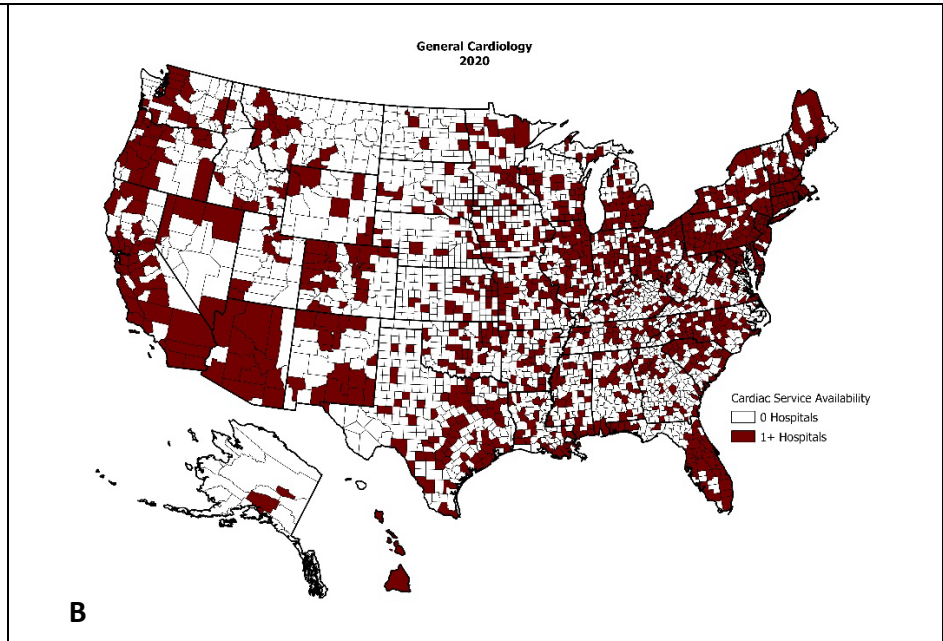
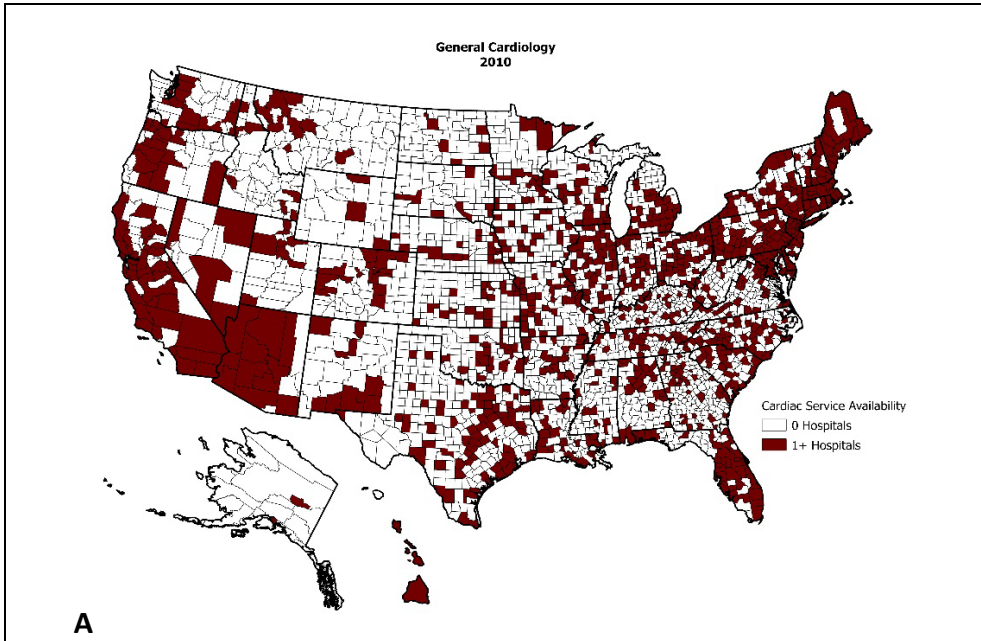


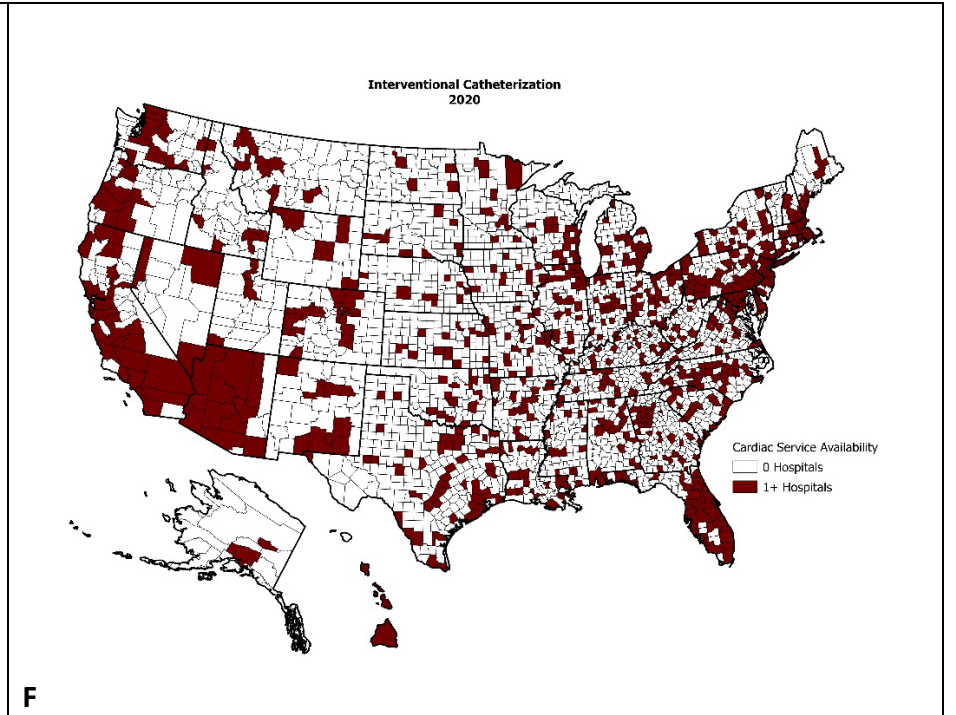
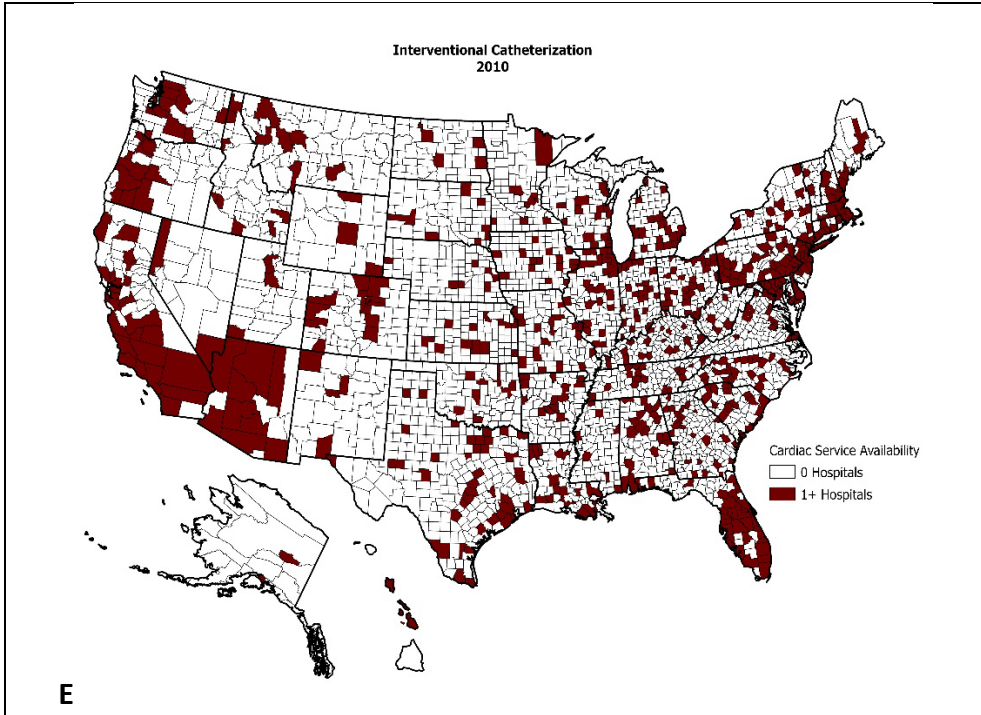
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